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RUNNING HEAD: Video Games and Dream Bizarreness

Video Game Play and Dream Bizarreness<sup>1</sup>

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## Abstract

In a series of studies, Gackenbach has been mapping the effects of heavy video game play on consciousness including dreaming. The reason that gamers are being investigated is that they represent a group of people who are engaging in the most immersive media experience widely available today. With its audio and visual interactive nature as well as the long hours often required to master a game, they are an opportune group to study media effects upon consciousness. In this study, the focus was on dream bizarreness. Dream bizarreness has been variously thought to be the differentiator between waking and dreaming thought, an indication of creativity, and, most recently, as a model for solving the binding problem in consciousness. Using the Revonsuo and Salmivalli's scale for dream content analysis it was found that high-end gamers evidenced more bizarre dreams than low-end gamers in two of three types of bizarreness categories.

Keywords: dream; dreaming; dream bizarreness; video game; gamer; consciousness; dream content; electronic media; media effects; computer mediated communication; neural network

## Video Game Play and Dream Bizarreness

We live in a world that is increasingly dependent on technology. The diffusion of computers and information technologies has changed the nature of activities that were previously accomplished using pen and paper. In this age of electronic media immersion, it is of increasing interest to investigate media affects including on consciousness. The most immersive media experience is video game play with its audio and visual interactive nature and the long hours often required to master a game. In a series of studies, Gackenbach and colleagues (e.g. summarized in Gackenbach, 2008) have been mapping the effects of heavy video game play on consciousness including dreaming. In this study dream bizarreness was the focus.

Dream bizarreness has been variously thought to be the differentiator between waking and dreaming thought, an indicate of creativity, and, most recently, as a model for solving the binding problem in consciousness. Initially, dream researchers attributed a lot more bizarreness to dreams than subsequent analyses have supported (Domhoff, 2007). However, with the claim that dreams are really more like waking thought than different, the nature of such bizarreness got a bit lost. Revonsuo (2006) argues that an examination of the nature of dream bizarreness offers clues to solving the binding problem in consciousness. That is, how does our phenomenal experience of self in the world, or being conscious, emerge from its biological bases? He points out that “a dream object does not transform randomly into another object, but into an object that shares many semantic or associative features with the first. In the waking state such associations do not intrude into our consciousness, for they are unable to override the externally supplied sensory information” (p. 247). Thus, dream bizarreness offers a rare window into the

nature of these semantic associative networks at work without their normal waking constraints. The question herein is; does exposure to electronically mediated worlds affect those associative networks?

It has been pointed out that modern technology affects even the basic cognitive abilities like writing and mathematics. For instance, it takes more cognitive effort to use word processors and calculators than to complete these activities by hand (Sternberg & Preiss, 2005). According to Sternberg and Preiss, our absorption in movies, our phone conversations, and our video game play all affect our range of mental functions. However, the most absorbing, immersive and widely available experience of technological mediation on mental functioning is video game play. A video game is a game interactively played with visual (and often audio) components on a digital device (Baranowski, 2008). Recent surveys indicate 69% of American households play computer or video games, on average, about seven hours a week (Entertainment Software Association, 2007). It has been shown that, at the very least, video games affect some mental functions. For instance, higher levels of visuo-spatial information processing are emerging in people who play video games (Greenfield, 1996; Subrahmanyam, Greenfield, Kraut, & Gross, 2001)

Much of the past research on video games has focused on the potential negative consequences: Anderson and Dill (2000) demonstrated that in both correlational and experimental investigations, violent video game play was positively associated with increases in aggressive type behaviors. There is also evidence of an addictive potential with video game play. Grusser, Thalemann, and Griffiths (2007) found that 11.9% of

their participants (840 gamers) fulfilled the diagnostic criteria for an addiction concerning their gaming behavior.

However, there is also considerable research suggesting that playing video games produces positive benefits: In terms of cognitive abilities and skills, video gamers were found to outperform non-video game players on a number of tasks. Sims and Mayer (2002) demonstrated the specificity of spatial expertise obtained by playing video games. Subrahmanyam and Greenfield (1994) reported improvements in the dynamic spatial reasoning abilities of 11 year old children. Relatedly, Maynard, Subrahmanyam, and Greenfield (2005) reviewed the attention and video game play literature and they found that experimental manipulations with attention as the dependent variable resulted in improved attention among those assigned to the video game playing condition. This is but a small sample of the many cognitive benefits of such play (Gee, 2003). Beck & Wade (2004) found numerous benefits to video game play such as being more sociable and more sensitive to thinking globally due to the breadth of gamers they come across during play online. On a personal level these researchers claim that gamers are more creative, positive, and confident.

