

Recall of a Specific Word List in Lucid Dreams: An Explorative Online Study

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Summary. The study of lucid dreams is a sophisticated method for exploring the ongoing dream from a first person perspective. The present study explores the ability of lucid dreamers to recall previously learned words in their dreams. For this field study 12 lucid dreamers finished the experimental protocol in a home setting. The results indicate that lucid dreamers are able to recall previously memorized words in their dreams. The recall rate showed a high variation from none to all words. Taking into account that three of the participants couldn't finish the task within the dream, the recall rate in the lucid dream seems to be rather high. To control for confounding factors it is suggested that sleep laboratory studies be conducted in the future. It also will be promising to study the impact of a lucid dream rehearsal in order to find out if this might be a new method for active learning during sleep.

Keywords: Lucid dreaming; Memory; Recall; Learning

1. Introduction

The study of lucid dreams is a sophisticated method for exploring the ongoing dream from a first person perspective, thereby opening the possibility of investigating questions in dream research from inside the dream (Schredl, 2008). A lucid dream is defined as a dream in which the dreamer – while dreaming – is aware that she or he is dreaming (cf. Schredl & Erlacher, 2004). After realizing that they are in the dream state lucid dreamers are able to consciously influence the action occurring in such dreams. Since lucid dreamers can remember waking memories in the dream and are therefore able to carry out specific instructions, lucid dreaming is a powerful approach for dream research.

The ability of lucid dreamers to recall waking memories in the dream have been demonstrated in several sleep laboratory studies (cf. Erlacher & Schredl, 2008b; LaBerge, 1988; Schatzmann, Worsley, & Fenwick, 1988). For example in a study by Erlacher and Schredl (2008a) lucid dreamers were instructed to carry out a protocol in their lucid dream which included eye movements, counting and performing squats. Five lucid dreamers were able to successfully carry out this task in 14 lucid dreams. Even though the lucid dreamers reported several problems within their dreams (e.g., false awakenings) recalling the protocol was not mentioned as a problem.

In contrast to this, Gillespie (1984) – an experienced lucid dreamer – claims that he usually does not have his normal intellectual faculties during lucid dreams and that he forgets most of his daily waking life (e.g., he does not know where he is sleeping or what year it is). Such lack of memory of the

waking life situation was also reported by other experienced lucid dreamers (cf. Worsley, 1988).

A study by Barrett (1992) showed that in fact dreamers are not able to recall waking memories in all of their lucid dreams. In her study she analyzed the content of 50 lucid dream reports with respect to four corollaries. One of these corollaries focused on memory in dreams, e.g., if the memory of the waking world in lucid dreams is intact rather than amnesic or fictitious. The analysis of the reports that included statements about waking facts (n = 19 reports) showed that in 37 % of the reports memories of the waking world were deluded in some way. In the study by Barrett (1994) a correlation was found between the memory abilities in lucid dreams and how experienced the participant was with lucid dreaming (i.e., being a novice vs. being proficient). The more experienced lucid dreamers showed better memory abilities in lucid dreams than novice lucid dreamers.

The controversial findings about the ability to remember waking facts in lucid dreams leads to the question as to how good this ability really is. Even though the possibility of remembering waking memories in a lucid dream is an important aspect for experimental lucid dream research so far no study has examined this issue in greater detail. The present study, therefore, explores the question as to whether lucid dreamers are able to recall words in their dreams that are memorized directly prior to going to sleep.

2. Method

2.1. Participants

The sample included 12 participants whose mean age was 38.2 ± 14.1 years ranging from 15 to 59 years. There were 7 women and 5 men. The participants were recruited by an internet page (<http://klartraum.de>) about lucid dreaming provided by the author. Participation was voluntary and unpaid.

2.2. Lucid dream task: word list

Twenty-one words of a common memory test (Alzheimer's Disease Assessment Scale; Ihl & Weyer, 1993; Schredl, We-

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ber, Leins, & Heuser, 2001) were randomly selected in order to construct three lists of seven words (versions A, B & C). The selected words are given in Table 1. Three lists were developed so the word lists could be changed after each month during the time the experiment was online. Seven words were chosen for a list because the capacity of working memory seems to be limited to this number of information units (Miller, 1956).

