Video Game Play and Consciousness Development: A Replication and Extension

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Summary. Cognitive skill improvement associated with video game play has been well documented showing a range of improved abilities from spatial skills to problem solving and general intelligence. The implications for consciousness and it's development have not been as widely examined. Recent research into the emergence of consciousness in sleep as related to video game play has suggested one consciousness development outcome, lucid dreaming. Other related consciousness experiences have been examined with less clear results. In the present study previous results are replicated and extended with an examination of flow. Specificially high-end gamers as defined by several variables, evidenced more lucid dreaming, consciousness during sleep, as well as other sleep and waking consciousness development outcomes than low-end gamers. Flow loaded positively with these consciousness experiences on a factor analysis for high-end gamers but negatively for low-end gamers. The implications for the impact of gaming on various consciousness growth indicates is discussed.

Keywords: Video Game Play; Dreams; Consciousness; Flow

1. Introduction

In previous research Gackenbach (2006) found that frequent video game players report experiencing more lucid dreams than those that do not play as frequently. This relationship was postulated based upon several lines of evidence. In the present study, in addition to a replication of the previous work, the role of psychological flow while playing video games are considered in trying to understand why playing a video game might be associated with experiences of awareness of dreaming while dreaming and other indicates of consciousness development.

The potential importance of having lucid dreams was originally based upon a transpersonal analysis (Gackenbach & Bosveld, 1989). That is, several eastern esoteric traditions speak of the importance of knowing your dreaming while the dream as a step in the process of "enlightenment" (Gackenbach & Karpen, 2007; Varela, 1997). Scientific explanations of lucid dreaming have tended to view it as a form of metacognition in sleep which requires near waking brain activity, REM sleep (LaBerge, 1990). Considerations of self awareness or self reflectiveness figure prominently in such conceptualizations (Kahan, 2001). While other research into consciousness during sleep have demonstrated that conscious awareness can also occur during deep sleep, NREM sleep and is a result of intensive meditation practice (Mason, Alexander, Travis, Gackenbach & Orme-Johnson, 1995).

Research into lucid dreams has found a variety of predictors and correlates which have been framed in a western psychological language (for a full review see Gackenbach & LaBerge, 1988). Among these are variables are some that have also been shown to be associated with video game play. These include spatial skills, such as field independence for lucid dreamers (Gackenbach, Heilman, Boyt & LaBerge, 1985) and visuo-spatial information processing for video game players (Sternberg & Preiss, 2005) and vestibular integrity for lucid dreamers (Gackenbach, Snyder, Rokes & Sachau, 1986) and less motion sickness, and thus vestibular integrity, for gamers (Preston, 1998). Finally, meditation, as a type of focused attention, has been shown to be associated with lucid dreaming (Gackenbach & Bosveld, 1989; Mason et al., 1995) and focused attention is a centerpiece of serious game play (Maynard, Subrahmanyam & Greenfield, 2005). In addition to the mutual correlates just noted it may be that the video game/lucid dreaming connection is also due to hours of practice in technologically constructed alternative realities during the day which may simply translate into accurate recognition of another artificial reality during the night, dreams.

1.1. Video Game Play and 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

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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 & Lara-Carrasco, 2007). In a review of the functions of dreaming, Hartmann (2007) notes about the function of dreams in memory consolidation:

> *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 (2006) who postulates that themes concerned with ancestral and current survival threats should be prevalent in dreams. Barrett (2007) argues 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).

Revonsuo (2006) 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 (Van den Bulck, 2004; Stickgol, Malia, Roddenberry & O'Connor, 2000; Bertolini & Nissim, 2002; Nielsen, Saucier, Stenstrom, Lara-Carrasco, & Solomonova, 2007). While these studies suggest that video game content is incorporated into dreams, it is important to consider the implications of such incorporation. So for instance, Schredle, Anders, Hellriegel and Rehm (2006) concluded that 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.

Gackenbach and colleagues have been examining the dreams of video game players. As noted earlier some of these studies examined lucid and control dreams in gamers' sleep (Gackenbach, 2006; 2008a; in press). 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 & Kuruvilla, 2008) and how gamers' game play might alter one evolutionary function of dreams, threat simulation (Gackenbach & Kuruvilla, in press). In the former study, gamer's 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 (in pres) 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. They found that individuals with a history of game play experienced fewer threat severity variables in their dreams supporting their thesis.

