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Abstract

In a follow-up from Gackenbach and Kuruvilla (2008b), data analysis was undertaken examining the metacognitive qualities of video game players dreams associated with lucidity. Kahan and LaBerge's (1994) MACE questionnaire responses were examined in a principle component factor analysis. Several factors loaded dream type and gaming variables along with items from the MACE. It was concluded that gaming may be associated with dream lucidity due to the enhanced problem solving quality of gamer's dreams.

Cognitive Structure Associated with the Lucid Dreams of Gamers

This is a report from an ongoing research program investigating the relationship between video game play and dreams. This association has been investigated for several reasons. First gaming is increasingly used as a presleep stimuli to investigate questions like the memory function of dreams (Stickgold, Malia, Maguire, Roddenberry, & O'Connor, 2000). Additionally, understanding the binding problem in consciousness (Revonsuo, 2006), illuminating the nature of bizarreness in dreams, exploring the evolutionary function of dreams (Revonsuo & Salmivalli, 1995), and prospecting methods for inducing lucid dreaming also constitute reasons for our investigation. These are explored and summarized in Gackenbach (2012).

In our work we have generally defined the hard core gamer as someone who (1) plays video games on average several times a week, (2) has typical playing sessions of more than two hours, (3) has played 50 or more video games over their lifetime, and (4) has been playing video games since grade three or earlier. In more recent inquiries we have also taken into account preferred game genre (Gackenbach & Bown, 2011). In several studies we were able to show that these hard core gamers had more lucid dreams than those who rarely gamed (Gackenbach, 2006; 2009; Gackenbach & Kuruvilla, 2008a). This finding was almost always associated with group differences in dream control and sometimes with a preference for the third person perspective in a dream. Generally dream recall and sex of subject were controlled.

Why might one expect this association between video game play and lucid dreaming? Video games are a technologically constructed alternative reality, while dream worlds are biologically constructed alternative realities. Thus one could argue that there is a kind of carry over learning effect. If you are in an artificial reality for hours a day, it follows that you might recognize something similar when you are in another one at night. Indeed Revonsuo (2006)

points out that "the dream world is thus 'virtual' for precisely the same reason as a computer-generated synthetic environment is: in both cases I feel physically present (i.e., I *am* [authors emphasis] phenomenologically present!) in an unreal place where my physical body is not really present at all" (p. 114). Additionally, we have examined perceived presence in dreams versus a video game. Gackenbach and Rosie (2011) compared ratings of presence after playing a video game to presence after having a dream about that video game. There were few differences in felt sense of being there between dreaming and gaming. This supports the idea of the similarities in the states, virtual and dream, and thus the potential for a learning transfer of appreciation for the "reality" or lack thereof for each experience.

Another reason one might expect to find an association between lucidity and gaming is video game play has been associated with improved spatial skills (Subrahmanyam & Greenfield, 1994; Sims, & Mayer, 2002), as has lucid dreaming (Gackenbach, Heilman, Boyt, & LaBerge, 1985). Some resistance to motion sickness is needed to play these games a lot (Preston, 1998) and correspondingly, lucid dreamers have better vestibular systems (Gackenbach, Snyder, Rokes, & Sachau, 1986) which render them insusceptible to motion sickness. Finally, the high attention and absorption reported both by players (Glicksohn & Avnon, 1997-98) and in the research on gaming (Gackenbach, 2007) is reminiscent of the same qualities associated with meditation (Weinstein, & Smith, 1992; Holzel, & Ott, 2006). Meditators' have been found to have very high levels of lucidity in sleep (Mason, Alexander, Travis, Gackenbach, & Orme-Johnson, 1995; Gackenbach & Bosveld, 1989; Hunt, 1989).

