The continuity vs. discontinuity hypotheses: A consideration of issues for coding video game incorporation

Commentary on "The continuity and discontinuity between waking and dreaming: A Dialogue between Michael Schredl and Allan Hobson concerning the adequacy and completeness of these notions"

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Summary. In response to the discussion between Hobson and Schredl, the history of our program of research for coding dreams of video game players both after playing a game and without such consideration, was reviewed. While many of our studies are about response style in dreams resulting from game play, we also have considered incorporation issues. Some of our previous results seemed to favour the continuity hypothesis, while others favoured the discontinuity perspective. Two approaches to coding gamers' dreams were considered and critiqued. Some of these problems were then taken up in a compilation of data from three previous research studies where games were played the day before a dream and dream information was gathered. The 182 dreams were categorized into three groups, no game incorporation, partial game incorporation, and full game incorporation (i.e., the dream is the game). Individual difference and game content variables were unrelated to incorporation into subsequent dreams. However, this classification of dreams did result in various content differences.

Keywords: Video games; continuity; discontinuity; incorporation; dreams; content analysis

The discussion between Hobson and Schredl (2011) regarding the viability of the continuity versus discontinuity hypothesis is considered herein from the perspective of the waking experience of video game play and its impact on subsequent dreams. While both dream researchers agree that there may be both continuous and discontinuous dream elements, the dream community, clinical and research, seem to be leaning towards a continuity conclusion. This is justified if one considers that while content analysis systems may fall short in raw count of actual continuous information from waking to sleep, when full access to a dreamers memory and experience base is available, i.e. as in clinical treatment or in first person dream diary accounts, then the apparently discontinuous elements can often be traced through the dreamers memory/semantic networks to include much more of the dream. A wide range of evidence has supported the continuity hypothesis of dream content. Events, personality, and pathology (Schredl & Hofmann, 2003) have all been demonstrated to show a waking to dreaming influence. Thus it seems that an inherent shortcoming of most dream content analysis systems that researchers use is the lack of rich connective associations that presumably only the dreamer can provide. But this is only one of various shortcomings with dream content analyses systems in addressing the continuity-discontinuity issue.

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A case in point of the limits of some dream content analysis systems is in our program of inquiry into the dreams of video game players. Historically, in the sleep and dream literature a related media experience, films, has been used as a presleep stimuli. They have been considered to be an easily controlled and an impactful pre-sleep event which allowed fairly easy evidence for dream incorporation and thus the continuity hypothesis. Films have been used to investigate stress, aggression (Foulkes & Rechtschaffen, 1964), dream intensity (Foulkes, Pivik, Steadman, Spear, & Symonds, 1967), sound incorporation (deKoninck & Koulack, 1975) and dream lag effects (Powell, Nielsen, Cheung, & Cervenka, 1995; Nielsen, Kuiken, Alain, Stenstrom, & Powell, 2004). The advantage of a film is it allows pre-sleep controlled manipulation in order to investigate incorporation questions.

As our media landscape is changing, so too are our opportunities to use media while awake to investigate issues of dream incorporation. The problem with film, television or radio is that they are all unidirectionally presented, or 'pushed' at the passive viewer. In real life we are not passive viewers, but active participants. This active participatory element is captured in computer use and video game play. It is increasingly being incorporated into previously push media in forms such as viewer call-ins or online voting. While these early efforts at a push/pull media approach increase audience engagement, they pale in contrast to video game play, where the entire experience can be almost completely interactive. Thus video game play offers an ideal pre-sleep stimulus to further investigate the continuity hypothesis.

Stickgold, Hobson, Fosse and Fosse (2001) used the method of pre-sleep video game play to investigate if episodic memories transitioned from waking to sleep. Isolated

elements of the video game Tetris were incorporated early in the sleep cycle, but nothing appeared about the context of playing the game (i.e., computer, keyboard). They concluded that the lack of context cues in subsequent dreams argues that the incorporation was not episodic. This study demonstrated the usefulness of video game play to investigate dream incorporation factors. In a later study from this same laboratory (Wamsley, Perry, Djonlagic, Babkes Reaven, & Stickgold, 2010), they used an arcade type video game in which the individual is downhill skiing, and examined its impact on sleep mentation. They found that 30% of verbal reports after various sleep lengths were related to the video game and concluded that, "the nature of this cognitive 'replay' effect was altered with increasing durations of sleep, becoming more abstracted from the original experience as time into sleep increased." (p. 59).

However, it is important to keep in mind that video games are not only a potential independent variable to be manipulated pre-sleep, but that because they are increasingly pervasive in today's youth and young adult culture, broader questions of their impact on dreams need also to be considered. The video game playing history of all potential research participants in any study where video gaming is manipulated as a pre-sleep stimulus should be taken into account. As Preston (1998, 2007) presaged, wide exposure to virtual reality (VR) environments will allow individuals who are not able to become deeply absorbed constitutionally to have experiences of altered states of consciousness.

Dreams are but one of a series of "imaginal" realms, or alerted states of consciousness, that have important implications for consciousness and its development. Hobson (2009) argues that REM sleep may be the fertile field upon which consciousness grows and that the phenomenal experience of REM sleep, dreams, thus are filled with all potential experiences (i.e., discontinuous from waking). Of course everyone experiences REM sleep. But other imaginal experiences may serve this function as well. For instance, Mason and Orme-Johnson (2010) has shown that the practice of meditation has profound effects on sleep EEG and on dream content as predicted by Hunt (1991).

Another deeply absorbing state that is much more widely practiced is the play of video games. This imaginal realm and its compelling playability is also affecting dreams. To be fair any compelling life experience informs subsequent dreams (Schredl & Hofmann, 2003). The difference is the wide spread use of games. Entertainment Software Ratings Board (ESRB) estimates 65% of all American households now have video game units as do virtually all cell phones.
The long term effects of video gaming have been the focus of inquiry in a series of studies by Gackenbach and colleagues and are summarized in Gackenbach (in press) and in Gackenbach, Kuruvilla, Dopko and Le (2010). Thus far we have found that like meditators, video gamers report more lucid and control dreams (Gackenbach, 2006; 2009a). Such dreams are transition sleep states between REM and waking according to recent research (Hobson, 2009). These dream qualities allow for conflict resolution in the dream. It is possible that video games fulfill the threat simulation role of REM sleep which can be argued supports the discontinuity function (Gackenbach & Kuruvilla, 2008a; Gackenbach, Hill, & Ellerman, 2011). Our lab also reported increased bizarreness in video gamers' dreams which we argued was not associated with day before the dream media exposure (Gackenbach, Kuruvilla, & Dopko, 2009). Additionally, we found an association between video gaming, dream bizarreness and creativity (Gackenbach & Dopko, 2011) controlled for amount of day before the dream game play. This bizarreness finding was associated with history of game play and supports the continuity hypothesis.

Our work implies that gaming may create a response style which was learned in waking VR and has generalized to sleep. One example is the self reported lucidity of gamers but especially and stronger is their self reported accomplishments of dream control. The adaptiveness of these alternative game based response styles is also illustrated in Gackenbach, Hill, and Ellerman's (2011) study. While specific game content may or may not have been incorporated into these soldiers dreams, the response of the high end gaming group to war threat in their dreams was empowered and adaptive relative to soldiers who rarely gamed. The point is that while incorporation of games into dreams is important when considering the continuity-discontinuity hypotheses, there may still be broader based effects on dreams which are important and potentially have real world consequences.

