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Video Game Play Effects on Dreams: Self-Evaluation and Content Analysis[1]

JAYNE ISABEL GACKENBACH AND BEENA KURUVILLA

Mediated communication, whether via modern electronic technologies or knots in a rope, have an effect on how we think. Cole and Derry (2005) point out that tool use is "both amplifier of human action and transformative of human mind" (p. 221). The growth curve of technologies and their absorption in society is nicely characterized when Preiss and Sternberg (2005) point out that cultural tools, while developed at great expense, create a learning and cognitive atmosphere for future generations that is much easier and allows them to move forward. Thus they point out that, "cognition becomes increasingly technological" (p. 203). They go on to explain that modern technology affects our most basic cognitive achievements like writing and mathematics so that calculators and computers allow more time for complex problem solving rather than endless computation. A main issue in evaluating the effects of technology on the mind is the increasing ability to couple our mental representational systems with technological systems that augment input data. There are many examples: absorption in a movie or TV show, chatting on a cell phone, or playing a video game. Not only are we immersed in and enjoying these augmented realities but it is becoming increasingly obvious that technology is altering our range of mental functions (Sternberg & Preiss, 2005).

The most immersive and absorbing experience of technological mediation on mental functioning, which is widely available, is video game play. It has been shown that at the least mental functions are affected like the specialized cognitive ability of visuo-spatial information (Greenfield, 1996; Subrahmanyam, Greenfield, Kraut, & Gross, 2001). Greenfield (1996) notes that "video games make it possible for the first time to actively navigate through representational space" (p. 91) or to be "in" virtual worlds. To date, media exposure has been largely a passive, observer experience: TV, videos, and radio come at the viewer. Although channels can be changed, the actual content of the experience is fixed even in today's vote-for-the-winner type of reality television, so any one individual's input is minimal. This is not the case with video game play where the player is an active participant in the emerging experience. Additionally, unlike passive audio/visual electronic media, such as TV and most movies, video gaming now uses three-dimensional visuals, thus enhancing the sense of felt presence in Virtual Reality (VR). Therefore, video game play effects represent the best way to examine the effects of computer-mediated communications on inner cognitive processing. Increasingly cognitive scientists are examining the realms of dreams as a primary place where information processing and memory consolidation occur (Hartmann, 2007).

Few researchers have examined gaming effects on nighttime dreams. In part, this is due to western cultures' shunning of dreams as an unimportant element in the life of the mind. However, scientific research in the last half century has established that dreams are important for memory consolidation, emotional regulation, and general

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information processing as well as having various evolutionary advantages. Even though most people in North America do not remember their nightly dreams, they all dream every night from 4 to 5 times and this nighttime mentation is doing its job (Barrett, 2007). The question in this paper is what are the effects of hard-core video game play on these experiences of the night? Are the effects simply alterations in dream content or are there more substantial effects? Are video games simply one of a range of computer mediated communications that are affecting dream content? If so, how? Finally, what are the implications of any media effects on dreams for waking life?

Importance of Dreams

Our understanding of the importance of nighttime dreams has come a long way since the days of Freud's 1900 "Interpretation of Dreams" where he claimed that dreams were the royal road to the unconscious. Although Freud did a lot for introducing the serious study of dreams into a culture that rejected them as unimportant, he also labeled dreams as the area where the individual's unconscious instinctual impulses are stored. Since the development of sensitive electrophysiological recording techniques and the subsequent discovery of rapid eye movements during sleep, this pathologizing of dreams has ended. In the last half century a body of work, while not absent of controversy, has generally shown that nighttime dreams are functional to the life of the brain. For a review of the most recent findings in dream science, see the three volume edited series "The New Science of Dreaming" (Barrett & McNamara, 2007a, b, c).

Various researchers have postulated dream functions and these include adaptation to stressful events (Wright & Koulack, 1987) or the lack thereof as in the case of post-traumatic stress nightmares (Barrett, 2001). Emotional regulation has been viewed as a central function of dreams beyond just stress response integration (Kramer, 2007). Nielsen and Lara-Carrasco (2007) emphasize the role of dreams in regulating especially negative emotions. Evidence for memory consolidation comes most recently from a virtual maze task which was dreamt about the following night and a week later (Nielsen, Kuiken, Ve Alain, Stenstrom, & Powell, 2004). In a review of the functions of dreaming, Hartmann (2007) notes about this memory consolidation and emotional regulation function(s):

> This making of broad connections guided by emotion (in dreams) probably has an adaptive function, which we conceptualize as "weaving in" new material – in other words, taking new experiences, especially if they are traumatic, stressful, or emotional, and gradually connecting them, cross-connecting them, weaving them, into existing memory systems (p. 172).