Lucid dreaming has been characterized as showing a heightened meta-cognitive capacity (Kahan & LaBerge, 1994). Koriat (2007) defines meta-cognition as the "process by which people self-reflect on their own cognitive and memory processes (monitoring) and how they put

their meta-knowledge to use in regulating their information processing and behavior (control)" (p. 289). Kahan (1994), building on Purcell, Mullington, Moffitt, Hoffman, and Pigeau (1986), argues that lucidity in sleep might be viewed as a type of self-reflective awareness. It is generally thought that such reflective awareness in dreams, culminating in lucid dreaming at its maximum, is weak (Hobson, 1988) or, at best, difficult to assess (Foulkes, 1985). Both physiological and psychological studies have brought this assumption to question, arguing instead that dreaming often includes controlled and rational thinking (Kahan, 2009; Kahn & Hobson, 1993). LaBerge and DeGracia (2000) point out that while non-lucid dreams can have meta-cognitive qualities, "meta-cognition during lucid dreams is not confined to events occurring in the dream, but references, either explicitly or implicitly, waking experience as well . . . hence, lucidity in the context of dreaming, implies meta-cognition framed by consciously accessible memories of waking experience" (p. 275).

A more elaborated definition of meta-cognition is that of Nelson and Narren (1994) who consider three separable components: intentionality, monitoring and regulation. Early efforts to draw a conceptual line between waking and sleeping cognition did not separate these components (Purcell et al, 1986). Using Nelson and Narren's model, Kahan and LaBerge (1994; 1996) developed the Meta-cognitive, Affective, Cognitive Experience Questionnaire (MACE) to determine the cognitive components of dreams and their relationship to waking cognition. This scale was administered as part of a study by Gackenbach and Kuruvilla (2008b) on the dreams of individuals who vary in their history of video game play. For the purposes of the current paper the answers to the MACE and self-reported lucidity, control and third person observer perspectives in dreams, along with history of video game play and hours played the day before

the dream, were analyzed. The question asked was when gaming is associated with lucidity what elements of meta-cognition are also evident.

Method

Details of the methodology for this study are reported in Gackenbach and Kuruvilla (2008b). Below is a summary of the relevant aspects of the methodology for this inquiry.

Participants

Eighty-three subjects from an introductory psychology pool at a western Canadian university (college at the time of the survey) completed the survey. Another 41 subjects completed the survey that was solicited from an external research participation website. A 40 word minimum was also imposed on all reports. This reduced the total number of subjects to 98 from both subject pools. This final participant pool consisted of 35 males and 63 females.

Instruments

In addition to an 11-item prescreening questionnaire and a Games and Dreams Questionnaire (adapted from Gackenbach, 2006), subjects filled out the MACE. The Games and Dreams Questionnaire required subjects to record a dream from the night before and answer 30 questions relating to media use and dream experiences. More specifically, the questionnaire contained three types of questions: media use questions, dream history questions, and last night's dream questions.

Secondly, the 10 item MACE Questionnaire (Kahan & LaBerge, 1994; 1996) was administered. Participants were asked to answer all 10 questions in terms of the dream they reported. These questions queried choice, internal commentary, sudden attention, focused attention, thwarted intention, public self-consciousness, emotion, reflective awareness of one's own thoughts, feelings, reflective awareness of one's own behavior, and reflective awareness of

external environment. Each question was posed in a yes/no format, with a line for a description to elaborate upon their answer.

Procedure

After consenting to participation, participants filled out the "Media Use Questionnaire" adapted from Gackenbach (2006). Upon completion, participants were presented with a debriefing statement, which provided information regarding the basic nature of the research and contact information in case further debriefing was preferred by the participant. Information regarding the nature of the study was limited in order to maintain the integrity of the hypothesis.

If participants met the necessary criteria (based on responses to questions inquiring about frequency of game play, length of gaming session, age of first gaming experience, and number of played game formats), they were emailed an invitation to participate in the second phase of the current study. In this section, participants again completed an informed consent form. Finally, they were presented with the "Games and Dreams Questionnaire" adapted from Gackenbach (2006). Subjects were to complete the questionnaire at a different time if they did not recall a dream from the night before. When they had completed the questionnaire, participants viewed a debriefing statement. They were thanked for their participation, provided the basic rationale for the current study, and offered the appropriate contact information.

It should be noted that the web access subjects were given a slightly altered form of the survey, in that a prescreening was not mandatory for participation. Instead, these individuals filled out questions regarding their demographic information and gaming history at the end of the survey.