1.2. Video Games and Flow

Flow, conceptualized as related to psychological absorption (Csikszentmihalyi, 1988; Csikszentmihalyi, Abuhamdeh and Nakamura, 2005), is another element of consciousness which has been reported as a result of video game play (Voiskounsky, Mitina & Avetisova, 2004; Chou & Ting, 2003; Choi & Kim, 2004) and is investigated in the present inquiry. Csikszentmihalyi, Abuhamdeh and Nakamura (2005) explain that flow consists of three major components, the merging of action and awareness, a sense of control and an altered sense of time. They delineated several conditions needed to have experiences of flow: a clear set of goals; a balance between perceived challengees and perceived skills; and the presence of clear and immediate feedback.

Sherry (2004) points out that, "some might comment that Csikszentmihalyi seemed to have video games in mind when he developed the concept of flow" (p. 339). And indeed several game studies researchers have noted such a relationship. Voiskounsky, Mitina and Avetisova (2004), Chou and Ting (2003) and Choi and Kim (2004) note a positive relationship between video game play and the experience of flow. Voiskounsky et al found flow evidenced by players in a Multi-User Domain role playing game while Chou and Ting examined self reports of flow on a scale they developed among the "membership of virtual communities devoted to Internet games" (p. 666). Sherry (2004) notes that "video games possess ideal characteristics to create and maintain flow experiences …. Games that facilitate flow are likely to be adopted whereas games that don't create flow are likely to be discarded" (p. 340). The last echoes Csikszentmihalyi, Abuhamdeh and Nakamura's (2005) point regarding how flow mediates the selection of cultural artifacts.

Of concern to a transpersonal interpretation of consciousness changes in gamers are conceptualizations of flow as a type of higher states of consciousness experience. For instance, the concept of flow appears on the surface to be similar to that of the peak experience described by Maslow (Privette, 1983). In a detailed analysis of the common characteristics of peak experience, peak performance and flow,

Privette argues that there are both common characteristics as well as differences between these states. Common to all three she maintains is "absorption, attention, or clear focus. Overwhelming other senses, this perceptual set is critical to full involvement that results in superior functioning in peak performance and is perhaps equally pertinent to enjoyment and joy in flow and peak experience. Also stressed in peak performance, but present in all phenomena, is the awareness of power" (p. 1366). She adds that also shared by all three is joy, valuing and the "spontaneous, effortless, letting-be of the process and the graceful, integrated, Taoistic nature of the person in the event" (p. 1366).

To summarize the work on flow just briefly reviewed, it is an element of consciousness which has some overlap with the transpersonal concepts of peak experience. It has been widely studied in the communications literature and seems especially to be manifest with video game play.

In conclusion, there is some recent evidence for an association between video game play and lucid/control dreams. However, less clear is the relationship between other indicates of consciousness development and such game play. Thus in the present study in addition to trying to replicate the earlier results of Gackenbach (2006) of more lucid dreams and control dreams among high-end video game players, additional questions regarding consciousness experiences thought to be associated with the peak experience were included (i.e., mystical dreams). Finally a questionnaire assessing flow during video game play was administered. It is hypothesized that as previous research has shown, high-end video game players will evidence more lucid and possibly related types of dreams (i.e., control and observer) and flow than those that play less frequently. Other indicates of consciousness development while awake may or may not show such a relationship as mixed results were previously found.

2. Methods

2.1. Participants

Data of some sort was collected on 464 participants over the 5 ½ month period that the survey was online. Ages of participants ranged from 12 to 60 with an average age of 24 of which 71% were male. The average education of the research participants was two years of college. Over half, 287 of 464 respondents, listed some college major. Nineteen percent of the majors were in the social sciences with a wide range of other majors represented.

2.2. Materials

Following an informed consent participants were presented a questionnaire in seven parts in this sequence:

PART 1. Demographics
PART 2. Video Games Habits/Experiences
PART 3. Types of Video Games (not discussed herein)
PART 4. Dream Experiences
PART 5. States of Consciousness Habits/Experiences
PART 6. Structural Characteristics of Video Games Scale (not discussed herein)
PART 7. Video Game Play and Flow Scale

The first questionnaire asked for various minimal demographic information while the next part covered video game habits and experiences: frequency of playing games in terms of number of days, length of typical session, length of last session, number of different video game formats played, age when played first game, age when peak playing occurred, who play with. This was followed by several questions regarding symptoms of apparent motion during video game play. Part 3 questions asked which type of games respondents typically play.