Despite the popularity of video games, there has been little research examining the effects of video game play on different states of consciousness. Dreams, an altered reality that our brains construct anew every night, are one state of consciousness. While previously there has been scattered attempts to examine the effects of media, including video game play, on dreams (Van den Bulck, 2004; Stickgol, Malia, Roddenberry & O'Connor, 2000; Bertolini & Nissim, 2002; Nielsen, Saucier, Stenstrom, Lara-Carrasco, & Solomonova, 2007; Schredl, Anders, Hellriegel, & Rehm, 2008), recently a more

organized and focused set of inquiries has been undertaken by Gackenbach and colleagues (summarized in Gackenbach, 2008). This group began by studying lucid dreaming frequency in gamers Gackenbach (2006; in press). In the first study, high-end video game players were more likely to report lucid dreams and dream control when dream recall frequency and motion disorientation during play were controlled. In the next study, morning after dreams were collected along with day before media use as well as selected self-reports on the content of the dream reported from the night before. High-end gaming history and day before play were associated with lucid and control dreaming. While this study did not prove that gaming caused lucidity, the inclusion of non-gamers and low-end gamers and the collection of night before dreams in this association strengthens the argument of a causal link. Additionally several variables have been identified as associated with both lucid dreaming and video game play. Specifically, both have been associated with spatial skills such as field independence for lucid dreamers (Gackenbach, Heilman, Boyt, and LaBerge, 1985), visuo-spatial information processing for video game players (Subrahmanyam and Greenfield, 1994). Additionally, vestibular integrity for lucid dreamers (Gackenbach, Snyder, Rokes, and Sachau, 1986), and less motion sickness during game play, and thus vestibular integrity, for gamers (Preston, 1998) is another parallel. Finally, meditation, as a type of focused attention, has been shown to be associated with lucid dreaming (Gackenbach and Bosveld, 1989; Mason, Alexander, Travis, Gackenbach & Orme-Johnson, 1995) and focused attention is a centerpiece of serious game play (Maynard, Subrahmanyam and Greenfield, 2005). Perhaps gaming increases skills like field independence and focused attention which then facilitate dreaming lucidly. Given the relative rarity of lucid

dreaming (Snyder & Gackenbach, 1988) and the widespread use of video games (Entertainment Software Association, 2007) it is unlikely that only lucid dreamers are playing video games.

In a study examining 27 high-end gamers by Gackenbach, Matty, Kuruvilla, Samaha, Zederayko, and Olisheski (in press), 56 dreams were content-analyzed using the Hall and Van de Castle (1966) system as delineated by Schneider and Domhoff (2006). The largest effect size for these video players' dreams was higher aggression/friendliness percentage and physical aggression relative to the Hall and Van de Castle norms. Large effect sizes were also found in gamers' dreams for lower bodily misfortunes. These seem to indicate that gamers are winning at their aggressive dream battles. This comes as no surprise when the amount of time spent with video games is taken into account.

It was also found that high-end gamers had more dead and imaginary characters in their dreams which has been replicated by Gackenbach and Kuruvilla (2008). This again comes as no surprise considering the amount of dead and imaginary characters in today's video games. Given that the one of the main functions of dreams is to process new information, this would be expected.

In our dreams we often experience unusual combinations of perceptual features that form new, creative, or even absolutely crazy or nonsensical wholes. Talking animals, dead relatives, spectacular fantasy characters, and distorted or metamorphosed persons and places are often found in dreams. Most people are familiar with these features but only recently has the idea been put forward that dream experience may reveal how the binding mechanisms in the brain functions. Bizarreness is thought of as the places,



objects, persons, and other dream contents that deviate in peculiar ways from their counterparts in waking life or show unusual combinations of phenomenal features (Revonsuo, 2006).

Freud believed that dreams are mostly strange and full of disguised impulses (Domhoff, 2007). He proposed that studying the content rather than the form of dreams was desirable. Dream bizarreness was seen as a psychological defense against unacceptable unconscious wishes. All dreams according to Freud needed to be interpreted (Hobson, 2002). More recently, bizarreness is seen as a dominant theme in the activation-synthesis theory. In this theory, bizarreness is not due to disguise as it is with Freudians, but it is the result of a non-prepared forebrain to random activation that arises every so often from the brain stem due to the onset on REM sleep (Hobson, 2002).

Reinsel, Antrobus, and Wollman (1992) believe that spreading activation in the underlying semantic networks have a relationship to the virtual objects and places that we are directly aware of. They argue that the disconnected nature of dream imagery may reflect spreading activation in associative networks. Activation of the networks during REM sleep may be insufficient to fully support the same activation patterns typically activated in the waking state. Atypical patterns of activation in the networks may thus correspond to the production of dream images with improbable or bizarre features.

A solution to the binding problem in consciousness has been suggested by Revonsuo (2006) by examining the nature of dream bizarreness. In other words such an inquiry can give us a better understanding of how thought emerges from our biological basis. Dream bizarreness can offer an insight into the nature of humans' semantic networks at work without their waking constraints.

Supporting these activation theories on dream bizarreness is research using physiological measures. PGO spikes (ponto geniculo occipital spikes) have been associated with REM sleep. Kahn and Hobson (1993) found that PGO waves can cause existing neuronal patterns to split into new patterns. In this case, the dreamer may experience not only an incongruous sequence of images but a bizarre change to an on-going image leading to a hallucinatory and disorienting dream experience. Another bizarreness marker is periorbital integrated potentials (PIPs). Dream reports from REM sleep when PIPs were present were significantly more bizarre, unusual, and disorganized compared to dream reports taken from REM sleep during the absence of PIPs, which were more mundane (Watson, 1972).