An evolutionary theory is that of Revonsuo (Revonsuo & Valli, 2000; Revonsuo, 2006) who postulates that themes concerned with ancestral and current survival threats should be prevalent in dreams. In a review of the evolutionary approaches to dreams, Barrett (2007) points out that the problem with the various evolutionary theories is that "each is overly specific in some way" (p. 138). She goes on to argue that "dreams are thinking or problem solving in a different biochemical state from that of waking" (p. 140). Finally, dreams as play, in the sense of practice for later events

beyond threat simulation, is a view which has also received empirical and theoretical attention (Bulkeley, 2004).

Virtual Reality and Dreams. It has been suggested that dreams offer a better model of the nature of consciousness itself than the currently favored visual attention model (Revonsuo, 2006). This function is particularly important in this inquiry as Revonsuo suggests that both dreams and virtual reality (VR) simulations are world simulations that result in models of self in the world. In other words, we can conclude from our experience of dreams and VR, where self is in artificially generated worlds (biologically driven in dreams and technologically driven in VR), that normal waking reality is also a "world simulation". This is one of various bodies of work that have taken the position that self in the world is a construction (Blackmore, 2004). In any case, these models of self in the world (dreams, VR, waking reality) impact each other, sometimes in profound ways as in the nightmares of trauma victims which wake them from sleep, making it difficult to get back to sleep no less cope with the trauma. Sometimes the impact is less profound, such as in playing a video game for so long that standing up from the sofa results in dizziness as one acclimates to the new "world" of waking reality from that of VR.

Previous research on video gaming and dreams has found an impact of gaming on dreams. Specifically, Van den Bulck (2004) found that computer games were less likely to show up in nightmares than television but that computer games were also present in pleasant dreams for the children. Players of the puzzle game *Tetris* reported intrusive, stereotypical, visual images of the game at sleep onset (Stickgol, Malia, Roddenberry & O'Connor, 2000). Bertolini and Nissim (2002) recognized fragments or characters from the video games in the material of children's dreams. Finally, Nielsen, Saucier, Stenstrom, Lara-Carrasco, and Solomonova (2007) found that a VR maze task showed increased incorporation into dreams when actively engaged in with a computer mouse than when passively watched on TV.

While these studies suggest that video game content is indeed incorporated into dreams, it is important to consider the implications of such incorporation. For instance, Schredle, Anders, Hellriegel and Rehm reported "that inter-individual differences in nightmare frequency were not explained by inter-individual differences in TV viewing or computer game playing habits" (2008, p. 69) of 11 to 13 year olds. In other words, contrary perhaps to popular lore, playing computer games in children does not cause nightmares. Nielsen et al's (2007) finding has implications for memory consolidation in terms of various time based cycles. Bertolini and Nissim (2002) concluded that due to this radical change in children's play patterns they must now incorporate video games into their child therapy practice. Thus, video games seem to be affecting dreams and these affects have theoretical as well as practical implications.

Gackenbach and colleagues have been examining the dreams of video game players. Initially, these studies examined lucid and control dreams in gamers' sleep (Gackenbach, 2006). However, they found a higher association of these dream types to gaming experience and play. More recently, this group of researchers looked at day before media use and the occurrence of self-reported lucid and control dreams and found that the connection of lucidity/control to gaming was, in fact, also to other high-end media use the day before a dream (Gackenbach, in press).

This group also examined bizarreness in the dreams of gamers versus non-gamers (Gackenbach and Kuruvilla, 2008) and how gamers' game play might alter one evolutionary function of dreams, threat simulation (Gackenbach and Kuruvilla, 2008). In the former study, gamers' dreams were more bizarre then non-gamers' dreams. This could be interpreted as suggesting a more complex neural network for problem solving or simply more exposure to unusual elements during gaming overlapping into dreams. Gackenbach and Kuruvilla (2008) propose that according to an evolutionary theory of dreaming, an individual is thought to prepare for real world threats in the safety of the virtual setting of the dream world. They propose that such preparation in another altered reality, VR of gaming, would thus serve the same function and it would thus affect the dream content outcome. In terms of threat simulation, they found that individuals with a history of game play experienced fewer threat severity variables in their dreams.