The fourth part of the online questionnaire dealt with frequency of various dream/sleep experiences including: dream recall, lucid dreams, observer dreams, control dreams, video game dreams, nightmares, night terrors, archetypal/mystical dreams and REM paralysis. Each was briefly defined in the question. The specific questions asked about dreams are listed below. Each question was followed by a drop down menu with four response options: never, rarely, sometimes or often. The instruction read "Dream Experiences: Please make your best estimate of the frequency with which you experience each of the following." Here are the specific dream questions:

1. How often do you recall your dreams upon awakening in the morning?

2. Most of us don't realize that we are dreaming until we wake up. Some people, however, do realize that they are dreaming while still in the dream. How often do you have these lucid dreams?

3. Sometimes in a dream you are not a participant but rather you are watching the events as they unfold. How often do you have these observer dreams?

4. While in a dream how often are you able to control the dream?

5. How often do you dream about playing a video game?

6. How often do you experience nightmares? These are bizarre, irrational and disturbing that you can recall clearly and in detail upon awakening. Negative emotions are associated with this experience.

7. An experience at night where you awake in a state of panic, without recall of a dream or the memory of having awakened. This is most likely to occur in the first hour or two of the night and is called a night terror. How often do you have these experiences?

8. Occasionally people have dreams that carry a sense of importance, awe and fascination. They may be reminiscent of mythology, or fairy tales, or be felt to have a religious/spiritual significance. This type of dream may still be remembered years later. Such dreams can carry with them a deep sense of significance to one's life either on a personal level and/or on a broader level. How often do you have these dream experiences?

9. Occasionally you may wake up and realize where you are but feel unable to move. Often associated with this

partial awakening experience are feelings of fear and sense of the presence of something in the room? How often do you have these partial awakenings?

The part of the questionnaire asking about dream and waking variables was essentially the same as the one used by Gackenbach (2006). This allowed replication information to be gathered. In this study an additional question regarding dreaming about playing video games was included.

Part 5 of the questionnaire asked about states of consciousness habits and experiences. Participants were asked to indicate their frequency of experiences with prayer, meditation, out of body experiences, precognitive experiences and mystical experiences. Again each was briefly defined in the item.

The 39 item structural preferences questionnaire from Wood, Griffiths, Chappell and Davies (2004) was the sixth part of this research survey. This questionnaire was not used in the current analysis but has been written up in terms of it's association to flow during gaming and to game types (Part 3 of the questionnaire) (Gackenbach, 2008b).

The last questionnaire presented was the Video Game Play and Flow Scale from Chou and Ting (2003). Two of the seven subscales dealt with addiction while the rest were conceptualized as collecting information regarding components of flow. The addiction subscales were included in order to differentiate between video game play that may be maladaptive from that which is passionate. Sample items from the two addiction subscales include:

1. I keep returning playing cyber-games even after spending too much money on on-line fees. (addiction)

2. Playing cyber-games becomes the most meaningful activity in my life. (salience – addiction)

The flow subscales included concentration (4 items including "My attention is always highly concentrated when playing cyber-games."); playfulness (8 items including "I experience the highest relaxation when playing cyber-games."); distortion in time (3 items including "Time goes by very quickly when playing cyber-games."); telepresence (5 items including "I feel that virtual world in the cyber-games is more real than the real world."); and exploratory behavior (8 items including "Playing cyber-games make me feel like exploring a new world.").

Following the 7 parts of the questionnaire research participants were asked to play an online version of Pacman in hopes of behaviorally verifying their video game skill .

Table 2. Descriptive Statistics on Dream Variables as a Function of Video Play Group for Gackenbach (2006) and Current Study.