More recent research has focused on the assumption that overall, dreams are not that bizarre. In a meta-analysis, Domhoff (2007) revealed that dreams (in the laboratory and outside the laboratory) are more coherent, patterned, and thoughtful than previously suggested. Dreams are now known to resemble the realistic simulation of waking life in terms of number of scene changes and thought disruptions when compared to everyday waking thought. There is still some bizarreness in adult dreams but far less than what was expected based on the claims by Freudians and activation synthesis theorists. Furthermore, everyday waking thought has more of the features that Freudians and activation theories see as unique to dreams. For example, in a study comparing REM reports to waking streams of thought from the same participants sitting in a darkened room, it was found that there were more abrupt scene changes in the waking sample than in the REM reports (Reinsel, Antrobus, & Wollman, 1992).

Despite these recent findings, bizarreness in dreams continues to be investigated by researchers due to its potential theoretical interest. Types of bizarreness have been examined. Hobson has devised a two step process (1988) that distinguishes three distinct forms of dream contents: 1) plot, characters, objects, action 2) thoughts 3) feelings and emotions. Hobson also identified three types of bizarreness: 1) incongruity or mismatching features of dream images 2) uncertain or explicit vagueness of dream images 3) discontinuity or sudden appearance, disappearance, or transformation of dream images. Using Hobson's three types of bizarreness but a more detailed list of dream contents or elements, Revonsuo & Salmivalli (1995) studied the frequency of each type of bizarreness. It was found that incongruity is a more common form of bizarreness than vagueness or discontinuity. More specifically, it was found that language and cognition were the most incongruent content and that the self is the least incongruent content. This indicates that the self is well preserved in dreams and rarely affected by features incongruous with waking reality. The analysis of vague and discontinuous elements revealed that place (the immediate environment) is most frequently vague or discontinuous in dreams (Revonsuo & Salmivalli, 1995).

In the present study, recent dreams were collected from individuals with a high-end and low-end history of video game play. These dreams were content-analyzed using Revonsuo and Salmivalli's system of content analysis for bizarreness. It is hypothesized that as has been the case in the literature dream overall will be judged to be more non-bizarre than bizarre. But group differences are expected such that high-end gamers will evidence more types of bizarreness in their dreams than low-end gamers.

## Method

*Participants.* Over the course of a calendar year (spring 2006 through winter 2007), 890 college students filled out the questionnaire both in face to face and online settings. Most were women (631) with 249 men and 10 with no sex identifier. Forty two percent were 19 years of age or younger with 45% 20 to 25 years of age. All were undergraduate students enrolled in psychology and sociology courses at a western Canadian college. Only 195 questionnaires were collected in face to face data collection while the remaining 695 were collected online for course credit in Introductory Psychology mass testing. From this pool of questionnaire responses, 232 were identified as high- or low-end gamers and were further selected based upon the number of words in their dreams.

*Materials and Procedure.* Following reading and signing an informed consent, participants were told that there were six parts to the questionnaire. A recent dream was collected first with these instructions:

Please enter into the dialogue box below your most recently recalled dream.

Although this is preferred to be from last night if you do not recall a dream from last night then sometime last week, month or year. Or later if that is all you recall.

Sex and age information was then gathered, followed by a series of questions about participants' video game playing habits (e.g. frequency, length, duration of play sessions, number of games played, age first played, favorite game type, and motion sickness during play). Following these were a set of questions about their dream type experiences of the past (e.g. recall, lucid, observer, control, nightmares, and media).

The next part of the questionnaire asked about the dream participants just reported including how long ago it happened, how many hours of sleep they got that night, and how many hours of sleep they normally get in order to feel rested.

Questions about the dream continued in terms of its content (e.g. recall clarity, lucidity, observer perspective, control, nightmare, and electronic media in dream). The final part of the questionnaire inquired about electronic media use the day before the dream. These questions asked about the number of hours of cell or land line use; CD or MP3 player use; TV, DVD or video use; computer or internet use; video game use either on a computer, a console, or a handheld; radio either online, on air, or by satellite; movie in a movie theatre; and other electronic media use. A debriefing statement followed the submission of the questionnaire.

## Results

High- and low-end gamers were selected based on four criteria that have been used before in this program of research (Gackenbach, 2006; 2008). These criteria are frequency of play, length of play, number of games played, and age began play. Younger start to gaming is associated with high-end gaming classification while more frequency, length and number of games is also so associated. Thus in this sample, the high-end gamers reported that they played more frequently ( $t(229)=25.79, p<.0001$ ), longer per session ( $t(111)=-10.94, p<.0001$ ), more games in their lifetimes ( $t(228)=-18.09, p<.0001$ ), and started younger ( $t(215)=-6.97, p<.0001$ ) than the low-end gamer group. Interestingly, however, there were no differences in self-reported motion sickness while playing a video game between gamer groups ( $t(220)=.712, ns$ ). The lack of motion sickness during play is thought to indicate the felt sense of being there in a virtual world

or presence (Preston, 1998). Both groups reported experiencing motion sickness from never to rarely while gaming.

In addition to the above criteria for gamer groups' dreams to be selected, they had to have a minimum of 50 words in the dream (mean 118; SD=81.57) to be included in subsequent data analysis. There were no gamer group differences in number of words per dream ( $t(230)=-0.649$ , ns; high-end gamers mean = 123.78; low gamers mean = 115.95).