This research group also examined the content of gamers' dreams using the Hall and Van de Castle (1966) system of content analysis. This most widely-used system of dream content analyses was selected because these scales have one assumption, frequency equals intensity. The Hall and Van de Castle method also allows for high inter-rater reliability, has well developed norms, and uses categories which are pertinent to waking concerns that may influence dreaming. In a study examining 27 high-end gamers by Gackenbach, Matty, Samaha, Kuruvilla, Zederayko, and Olischefski, (submitted) 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 game players' dreams was evidenced in larger numbers of dead and imaginary characters, aggression/friendliness percentage, and physical aggression than the Hall and Van de Castle norms. Large effect sizes were also found in gamers' dreams for lower bodily misfortunes and lower in dreams with at least one instance of friendliness. The fewer bodily misfortunes would seem to indicate that they are winning at their aggressive dream battles. This is not surprising given all their practice while awake in virtual reality battles (i.e., the majority of the interviewees expressed a preference for role playing games with a battle motif such as *World of Warcraft* or first person shooters). Another interesting finding is the higher incidence of dead and imaginary characters. This certainly seems to characterize the virtual world of many of today's games showing up in their dreams. In fact, in interviews, one gamer commented that there is no reason to be a human in a game as they have fewer powers than other types of creatures.

This study was limited in that there were few dreamers and dreams, the dreams were recalled from any period in their lives, they were collected in interviews with various prompts, and video game dreams were primarily asked for. The present inquiry seeks to correct some of these problems. It is hypothesized that some if not all of the findings from Gackenbach et al (submitted) will replicate with a more systematic dream selection. Additionally, the current study seeks to go further with the content analysis of dreams by also examining media use the day before the dream, game play history, and self-evaluations of dreams. These analysis should shed additional light on the effects of media use on dreams and thus on the processing of information and consolidation of memory while asleep.

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. 42% 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.

Materials and Procedure. Following reading and signing an informed consent, participants were told that there were 6 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 (i.e. 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 (i.e. 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. These three questions allowed the selection of relatively recent dreams that occurred last night, last week or last month, and only from nights where they were rested.

Questions about the dream continued in terms of its content (i.e. 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 cellular telephone 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

Only a portion of the 890 participants fulfilled the criteria for inclusion in the content analysis component of this research. That is, 229 dreams were identified that were recalled from last night, last week, or last month, were 50 words in length, and were dreamt by individuals classified as either low-end or high-end video game players. However, as with previous research on gaming, the high-end gamers tended to be male (Males=61; Females=25) while the low-end ones tended to be female (Males=14; Females=129) (Reinhard & Dervin, 2007). The first set of analysis

examined high-end gamers only with gender collapsed into gamer category, while for the second set of analyses sex was entered into the factor analysis separately.

Hard-Core Gamer Dream Comparisons. In order to determine if these data from high-end gamers (n=86 with one dream each) replicated the earlier study of Gackenbach et al (submitted) (n=27 with on average 2 dreams each), both were compared to the Hall and Van de Castle norms. The summary of this is portrayed in Table 1.

	Male Hall and Van de Castle Norms	Inter-viewed Gamers	online M/F Gamers	h: inter-views vs. HV norms	h: online M/F Gamers vs. HV norms	p: inter-views vs. HV norms	p: online M/F Gamers vs. HV norms
Characters							
Male/Female Percent	67%	67%	42%	-.01	-.52	.937	** .000
Familiarity Percent	45%	58%	75%	+.26	+.62	* .026	** .000
Friends Percent	31%	16%	54%	-.36	+.47	** .002	** .000
Family Percent	12%	15%	13%	+.09	+.04	.429	.638
Dead & Imaginary Percent	00%	21%	05%	+.83	+.34	** .000	** .000
Animal Percent	06%	04%	04%	-.08	-.11	.485	.218
Social Interaction Percents							
Aggression/Friendliness Percent	59%	100%	60%	+1.39	+.02	** .000	.893
Befriender Percent	50%	--	40%	--	-.21	--	.379
Aggressor Percent	40%	33%	48%	-.13	+.18	.598	.329
Physical Aggression Percent	50%	86%	49%	+.80	-.03	** .000	.878
Social Interaction Ratios ***							
A/C Index	.34	.38	.28	+.09	-.13		
F/C Index	.21	.01	.18	-.47	-.07		
S/C Index	.06	.00	.04	-.15	-.04		
Settings							
Indoor Setting Percent	48%	47%	71%	-.04	+.46	.805	** .000
Familiar Setting Percent	62%	56%	70%	-.11	+.18	.560	.206
Self-Concept Percents							
Self-Negativity Percent	65%	84%	69%	+.45	+.08	* .028	.573
Bodily Misfortunes Percent	29%	00%	25%	-1.14	-.10	* .024	.746
Negative Emotions Percent	80%	81%	81%	+.02	+.03	.941	.901
Dreamer-Involved Success Percent	51%	40%	36%	-.22	-.31	.496	.267
Torso/Anatomy Percent	31%	27%	33%	-.08	+.05	.720	.818