2.3. Dream and lucid dream recall frequency

On the protocol the participants had to report their dream recall frequency and lucid dream recall frequency. Dream recall frequency was measured by a seven-point rating scale (0 = never to 6 = almost every morning) developed by Schredl (2002). Its retest reliability is high ($r = .85$; Schredl, 2004). In order to obtain units of mornings per week, the scale was recoded using the class means (0 → 0, 1 → 0.125, 2 → 0.25, 3 → 0.625, 4 → 1.0, 5 → 3.5, 6 → 6.5). For measuring lucid dreaming frequency, an eight-point rating scale was presented (0 = never to 7 = several times a week). In order to obtain units in frequency per month, the scales were recoded using the class means (0 → 0, 1 → 0.042, 2 → 0.083, 3 → 0.25, 4 → 1.0, 5 → 2.5, 6 → 4.0, 7 → 18.0).

2.4. Procedure

The experiment was conducted as a field experiment, e.g. the participants conducted the test by themselves in a home setting. The participants received the instructions for the experiment either as an email attachment by the first author or they downloaded the instructions from the internet (<http://klartraum.de>). The instructions contained a general introduction, instructions for the experiment and a protocol to record the results. Lists A and B were online from the 27th of January till the 14th of March, 2005 and List C was online from the 14th of March till the 15th of April 2005.

The participants were instructed to perform the experiment in a night in which they were confident they could successfully induce a lucid dream. Before going to sleep, the participants were asked to memorize seven words from a word list for at least five minutes so that they could easily remember all of them. Afterwards they had to put the list and the protocol aside, turn off the lights, and go to sleep. At this point the participants were asked to no longer think about the words until they experienced a lucid dream. If the participants were successful in inducing a lucid dream during the night their task was to remember as many words from the list as possible. After awakening they were to record all the words they remembered on the protocol. The participants were to record all the words which came to their mind and it was therefore possible that a subject could record more than seven words. Furthermore a precise report of the lucid dream also had to be recorded on the protocol. After finishing the experiment the protocol was sent to the first author via the Internet.

Since this is an exploratory study the analysis focuses on a descriptive level of the results and on the lucid dream reports by the participants. For analyzing the correlation of the lucid dream recall frequencies and recalled words and since the lucid dream scale was ordinal prior to transformation, Spearman-Rank correlations were computed. Statistical analyses were carried out with the SPSS 15.0.1 software package for Windows.

3. Results

The participants reported that they recall dreams on average on 6.3 ± 0.9 mornings per week. The average lucid dreaming frequency was 8.0 ± 7.4 lucid dreams per month. All participants were frequent lucid dreamers (frequency equal or higher than once per month) in the terminology of Snyder and Gackenbach (1988).

In all submitted protocols the participants were able to recall the task within the lucid dream. For two participants the lucid dream was too short to finish the task, e.g. the participants woke up before they could remember more words. In one case, the participant lost lucidity and was caught up by the ongoing dream scene. Excluding those three participants the mean of correctly recalled words for all participants were $4.7 (\pm 2.1)$. Three of the nine participants were able to recall all the words from the word list and one participant remembered no correct word. For the nine participants no correlation was found between the recall rate of correct words and the lucid dream frequency ($r = -.27$; $p = .49$). The following dream example is from one participant who recalled all the words:

"I memorized the words in one sentence: 'There is a man, whose RESOURCEFULNESS finds an EXAMPLE for how the AIR INFLUENCES finding an EXPLANATION for the CLOCK being an ILLUSION.' Before falling asleep I told myself that I will remember this sentence clearly in my lucid dream ... In the dream I recognized that I was just saying this sentence. I became lucid due to my finding myself saying the sentence in my dream. I thought that I should go through the words again to be confident. I could remember all words. At first I thought that I was already awake since it was so easy for me to do the task but I noticed several features that let me know I was dreaming." (female; 30 years of age)