Results and Discussion

The results of the MACE questionnaire are the focus of this analysis. Each answer was examined by a judge as to whether the dream or the comment provided actually demonstrated the dreamers' response to the MACE question. Only those items where the response by the dreamer was judged to be consistent with the dream or comment were used for subsequent analysis. This dropped the dreams, and thus the MACE responses, to 79.

The primary question our analysis seeks to answer is, when lucidity and related dream conditions occur in the dreams of video game players, what other cognitive qualities are also present? This being the case, two media variables from the Games and Dreams Questionnaire (adapted from Gackenbach, 2006) were included in the MACE item factor analysis: gaming history as a z-score sum of the four game play variables noted earlier and number of hours of game play the day before the dream. Additionally, three variables from the self-reported dreams, were also entered into the factor analysis: dream lucidity, control of dream, and third person observer perspective. Dream control and perspective were included because they evidence elements of meta-cognition (intentionality, monitoring and regulation (Nelson & Narren, 1994) for example) and thus further illuminate occurrences of lucidity in dreams. One of the most often noted characteristics of lucid dreams is the ability to control ones dream, in some manner, after becoming aware that it is a dream (Gackenbach & Bosveld, 1989). Additionally, in previous game research on dreams, gamers have reported more dream control than non-gamers (Gackenbach, 2006; summarized in Gackenbach, 2012). The third person perspective has been investigated in this research program because of a type of lucid dream reported by meditators called witnessing (Mason et al, 1995), where a key feature is being in an observer's stance. This observer feature has had mixed associations to gaming and may be conceptually confounded or perhaps rehearsed with the third person perspective so common in video game play. Here is an

excellent example a third person dream from this data set. This young man played from four to seven hours the day before this third person perspective 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 #28)

Three of the four games he played the previous day were first person shooters. These games DO NOT allow third person perspectives BUT the real self is actually in third person while playing a first person shooter. Thus hours of being in that perspective may have helped to mediate this dream. Additionally, this hard core gamer reported an interesting detachment from the dream events:

> 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. (Subject #28)

This is noteworthy because it echoes the descriptions of witnessing dreams that previous research has found among meditators with the same observing but uninvolved emotional reaction (Gackenbach & Bosveld, 1989).

Ultimately, the 10 MACE item responses and five supplementary items were entered into this principle component factor analysis[i]. This was chosen in order to see the initial associations

between variables. The factors loading above eigen values of one were retained. This is portrayed in Table 1.

Insert Table 1 about here

The percentage of the variance for each of the factors loading above one eigen value were Factor 1 was 15.184%, Factor 2 was 12.750%, Factor 3 was 10.919%, Factor 4 was 9.538%, Factor 5 was 7.399%, and Factor 6 was 7.115%. While there is a lot to think about in this analysis, it is Factor 2 that is of interest to the question at hand. It can be seen that when .3 is the cutoff, both gaming variables loaded positively and were associated with all three dream variables. These gamers are commenting to themselves during the dream and reflecting on their own thoughts and feelings. These items were associated with not experiencing unusual difficulty accomplishing a task. This appears to be similar to gamers playing while awake, the only difference being that, they are now in the dream. They are thinking about what they are doing and are not distracted from their task.

Of the three items from the MACE that loaded with gaming/lucidity, two of the three were found by Kahan (2009) to distinguish dreaming from waking (i.e., thwarted intention and reflective awareness of own thoughts/feelings) while the third (i.e., internal commentary) did not differentiate. This distinction is important if the model that gaming cognition translates into dream cognition is to be accepted. Thus, thwarted intention in Kahan's data was more likely to be expressed in dreams while reflective awareness of one's own thoughts/feelings was less likely to be experienced in dreams. Internal commentary showed no dream-waking difference in Kahan's data. In summary, two of the three items loading with gaming/lucidity, the opposite of

the dream-wake distinctions found by Kahan, were found herein. In other words, the cognitions in the lucid dreams of gamers were more like waking cognitions than typical dream ones. This factor analysis suggests that there is monitoring (i.e., reflective awareness of own thoughts/feelings and internal commentary) in the context of lucid/control dreams. This picture is consistent with the (presumed) dual perspectives of participant and observer in lucid dreams and is further supported by the positive loading of gamers in the third person perspective in the lucid dream. This is common in games but not in dreams.