Dreams with at Least One:							
Aggression	47%	32%	29%	-.32	-.37	* .023	** .001
Friendliness	38%	02%	24%	-1.07	-.30	** .000	* .010
Sexuality	12%	00%	05%	-.70	-.26	** .000	* .026
Misfortune	36%	07%	14%	-.75	-.53	** .000	** .000
Good Fortune	06%	00%	00%	-.49	-.49	** .000	** .000
Success	15%	09%	06%	-.19	-.31	.165	** .008
Failure	15%	09%	12%	-.21	-.11	.142	.343
Striving	27%	18%	17%	-.23	-.23	.102	* .048

* *Significant at the .05 level.*
** *Significant at the .01 level.*
*** *These ratios do not use the h statistic.*

Table 1: Comparison of Interview Collected versus Online Collected Dreams from Hard-Core Gamers to Hall and Van de Castle Norms

Before explaining these results it should be noted that the major difference between these two groups of hard-core gamers is how the dreams were collected. Both are between 20 and 25 years of age on average, both started playing in grade 3 or earlier, both play 1 to 2 or more hours a day, both have played 50 to 100 or more games in their lifetime, and both play several times a week. It can be seen that despite these general demographic similarities, there are, nonetheless, several differences in their dreams. The interviewed gamers in the Gackenbach et al. study were prompted to give recent dreams but ended up sharing dreams from a wide range of time periods. Additionally, during these interviews participants were asked for dreams with video game play in them. Thus the 27 interviewees offered an average of 2 dreams each. In contrast, the online dreams are all fairly recent, a dream topic was not asked for, and they all gave only one dream. Thus, any differences between the two groups are likely a function of data collection method rather than individual differences and especially the request for dreams about video games.

That said, of the 25 subscales for which group differences could be determined, over half (16) showed a difference between either of the two gamer groups and the norms. Half of these were for both gamer groups while the other half were for one group or the other. Of the eight that showed a difference between both gamer groups and the norms, seven were in the same direction. These included more familiar and dead/imaginary characters and fewer dreams with at least one instance of aggression, friendliness, sexuality, misfortune, and good fortune than the Hall and Van de Castle norms. In both cases, the hard-core gamers had more familiar characters than the norms. These are scored if it is directly stated or implied that the character in the dream is known (i.e. the boy next door). The relatively restricted worlds of gamers might account for their scoring higher on this scale than the norms. They are perhaps less likely to venture into unknown real worlds and thus less likely than the male norms to meet strangers. While literally there are many strangers in online gaming the familiarity of the gaming environment and characters might result in gamers' perceptions of being among familiar and not unfamiliar players. This is

partially supported by the significantly higher indoor settings in the dreams of the online gamers.

Another character difference that replicated across populations was higher incidences of dead and imaginary characters. This is obviously a function of the characters that populate dreams, like this from Gackenbach et al. (submitted), "I dreamt I was a character in *Underworld 2*, it was a werewolf character." Dreams reflect activities and feelings of the day before as well as a week before and general themes of concern (Domhoff, 2007).

In one instance, the two gamer groups differed in the direction of their difference from the norms. The interviewed gamers were judged to have reported fewer friends in their dreams than the norms while the online gamers reported more. The fact that dreams of video game play were encouraged from the Gackenbach et al. sample but not in the current sample (i.e., the dream request was for any dream, preferably from the night before) may explain this difference. If you're talking about a video game dream, then you're less likely to have friends, but not necessarily strangers in the dream. While if you're talking about any dream, so long as it is recent, then friends are likely to appear. It could be that while the gaming dream reflects game characters, in fact most gaming is highly social with friends and thus the higher than normal incidence of friends when a dream is relatively randomly picked.

The other half of the scales which showed significant gamer group/norm differences were for only one or the other of the gamer groups. So while the interviewed gamers reported no difference from norms in terms of male/female percentage of characters in dreams, the online gamers were judged to have reported significantly fewer than the norms. This is perplexing but could be a function of the relatively higher ratio of women in the online sample (25 out of 86 high-end gamers) relative to the interview sample (2 out of 27 gamers). Given that dreamers tend to focus on their own sex, the higher incidence of women in the online sample would account for the lower male to female ratio (Van de Castle, 1994).