But to return to the continuity-discontinuity discussion, our work seems to support both continuity (Gackenbach, Sample, Mandel, & Tomashewsky, 2011; Gackenbach, Rosie, Bown, & Sample, 2011; Gackenbach, Kuruvilla, & Dopko, 2009) as well as for discontinuity (Gackenbach & Kuruvilla, 2008a; Gackenbach, Hill, & Ellerman, 2011). Thus it becomes important to consider how are game influences coded in dreams. There are two questions when considering the relevance of coding for video games. The first is what presleep gaming elements might be associated with later dream incorporation and the second, how does one code for game elements in dreams that may be different than what normal dream coding systems allow?

Video Game Presleep Elements Potentially Predicting Incorporation

We have considered various types of pre-sleep gaming related information. This includes most often, individual differences in gaming history, such as frequency of play, length of play, number of games played, and age begun play. However, in some studies we also considered susceptibility to motion sickness, history of dream recall, gender, mediation/prayer history among other individual difference variables (see Gackenbach, in press for a review). We will next review some of the game and dream content analysis issues that can arise when considering game incorporation. These considerations are not comprehensive but they are ones that we bring new empirical evidence to bear upon later in this paper.

The obvious starting point when examining more than one game prior to sleep is type of game. Indeed, we are most often asked what games produce specific dream effects. Since there are literally thousands of games we have considered game genre in some of our work. Genre is a term used to categorize things by a loose set of criteria. It is widely used in the literary world and media studies but tends to have no fixed boundaries. Genre applied to video games has a fundamental difference from other media applications. Specifically, video game genre's have developed along the lines of the nature of the interactions rather than visual or auditory differences (Apperley, 2006). Unlike literary genre's, a video game genre is independent of its game play content

(Adams & Rollings, 2006). Thus a first person shooter set in the wild west is comparable to one set in the far future. This categorization of game genres allows for comparisons across genres. Game genre has been used to look at game motivation (Tanis and Jansz, 2008), addiction (Huh, 2008) and cognitive load (Gackenbach & Rosie, 2009). Additionally, conceptual associations between genre and presence have been made (McMahan, 2003; Gackenbach & Bown, 2011). In the gaming world (i.e. gamespot.com) genre's are increasingly being subdivided into more specific types. Thus Halo 3 is not identified as only a "first person shooter" but as a "science fiction first person shooter". These subtler differentiations are becoming increasingly common, so much so that there are now over 100 genre used in gamespot.com. Indeed the entire issue of the relevance of genre to understanding the video game experience is under serious consideration in the game studies literature (Clearwater, 2011). Despite these qualifications, as in the meditation literature, where it has become increasingly clear that you cannot lump all types of meditation together, so too in the gaming literature there is typically a lot of care placed on what game is being considered or at least what genre. In our laboratory we have increasingly collected information on what genre of game is either preferred, most frequently played or was last played (Gackenbach & Bown, 2011).

There are two additional generic concepts related to video game content, which may inform game incorporation into dreams. These are cognitive load and emotional intensity. Easily available to researchers are the Entertainment Software Rating Board (ESRB) rating categories for video games. These can be adapted to dream content analysis for games. The ESRB categorizes games along dimensions of concern to parents regarding what their children would be exposed to when playing a specific video game. But it also allows consumers to be informed about the content of what they are considering purchasing. There are seven ratings categories: Early Childhood, Everyone, Everyone 10+, Teen, Mature, Adults Only and Rating Pending. The categories assigned to each game by the ESRB are based on the degree to which the game includes elements which are thought to be problematic for children to be exposed to, and thus often emotionally evocative. Here are some examples of these content descriptors:

- Fantasy Violence: Violent actions of a fantasy nature, involving human or non-human characters in situations easily distinguishable from real life
- Intense Violence: Graphic and realistic-looking depictions of physical conflict. May involve extreme and/or realistic blood, gore, weapons and depictions of human injury and death
- Sexual Themes: References to sex or sexuality
- Strong Sexual Content: Explicit and/or frequent depictions of sexual behavior, possibly including nudity
- Use of Drugs: The consumption or use of illegal drugs

Because games with these elements may be emotionally evocative, they may be indicative of what games or game elements are more likely to be incorporated into dreams. Therefore the ESRB information on games may be useful in determining which games or genre of games are more likely to result in dream incorporation. The ESRB website has a search tool to find out how a game is rated. Thus Halo 3 is rated Mature with blood, gore, mild language and violence.

Cognitive load is not easily obtained from the video game industry as genre and ESRB ratings are, thus the cognitive model of Das (2002) identifying planning, attention-arousal, simultaneous and successive cognitive processing (PASS) was adapted for our program of inquiry. Johnson (2008) has shown a relationship between subscales on the PASS and frequent internet use. She found "insignificant differences in cognitive processing were most apparent between students who reported frequent and infrequent recreational use of the Internet (e.g., dating, downloading music and videos, playing games)" (p. 2098-2099). However, her finding may be in part due to the nature of her sample which was 72% female who reported (70 to 82%) never playing video games. Indeed, Bowman and Boyan (2008) report cognitive skill as related to game play, which was supported by Sherry, Rosaen, Bowman, and Huh (2006). In any case the PASS model was adapted to video games and the categories are listed below (Gackenbach & Rosie, 2009):

1. Planning: An example would be the strategic pairing of units in a real time strategy game, matching complementary classes in an MMORPG or RPG, or picking plays that complement your team in a sports game.
2. Attention: How much attention did the game require in order to be successful and to enjoy the game (i.e.: did you have to pay attention to only one thing, multiple things, successive things etc.)?
3. Physiological Arousal (i.e. increases in heart rate, breath rate, blood pressure): An example would be heart rate increasing during a fighting game, a close Player vs. Player fight in an MMORPG, or a shootout in a hockey game.
4. Simultaneous Processing: An example would be controlling units on multiple battle fronts in a real time strategy, changing lines during play in a hockey game, or healing your party and attacking enemies in an MMORPG or RPG (can involve multiple senses; sight, hearing etc.).
5. Successive Processing: An example would be inputting a complex sequence of buttons into the controller to get your fighter to initiate a powerful combo in a fighting game, waiting for an event to occur to allow you to successfully initiate an action in an MMORPG or RPG, or correctly manipulating 7 steps in sequence in order to finish a puzzle.

The perception of the cognitive load of many games were identified by over 1000 video game players who were asked to evaluate three games each (Gackenbach & Rosie, 2009). The reason we pursued this line of inquiry was because such cognitive load information is not available about video games, unlike genre where there seem to be clear definitions emerging. Thus we have created an information base of the cognitive load of specific games, which we can draw upon in our work on dream content analysis of video game players dreams. In summary, game information (genre of game, cognitive load of game and ESRB rating) can be culled and matched with comparable dream information coded with a content analysis system.