Here is an example of one subject who seems to somewhat exemplify this factor. This young man was identified as a high end gamer who played three to five hours of two games the day before the dream. These were Guitar Hero and Halo, the first is a first person music playing game while the latter is a first person shooter type game. He dreamt:

> I had a dream that I was playing paintball with my brother (he is shorter than me at 5'9 and was dressed in his paintball gear) It was a very pleasant dream. My brother and I had to play a team of paintballers that was like a thousand of them on the two of us. They couldn't seem to hit us though. We shot all on them. I felt really happy and victorious. (Subject #39).

He identified this dream as lucid, as it took the first person perspective, and involved control of the dream ego. It should be noted that in addition to playing a first person shooter, he also watched paint ball videos on YouTube the previous day. In terms of the MACE, he reported that he did comment to himself (MACE#2), "I said "Holy Shit this isn't good". While he did not reflect on his own thought and feelings (MACE#5), he did reflect on his actions, "It was a lot of people on a small field" and his surroundings, "Paintballs flying everywhere". Additionally, he

said that he did not experience any difficulty accomplishing the task (MACE#8). While not a perfect example it does demonstrate some of the key components of this factor.

This is a set of cognitive circumstances that can be conceptualized as flow (Sherry, 2004) during game play. The fact that they are in a dream at that time does not take away from this conclusion. So from this factor we might conclude that when "gaming" in a dream one is more likely to notice it is a dream, experience themselves as having control and perceive the dream from the third person perspective, a typical gaming perspective. This happens, not surprisingly, when these are dreams of gamers who have spent a lot of time gaming the day before. While any one case study does not illustrate all factors, mathematically they co-varied in this analysis.

In support of this gaming in a dream interpretation was a finding from another of our studies. Specifically, among hard core gamers, lucid dreaming was associated with video game content in the dream as well as control of the dream (Gackenbach et al, 2009). In this case we do not have information about whether or not there is game content in the dream beyond reading the dreams as indicated in the two examples just given.

To further understand the lucidity-gaming link in Factor 2 (lucidity/gaming) we might contrast it to Factor 4 (gaming) which is gaming without lucidity and to Factor 5 (lucidity) which is lucidity without gaming. The gaming factor negatively loaded the self-comment MACE item along with focusing on accomplishing a task and being thwarted in terms of the same MACE items. Using again the gaming mind set as optimum dream mind, this factor seems to indicate game play gone wrong. In this example from a young woman who is not normally a high end gamer but played several hours of driving games the day before this dream:

> My brother and I arrive home from school on this every day. Our large wooden house had a very large porch on it with a series of gates which was very unwelcoming considering it was supposed to be our home. Then there is this vicious wolf glaring at us. We run until we make it to the porch. The wolf keeps chasing us through the gates until he gets stuck at the last one and is trying to dig under it. At the front door we see our mom staring blankly out into the yard and she won't let us in. (Subject #47)

This research participant reported that the dream was not lucid but that she had both first and third person perspectives during the dream. Additionally she reported that she focused on accomplishing a task in this dream, "I focused on trying to get my brother and I through the gates and into the house without the wolf getting us." However, this dreamer was having difficulty with accomplishing the task, "It was harder than usual to get through all the gates because of the stress and fearfulness."

The fifth factor (lucidity) had the third person perspective and was associated with feeling emotions in the dream. This factor primarily illustrates that lucidity happens with and without gaming but may be of a different quality. In this case two MACE items above the .3 cutoff loaded on this factor, a lack of choices and presence of emotions felt during the dream. This may represent the emotional rush that is most often reported upon realizing one is dreaming (Snyder & Gackenbach, 1988) either due to joy or the emotions of a nightmare and then realizing one is dreaming. This can happen no matter what your gaming experience. In this example the young woman had not played any games the night before this dream which she reported as lucid and in the first and third person perspectives. She dreamt:

> my boyfriend suddenly appeared in the dream, with the impending doom day my morals appeared irrelevant and we had sex in my dream. i don't believe in sex before marriage

> however the sudden appearance of my boyfriend in my dream was when we were on our way to have sexual intercourse becuse we had both decided we wanted to try it before we died ... we were going to die anyway so who cared? .... this was my reasoning in the dream ... (Subject #41)

Despite this reasoning she also reported that she felt like she had no options (MACE #1). The emotions she felt during this dream "i also felt aroused when i watched myself have sexual relationship with my boyfriend.. . . i felt helpless and scared most of the other times in the dream ... the whole dooms day thing."