In terms of the demographic information available, there was no difference in age between the two gamer groups ( $t(229)=1.602$ , ns) with the average age being less than 25 years. Gender was unevenly distributed between gamer groups ( $\chi^2(2)=84.71$ ,  $p<.0001$ ) such that, as is typical in the gaming literature, low-end gamers were primarily female (males = 13; females = 155) and high-end gamers were primarily male (males = 41; females = 22)<sup>i</sup>. Because there were not enough males in the low-end gamer group, sex of subject could not be treated as an independent variable therefore it was entered as a covariate in all statistical analyses.

On the questionnaire they filled out after providing their dream, all participants were asked which media they used the day before. These included phone, CD/MP3 player, radio, TV/DVD/Video, movie in a theatre, computer/Internet, video games, and a general other electronic media category. In each case they indicated how many hours they had engaged in each activity the day before the dream. These included 1) no time doing this activity; 2) less than one hour; 3) one to two hours; 4) two to three hours; 5) four or more hours. Gamer group X media use repeated measures ANCOVA with sex of subject as the covariate was computed. A main effect for gamer group and the

interaction were significant (gamer group:  $F(1, 221)=32.414$ ,  $p<.0001$ , multivariate partial eta squared=.096; gamer group X media use interaction: Wilks' Lambda=.851,  $F(7, 215)=5.392$ ,  $p<.0001$ , multivariate partial eta squared=.149).

It can be seen in Table 1 that the high-end gamer group used more of a variety of media types the day before the dream than the low-end gamer group. There was one exception; high-end gamers listened to less radio than low-end gamers. Otherwise, high-end gamers reported more time spent in all the rest of the media activities the day prior to the reported dream. One would think with this overall group advantage in day before media use that the high-end gamer group would then self-report more electronic media in the dreams just recorded but that was not the case ( $F(1,227)=2.701$ ,  $p=.102$ ; multivariate partial eta squared=.012). However, the direction of the means is as expected with high-end gamers reporting their dreams as more likely to have an electronic media reference. This marginal to no significant finding is somewhat surprising when in retrospective questions about their dream history, high-end gamers reported that they typically experience more media dreams than low-end gamers ( $F(1,227)=14.988$ ,  $p<.0001$ ; multivariate partial eta squared=.062).

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Insert Table 1 about here

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Most dreams were from last night or last week (78%) and most participants got the amount of sleep they needed to be rested (69%). There were no group differences in terms of when the dream occurred (sometime between last night and last week) ( $F(1,226)=0.561$ , ns; multivariate partial eta squared=.002) or in the hours of sleep they got the night before the dream ( $F(1,223)=2.646$ ,  $p=.105$ ; multivariate partial eta

squared=.012). However, there was a gamer group difference in terms of number of hours they reported they needed to feel rested ( $F(1,226)=6.232, p<.013$ ; multivariate partial eta squared=.027), high-end gamers reported a need for less sleep.

Dream content analysis for bizarreness was conducted using the system developed by Revonsuo and Salmivalli (1995). There is a cognitively motivated content analysis which distinguishes between types of bizarreness and allows for a bizarreness baseline. This procedure involves two steps. Element identification is the first step. Fourteen elements are identified in each dream and include: self, cognition, place, sensory experiences, time, objects, persons, events, animals, emotions, body parts, language, plants, and actions. The second step is the bizarreness coding of these elements along several dimensions. First the element is identified as bizarre or not and those that are identified as bizarre are further classified in terms of incongruity and vagueness. Additionally, each of these classifications, including the non-bizarre elements, is further identified in terms of discontinuity. Incongruous elements further break down into internally distorted/contextually incongruous elements, exotic elements, or impossible elements. This procedure allows a comparison across content categories (e.g. elements) for the three major types of bizarreness (inconsistency, vagueness, and discontinuity) which have been identified in the literature (Hobson, 1988). A judge was trained on this system and coded all dreams.

All dream codings were initially collapsed into bizarre and non-bizarre categories and a gamer (between subject: High vs. Low) X bizarreness (within subject: bizarreness present vs. absent) ANCOVA with sex of subject as the covariate was computed. There was a significant within subject (Wilks' Lambda=.989,



$F(1,228)=4.918, p<.028$ , multivariate partial eta squared=.021) main effect but nothing involving gamer group. As expected dreams overall were judged as more non-bizarre than bizarre.

In order to examine any gamer effects in dream bizarreness, which addresses the major question of this study, several additional analyses were calculated focusing only on the bizarreness types and then within each type on bizarreness elements. Thus, the second ANCOVA computed, with sex of subject as the covariate, was on gamer group (between subject: low vs. high) X type of bizarreness (within subject: incongruous, vague, and discontinuous). In this case, the gamer influence was found. While there was no significant main effect for type of bizarreness (Wilks' Lambda=.987,  $F(2, 227)=1.493$ , ns, multivariate partial eta squared=.013), there was a significant main effect and the interaction for the individual difference variable of gamer group. Specifically, gamer group main effect ( $F(1,228)=18.341, p<.0001$ , multivariate partial eta squared=.074) and the bizarreness type X gamer group (Wilks' Lambda=.911,  $F(2, 227)=11.044, p<.0001$ , multivariate partial eta squared=.089) interaction were both significant. These are portrayed in Figure 1.

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Insert Figure 1 about here

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It can be seen in Figure 1 that high-end gamers had more bizarre elements in their dreams overall than low-end gamers. The interaction was due to the lack of gamer group difference in discontinuous types of bizarreness whereas the other two types were found more so in high-end gamers than in low-end gamers dreams.