Coding for Video Games in Dreams

While the above considerations have been used in our program of inquiry in order identify what presleep gaming

information might predict incorporation, another problem emerged as we moved down this path of dream content analysis of video game players. We have used a variety of dream content analysis systems in our laboratory. These include examinations of, threat simulation (Gackenbach & Kuruvilla, 2008a), bizarreness (Gackenbach, Kuruvilla, & Dopko, 2009), lucidity/control (Gackenbach, 2006; 2009a), war content (Gackenbach, Hill, & Ellerman, 2011) and broad dream content analysis by judges using the Hall and VandeCastle system (Gackenbach & Kuruvilla, 2008b; Gackenbach, 2009b). The central problem with all these systems is that they do not allow for virtual worlds to be coded in dreams. Most were developed before the widespread use of virtual type technologies so it's not surprising that this element is missing.

Here is an example with the content analysis of lucid/control dreams (Gackenbach & Hunt, 2010). This is a dream from a male hard core gamer, who had played from 4 to 7 hours the day before this dream. The games he had played were first person shooters including Half-Life 2 and Halo 3. It should be kept in mind that what is interesting about the first person point of view (POV) games is that they do not always allow a third person perspective. However, the real self is actually in third person while playing a first person shooter and thus hours of being in that perspective may have helped to mediate this dream.

I was in a desert. I looked bad, dusty. I saw my tiny silhouette against a large sun, meaning I was watching myself, in 3rd person. While I looked bad I didn't feel bad. I was indifferent to the "my" feelings. I came upon a carnival, but it gets sketchy at that point. Eventually I'm driving a car, again not at a real POV (point of view), but following behind the car. It didn't matter to me that I was crashing into other cars or walls. My car caught fire, I saw it melt from within. I died not trying to escape. (Subject #27)

This gamer went on to report an interesting detachment from the dream events when filling out the Metacognition, Affect, Cognitive Experiences (MACE) questionnaire (Kahan, 2001) as a follow-up to the subjects dream report:

As the car was burning I opened the door and leaned out to leave but made the decision to stay inside instead because I was curious to see what I would look like burning alive. While I felt the heat, smelt the smoke, I didn't feel any pain. I felt detached from the feelings, but recognized that they were my own.

He also reported that it was not a nightmare, he was not scared, but that the dream was violent. Finally, he reported that the dream was not lucid and that he had no control over it. At first glance this seemed odd. Our judges thought that certainly he must have known or suspected it was a dream? When asked "did you feel any emotions during the experiences?" he commented:

Sort of. I knew what the person I saw as myself felt, but didn't share those feelings. Throughout the emotions of disgust, loneliness, or excitement were all ones I thought best fit the "character" of myself based on the situation.

Then he was asked "Did you think about what you were doing?" and he wrote:

I was constantly thinking about my every move, making sure that whatever I did was in my best interest. If anything was off-putting (the carnival owner, the desert) I simply moved on.

Then he replied to this question "Did you think about what was happening around you?" by saying:

I was constantly analyzing my surroundings... At the city where I drove my car, I noticed the simplicity of the environment, which seemed to be constructed out of simple polygons.

With this final comment it became clear that he thought he was in a video game environment while in the dream. He did not think it was real, thus his remarkable choices, but nor did he recognize that it was a dream. This sort of game within a dream presents a tricky question as just identifying if a dream is lucid can be challenging for researchers, no less when you add the dimension of virtual worlds represented in dreams.

Virtual Worlds in Dreams Coding with the Hall and VandeCastle Scale

This section is an analysis, in part by one of our coders (i.e., Coder A) who was trained on the Hall and VandeCastle (JH-VDC) dream content analysis scale (Hall and VandeCastle, 1966), as articulated by Domhoff (1996), regarding the problems he encountered when coding a video game players dreams from a long series (Gackenbach, Sample, Mandel, & Tomashewsky, 2011). Coder A is a lifelong serious gamer thus he brings that expertise to bear on his observations of virtual worlds in dreams.

Of the 131 Dreams that Coder A coded, a subset (n=23) of dreams had the largest instance of virtual environments. This group of dreams was compiled by the dreamer into a set that had a major theme of video games present in the dreams. We will now examine some of the subscales of the HVDC coding system used and how the presence of a virtual environment inside of a dream is problematic for proper HVDC coding.

Characters

When coding for characters the judge needs to select from a number of discriminators in order to properly label the existence of a character in the dream. While the system has no problem stating the existence of a character, it does not properly allow for virtual characters or a virtual relationship to the dreamer. What this means is that the coding system does not allow a dream character to flip in and out of a game character. So in the burning to death dream there was a dual perspective of self with one being in a game and the other watching the game unfold.

Another problem is when controlling a virtual character in virtual space, which is the essential game play experience. Take dream 2-114 for example:

I'm playing a Metroid game and I enter a chamber filled with red lava below. There was an area above that I needed to get to but couldn't. The lava below lowered with time. I recall deliberately jumping in. In 2 replays of this area, I went in the deep lava and sunk more than 2 screens in it. I "swam" in it by jumping repeatedly. I once got close to my intended area, just 80 pixels short (I could see the top with 32 px of extra space.).

While the dreamer does not say anything in particular about actually using a character, it can easily be inferred by the simple fact that he is using an imaginary character inside

the Metroid game. The apparent problem is that while the dreamer is using a character in the videogame there is no way to properly code for the use of the virtual character. In fact, the virtual character would not even be coded using HVDC since the dreamer did not provide details about who or what is being controlled in the video game.

The inability to separate the dreamer from the virtual world may adversely affect the results of the data because the dreamer is now being coded as if they are physically acting in the video game. While one could argue that perceptually the sense of self is transferred to the game avatar (Blascovich & Bailenson, 2011), there are also instances where physical and virtual selves coexist in waking reality while gaming, thus why not in subsequent dreams.

Activities

The activities section of coding classifies what a character does in a dream. As was discussed above, when a virtual world, such as a video game, is present inside of a dream the activities of the dreamer can be, he is playing a game, or she is in a game. In the former case the dreamer is controlling a virtual character in the game, which is participation in different activities. The dreamer often refers to this virtual character in the first person which skews the results from an analysis of the dreamer to an analysis of a video game character. Taking a piece from dream 2-114, "I went in the deep lava" would be coded as though the dreamer was moving into the lava. While the Hall and Van De Castle's system of dream coding does not code for the danger of the objects present in the dream, moving into the lava could be viewed as an attempt for the dreamer to harm himself and coded under the social interaction - aggression category. This apparent self harm was brought home in the letting the "self" burn to death dream also discussed. However, in that case there were two dream egos. The player of a game who watched events unfold and the avatar in the game, who was also clearly himself and who burned to death. If the dream ego stays as one self-character then the problem could be fairly easily rectified by describing in the activities category when a character assumes control of a virtual character. If this relationship is acknowledged in coding then where the dream character is the character taking virtual control of the virtual character then any following actions by the dreamer, while they control the virtual character, are coded normally through the virtual character. It is easy to think of this in terms of a transfer of consciousness from one character to another. In the case of two selves, each could be separately coded.