Likewise two social interaction variables and two self-concept variables were judged to be different from norms for the interviewees but not for the online gamer dreams. So while the interviewee dreams were judged to have significantly more aggression/friendliness and physical aggression overall than the norms, this was not replicated in the online gamer dreams. This is likely due to the demand characteristic in the interview to provide dreams of video game play (Gackenbach et al., submitted). One might expect more aggression of different forms in video game dreams.

In terms of self-negativity and bodily misfortunes, the interview collected dreams had more of the former and less of the latter than the norms while the online gamers dreams did not differ significantly from the norms. The bodily misfortune finding is consistent with the hypothesis of Gackenbach and Kuruvilla (2008) that gaming serves to engage the need for threat simulation rehearsal normally reserved for dreams and thus, less bodily misfortune would be expected of video game dreams. The number of dreams with at least one instance of general misfortune was less for both gamer samples than for the norms and supports the threat simulation function of gaming relative to dreaming. As for the higher self-negativity in the dreams of the

interviewed gamers, perhaps gamers are reprimanding themselves for errors made while dreaming as they might in a game. Thus for those who are not specifically reporting video game dreams this effect washes out.

Finally, eight scales indicated the incidence of some social element occurring at least once. These included dreams with at least one incidence of aggression, friendliness, sexuality, misfortune, good fortune, success, failure, and striving. Five of the eight categories (aggression, friendliness, sexuality, misfortune, and good fortune) showed significant differences from norms for both samples. In all five cases, the direction was less than the norms but when all males that had dreams coded were compared to all male norms, the same finding emerged. This may be more of a generational finding than one specific to gamers. The same was true of all females, sans sexuality where there was no difference from the norms. These larger sample differences could be as much a function of the way that the dreams were collected online as anything else.

In summary, we can say that while there was some replication with the previous research, about 1/3 of the time there were also some differences and one instance with opposite results. The cause for these differences as noted is likely more a matter of data collection than individual differences including especially a call for video game dreams in the interviews.

Day Before Media Use, Gaming History, and Dream Content. In order to further examine the effects of media use the day before the dream in the broader context of gaming history, a principle component factor analysis was calculated with two types of dream variables: the sum score for each general category from the Hall and Van de Castle dream content analysis and the dreamers' self-evaluation of the dream they reported just having experienced. In this case, dreams were selected from low- and high-end gamers, that were recalled the night prior to filling out the questionnaire (n=63) and were at least 50 words in length.

Sixty-three students, 25 males and 38 females, fulfilled these criteria, 84% of whom were 25 years of age or younger. Most had six to ten hours of sleep the night of the dream, which is what they report they typically need to feel rested. Almost all were collected in the fall of 2006 and the winter of 2007. 30 were identified as low-end gamers while the rest (n=33) were identified as high-end.

The sum scores from the dream content analysis were for characters, aggression, friendliness, sexuality, activities, success, failure, misfortune, good fortune, emotions, settings, objects, and modifiers. Additionally, the dreamers' self-evaluations along six dimensions were included: clarity of recall, lucidity, type of observer, dream control, nightmarishness, and electronic media reference.

This analysis was done to examine both the day before use of general media types (i.e., these individual types of media were collapsed into three z-scores for audio media, audio/video media, and interactive media) and the history of use of the most immersive medium, video game play. In this case, rather than collapsing all the video game variables into one general identifier, they were somewhat separated. Specifically a mean z-score of frequency of game play, length of game play, and number of games played was collapsed together, but normally the age when

participants first played video games is included to identify high-end gamers. In this analysis, age of first play was kept separate. Additionally, an estimate of presence or immersion in gaming, motion sickness prevalence during gaming, was included as was an estimate of game type preference. The last was identified by the mean of two questions asking about game type preference (i.e., favorite and currently playing) was calculated. The game type on this variable ranged from none to casual games (i.e., puzzle and board games), to driving/sport to role playing, and finally, action. Roughly speaking, one can argue that these fall along a line of active and absorbing (low for puzzle/board and high for action). Additionally, the higher end games on this continuum tend to be the more violent type while obviously the low-end ones are not at all violent.[2] Finally, as gaming is so confounded with gender, sex of subject was included in this analysis.

Table 2 shows a principle component factor structure from this analysis. The first and the sixth factors load only dream variables with no media variables, thus they will not be discussed. A benchmark of +/- .30 is used to interpret each factor.