As mentioned above, not all participants were able to finish the task successfully and several participants encountered different problems within the lucid dream. The following dream example is from the participant who was unable to remember a single correct word from the list:

"... I thought about the experiment and tried to recall the words from the list. I realized that I couldn't recall the list's first word. Despairing I thought again and again 'Which word does the list start with?'. Words came up in my mind and while I thought about them I knew that those were the wrong words. At this time I was preparing some spinach with salmon in the dream and so I thought about LEMON and knew LEMON belongs to fish. I knew that this is a correct word, but it is on the wrong list. After that I recalled MOOR. Then I woke myself up because I realized that I wouldn't recall the correct words." (female; 59 years of age)

In general the participants – mostly those who recalled only three or fewer words – described one of the following problems: The lucid dream was too short to finish the task, the participants were not able to remember more words even if they tried, or they lost lucidity and were caught up by the ongoing dream scene. The following three examples will illustrate the problems:

"After some changes in the dream I started to think that I have something important to achieve. After I recalled the first word, which was GOLD, I also remembered STREET.

Table 1. Overview of the three word lists and the recalled words from each participant. Original German words and the English equivalents are depicted.

Vp	Word list A							correct words
	<i>Findigkeit resourcefu.</i>	<i>Beispiel example</i>	<i>Luft air</i>	<i>Einfluss influence</i>	<i>Erklärung explanation</i>	<i>Uhr lock</i>	<i>Illusion illusion</i>	
01	ok	ok		ok				3
02	ok	ok	ok	ok	ok	ok	ok	7
03	ok	ok	ok	ok	ok	ok	ok	7
04		ok	ok		ok	ok	ok	5
05								0
06		ok	ok	ok		ok		4
	Word list B							correct words
	<i>Begriff concept</i>	<i>Notwendigkeit necessity</i>	<i>Moor Moor</i>	<i>Zitrone lemon</i>	<i>Eingebung inspiration</i>	<i>Wert value</i>	<i>Hemmnis abashment</i>	
07	ok		ok	ok	ok	ok		5
08		ok		ok		ok	ok	4
09	ok	ok	ok	ok	ok	ok	ok	7
	Word list C							correct words
	<i>Straße street</i>	<i>Körper body</i>	<i>Felsblock boulder</i>	<i>Reptil reptile</i>	<i>Gold gold</i>	<i>Auftakt prelude</i>	<i>Einwirkung impact</i>	
10	ok				ok			2
11	ok			ok	ok			3
12	ok	ok	ok	ok	ok			5

Note. Participants who couldn't finish the task are highlighted in grey; „ok“ designates that the participant was able to recall this word.

And then I knew that I had forgotten the rest of the words. But in my condition in the dream I had no time to care about it. I told the dream character that we have to leave him and this led to a discussion. The discussion made me to go to sleep and so the dream ended.” (female; 47 years of age)

“... and then I remembered the word STREET. I tried hard to recall the last two words which didn't name an object ... Again I thought about the word on the list and that I will not remember all of them. Therefore I let it go and woke up.” (female; 50 years of age)

4. Discussion

Overall, the findings indicate that lucid dreamers are able to recall words in their dreams that were memorized directly prior to going to sleep. The recall rate was about five out of seven words. The number of recalled words ranged from none to all seven words whereby three participants recalled all the words and one participant remembered no correct word. Since this was an exploratory study several methodological issues should be discussed.

The study was conducted as a field experiment, e.g., the participants received instruction via the Internet and conducted the experiment by themselves in a home setting. The advantage of field research is that more lucid dreamers can be reached. In general the prevalence rate of lucid dreamers is rather small (26%, Stepansky, et al., 1998) and within lucid dreamers the rate of frequent lucid dreamers (frequency equal or higher than once per month) ranges from 17% to 38% (cf. Snyder & Gackenbach, 1988). For

sleep laboratory studies, however, it is necessary to have dreamers who have lucid dreams within a few nights in the sleep laboratory, reducing the above mentioned percentage further. The online experiment, therefore, allowed reaching a greater number of participants for this study.