Social Interaction

The HVDC dream coding system breaks social interaction down into three categories: Aggression, Friendliness, and Sexuality. As was discussed in the last section, if the dreamer is controlling a virtual character and does something that the dreamer would not normally do with his own body in a dream, i.e., deciding to burn to death, the results can be misinterpreted (the coders initial impression that he must have known it was a dream). When playing a video game the player is often combating other virtual non player characters (the artificial intelligence of the game engine). This combat can be very aggressive and violent. When combat is dreamt about, if the dreamer is not linked to the virtual character, which is actually doing the combat, the aggressive actions recorded to the dreamer may be significantly higher than how the dreamer might actually behave. This is illustrated if we look back again at the burning to death dream. The one dream ego (game character or avatar) was engaged in violence while the second dream ego (watcher) was not. Since video games are normally based around the use of violence against nonplayer characters in order to progress, if video games were dreamt about, the dream would show an unusual amount of aggression to and from the dreamer. This has been the case in our analysis of gamer dreams where dream ego's virtual perspective was not accounted for (Gackenbach, Matty, Kuruvilla, Samaha, Zederayko, Olischefski, & Von Stackelberg, 2009) and is taken up in the current inquiry.

In the dreams that Coder A coded there was no friendliness recorded inside the dreams' virtual space. There is the potential for friendliness to appear in this type of dream. This will most likely occur when a virtual character helps the dreamer's character to accomplish some goal, help defeat enemies or if the dreamer helps a virtual character in some way. Likewise there was no sexuality in any of the video game dreams coded in this one study. These may be because the dreamer in the case that Coder A was coding suffers from Obsessive Compulsive disorder and potentially from several other problems.

On the speculative side, it is reasonable to assume that there is the potential for such dreams to occur especially since the sexual aspect in many games is becoming increasingly apparent as graphics improve and clothing styles evolve. Video games often portray a gender gap between males and females, with males as strong and mighty and females as weak and in need of saving. Even though, there are more games coming out now then five or ten years ago which empower the female characters, and remove this gender bias, women are still scantily clad. The difference in appearance and actions could easily lead to the emergence of sexual events in dreams about video games. Indeed in several other studies we found greater sexuality in gamers dreams relative to norms (Gackenbach & Kuruvilla, 2008b; Gackenbach, et al., 2009; Gackenbach, 2009b). Thus the actual coding of friendliness and sexuality in a context of sensitivity to virtual elements would be useful for at least some game genres.

Setting

The setting is where the dream takes place. Dreams rarely occur in a void and as such there is normally something within this category. When a dream contains a virtual environment it becomes problematic to explain the setting. In some dreams that Coder A coded, the dreamer started by saying he was playing a game, this suggests that he was indoors and probably in a familiar place. Unless the dreams specified location, Coder A treated the dreams as though they were played in the dreamer's home, since this is where the majority of people play video games. Although, with hand held gaming devices and games on cell phones, it is possible to play video games almost anywhere. Once the dreamer began to describe the virtual aspects of the dream, other problems emerged. Consider dream 2-97.

I'm playing some game - Sonic in a freely explorable city. I find an area with a very high slope resembling Ice Cap's mountain. I use the spin dash to climb it. I see the familiar mountain scene but in 16-bit color and true 3D is used making it look so much better and much more realistic. The polygon count also seems very high, well into the millions. I climb to the top in about a minute and a half and look around. I can see one extremely large tree about 400 feet tall and some human-built infrastructure 5

times as distant and easily seen due to its gigantic size. I charged back down as I urgently needed to do something but don't recall what. Faulty collision detection prevented extreme speeds - I got the fastest speeds through falling which took a lot of it.

This dream is packed with scenery descriptors but the problem is that the dream is almost completely inside a virtual environment. According to the HVDC system of dream analysis the setting would be in the dreamer's house where he is playing a video game. This would cause the loss of almost the entire dream setting since it cannot be coded. The setting is not hearsay, as in Domhoff's instructions, rather it is a perceptual experience in a dream about being in a video game. The freely explorable city is not really there and as such is left out of the setting criteria. Some of the dream content will find its way under the Objects heading, like the mountains and trees, but not where the majority of the dream is actually occurring. This might be fixed by adding a condition to the setting criteria which would create a separate grouping of virtual setting. For example the above dream, the city would be coded with the condition modifier of virtual, outdoors, and unfamiliar. The simple application of this modifier to the setting would keep the virtual and physical dream worlds separated if needed for analysis or could be combined to get an overall analysis of settings encountered. However, as real world physics rarely applies to virtual worlds, witness how many houses in Second Life float in the air, then assuming the lava is "outdoors" might be a stretch.

Emotions, Success, Failure, Good fortune and Misfortune

These categories are not significantly affected by the presence of a virtual environment inside a dream. If the characters are properly selected, the use of any of these categories is not reliant on the setting. If the characters are controlling a virtual character and one of these categories is needed, the selection of one of these characters should link back to the character that is controlling them. For example dream 2-74 describes the effort needed for the dreamer to defeat the main enemy from the dream:

The main enemy I recall is a long gray snake-like object nearly 50 feet long and 18 inches in diameter having a head nearly a foot wide. You had to stab it in 3 spots in order. The first was far from the head, about 1/3 of the way to tail. The second was about 1/6 of the way to the tail from the head and the third was the top of the head. The first was very easy and the second was quite easy as well. The third was hard as you needed a lot of force. I recall playing the game twice. The first time was where I couldn't defeat the snake and the second time I did, with a second to spare and it took me 5 tries to get the head.

The final success of the dreamer with defeating the enemy would be coded as though dreamer was actually there to defeat the enemy since it was his effort that resulted in the success. Likewise, emotions are felt through the character playing the game and as such they are the ones that will feel happiness, apprehension or any other emotions. Good fortune and misfortune should also be coded towards the character controlling the virtual character since a misfortune in the game results in a problem for the dreamt character to overcome and good fortune in a game saves the character from having to use effort to pass an obstacle. Indeed we have found in past research on gamer's dreams, differences from norms in good fortune and misfortune (Gackenbach, et al., 2009; Gackenbach & Kuruvilla, 2008b). Finally, the categories of objects and modifiers were the least problematic when coding virtual environments in dreams.

While the HVDC system does account for most dream events, it does not account for how to code virtual environments inside a dream. The system was designed in the 1960s when computers were very basic and as such it's not surprising that they did not include a coding system for virtual environments. This analysis illuminates some of the problems with using a standardized act frequency method of dream content analysis for virtual worlds within dreams. Alternatively we have approached the content analysis of dreams for gaming information from a grounded theory perspective.

Grounded Theory Approach to the Content Analysis of One Game in Dreams

In one study (Gackenbach, Rosie, Bown, & Sample, 2011) we needed to develop dream content analyses system for one video game, Mirror's Edge, as we were looking at game incorporation as a function of fidelity and interactivity of exposure to the game. We took a grounded theory approach to the development of this content analysis system. That is, judges would read the dreams and view the game to see if there are specific elements that emerge that might inform our content analysis. Five categories emerged:

1. Primary in-game elements - Game elements that are essential to the mechanics of Mirror's Edge and/or must be interacted with while playing the game. List items can be flagged with 'EG' (extra-game) or 'LE' (laboratory elements) when the particular instance of dream content does not occur in a Mirror's Edge setting and/or context.
2. Secondary in-game elements - Complementary or reinforcing to primary elements – can either be static parts of setting, interacted with in non-necessary ways or used infrequently. List items can be flagged with 'EG' (extra-game) or 'LE' (laboratory elements) when the particular instance of dream content does not occur in a Mirror's Edge setting and/or context.
3. Conceptual themes from Mirror's Edge – Things like mazes or roof tops.
4. Physiological and psychological responses – Fears of heights would be one example that could be associated with Mirror's Edge.
5. Laboratory elements – Things like the video goggles from the laboratory session would be included herein.