The third type of ANCOVAs computed were separate ones for each bizarreness type examining the elements. That is, each type of bizarreness was coded in terms of fourteen elements: actions, animals, body parts, cognition, emotions, events, language, objects, persons, place, plants, self, sensory experiences, and time. Thus, three (discontinuous, incongruent, and vagueness) gamer type X bizarreness elements ANCOVAs were calculated with sex of subject as the covariate. Neither of the main effects nor the interaction were significant for the discontinuous ANCOVA (Within Subject: Wilks' Lambda=.988,  $F(7, 222)=0.380$ , ns, multivariate partial eta squared=.012; Between Subject: Subject:  $F(1, 228)=0.103$ , ns, multivariate partial eta squared=.000; Interaction: Subject: Wilks' Lambda=.995,  $F(7, 222)=0.148$ , ns, multivariate partial eta squared=.005).

The second of these three ANCOVAs was on incongruous elements. Here both main effects (gamer group and incongruous bizarre type elements) and the interaction reached conventional levels of significance. Specifically, it can be seen in the bar chart in Figure 2 that of the incongruous bizarreness elements that were coded as present, the highest codings went to actions, objects and place (Wilks' Lambda=.891,  $F(12, 217)=2.213$ ,  $p<.012$ , multivariate partial eta squared=.109).

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Insert Figure 2 about here

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Gamers were highest overall on all elements of the incongruous type ( $F(1, 228)=9.797$ ,  $p<.002$ , multivariate partial eta squared=.041). So too the interaction between gamer type and incongruous bizarreness elements was significant (Wilks' Lambda=.838,  $F(12, 217)=2.396$ ,  $p<.0001$ , multivariate partial eta squared=.162). While

there was an overall main effect for gamer type with gamers showing the advantage, this was only true for some of the scales for which elements were coded as incongruous: actions, events, objects, body parts, and place. The other incongruous elements showed no difference as a function of gamer type thus the interaction.

The final ANCOVA was for vagueness elements with sex as the covariate. Both effects involving gamer were significant; main effect for gamer group and the interaction. These can be viewed in Figure 3.

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Insert Figure 3 about here

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The main effect for gamer type ( $F(1, 228)=12.482, p<.0003$ , multivariate partial eta squared=.052) was accounted for again by the high-end gamers higher overall vagueness bizarreness rating. The interaction between vagueness bizarreness elements and gamer type was also significant (Wilks' Lambda=.894,  $F(6, 223)=4.403, p<.0001$ , multivariate partial eta squared=.106). The interaction was accounted for by gamer group differences in persons and place, favouring gamers but no group differences in the other elements for which there were some vagueness coded.

### Discussion

Based upon previous content analysis of high-end video game players' dreams, it was thought that they might be more bizarre than those who do not play often (Gackenbach, et al, in press; Gackenbach & Kuruvilla, 2008). High- and low-end gamers' recent dreams from largely well rested night's sleep were content-analyzed for bizarre content using the system developed by Revonsuo and Salmivalli (1995). In this two step process 14 elements are identified as present or absent in the dream and each element is

evaluated along three dimensions of bizarreness initially identified by Hobson (2002); vagueness, incongruities, and discontinuity.

Due to the uneven distribution of males and females in the two gamer groups, sex of subject was entered as a covariate in all subsequent analyses. When all bizarre and non-bizarre elements were collapsed, it was found that most dreams were not bizarre as has been noted in the literature on dream bizarreness (Domhoff, 2007). In order to discover any gamer type effects, further analyses were conducted focusing only on the bizarre aspects of these dreams.

This was first investigated as a function of bizarreness type. Vague and incongruent bizarreness types were found to be significantly higher in the dreams of high-end gamers while there were no gamer group differences in discontinuities in bizarreness. Each type of bizarreness was further investigated in terms of the 14 elements as a function of gamer group. There were no gamer group differences for the discontinuous analyses and like the norms of Revonsuo and Salmivalli (1995) place was the category of the highest bizarreness.

The other two types of bizarreness had gamer group effects. Place and persons were rated as the most vague in both gamer groups but significantly more so in the high-end gamer group. These two were also rated in the Revonsuo and Salmivalli norms as second and third highest. However, in the norms events were rated as highest and that was not the case for this sample.

Finally, in terms of incongruities more scales were rated here than in either discontinuities or vagueness which is similar to the norms. Here, however, the ranking of bizarre elements is quite different from the norms. Whereas Revonsuo and Salmivalli had

cognition and language as the top two incongruous dream elements, in the present inquiry it was actions followed by events and place. Cognition was not scored at all and language was quite low. All of the categories where there was a high rating in this sample favored high-end gamers. The difference in this instance between the norms and the current sample may be due to gender. The norms are all on women while these data are a mixture of males and females. Dream content analysis has classically been very sensitive to gender differences (Hall and Van de Castle, 1966). However, it should be noted that all analyses in the study used sex of subject as a covariate.