	1	2	3	4	5	6	7	8	9
sex (1=M;2=F)	.103	-.722	.014	.353	.227	-.141	.041	-.141	-.014
Age of first gaming experience (hi=younger)	-.071	.738	.022	-.022	.192	.132	.083	-.128	-.240
Motion sickness during game play (hi=low)[3]	.014	-.180	-.352	-.501	-.512	-.057	.064	-.093	.226
Mean of favorite and current games played[4]	.221	-.531	.295	-.343	-.063	.139	-.112	.325	.005
Mean of z-scores for frequency, length, & number of games played	-.016	.821	.060	-.040	-.270	.141	.087	.139	-.010
Mean of audio only media (phone, radio, CD/mp3)	-.144	.164	.144	.282	-.501	-.254	.352	-.111	.244
Mean of audio and video media (TV/DVD, movie)	.168	.526	-.078	.411	.086	-.272	.016	.142	-.075
Mean of interactive media (computer/internet, video games)	-.043	.619	.267	-.060	-.088	.170	.164	.095	.322
Character sum	.721	.033	.141	.184	-.025	-.016	.036	-.135	-.114
Aggression sum	.582	.172	-.043	.138	-.184	.055	-.527	.171	.108
Friendliness sum	.524	.116	.255	-.017	.429	.414	.015	-.096	-.177
Sexuality sum	.165	.142	-.274	-.019	.177	.552	-.156	-.296	.375
Activities sum	.762	.014	-.028	.077	-.361	-.144	-.250	.088	-.055
Success sum	-.001	.093	-.037	-.404	.279	-.494	-.156	-.136	.087
Failure sum	-.224	-.146	-.132	-.065	-.181	.379	.208	.303	-.027
Misfortune sum	-.007	-.313	.666	-.127	-.109	.197	-.043	-.207	.101
Good fortune sum	.327	-.113	-.085	-.026	.206	-.105	.667	.039	.036
Emotions sum	.258	.195	.260	-.030	.250	-.188	.025	-.334	.576
Setting sum	.754	.029	-.239	-.125	-.007	.036	.221	-.081	-.110
Objects sum	.910	-.016	-.097	.016	-.117	-.166	-.056	.029	.040
Modifiers sum	.679	-.030	.042	-.220	.111	-.180	.160	.084	.025
Clarity of dream recalled	.517	-.100	-.221	-.056	-.295	.356	.228	-.341	-.170
Recent Dream self-evaluation Lucidity	-.077	.006	.242	-691	-.024	-.045	.007	-.092	-.090

Recent Dream self-evaluation Lucidity	-.077	.006	.242	-691	-.024	-.045	.007	-.092	-.090
Recent Dream self-evaluation Observer[5]	.106	.095	.594	-.130	-.085	-.130	.344	.046	-.227
Recent Dream self-evaluation Control	.075	.462	-.079	-.485	.139	-.147	-.225	.056	-.172
Recent Dream evaluation Nightmare	.127	-.004	.778	.196	-.162	.054	-.201	.022	-.004
Recent Dream self-evaluation Electronic media	.319	-.078	-.013	-.051	.304	.121	.178	.647	.362

Table 2: Principle Component Factor Analysis on Media Use and History and Dream Content Categories for Last Nights Dream

Factor 2 can be called the primary gaming factor as it loads three of the four gaming variables along with interactive media, which includes gaming, the day before the dream. Gender and audio/video media viewed prior to the dream were also above benchmark. Basically, men who are gamers and played games and/or used their computers the day before the dream (and watched TV/movies) had dreams which were coded as low in misfortune by judges and evaluated by the dreamer as high in control. As noted earlier this has been discussed in previous research by Gackenbach et al (submitted) as the protective factor that high-end gaming offers in dream. The gamer is not a victim; rather they take control of the situation. Alternatively it could be that because there is less misfortune, the dreamers/gamers perceive themselves as in control of the dream events. In any case, this low misfortune/high control combination emerges only after an intense day of interactive media in conjunction to a history of such exposure.

The third factor loaded having motion sickness during play (low presence in VR) but no day before media exposure with three dream variables: misfortune, dreamer as observer, and nightmare. Thus, those with this vestibular problem during VR reported their dreams of the previous night as nightmares which they watched and the judges agreed in that they were marked by misfortune. This factor is more about a vestibular problem than media use per se and is discussed below in terms of its relationship to dreams.