We expected the highest dream incorporation in the high fidelity/high interactivity condition. Incorporation was assessed by subject self-report and judges' evaluations. The independent variable of fidelity was especially strong both in the manipulation and in the subsequent dream incorporation for self report while interactivity became the dominant variable when viewed from the judges' perspectives. Given the conflicting results as a function of dream coding source, subject versus judge, it's clear that even with a scale developed for the particular elements of a specific game there are still problems in coding for games in dreams.

Present Study

Over the decade of this research program we have collected dreams from the night before, where a video game was played the day prior to the dream. Selective data from three studies were collapsed as similar information was gathered each time. This allowed a more comprehensive analysis of game incorporation into dreams. The purpose of this inquiry, is to address some of the concerns just outlined with coding games in dreams. These game-dream reports were gathered from (Study 1: Gackenbach & Kurvilla, 2008a; Study 2: Gackenbach & Dopko, 2011; and Study 3: Gackenbach, Rosie, Bown, & Sample, 2011; Study 1 was conducted during the 2007-2008 academic year. Study 2 was conducted during the 2008-2009 academic year. Study 3 was conducted during the 2009-2010 academic year. All subjects were drawn from students in introductory psychology who participated for course credit at the same western Canadian university). Data explored as potentially predictive of dream incorporation of games included: presleep information from individual differences to game characteristics, game incorporation criteria, and some content analysis of dreams. The questions asked in this compilation of data are:

1. Is there anything that distinguished the dreams that showed some game incorporation from those who were rated as no incorporation?
2. Is type of incorporation, dream is game versus gaming is in dream, associated with other dream or game content information?

Method

Information (n=182) was gathered from previous research studies where the dreamer reported having played a game the day before the dream. This information was garnered from three previous studies in our laboratory over a four year period. Three types of information were available for each game-dream occurrence either as previously coded or coded for the purposes of this inquiry. This information is summarized below:

1. Information about games included:
   a. ESRB: emotionality of game content
   b. Cognitive load: based on PASS model with non-subject game players having previously rated each game
   c. Game Genre information
2. Information about Players:
   a. Sex
   b. Gaming history of subjects
   c. Media use the day before dream
   d. Length of playing video game on the day before the dream
3. Information about Dreams
   a. Game in dream
      i. Type of incorporation
         1. Dream is game world
         2. Video game is being played in dream
         3. Some references to games other than the previous two
      ii. As a function of selected HDVC scales (i.e. character)
      iii. As a function of selected ESRB content categories
   b. Dream content scales independent of game in dream considerations
      i. Lucid/control/watching coding
      ii. HVDC sum scores

Specifically while we knew which video game the research participant played, we entered its genre, taken primarily from www.gamespot.com; cognitive load, taken from the game data base of Gackenbach and Rosie (2009); and ESRB information, obtained from www.esrb.org. As noted earlier gamespot has over 100 genre, but there are levels of classification such that one can use only the base level of genre as was the case in the present study.

Information about the players was already available as was some of the dream content scale information. However, additional dream content coding had to be done specifically for this inquiry. It should be noted that the HVDC training of all judges was interconnected. That is, the Study 1 coder was the first research assistant to be trained and she trained the Study 2 and Study 3 coders. All achieved at least 80% concurrence in HVDC coding with the Study 1 coder.

The game in dream coding, as defined herein, was done for this combined data set by two research assistants. Specifically, in consultation with the lead author they read all dreams and determined if the game was in the dream along these lines:

1. Dream is game world
2. Video game is being played in dream
3. Some references to games other than the previous two

It should be noted that in order to do this coding both coders had some video game playing experience. However, if they were unsure of a coding for a game they researched the game online. Initially they coded the dreams in terms of non-game elements that were not already available (i.e. lucid dreaming related variables).Then they coded if the dream was the game or if gaming was in the dream. Finally, these research assistants coded the dreams in terms of specific gaming elements, i.e. dream characters as game characters (see results section for a detailed list of what was coded). They were also asked if the game in the dream matched the game that was played and finally they made an overall incorporation rating along a 5-point likert type scale, from highly incorporated to no dream incorporation. These two coders each coded the same eight dreams along the dimensions just listed with correspondences per dream ranging from 56% to 89% with an average of 75% concordance.

Results

Since the primary question was differentiating game incorporation from no game incorporation, three groups of game/dream pairs were identified based upon the judges evaluations. Three game in dream coding questions were used to derive these dream groups. Judges were asked to determine if in the dream the dream ego is in the game world, that is the dream is the game, or if in the dream playing a video game was mentioned or, finally, if in the dream, games were mentioned.

Of the 182 dreams collected from the three previous studies where a game was played the day before the dream, 115 dreams were classified as not having the game in the dream (no game group), 26 dreams were identified as either playing

a video game in the dream or some other mention of games in the dream (partial game group). Finally, 41 dreams were identified as the dream is the game world (game group). While there was some overlap between the two dream categories for gaming it was minimal. Specifically, only one of the 41 game group dreams also had playing a video game mentioned. The partial game group included eight dreams where playing a video game was mentioned and 18 where games were mentioned (i.e., my mom was shopping for the new x-box controller or I was playing hockey). Any reference to playing any type of game was included in this category because there are so many games that are both real and video like hockey or jigsaw puzzles. This differentiation between inclusion and non-inclusion of gaming, and between two types of inclusion (game group and partial game group), allows us to consider some of the virtual worlds in dreams coding problems highlighted earlier, as well as the question of continuity versus discontinuity.

Verification for this dream group classification was obtained through two one way ANOVA's. One was for dream group on judges overall incorporation rating and the other was for game matching dream rating. Both were significant (overall incorporation $F(2,177)=117.00$, $p<.0001$ and game matching dream $F(2,176)=105.446$, $p<.0001$). In both cases dreams from the game group were more likely to be rated as evidencing more overall game incorporation and as having the game elements in the dream match the game elements of the game played prior to sleep. For overall incorporation there was no difference between the no game group and the partial game group with the most incorporation in the game is dream group. The game is dream group was the strongest match followed by the partial game group and then the no game group. All groups differed in post hoc analyses

The results are broken down into three sections of dependent variables: background of the subjects, game qualities, and dream content. The last is subdivided into content analysis examining game related content versus content analysis irrespective of game elements. In all sections either one way ANOVA's or chi-squares, as appropriate, were computed with dream group (i.e., no game, partial game, and game) as the independent variable.

Background of the Subject

This information was available from each of the previous studies and included which study they were drawn from, sex of subject, gaming history classification, and media use the day before the dream. Because these variables were not always collected in the same way sometimes they had to be reduced to present/absent or high/low. This included media use and game history which were sometimes measured along a likert scale. While individually each backgroud variable is significant across dream type groups, sans the media use one, there was no difference as to the distribution of each variable across dream groups. Specifically, the most cases were drawn from Study 3 ($\chi^2(2)=43.923$, $p<.0001$), more males were represented ($\chi^2(1)=45.098$, $p<.0001$), and more high end gamers ($\chi^2(1)=73.066$, $p<.0001$). However, it's important to keep in mind that none of the chi-square calculations for each of these variables with dream group were significant. That is, while there were more cases from Study 3, they were evenly distributed across all dream groups. So too with gender and game history.