Given this high-end gamer advantage in dream bizarreness, the question becomes why. The first and most obvious reason is because gamers are submerged in strange worlds during the day in their video game play. Thus, all we are seeing here is straight dream incorporation of day time activities. Indeed the first author asked three video game consultants (e.g. young men who would be classified as hard core video game players) to rank the 14 elements scored in dreams in the Revonsuo and Salmivalli's dream bizarreness method in terms of their bizarreness in video games. In other words, to what degree did these gamers see bizarreness in games for each of these 14 elements? Five of the six elements ranked highest by these young men as bizarre in video games were those that were placed highest in the incongruity and vagueness analyses (e.g. events, place, actions, objects and persons). This seems to support the idea that bizarreness in gamer dreams is a simple incorporation. However, if you look at Figures 2 and 3, where these findings are portrayed, you can see that both the high- and low-end gamers' dreams had these same elements as most often occurring in their dreams.

Furthermore, the subjects themselves rated whether there was any reference to electronic media in the dreams that were content-analyzed herein and there were no gamer group differences. This is especially interesting in the context of the significantly higher electronic media exposure that the high-end gamers reported from the day prior to the dream. Thus one might conclude that both low and high end gamers are being exposed to the same bizarre elements in waking media and thus the lack of a group difference in morning after reports of dream content type.

An alternative reason for the higher bizarreness in gamers' dreams may be due to the nature of their semantic networks. Specifically, Revonsuo and Salmivalli (1995) point out that, "one possible way to understand the underlying mechanisms of dream incongruity is to think of them in terms of connectionist networks (Antrobus, 1993). During dreaming there is no sensory input to constrain the possible combinations of activation patterns, which may result in an atypical configuration of activation in the network. Such activation could be reflected in subjective experience as incongruous dream imagery" (p. 184). One might argue that a more diverse network allows for more incongruous dream bizarreness. This interpretation is consistent with other research on high-end video game players who have been found to evidence a variety of cognitive type skills which may implicate more diverse neural networks. Specifically, higher levels of non-verbal problem solving in the specialized cognitive ability of visuo-spatial information processing are emerging in people who play video games (Greenfield, 1996; Subrahmanyam, Greenfield, Kraut, & Gross, 2001). Maynard, Subrahmanyam, and Greenfield (2005) reviewed the attention and video game play literature. They found that

experimental manipulations with attention as the dependent variable resulted in improved attention among those assigned to the video game playing condition.

Additionally, creativity, which presumably would require a wide spread network, has been associated with dream bizarreness and video game play. Several experimental studies link dream bizarreness and creative imagination. Adelson (1974) found that subjects with more fantastic dreams were significantly superior students in creative writing classes. Schechter and her colleagues (Schechter, Schmeidler, and Staal, 1965) found that university students in the creative arts recalled significantly more dreams and that their dreams were more vivid, bizarre, aggressive, and characterized by philosophical-religious themes than dreams of students enrolled in the sciences or engineering.

This view linking waking creativity with dreams is consistent with a variety of psychological theories. First, psychodynamically oriented theorists have suggested that both creativity and dreams involve a partial breakthrough of primary process thinking into consciousness (Freud, 1965). Second, Jung (1960) and others believe that dreams are metaphorical representations of inner and outer situations of importance to the dreamer. One might expect that individuals proficient at creating metaphors while awake would be more proficient at creating them while asleep and hence would have more metaphorical, more implausible dream imagery. Third, cognitive oriented theories (Foulkes, 1985) predict continuity between mental processes during waking and sleep, so that individuals with a wider, more imaginative range of semantic reference while awake would display a broader range of content in their dreams. Fourth, the physiological based activation-synthesis model of dreams (Hobson & McCarley, 1977) suggests that the brain is actively

creative during dreaming sleep, devising new solutions to old problems (as cited in Wood, Sebba, & Domino, 1989).

Despite early dire warnings that video game play would stifle creativity (Provenzo, 1991), Squire (2003) pointed out that “there has been little evidence to suggest that children have grown up without the ability to think creatively” (p. 9). For instance, Wright, Boria and Breidenbach (2002) found through text analysis “that the playing of FPS [first person shooter] multiplayer games by participants can both reproduce and challenge everyday rules of social interaction while also generating interesting and creative innovations in verbal dialogue and non-verbal expressions” (para.2). But probably one of the most concrete examples of how video game play enhances creativity is the wide practice of player generated digital objects, avatars, levels among other things from which game companies and players both benefit and make money. Bruce (2008) points out that game companies are “encouraging players to take a more active role in creating games. And an increasing number of games let players customize a character — choosing hair color, body type and weapons” (para. 3-4).

The lack of group differences in the discontinuous type of dream bizarreness elements also needs explanation. Revonsuo (2006) points out that discontinuous elements in dreams illustrate that these “transformations prefer to take routes where the underlying activation patterns slide smoothly across the networks of sensory and semantic features, instead of jumping abruptly from one type of object to an object belonging to a completely different or arbitrary category” (p. 245). Thus, a wider network of connections, which is hypothesized as one reason for higher-end gamer incongruent dream bizarreness, would not be evidenced in the discontinuous scores. These scores



reflect bumps along the connections that have been established and not new directions in the network.

Limitations in the present inquiry include collecting only one dream per participant where Revonsuo and Salmivalli (1995) used dream diaries. Additionally, only one judge was trained in their content analysis method. While the majority of the dreams were fairly recent, not all were morning after dreams which are preferable. Finally, future research on dream bizarreness in gamers needs to consider what the dreamer/gamer considers bizarre in their own dreams as well as gathering a detailed description of what games were recently played in order to match game content to dream content.