	Video Game Groups	Study 1a*		Study 1b		Study 2	
		N	*M* ± *SD*	N	*M* ± *SD*	N	*M* ± *SD*
Lucid Dreaming	Low	107	2.46 ± 0.77	88	2.42 ± 0.83	119	2.35 ± 0.97
	High	101	2.69 ± 0.97	86	2.44 ± 0.96	125	2.62 ± 0.90
Observer Dreaming	Low	107	2.42 ± 0.84	88	2.45 ± 0.86	119	2.22 ± 0.89
	High	101	2.42 ± 1.013	86	2.43 ± 0.78	125	2.33 ± 0.88
Control Dreaming	Low	107	2.21 ± 0.887	88	2.33 ± 0.89	119	2.07 ± 0.95
	High	101	2.46 ± 1.025	86	2.40 ± 0.86	125	2.32 ± 0.89
archetypal**	Low	-	-	88	2.07 ± 0.83	119	1.99 ± 0.94
	High	-	-	86	2.08 ± 0.91	125	2.12 ± 0.90
nightmare	Low	-	-	88	2.35 ± 0.82	119	2.10 ± 0.90
	High	-	-	86	2.01 ± 0.62	125	2.06 ± 0.79
night terror	Low	-	-	88	1.61 ± 0.82	119	1.39 ± 0.69
	High	-	-	86	1.64 ± 0.83	125	1.42 ± 0.66
REM paralysis	Low	-	-	88	1.62 ± 0.79	119	1.68 ± 0.91
	High	-	-	86	1.72 ± 0.89	125	1.76 ± 0.96
Video Game Dreams	Low	-	-	-	-	119	1.28 ± 0.52
	High	-	-	-	-	125	2.10 ± 0.95

Note. *Study 1 is data from Gackenbach (2006) with "a" representing the in class data while "b" represents the online data. More dream information was gathered online than in class. Study 2 is the current research data.
** The item wording was the same in all studies as in the method section herein, the label differed in the write-ups calling this dream description either an archetypal or mystical dream

2.3. Design and Procedure

Links to the research questionnaire were listed on seven Internet sites designed for psychological research solicitation. The study was listed on November 21, 2005 and removed on April 30, 2006. Sites listed from a dozen to several hundred psychology experiments often under a variety of headings. Five of the seven listings were with general psychology experiment sites while there were two specialty listings: one for video game research and one for dream research.

The research questionnaires and game were mounted on the first author's website with all research participation links going directly to the research itself. After completing the Pacman game the research participants were presented with a debriefing statement.

The four judges received forms to record their decision (male or female). In addition, the judges were asked to estimate their subjective confidence in each decision on a four-point scale (0 = very low confidence, 1 = low confidence, 2 = moderate confidence, 3 = high confidence).

3. Results

As in the previous study video game groups were defined by largely the same variables. These included frequency of play, length of typical play session, age begun play with high scores given to younger starts, number of types of games played, length of last video game played and age of peak frequency of video game play (younger ages scored higher). As well as with the previous study, the video game playing variables were first converted to z scores and then summed. This score was then split into thirds, creating low, medium and high video game playing groups. Group difference calculations on all dependent variables compared high versus low video game play groups.

The high video game play group reported playing more frequently, started younger, played more games of different formats and played longer typically and in their last session than the low video game play group. Interestingly both groups peaked in their video game play at about the same time no matter how old they were when they started. There were about the same number of men and women in the low end gaming group (N = 131; Males = 63; Females = 68) but in the high end gaming group (N = 132) there were considerably more men (112) then women (20). Needless to say this distribution of research participants by sex and video game group was significant ($\chi^2(1) = 39.90$; $p < .0001$). While the low end group was significantly older (mean age = 25.26) than the high end gamers (mean age = 22.22; $t(261) = 3.40$, $p < .001$) both groups were on the average in their 20's.

3.1. Dream and Waking Variables: Replication

Analyses of covariance with dream recall, motion sickness sum and sex as covariates were calculated on all of the dream variables. High video game players in this group reported significantly more lucid, control and video game dreams [Lucid: $F(1,239) = 6.548$, $p = .011$, $\eta^2 = .027$; Control: $F(1,239) = 5.561$, $p = .019$, $\eta^2 = .023$; video game: $F(1,239) = 57.572$, $p < .0001$), $\eta^2 = .194$] than the low video game playing group. Also of interest are the lack of group differences in the three negative dream type questions, i.e., nightmares, night terrors and REM paralysis). Nor was there a gamer type group difference in the mystical or observer dream types. Descriptive statistics from the original study (Gackenbach, 2006) and the current study are given in Table 1.

As in previous research the same waking variables were also

Table 2. High Video Game Players Principle Component Analyses on All Consciousness Variables.