As for media use the day prior to the dream three types of information were gathered in each study; audio media, video media, and interactive media. These were classified as present or absent and chi-squares were computed for each media type as a function of dream groups. One analysis approached traditional significance levels (audio media: $\chi^2(2)=5.356$, $p<.069$), while video media use nor interactive media use were not significantly different as a function of dream group. It should be noted that interactive media use does not include video game play as that was inquired about in separate questions. As for the audio media use this could include listening to music or talking on the phone. In all three dream groups subjects reported more often having done one of these audio media activities than not, but slightly less so for those whose dreams were categorized as game dreams (82% versus 94 and 95 percents for the other two dream groups).

Video Game Played

The next question addressed in these analyses is, are there qualities about the game that might predict incorporation or the lack thereof into subsequent dreams? Four types of information were available to address this question: length of video game play the day before the dream and three game type variables: genre, cognitive load and ESRB rating. Keep in mind that while most subjects dreams were not found to incorporate a game they all reported having played a game the day prior to the dream and most were high end gamers. Thus, it's important to see that there were no dream group differences in the length of game play ($F(2,179)=0.212$, ns). All groups reported playing between 1 to 2 hours ranging from less than an hour to more than four hours.

This lack of dream group difference was replicated for the other game information variables. Seven general game genre were identified from gamespot (i.e., first person shooter, music, action/adventure, sport/racing, role playing, casual, and strategy) but the chi-square as a function of dream group was not significant ($\chi^2(12)=16.568$, ns). However, across groups there was a difference in genre's played ($\chi^2(6)=52.599$, $p<.0001$) such that first person shooters were played the most often (31%) followed by action/adventure, sports/racing, and role playing each with about 16%. Less frequently played were the music and casual genre averaging 9% each and finally strategy was reported as least often played at 5%. Keep in mind that the genre classifications were based upon gamespot.com and not from the players who only reported one game they had played.

A repeated measures ANOVA on the five cognitive load variables for the video games played by dream group was computed. The interaction was not significant ($F(2,134)=0.012$, ns) nor was the main effect for dream group ($F(2,134)=1.962$, ns). However the main effect for cognitive load was significant ($F(1,134)=72.436$, $p<.0001$). The highest reported cognitive load by gamers in a separate study (Gackenbach & Rosie, 2009) but applied to these dreams was successive processing (x=2.16, standard error=.016) followed by planning (x=2.312, standard error=.068) and simultaneous processing (x=2.26, standard error=.073). At the low end was physiological arousal (x=2.171, standard error=.055) and finally attention (x=1.641, standard error=.068). When each cognitive load was examined separately as a function of dream group, all were non-significant: planning ($F(2,136)=1.124$, ns), attention ($F(2,136)=2.233$, ns), physiological arousal ($F(2,136)=0.689$, ns), simultaneous processing ($F(2,136)=1.719$, ns), and successive processing ($F(2,136)=0.781$, ns). In other words, the type and amount of cognitive load required for the wide range of games played did not differentially discriminate between incorporation or

not into subsequent dreams.

The final game type variable examined was the ESRB ratings. These were considered as overall ESRB rating and six mean scores from the 31 specific content categories. None of these dependent variables showed a difference as a function of dream group (main effect F(2, 165)=.982,ns) and interaction (F(2,165)=.522, ns). However, there was a main effect for content categories (F(1,165)=73.745, p<.0001) such that violence has the most descriptors (x=.137, standard error = .008) followed by language (x=.124, standard error = .011). No games were rated as having gambling. The rest fell in between these extremes.

In conclusion, there was nothing about the games played per se that predicted incorporation or the lack thereof. However, as will shortly be seen this is not the case when dream content was considered.

Dream Content Analysis

There were several ways that these dreams were all content analyzed, in the original study or additionally for this combined effort. Some of the new analyses were focused on game imagery in the dreams. But additionally all dreams were examined for lucid/control types of imagery and those dreams that had not been content analyzed using the HVDC were so analyzed for this study by Coder A. Thus two conceptual types of analyzes were available for all 182 dreams, game relevant and non-game relevant. These will be separately presented.

Game Relevant Dream Content Analysis

In addition to the three broad questions regarding game in dream, which created the three dream groups (no game group, partial game group, and game group), dreams were also coded with adjusted HVDC scales with a focus on gaming. Specifically, judges were instructed to indicate present or absent for several HVDC categories relative to the game components of the dream. These analyzes are summarized in Table 1.

Fifteen chi-squares were computed with all but four evidencing significant differences between dream groups. For the 11 chi-square tests that were significant the partial game group was roughly the same as the no game group in 4 cases, fell between the other two groups in 4 cases, was highest in one case and matched the game group in one

Table 1. Chi-squares and Percent Present of Selected HVDC Content Categories Coded for Game Type Content.

Categories	Characteristic	Chi-Square	% of dream groups yes
Characters	Self is game character	$\chi^2(2)=114.928$, p<.0001	No game - 1.8% Partial game – 0% Game – 75.6%
	Other is game character	$\chi^2(2)=29.098$, p<.0001	No game – 4.5% Partial game – 8% Game – 36.6%
	Self changes into game character	$\chi^2(2)= 10.196$, p<.006	No game - 0% Partial game – 0% Game – 7.3%
	Self controls game character	$\chi^2(2)= 6.155$, p<.046	No game - 0% Partial game – 4% Game – 0%
	other	$\chi^2(2)= 3.36$, ns	
Activities	(Physical, Movement, Location Change, Verbal, Visual, Auditory, Thinking)	$\chi^2(2)= 76.873$, p<.0001	No game – 12.5% Partial game – 20% Game – 85.4%
Emotions	Positive emotions	$\chi^2(2)= 0.154$, ns	
	Negative emotions	$\chi^2(2)= 16.505$, p<.0001	No game – 1.8% Partial game – 4% Game – 19.5%
	Neutral emotions	$\chi^2(2)= 17.190$, p<.0001	No game – 0% Partial game – 0% Game – 12.2%
	No emotions	$\chi^2(2)= 1.798$, ns	
Objects	(Architecture, Household, Food, Travel, Streets, Regions, Nature, Body Parts, Clothing, Commun-ication [including technological], Money, Miscellaneous)	$\chi^2(2)= 33.398$, p<.0001	No game – 7.1% Partial game – 12% Game – 46.3%
Implements	weapons	$\chi^2(2)= 33.765$, p<.0001	No game – 1.8% Partial game – 0% Game – 29.3%
	recreation	$\chi^2(2)= 5.25$, p<.072	No game – 0% Partial game – 4% Game – 4.9%
Descriptive Elements	(Colour, Size, Age, Thermal, Velocity, Linearity, Intensity, Evaluation, Temporal Scale)	$\chi^2(2)= 4.503$, ns	

case. This substantiates the concept of that group as falling between the other two.