In summary, while gamers, both high- and low-end, had more non-bizarre elements than bizarre ones, of the bizarre elements high-end gamers dreams were coded as containing more incongruent and vague elements than low-end gamers. However, no gamer group difference was found for discontinuous elements. Interpretation was given in terms of the semantic neural networks that may result from high-end gaming.

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Table 1

Gamer Group Differences in Day Before the Dream Media Use Controlled for Sex of Subject

Media Used Day Before Dream	Gamer Group	Mean	Standard Deviation	N
Telephone	Low	2.44	.925	162
	High	2.52	1.036	62
CD/MP3	Low	2.12	1.038	162
	High	2.84	1.231	62
Radio	Low	2.02	.990	162
	High	1.71	.930	62
TV/DVD/Video	Low	2.56	1.142	162
	High	2.92	1.149	62
Movie Theatre	Low	1.12	.543	162
	High	1.19	.721	62
Computer/Internet	Low	2.48	1.087	162
	High	3.21	1.103	62
Video Games	Low	1.07	.379	162
	High	2.05	1.165	62
Other electronic media	Low	1.36	.761	162
	High	1.65	.925	62



Figure 1

Gamer Type by Bizarreness Type ANOVCA with Sex of Subject as Covariate

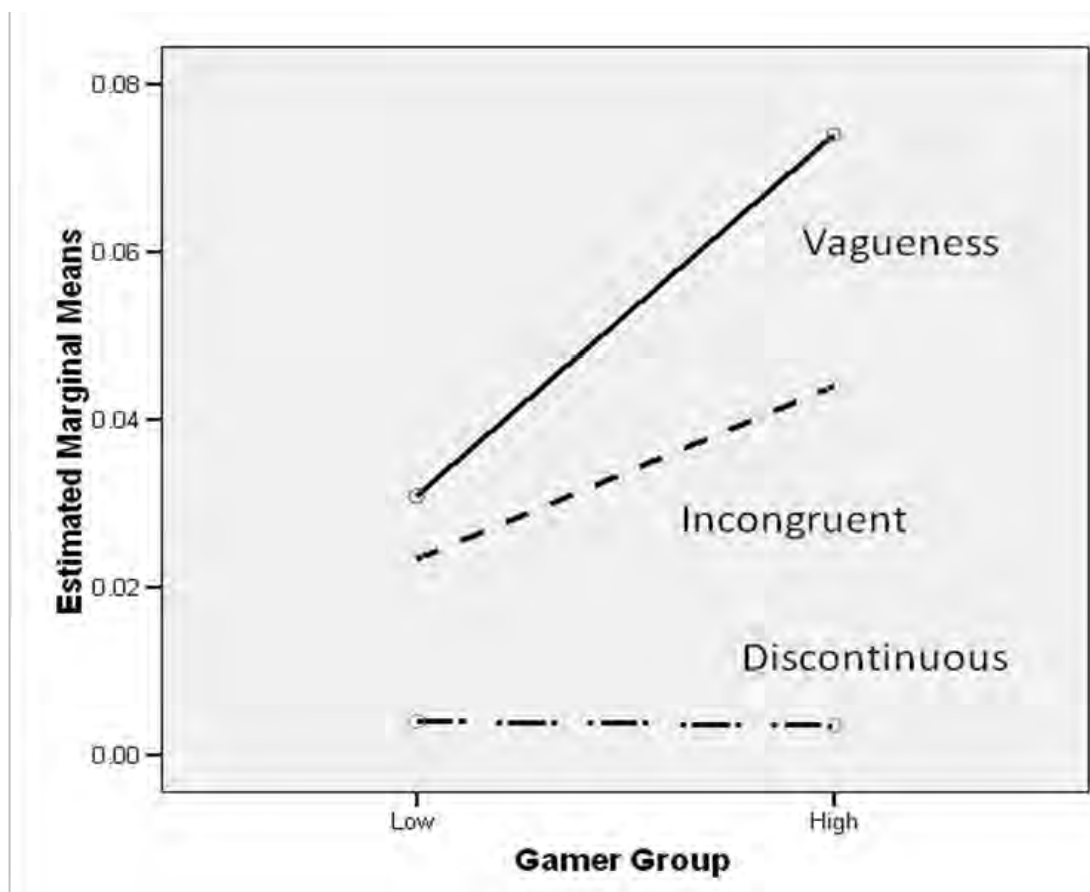


Figure 2

Gamer Type by Incongruous Bizarreness Elements ANOVCA with Sex of Subject as Covariate