Relatedly, in another study, Swanston and Gackenbach (2011) also examined lucidity and control dreams as a function of gaming versus meditation including responses to the MACE. In addition to the meditation group they added a high activity versus low activity manipulation. That is, participants were asked to report a dream after a day of high activity, i.e. gaming, meditation/prayer, and after a day of low activity. Two of the three items associated with gaming and lucidity in the previous study were also found to be associated in an interaction with group and condition in this study. Specifically, while the meditating/prayer group self-reported more lucid dreams overall the gaming group reported the most control dreams across conditions. Internal commentary item on the MACE was highest in the gamer group after a high activity day while lowest in the meditation/prayer group after high meditation/prayer activity. The opposite was the case after a day of low activity. In terms of thwarted intention the gamer group was reported less thwarted intention in their dreams after a day of playing video games while the meditation/prayer group reported more thwarted intention after a day of high meditation/prayer activities and less thwarted intention in their dreams after a low activity day.

Several limitations to this study need to be pointed out. First, is the self-report nature of the inquiry. While these conclusions are based upon morning after dream reports the question of the reliability of self-report in general is always a concern. Also the sample is split between college students and online participants, and thus offers a mixed background. The sample of acceptable dreams, while not very small, is also not very large and thus also a concern. Finally, the study is entirely correlational, and as such, causal implications cannot be made.

In conclusion, it appears that gaming may be associated with a metacognitive dimension to the lucid dream, such that its full potential for focused problem solving is possible. Also it may be that lucid dreams of gamers are more like waking cognition than other dreams.

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Table 1

Principle Component Factor Analysis on Game Play, Lucid Related Dream Variables and MACE Questionnaire Items

	Component					
	1	2	3	4	5	6
Z-score for gamer type	.023	.466	-.076	.569	-.099	-.063
Total length Played day before dream	-.267	.455	-.068	.588	-.248	.036
lucidity in dream	.102	.591	-.026	-.270	.327	-.441
Observer POV in dream	-.348	.315	-.299	.349	.528	-.006
control in dream	-.128	.708	.252	-.238	.095	.120
Choice/MACE1- choose between two options in dream (yes/no) all reversed so 1=no and 2=yes	.385	.102	.249	.067	-.339	-.402
Internal Commentary/MACE2- comment to self during dream (yes/no)	.473	.354	-.220	-.406	-.278	-.061
Sudden Attention/MACE3- sudden attention shift during dream (yes/no)	-.167	.037	.589	-.065	.193	-.008
Focused Attention/MACE4- focus on accomplishing a task during dream (yes/no)	.662	.096	.355	.354	.088	-.092
Thwarted intention/MACE5- experience unusual difficulty accomplishing task during dream (yes/no)	.463	-.343	.191	.343	.299	.203
Public self-consciousness/MACE6- subject concerned with appearance or impression made on others (yes/no)	.388	-.126	-.649	.095	.019	.188
Emotion/MACE7- subject feel emotions during dream (yes/no)	.352	-.001	-.446	-.158	.458	-.182
RA own thoughts, feelings/MACE8- subject thinks about their thoughts or feelings during dream (y/n)	.072	.463	-.184	-.172	-.169	.614
RA own behaviour/MACE9- subject thinks about their actions during dream (yes/no)	.764	.132	-.062	.129	-.080	.000
RA external environment/MACE10- subject thinks about their surroundings during dream (yes/no)	.377	.161	.443	-.114	.269	.438

[i] Principle component factor analysis was chosen as a correlation matrix focuses on any two variables while a rotated factor analysis while normally preferred when trying to look at relationships across domains can miss associations. Thus the initial factor analysis, principle component, was chosen as an investigative tool.