The category of characters was further broken down into virtual world dimensions (i.e., game character versus personal self). The game group had more of each type of self than the other groups except for the category of self controls game character. In that case it was the partial game group that was highest which makes sense if you're playing or talking about a video game in a dream. The most direct of the ways to view self in dreams relative to gaming, was the self is the game character which constituted 75.6% of the 41 dreams that were determined to be the game world.

Two other HVDC type scales were subdivided, emotions and implements. Negative and neutral emotions were highest in the game dream group. There were no dream group differences in coding for positive emotions or coding for the lack of emotions. Finally, the game group had highest activities, settings and objects that were game related.

The other content analyses focused on the game in the dream were for social interactions. While friendliness coding followed HVDC, the negative side of social interactions were modeled after ESRB content descriptors because they were derived specifically from video games, coded by ESRB personnel for each game and included a wider range of topics than most dream coding systems allow. These 31 descriptors were clustered into six categories; violence, sex, drugs and alcohol, language, humor and gambling. Coders were instructed to count the number of incidents of each ESRB type content category in each dream relative to gaming in the dream. The results of these analyses are portrayed in Table 2.

Not surprisingly the sum of all ESRB codes favoured the game group which was primarily accounted for by the violence coding. While the means for the non-significant categories are not presented in Table 4, they collectively favoured the gaming group. Interestingly, gambling was highest in the partial game group.

As with the ESRB game in dream content coding, friendliness was a count of the number of incidents of game relevant friendliness. This time the category was defined by HVDC. The one way ANOVA approached significance, $F(2,176)=2.788$, $p<.06$. The game group fell between the partial game group and the no game group in terms of total number of game related friendly interactions in the dream.

No Game Relevance Dream Content Analysis

Two types of nongame related dream content analyses were done on these dreams. Traditional HVDC was done but only subscale sums were compared across dream groups. Also coded were various scales examining the lucid/control dimension. Of the 13 HVDC subscale sums only 3 evidenced significant or near significant dream group differences: aggression, $F(2,110)=4.358$, $p<.01$; friendliness, $F(2,110)=2.667$, $p<.07$; and good fortune, $F(2,110)=2.749$, $p<.068$. It should be noted that dreams were not coded that were less than 50 words on the HVDC. Aggression was significantly higher in the game group than in the partial game group but the no game group was not different in aggression from either of the other two groups. On the flip side friendliness was significantly lower for the game group than for the partial game group with the no game group falling in between. Finally, the good fortune sum was highest for the two gaming type groups relative to the no game group.

Finally, the lucid/control dimension was coded along several dimensions which are portrayed in Table 3.

While not lucid, various prelucid or lucid related variables showed dream group differences. These included two of the control variables and four items from the MACE. Thus one gets a picture of dreams that are games, as ones where the

Table 2. Descriptive Statistics and F-values for ESRB Dream Coding.

ESRB based Dream Coding *(N/mean/SD)	**No game in dream**	**game mentioned in dream**	**dream is game**	**F-values**
ESRB violence	115	26	41	F(2,181) = 9.145, p < .0001
	0.38 [a]	0.42 [a]	1.51 [b]	
	0.894	1.172	2.58	
ESRB Sex				F(2,181) = 0.524, ns
ESRB Drugs & Alcohol				F(2,181) = 0.147, ns
ESRB language				F(2,181) = 1.733, ns
ESRB Humor				None coded
ESRB Gambling	115	26	41	F(2,181) = 3.069, p < .05
	0 [a]	0.04 [b]	0 [a]	
	0	0.196	0	
Sum of ESRB category	115	26	41	F(2,181) = 8.322, p < .0001
	0.4261[a]	0.5 [a]	1.561 [b]	
	0.93716	1.27279	2.69304	

Note. [ab] Duncan post hoc test results are indicated in the superscripts of a,b. Those that are the same did not differ while those letters that are different indicate group differences.

*Of the 11 ESRB content categories related to violence only one was significantly correlated to count of violence in dreams, animated blood [r(170)=0.376,p<.0001]. None of the other specific content categories from the ESRB website for the games played correlated significantly with any of the ESRB type dream content coding categories.

dream ego is in control of themselves and other characters while commenting to self, being focused on task and reflecting on thoughts/feelings and not having difficulty in accomplishing tasks.

Finally, several pearson product moment correlations were computed between very similar dream content scales coded with gaming in mind and coded by separate sets of judges as part of a general coding of all dreams from the previous studies. Ten such tests were possible and most were significant. These are portrayed in Table 4.

It might be concluded from these results that coding separately for game elements makes no difference from general HVDC coding. However, there are some notable exceptions. The virtual nature of characters was articulated the most in this new coding scheme and when that was done there was no correlation to the original HVDC coding. Emotions and objects also failed to correlate, although the subset of objects called weapons might correlate but the data output from the Domhoff method did not provide that information. Additionally, two of these 10 correlations were with ESRB based coding schemes which were broader based than the classic HVDC system. Interestingly, in one case this correlation was the highest, aggression, and in the other case the lowest (marginally significant), sex. In a sense it's surprising that there were even these magnitudes of correlations as only about 1/3 of the dreams coded had game elements. But then while significant, the correlations were low to moderate in magnitude and the traditional HVDC coding resulted in few significant dream group differences.

Discussion

The history of our program of research for coding dreams of video game players both after playing a game and without such consideration was reviewed. While many of our studies are about response style in dreams resulting from game play, we also have considered incorporation issues. Some of our previous results seemed to favour the conti-

Table 3. Descriptive Statistics and Chi-Squares or ANOVA's for Lucid/control Type Variables.

Lucid/control Type Variables*	No game	Partial game	Game	Test
Lucid Dream				F(2,178) = 1.087, ns
MACE Sum Score (sum of judges yes responses to each question)				F(2,178) = 1.593, ns
Did the dreamer choose between two or more options				$\chi^2(2) = 0.043$, ns
Did the dreamer comment to him or herself about any person or event	33.9%	26.9%	58.5%	$\chi^2(2) = 9.408$, p = .009
Did something or someone suddenly capture the dreamers attention				$\chi^2(2) = 1.561$, ns
Did the dreamer focus for a period of time on accomplishing a particular task	33.9%	42.3%	61.0%	$\chi^2(2) = 9.066$, p = .011
Did the dreamer experience any unusual difficulty in accomplishing anything he/she was trying to do	13.4%	26.9%	7.3%	$\chi^2(2) = 5.172$, p = .075
Was the dreamer concerned about the impression he/she made, how the dreamer looked or how the dreamer appeared to others				$\chi^2(2) = 0.137$, ns
Did the dreamer feel any emotions during the experiences				$\chi^2(2) = 0.750$, ns
Did the dreamer think about their own thoughts or feelings	19.6%	7.7%	31.7%	$\chi^2(2) = 5.788$, p = .055
Did the dreamer think about what he/she was doing				$\chi^2(2) = 2.198$, ns
Did the dreamer think about what was happening around the dreamer				$\chi^2(2) = 2.718$, ns
Control of dream self (high=more)	104	25	40	F(2,178) = 2.922, p = .057
	2.65 [ab]	2.44 [a]	3.13[b]	
	1.245	1.417	1.09	
Control of dream characters (high=more)	64	19	20	F(2,178) = 4.314, p = .016
	0.81 [a]	0.58 [a]	1.2 [b]	
	0.5	0.507	1.152	
Control of dream environment				F(2,178)=0.767, ns
Dream ego stance				F(2,178)=0.379, ns
Dream ego as watcher				F(2,178)=1.018, ns

Note. * Continuous variables when significant are expressed in number of cases, mean and standard deviation. Yes/no variables are expressed in the percent of yes's.

nuity hypothesis others favoured the discontinuity perspective. Various approaches to coding gamers' dreams were considered and critiqued. Some of the problems were then taken up in a compilation of data from three previous research studies where games played the day before a dream and dream information was gathered. All of these dreams had been coded using the HVDC or were coded specifically for this compiled analysis using the HVDC. Additionally, an initial effort to create a system of coding sensitive to gaming in dreams was constructed and used to code all dreams in this compilation. A second new dream content analysis focused on the lucid/control dimension of dreaming.