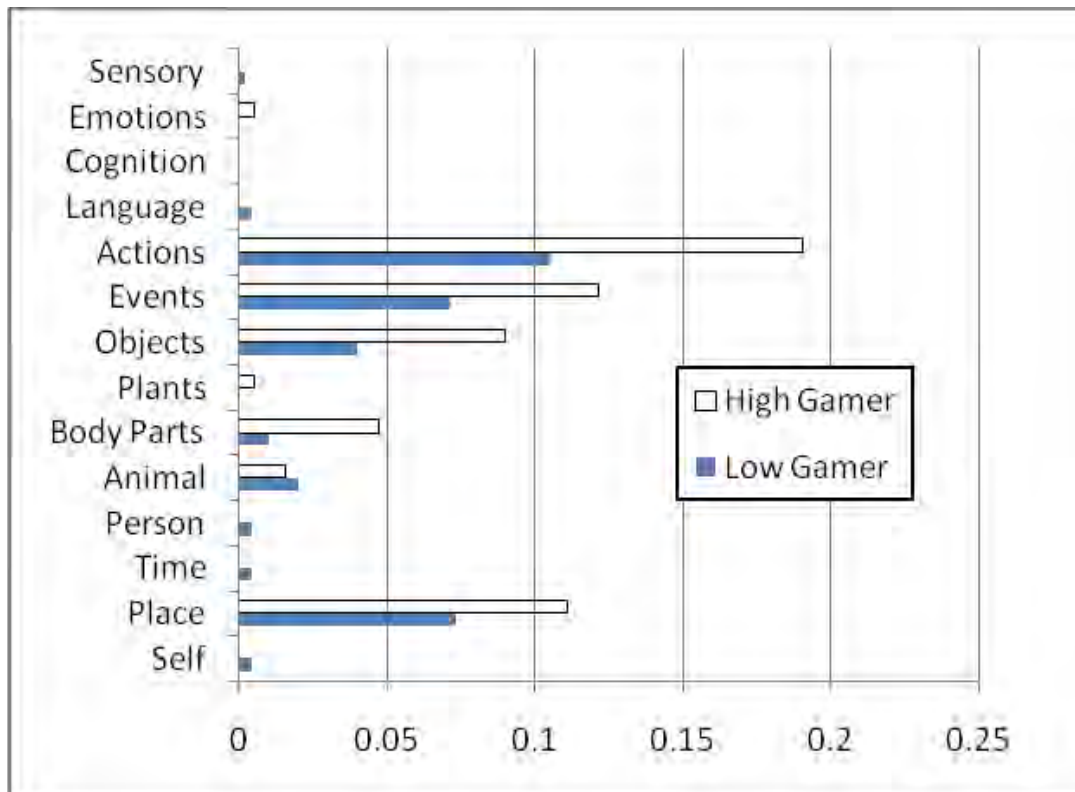
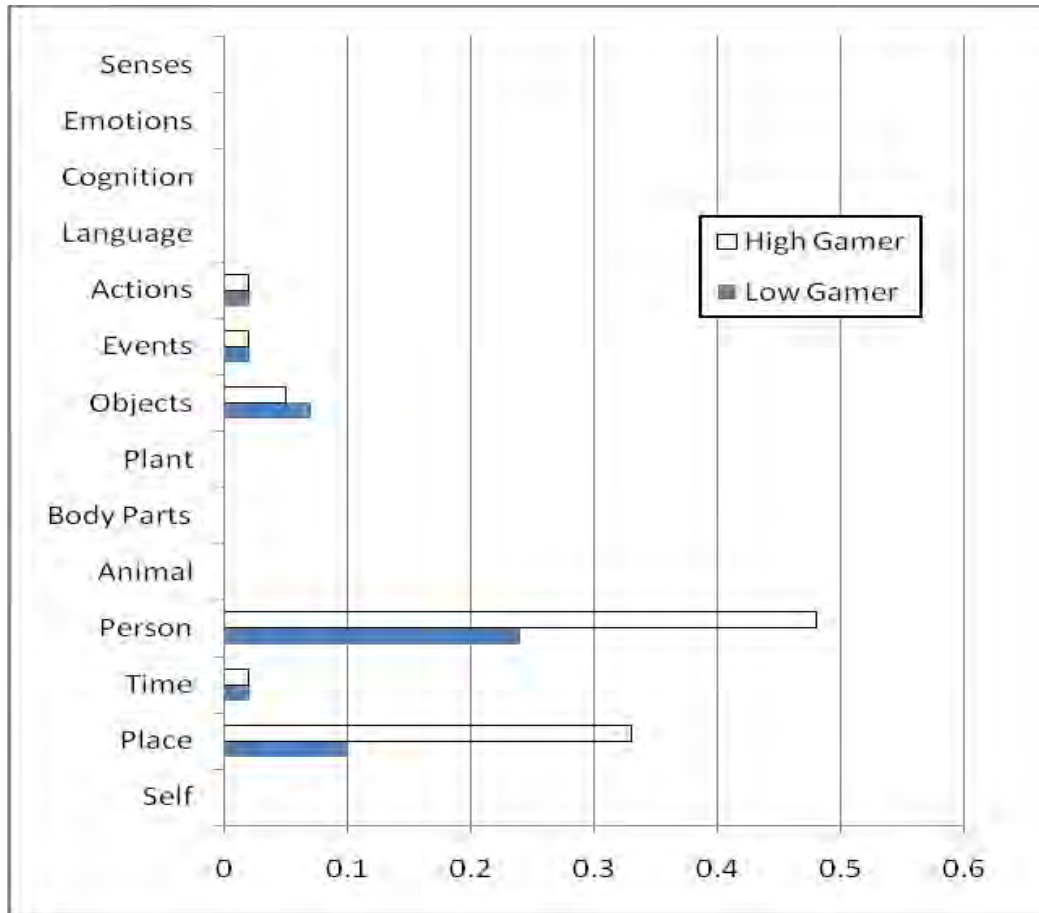


Figure 3

Gamer Type by Vagueness Bizarreness Elements ANOVCA with Sex of Subject as

Covariate



## Endnotes

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<sup>i</sup> One subject gave no gender information.