In the fourth factor, three media variables – one day before media variable; TV/movie watching; and two others, low-presence (high score on motion sickness) and liking games that were not absorbing/violent – were loaded with three dream variables: lack of success, low dream lucidity, and the lack of dream control. Gender also loaded on this factor. The marker was low lucidity followed by high motion sickness during video game play which also loaded with femaleness. These make some sense as Gackenbach, Snyder, Rokes, and Sachau (1986) found that lucid dreams are associated with vestibular integrity. Control is often associated with lucidity as well (Gackenbach and Bosveld, 1989). The lack of success in the dream could be seen as resultant from a lack of felt sense of dream awareness and control. One could argue that the passive media viewed the day before would set up this situation for those who don't have that vestibular integrity and of course they would not prefer games that are more engaging and absorbing because they would get sick. It should

be pointed out that in both factors three and four motion sickness was associated with unpleasant dreams.

A slightly different picture emerged in Factor five, which again loaded motion sickness during game play but this time with the absence of listening to audio media prior to the dream. In this case, high dream friendliness but low dream activities and viewing the dream as representing electronic media were associated with the two media variables. The low activities could be indicative of the motion sickness proneness; the more you do in VR it may increase the likelihood of getting motion sickness. Factor six had no media/dream elements loading together, thus is not of interest to this analysis.

The last three factors each loaded one media variable associated with various dream variables. Factor seven loaded listening to audio media the day before the dream with the lack of aggression, good fortune, and being an observer. This seems like a pleasant dream factor, perhaps following music listening. The eighth factor loaded preference for absorbing/violent games with failure, not much emotion, low recall clarity, and electronic media in the dream. It seems to be a media-related dream which has failure for the dreamer but not a lot of emotions and thus likely is not especially memorable. While there is not day before media loading on this factor research has shown that daily concerns also show up about a week later (Nielsen, et al., 2004), one might conjecture that dreaming about the media sets one up for failure as it's an impossible realm to emulate. Also there is some protection in that there are few emotions which would contribute to the low recall clarity of the dream. So why would a violence/absorbing game type preference be associated with this unpleasant media dream? Perhaps the failure in the face of media in the dream is about desires for the most powerful and violent type of game. In other words, the waking preference/fantasy is for power/violence and this may contrast in a dream with media where we are often passive witnesses and thus lead to failure.

The final factor is a secondary gaming factor as interactive media use including gaming, the day before the dream loaded with sexuality, emotions, and electronic media references in the dream. While two of these seem straightforward, interactive media use the day before the dream associated with media references in the dream, the high emotions and high sexuality are less obvious. Of course, if there is sexuality in a dream it is likely to result in high emotional responses. Perhaps the media based arousal through the use of interactive media before sleep led to a media dream which was sexual and emotional.

Discussion

Following a discussion of the importance of dreams for our understanding of how the brain processes information, the results of the present inquiry on media use and dreams were presented. This was investigated in two ways. First, hard-core gamer dreams from two samples were compared to dream content norms. Focus was put on hard-core gamers as their media use and absorption is among the highest in terms of its interactivity. This interactivity should increase the likelihood of media affecting dreams as research has shown that dreams most often reflect concerns of the day before (Kramer, 2007). Secondly, day before media use, low end gamers,

and self-reported evaluations of dreams were added to the mix to further examine how media use may be influencing dreams.

Previous research on hard-core gamers' dreams was replicated in several ways. Specifically, familiar yet also dead and imaginary characters showed up significantly more in both hard-core gamer samples relative to norms. Gamers scoring higher on familiar characters in dreams than the norms might come from their relatively restricted worlds. They are perhaps less likely to venture into unknown worlds and thus, less likely to meet strangers than the male norms. So too with the dead or imaginary characters finding they "actually" encounter more characters of that sort in games than norms. Thus what might seem bizarre to nongamers is actually part of gamers' day before the dream experience.

However, this bizarre element in gamers dreams was further pursued by Gackenbach and Kuruvilla (2008). They found that across a wide variety of dream elements gamers dreams were evaluated as more bizarre than nongamers'. While this can be interpreted as a straightforward reflection of waking activity, nongamers in their sample also reported high levels of bizarreness in the same dream elements as gamers. Thus an alternative explanation of higher creativity was suggested by these authors. This is a question that is currently being pursued by these researchers.

The other set of findings that were consistent across samples were a series of subscales demonstrating that the number of dreams with at least one instance of aggression, friendliness, sexuality, misfortune, and good fortune was less in gamers' dreams than in norms. The aggression and misfortune findings herein were interpreted from the work of Gackenbach and Kuruvilla (2008) who found that less threat simulation is needed in gamers' dreams because they experience it while gaming. However, the replicated lower friendliness, sexuality, and good fortune is concerning. Might the lower incidence of these three variables in gamers' dreams indicate some social problems resulting from gaming? The social interaction implications of gaming have been investigated by others with mixed results (Anderson & Dill, 2000; Durkin & Barber, 2002). Indeed, Gackenbach et al. (submitted) point out an example of how gaming might interfere with sexuality in real life, which of course could translate to dreamed life:

> I tune out everything like there's very little distractions if I'm really set into a game like my fiancée has tried to do…sounds silly but [she has] tried sexual advances on me and I'll just be oblivious to her you know, she pretty much has to get in front of me or shut off the game before I realize that she wants something.