Variable/factor number	**1**	**2**	**3**	**4**	**5**
Explained variance	**21.499**	**13.074**	**9.847**	**7.634**	**7.117**
Dream Recall	.465	-.164	.142	.180	-.375
Lucid Dreams	.544	-.177	.092	.302	-.364
Observer Dreams	.403	-.399	-.225	-.392	-.079
Control Dreams	.419	-.074	.425	.235	-.358
Video Game Dreams	.466	.131	.213	.065	.047
Mystical Dreams	.718	-.061	-.188	-.166	.182
Nightmares	.348	-.403	.507	.074	.166
Night Terrors	.455	-.232	.457	-.223	.519
REM Paralysis	.523	-.330	.106	-.361	-.113
Prayer	.034	-.154	.026	.642	.573
Meditation	.404	-.054	-.366	.349	-.080
Out of Body Experiences	.431	-.007	-.501	.251	-.001
Precognitive Experiences	.553	.080	-.465	-.231	.164
Mystical Waking Exp.	.576	.227	-.250	.117	.149
Mean of 2 Addict Flow Subs	.366	.851	.249	-.042	.046
Mean of 5 Flow Subscales	.367	.845	.178	-.081	-.037

Table 3. Low Video Game Players Principle Component Analyses on All Consciousness Variables.

Variable/factor number	**1**	**2**	**3**	**4**
Explained variance	**30.184**	**12.567**	**9.553**	**6.771**
Dream Recall	.777	-.208	-.035	.047
Lucid Dreams	.769	-.045	-.104	.072
Observer Dreams	.581	-.052	.178	.515
Control Dreams	.636	.042	.138	.239
Video Game Dreams	.244	.258	.251	.590
Mystical Dreams	.614	.170	.132	-.041
Nightmares	.620	.072	-.550	-.069
Night Terrors	.378	.476	-.567	.022
REM Paralysis	.502	.332	-.492	-.203
Prayer	.513	-.101	.241	-.225
Meditation	.491	.224	.444	-.345
Out of Body Experiences	.272	.521	.054	.184
Precognitive Experiences	.354	.419	.166	-.182
Mystical Waking Exp.	.492	.252	.474	-.340
Mean of 2 Addict Flow Subscales	-.638	.670	.039	.066
Mean of 5 Flow Subscales	-.568	.710	.083	.031

analyzed but in this case, unlike before, some of these variables showed group differences. With motion sickness sum and sex of subject as covariates, the three waking variables reached or approached conventional levels of significance [prayer: $F(1,236) = 4.429$, $p = .036$, $\eta^2 = .018$; precognitive experiences: $F(1,236) = 8.86$, $p = .003$, $\eta^2 = .036$; out of body experiences [OBE]: $F(1,236) = 2.838$, $p = .093$, $\eta^2 = .012$]. These findings might be said to point to the relative religious traditionalism of the low video game playing group as they reported praying more than the highs while the highs reported more precognitive experiences and OBE's. These experiences might be thought to be associated with a more spiritual or nonsecular rather than formal religious perspective.

3.2. Video Game Flow

As noted earlier the Flow and Video Game Play Scale was from Chou and Ting (2003) and has 6 subscales dealing with flow and two with addiction. To examine the overall findings with this scale, the same video game group analyses of covariance were calculated on subscale scores with motion sickness as the covariate. In this case sex was an independent variable rather than a covariate even though there were only 18 women in the high video game playing group. Both the addiction subscale sum and the pure flow subscale sum there was a main effect for sex of subject (addiction: $F(1,201) = 5.104$, $p < .025$, $\eta^2 = .025$; pure flow: $F(1,201) = 6.884$, $p < .01$, $\eta^2 = .033$). Males reported more flow during gaming than females. There were no main effects or interactions with gamer group. Thus this experience of flow during gaming may be more about gender roles than about gaming per sec. Gaming is a big part of young men's culture and it's overwhelmingly seen as positive and fun thus the higher flow scores. This concept of gaming is not prevalent among young female culture. These sorts of gender differences are widely reported in the gaming literature (Farley Gillespie & Gackenbach, 2007).