Three groups of dreams were identified using the new content analysis scheme. These were dreams where there was no incorporation (no game group), dreams where there was some mention of gaming (partial game group), and dreams that were the game (game group). The classification of these dreams was verified by judges overall incorporation rating and matching game to dream rating.

The first point to be noted was that these groups did not differ in a variety of important variables including gaming history and length of play of the specific game mentioned. Thus, the finding of 63% of the dreams not mentioning games points to a lack of incorporation or continuity. This would seem to support the discontinuity hypothesis. However, it's important to keep in mind that this group of subjects overall were male, high end gamers who were recruited for one specific study. So the finding that most did not evidence game incorporation may be due to their long history of play, their choice of which specific game they played or reported playing, or other individual difference or situational considerations.

A similar distinction between partial incorporation and dream as game was used by Murzyn (in press) in an analysis of World of Warcraft (WoW) players dreams. Of the 233 WoW dreams she collected slightly less than half could be identified as having some game element. While we collected dreams after a game was played and got a small number of overall incorporations, she collected dreams from gamers who claimed that the dream was about WoW, thus the slightly higher incorporation rate.

In terms of the continuity hypothesis, of particular interest were the dreams that did evidence some form of incorporation. These two dream groups (partial game and game) were compared to the no game group dreams along three sets of dimensions: subject differences, game content measures and dream content judgements. As just noted subject variables showed no notable differences as a function of dream group type nor did game information provide any specific information to distinguish either between incorporation or no incorporation or between partial and full incorporation. That is, not to say that there are not predisposing subject variables or game content that might be valuable to consider, but they did not show up here. It may be, regarding the game variables, that once you go beyond one specific game there is too much variance to detect incorporation and these generic measures did not capture the relevant information.

So while we can't yet say what individual difference or situational information predisposes incorporation of games into dreams, we can say that this manner of distinguishing between dream groups is related to dream content differences. This goes to our second purpose for pursuing this research. That is the problems inherent in coding dreams for virtual worlds. As noted earlier, this will become increasingly a problem as members of at least industrialized societies are "living" in part in their own technologically created virtual worlds. Thus coming to grips with these coding problems is important for dream content analysis research to remain current. Video game play is the ideal test case because it represents the most immersive VR experience that is widely available.

While a series of problems associated with coding gaming dreams were discussed, this compilation of data attempted to address only a few. First the issue of game characters in dreams was addressed by creating relevant coding categories (see Table 1) which resulted in appropriate differentiation between dream groups. The partial game dream group had more instances of self controlling game characters, while game group had more of the other three types of game

Table 4. Correlations between HVDC sum scores and game in dream coding sums.

HVDC Variables/Game Coding Variable	Correlation Statistic
Activity sum of subscales/activity count in game elements	r=.252, n=109, p<.008
Settings sum of subscales/settings count in game elements	r=.273, n=109, p<.004
Objects sum of subscales/objects count in game elements	r=.209, n=109, p<.029
Modifers sum of subscales/descriptive elements count in game elements	r=.374, n=109, p<.0001
Aggression sum of subscales/ ESRB Violence subscale sum	r=.468, n=111, p<.0001
Sexuality sum of subscales/ ESRB Sex subscale sum	r=.166, n=111, p<.081
Character sum of subscales/sum of characters in game subscales	r=.090, n=109, ns
Emotions sum of subscales/sum of positive and negative emotions count	r=.124, n=109, ns
Friendly sum of subscales/sum of friendly game elements	r=.372, n=109, p<.0001
Objects sum of subscales/sum of implements in game elements	r=.140, n=109, ns

characters in dreams. Furthermore, this conceptualization, unlike many of the others, did not correlate with standard HVDC characters in dreams coding sum scores. For all the rest of the HVDC categories, which were adjusted to code counts of things relative to gaming in the dream, there were dream group differences. There were also generally positive correlations with standard (nongame sensitive) HVDC coding. This could mean that virtual considerations are not important or more likely in our opinion, that this approach was too simplistic. Additionally, while significant, the correlations were moderate in magnitude.

A second alteration in coding game in dream content was the adaptation of the ESRB to dream coding. Although it also measured act frequency, there were more potential acts that could be coded in any one type of content, i.e., blood for the violence type content. This alternative scale (violence or sex) was the highest correlation with standard HVDC aggression sum scores and marginally correlated with HVDC sexuality sum scores. Additionally, ESRB violence ratings of dreams showed significant dream group differences, while sex did not. No dream group differences were evident for the other ESRB content scales other than gambling. So when the ESRB coding of gaming dreams was more violent, these dreams were also coded as more aggressive using the standard HVDC. Given that these were largely classic male hard core gamers this is not surprising as the games they tend to prefer involve a lot of violence.

This is not as dark as it appears on the surface as we have found and pointed out in previous work. There was no dream group difference in positive emotions while more negative emotions were evident in the game dream group but also more neutral emotions. This neutrality to violence was nicely illustrated in the burning to death dream mentioned earlier. Indeed in some of our studies violence in dreams was viewed as fun (Gackenbach, Hall, & Ellerman, 2011)! Consistent with the violence finding is that game dreams were higher in activity and weapons. This activity and weapons effects, we also found as differentiating military dreams of high versus low end gamers (Gackenbach, Hill, & Ellerman, 2011).

The cognitive elements of this higher activity were flushed out in the lucid/control type coding and analyses. While the game dreams were not judged to be lucid, they were judged as highest in self and character control. Also in terms of using the MACE with questions about the dream answered by judges, game dreams were characterized as having significantly more self comments, thinking about thoughts and feelings and focusing on accomplishing a task without being thwarted in their intention. Games dreams were less likely to be characterized by difficulty in accomplishing a task. The internal commentary of gamers and a lack of intention being thwarted were found in Swanston and Gackenbach (2011) as was the higher dream control but no lucid dreaming. Their sample is a different gamer group several years later from the same university. This combination of cognitive dream skills can be viewed as adaptive in the soldier gamers who were judged as less susceptible to threat in their dreams during military service (Gackenbach, Hill, & Ellerman, 2001).

Conclusion

The issue of virtual world immersion during the day and its implications for subsequent night time dreams was taken up in two respects, incorporation and coding. Evidence from previous work and the current inquiry support both continuity and discontinuity. Some suggestions for adjusting dream coding for the presence of virtual worlds were considered and tested.

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