So too the gaming single mindedness was repeatedly brought up in the Gackenbach et al study, which may have resulted in excluding family or friends.

The lack of good luck could be related to dream control. Just as they perceive themselves as in control of the dream, they may not therefore experience either misfortune or good fortune as luck, which at the heart of the good and bad fortune dream codings. Due to their daily practice in VR worlds they've learned that the outcome is not about any sort of luck but about skill (Gee, 2003).

The second set of analyses focused in on the most recent dreams, last night, from a range of people who varied in their gaming history. By examining the media use the

day before the dream and the dreamers' self-evaluation of the dream along with the judges' ratings of the dreams, media effects on dreams were better able to be viewed. The major clear finding was the gamer protection from misfortune affect noted earlier. That is, by gaming, young people may be practicing the evolutionary necessity to prepare for threat and thus not have to dream about it as much (Gackenbach and Kuruvilla, 2008). But gaming, or at least high use of interactive media the day before the dream, was also associated with sexually arousing and emotional dreams with media references. The individual difference variable of motion sickness vulnerability loaded on three factors in this analysis and was associated with some negative dream experiences as per Gackenbach et al (1986).

Previous research has found a positive relationship between the idea of awareness of dreaming while dreaming, lucidity and video game play (Gackenbach, 2006; in press). In this analysis, lucidity loaded negatively on factor four. However, if you flip the signs across the factor you see that lucidity, the marker, was associated with dream control and success. These make sense as the control lucidity association has often been cited (Gackenbach and Bosveld, 1989) and that success would result from such a combination is also not surprising. The media that were also associated with these variables were low motion sickness, which is consistent with previous work on lucidity (Gackenbach et al., 1986), and preferences for absorbing/violent games (i.e., action/adventure) but not watching audio/video media the day before the dream. While not directly linking to the broader gamer history variables to the day before game play variable, this factor when read this way does support the general lucidity/control dreams in gamers with absorbing/violent game preferences and who report presence (i.e., low motion sickness during play) during gaming. These two gamer variables point to an interpretation of lucidity emerging more as a function of attention/absorption (Preston, 1998; Blagrove & Wilkinson, 2008) than as self-reflective metacognition as has been suggested in recent formulations (Kahan, 1994).

While media effects on dreams other than direct incorporation are beginning to be understood more work needs to be done. The limits of this study are insufficient dreams to draw a firm conclusion from the Hall and Van de Castle analysis (i.e., 200 dreams from a series are preferred). The collapsing of gender into gamer categories is problematic as well as the norms are given as a function of gender. Media use needs to be opened up from type and length used the day before the dream to more sensitive indices of what specifically impacted the dreamer.

In sum, these findings support the idea that media, and especially interactive media, affect dream content both empowering the dreamer through lucidity/control and threat simulation protection but resulting in some negative effects as well. So, does electronic media exposure affect the function of dreams? Perhaps in terms of the evolutionary function of threat simulation (Revonsuom 2006) and possibly yes in terms of the problem solving function through the lucid/control factor (Barrett, 2007). In terms of emotional regulation (Kramer, 2007), there is some indication of an effect but not much in terms of emotion scores by judges. Indirectly, the lower friends and sexuality of high-end gamers relative to norms implies some emotional disconnect if not nightmares. One question that emerges from the threat simulation findings is so what is a nightmare for a hard-core gamer? We might speculate that it involves discordant personal relationships. In any case much work is yet to be done to fully

understand the effects of media on dreams and thus on the unconscious processing of information.

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Notes

[1] We would like to acknowledge the support of Grant MacEwan College and the editorial assistance of Danielle Klassen in the preparation of this manuscript.

[2] It should be noted that this ranking of game types is a very rough approximation and that increasingly games do not neatly differentiate into these classic genres.

[3] Low motion sickness reports during game play are thought to be a rough indicate of degree of immersion in the virtual reality of game play (Preston, 1998).

[4] High scores indicate more active and absorbing games. Additionally, the higher-end games on this continuum tend to be the more violent while obviously the low-end ones are not at all violent.

[5] High scores represent a third person observer role while low scores are the dreamer embodied.