3.3. Gaming, Dreams and Flow

In order to understand relationship of flow to the dream and waking consciousness variables separate factor analyses were calculated for the low and high video game play groups. The analyses were done separately for the two gamer groups because of the very different clusters of consciousness type variables that emerged relative to entering gaming group as a variable in the analysis. The point here in is to talk about gaming history implications for waking and dreaming consciousness and thus separate factor analyses were thought justified. A Principal Component Factor Analysis with eigenvalues of 1.0 as the cut off for a factors inclusion was used in order to see how these diverse variables might cluster. A point .3 cutoff for interpretation of a variable on a factor was used in order to examine more components of each factor.

Loaded on these analyses were all the dream and waking consciousness variables as well as the mean of the two addiction subscales and the mean of the 6 flow subscales. These mean scores were used rather than the flow subscale scores because when the subscale scores were loaded they constituted a separate factor with no connection to the other variables of interest. But when the total mean's of the two types of subscales were used a relationship to the other consciousness variables emerged which was quite distinct for each group of game players. Tables 2 and 3 depict the

high game players' factor analysis (Table 2) and the low game players' factor analysis (Table 3). Both analyses were done on the same set of variables.

The striking finding here is that just about all the sleep and waking consciousness variables loaded together on the first factor in these two principle component analyses but in the opposite direction for flow as a function of gamer group. Specifically, flow was positively associated with all but one variable (prayer) for high gamers but negatively associated with all but two variables (video game dreams and OBE's) for low gamers. A positive association between flow and some sleep/wake consciousness variables was found on the second factor for low gamers but it seemed to characterize scary experiences (night terrors, REM paralysis, OBE's and precognitive experiences). While for the high gamers principle component analysis, high flow was associated on the second factor with the lack of two of these scary type variables (nightmares and REM paralysis) as well as the lack of an observer perspective in dreams. Thus on both the first and second factors high and low gamers evidenced the opposite relationship between flow and sleep/waking consciousness variables. The remaining factors in both principle component analyses did not show a flow association.

4. Discussion

The present study was a further exploration of the thesis that there is a relationship between playing video games and variables related to consciousness development. An additional consciousness variable closely related to game play was added, flow during game play. In this inquiry video game groups were defined with the same procedure of Gackenbach (2006) by considering a variety of game playing variables. High and Low groups were identified and the middle group was discarded from subsequent analyses. A variety of questions about sleep and waking experiences thought to be associated with the development of consciousness (Hunt, 1995) were inquired about as with the first study. The results with the dream/sleep experiences will be taken up first followed by those regarding the waking experiences and finally the flow scale results.

4.1. Dream Variable Differences

Of the dream type variables, high video game players defined by a variety of elements, reported more frequency of lucid, control and video game dreams than low video game players. The higher incidence of video game dreams is consistent with research looking at video game play becoming incorporated into dreams by Van den Bulck (2004), Stickgold et al. (2000) and Bertolini and Nissim (2002). The group difference finding herein is consistent with the face to face data collected a year earlier by Gackenbach (2006) and later online from college students (Gackenbach, in press), high gamers reported more lucid and control dreams than the lows.

There was a nightmare difference between the two samples. The high gamer group a year ago reported fewer nightmares than the low or medium gamer groups. In the current study there were no group differences in nightmare reports. So too, in more recent data Gackenbach and Kuruvilla (2007) reported that there was no association between nightmares and game play. While intensive interviews with hard core gamers about their dreams showed fewer misfortunes, a primary characteristic of nightmares, among these gamers dreams than for the scale norms (Gackenbach, Zederayko, Kuruvilla, & Olischefski, 2007). Relatedly, Schredle et al. (2008) reported no incorporation of video games into nightmares of 11 to 13 year olds. We can conclude from these studies, including the present one, that high end gamers have the same or fewer nightmares than low end gamers

4.2. Waking Consciousness Variables

Group differences on the various consciousness variables were also examined. In the previous study (Gackenbach, 2006) prayer, meditation, out-of-body experiences, precognitive experiences and mystical experiences were examined with gamer groups reporting no differences except for meditation where high gamers reported more interest. In this study the waking consciousness variables showed a different pattern. The high end gamers reported less prayer but more OBE's and precognitive experiences than the low end gamers.