Field research, however, has known disadvantages (cf. Bortz & Döring, 2002). The missing oversight of the experimental procedure is one of them. Even though we kept the lucid dream task as simple as possible and formulated clear instructions for the participants, we cannot rule out possible errors by participants who did not adhere to the instructions, e.g., it might be possible that some of the participants did not follow the experimental protocol exactly and memorized the words better or worse than other participants. In future studies it would be desirable to conduct the experiment in a sleep laboratory in order to have a better oversight of confounding variables. In the sleep laboratory environment a lucid dream could also be validated by pairs of eye movements (e.g. Erlacher & Schredl, 2008a).

The results of this study revealed a rather high variation of recalled words, ranging from no right word to all of them being correct. Since the participants were instructed to sleep after memorizing the words, no interfering additional information was likely. Half of the participants, however, recalled less than five words in their lucid dreams. The low recall rate of those participants might be explained by several factors. At first, the low recall rate was in part caused by factors independent of memory processing because in two cases the lucid dream was too short for the participants to finish the task and in two cases the participants lost lucidity and were caught up by the ongoing dream. For those three participants the low recall rate is not due to memory problems

but rather to limited time for finishing the task in the lucid dream. This was taken into account in the results section and those participants were excluded from the analysis. This problem, however, might be present but not obvious in other participants.

As above already stated the difference in the recall rate could also be described by the missing oversight of the experimental procedure. The participants might spend differing amounts of time for memorizing the words before going to sleep. Even though the instructions were the same for all participants we cannot rule out the possibility that a high recaller might have spent more time learning the list than the low recaller. A controlled laboratory study will exclude such confounding factors. Furthermore, to ensure that the participants had the same learning rate, a learning criterion should be installed (e.g., all words must be recalled at least three times). A further explanation might be that there is a variation in the memory capacity of the participants, e.g., a participant who recalled three words in the lucid dream would have also recalled three words after awakening without a lucid dream. For future studies, it would be interesting to determine whether the dreamer is able to recall the words in the morning, being fully awake. The same is true for the use of some kind of learning strategy (mnemonic strategy), e.g., in the first dream example from the results section the participant reports that she memorized the words in one sentence. To control for these possible variables it is suggested that a control group be installed without the lucid dream task.

In the study by Barrett (1994) a correlation was found between the memory abilities in lucid dreams and the participant's experience with lucid dreaming (novice vs. proficient lucid dreamer). In this study this correlation was not found, however, in contrast to the study by Barrett, since only experienced lucid dreamers participated. Therefore it seems plausible that proficient lucid dreamers also have problems in recalling specific waking memories in lucid dreams and the question is open as to whether or not this is true in all lucid dreams, or only from time to time, or maybe only for specific information (e.g., words). Nevertheless, the experience of lucid dreaming was elicited by the lucid dream recall frequency scale and no further information about experience with lucid dreaming was collected. In future studies this fact should be considered since it is possible for lucid dreamers to be rather passive or active in their dreams.

The ability to recall specific information in lucid dreams raises the question as to whether it is possible to improve waking memory by rehearsal in the dream. For procedural memory (e.g., motor skill learning) pilot studies by Erlacher, Schredl and LaBerge (2003) and Erlacher and Schredl (2008a) showed a relationship between lucid dreamed action to actual motor activity (e.g., heart rate) and this leads one to the hypothesis that the learning of motor skills in the simulated environment of dreams is very likely to improve waking performance. For declarative memory thus far no studies have been conducted. It would be interesting to study the impact of lucid dream rehearsal on a standardized learning test in comparison to a control group.

To summarize, the results of the present study indicate that lucid dreamers are able to recall previously memorized words in their dreams. The recall rate showed a high variation from none to all of the words. Taking into account that three of the participants couldn't finish the task within the dream the recall rate in the lucid dream seems to be rather

high. To control for confounding factors it is suggested that sleep laboratory studies be conducted. It also will be promising to study the impact of lucid dream rehearsal in order to find out if this might be a new method for active learning during the night.

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