It may be that absorption offers an explanatory construct. Funk, Buchman and Jenks (2003) point out that although absorption in computer game play is often reported, it is seldom studied. Although Wood, Griffiths, Chappell and Davies (2004) found that rapid absorption into games was rated as highly important by gamers. Psychological absorption in gaming has been examined by Glicksohn and Avnon (1997), who found that some of their subjects reported experiences during video game play indicative of altered states of consciousness (e.g., drifting, flying or changes in visual or auditory perception). These subjects also showed significant increases in absorption associated with video game play relative to subjects who did not report such consciousness alterations during video game play. Preston (1998) reviewed the research on absorption and VR immersion, which is most commonly experienced in video game play, concluding that those that score high on psychological absorption:

> *evaluate information in a distinct way that links it to self. This strongly implies that, regarding vision, audition, touch and balance, information to more modalities increases absorption. Multimodal stimulation creates a greater sense of presence in immersive VR. Immersive VR has the potential to offer low absorbers access to altered states of consciousness like those which high absorbers experience and also has the potential to offer to us all access to a higher level of consciousness (p. 285).*

Relatedly, Gow, Lang and Chant (2004) found that believers in paranormal experiences tended to be high in absorption. Although Makasovski and Irwin (1999) report no such association, Hunt (1995) has argued that absorption is central to the emergence of such experiences of consciousness associated with its development. In 27 interviews with high end gamers Gackenbach et al. (2007) reported that absorption was one of the most spoken of experiences of gamers. So too Gackenbach (2007) found high scores on the Tellegren Absorption Scale to be associated with reports of recent game play. In this study as well, dreams of the night before were gathered and these results seem to indicate that absorption, lucid/control dreams and video game play are associated. Thus while this study relative to the Gackenbach (2006) study resulted in mixed pattern of results, in

both cases some experiences associated with conscious development showed gamer group differences. While the exact pattern of these results, sans the lucid/control dream finding, is unclear what is clear is that heavy exposure to VR and thus experiencing absorption may offer an explanatory mechanism.

4.3. Video Game Flow

Absorption is of course a central component of flow which is an additional consciousness variable examined in this study. The reason for this was that in the Gackenbach (2006) study most of the waking consciousness variables showed no group differences and the mystical experiences scale also showed no group difference. The thinking was that perhaps if consciousness alterations experiences were couched in gaming terms and settings then any alterations in consciousness would be more evidenced. Several studies (Voiskounsky, Mitina & Avetisova, 2004; Chou & Ting, 2003; Choi & Kim, 2004) have already demonstrated a flow and gaming association, thus one was expected here as well.

However, contrary to expectation all but one of the flow subscales showed no gamer group differences nor did the sum of addiction subscales or nonaddiction subscales sum show such a difference. Gender was more powerful in accounting for flow experiences with males of both high and low gamer groups reporting more flow. This suggests a gender role affect such that gaming is fun and thus produces flow for men as part of their role more so than as a function of actual playing experience. While for women, this script of gaming as fun and thus ok is not generally accepted and thus the lower flow scores no matter the level of gaming. Sherry (2004) also took up the question of gender suggesting that it was an important individual difference variable when considering flow and gaming.

The relationship between flow and the other consciousness variables for each video game group were then examined. To this end separate factor analysis were computed on the various consciousness variables with flow entered two ways, addiction and flow subscale means. High gamers reported a positive association between flow during gaming and dream/waking consciousness variables, low gamers reported the opposite effect. In their case less flow during gaming was associated with more of the various dream/waking consciousness experiences. It's important to keep in mind that absolute levels of flow in gaming did not differ across gamer group. Thus the differential association to other consciousness variables is not simply reducible to liking or not liking gaming. Flow has been reported as a transformative practice (Galloway, 2005). Perhaps this is beginning to happen with today's young video game players and may broaden as more play, start younger and experience more VR immersion.

In conclusion, this study further explored the notion that video game play may be associated with the development of consciousness. It is important to keep in mind that video game play is only one of a variety of electronic media that today's youth are regularly immersed in (Farley Gillespie and Gackenbach, 2007). It may be that video game play is but the tip of an iceberg of these consciousness development effects as it represents the most immersive virtual reality but not the only one. In fact, Gackenbach (in press) found for dreams reported from the night before from well rested subjects, that high electronic media use the day before the dream, but especially video game play, were associated with lucid/control dreams. Thus it may be, as argued by Gackenbach (2008a), that video game play and other electronic media immersion, is another of various amplifiers of consciousness along with drugs, dream recall, enhanced self awareness and meditation.

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