Lucid dream induction by visual and tactile stimulation: An exploratory sleep laboratory study

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Summary. In a lucid dream the dreamer is aware of the dream state. Previous research has shown that external stimuli (e.g. flashing lights) presented to a person during REM sleep can trigger lucidity. To further examine the possibility of lucid dream induction by external stimulation, visual and tactile stimuli were investigated in an exploratory sleep laboratory study. In the first experiment 10 participants spent two none-consecutive nights in a sleep laboratory. In the first night a visual stimulus (flashing lights) was presented during REM sleep and in the second night tactile stimulation (vibration) at the index finger was utilized, again in REM sleep. In the second experiment 14 participants spent a single night in the sleep laboratory and tactile stimulation (vibration) either at the wrist or at the ankle was applied during REM sleep. The participants were instructed to perform two consecutive left-to-right eye movements to indicate lucidity in the dream. Light stimulation yielded one signal-verified lucid dream out of 18 application trials (5.6 %) whereas tactile stimulation at the index finger did not provoke any lucid dream at all (21 applications). Tactile stimulation at the wrist or ankle resulted in two signal-verified lucid dreams out of 27 trials (7.4 %). Stimuli were incorporated in 38.9 %, 42.9 %, and 55.6 % of stimulations, respectively. The results suggest that lucid dreams can be triggered by visual or tactile stimulation. However, the frequencies of the induced lucid dreams are – in comparison to earlier studies – quite low. Furthermore, for tactile stimulation it seems important at which part of the body the stimulation is applied. In general, the intensity of stimulation needs to be adjusted because stimulation often led to an awakening of participants. Thus it seems important for future studies to focus on factors like waking thresholds and preparation of participants in order to minimize awakenings and to maximize lucid dream induction.

Keywords: Lucid dream induction, visual stimulation, tactile stimulation, incorporation

1. Introduction

In a lucid dream the dreamer is not only aware of the fact that he or she is dreaming, but is also able to control the dream content (LaBerge, 1985). Lucid dreams can occur spontaneously or can be induced by different techniques (cf. Stumbrys, Erlacher, Johnson & Schredl, 2014). Stumbrys, Erlacher, Schädlich and Schredl (2012) differentiated lucid dream induction techniques into two main categories: Cognitive techniques and external stimulation. Cognitive techniques include all cognitive activities that are carried out to increase the likelihood of achieving lucidity in the dream state (e.g. lucid awareness training). The rationale behind the second category is that an external stimulus presented to a sleeping person can be incorporated into their dream. For example, Dement and Wolpert (1958) sprayed water on uncovered body parts of twelve participants while they were in REM sleep. In 33 trials, where participants did not awake from the procedure, dream reports revealed in 42 % of the cases that water-spray was incorporated into the dream (e.g. sudden rainfalls, leaking roofs, or being squirted by someone). For lucid dream induction the idea is that the incorporated stimulus serves as a cue for the dreamer which reminds him of the dream state, e.g., someone squirts water reminds the dreamer that he or she is dreaming.

Sleep laboratory research demonstrated that external stimuli applied to most of the sensory modalities (e.g. auditory stimulation) are able to be incorporated in at least some dreams (cf. Nielsen, 1993). However, incorporation rates vary massively, e.g., Dement and Wolpert (1958) presented a tone or light flashes but they were incorporated in only 9 % and 23 % respectively – which is far less than using water-spray (42 %) (for an overview see: Nielsen, 1993). Therefore it seems that some stimuli might be superior when it comes to lucid dream induction than others. In the review by Stumbrys et al. (2012) eleven studies were identified which used external stimulation during REM sleep to trigger lucidity. External stimulation includes light stimuli, acoustic stimuli, vibro-tactile stimuli, electro-tactile stimuli, vestibular bodily stimuli and water stimuli (overview: Stumbrys et al., 2012).

Hearne (1978) firstly reported a study with external stimulation for lucid dream induction. He was inspired by the findings of Dement and Wolpert (1958) and used water-spray to induce lucidity in an experiment with 10 participants who spent a single night in the sleep laboratory. Results revealed that water-spray was incorporated in 60 % of the dream reports, but no lucid dream was provoked. In a later study, Hearne (1983) applied electrical impulses at the wrist. This time, six out of 12 participants (50 %) who spent a single

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night in the sleep laboratory achieved lucidity. Two other participants also became lucid, but woke up at signalling and another one became lucid after falsely perceiving stimulation. In one field study tactile stimulation was also utilized for lucid dream induction (Reis, 1989). However, these findings are limited because vibro-tactile stimulation was used in an unsystematic way either alone or in combination with reflection technique and/or acoustic stimulation. Whereas the tactile cues alone induced no lucid dream, the combination seemed to have an effect in 50 % of the cases. But again, due to a great variety of conditions used (e.g. training sessions) interpretations should be carried out carefully.

Beside tactile stimuli, visual stimulation with flashing lights appears to be a promising way of cuing lucidity during REM sleep. LaBerge and colleagues conducted four studies: One sleep laboratory experiment (LaBerge, Levitan, Rich & Dement, 1988) and three field studies which used self-constructed and commercially available devices (e.g. DreamLight) to present light stimuli during REM sleep (LaBerge & Levitan, 1995; LaBerge, 1988a; Levitan & LaBerge, 1994). In the sleep laboratory study (LaBerge et al., 1988), 24 of 44 participants (55 %) reported one or more lucid dreams. However, participants spent one to five nights (for a total of 58 recording nights) in the laboratory and therefore, chances to experience a lucid dream are higher in comparison to the single-night study by Hearne (1978). In the field studies, the success rates are even higher: 70 % of the participants in the study by Levitan and LaBerge (1994) and almost 80 % of the participants in the study by LaBerge and Levitan (1995) experienced at least one lucid dream (no exact figures available for LaBerge, 1988a). These figures only provide information about the amount of participants who achieved lucidity, the number on trials/nights is disregarded with this approach. For example, if two participants sleep five nights with an induction device and each person reports one lucid dream, the induction rate would be 100 % when only the number of partcicpants who got lucid is taken into account. As a consequence, induction rates appear to be very high. But if one only counts the number of nights with lucid dreams, the induction rate is just 20 % (two lucid dreams in ten nights). All of the field studies allow such statements about the frequency of successfully induced lucid dreams in relation to the number of awakenings or stimulation trials. Levitan and LaBerge (1994) reached 3.7 %, LaBerge and Levitan (1995) 27.16 % (with 12.35 % lucid dreams in a control grout without stimulation) and LaBerge (1988a) 5.5 % of lucid dreams. But again, the total number of nights for each participant slept with the DreamLight ranged in the study by LaBerge and Levitan (1995) for example from four to 24 nights. Furthermore, the field studies lacked of the objective validation of lucidity by eye-signaling, which usually leads to higher lucid dream rates compared to the more conservative sleep laboratory criterias with eye-signaling (e.g. Kueny, 1985, where 22 lucid dreams were reported but only five could be confirmed by eye signals and sleep stage).

Up to now only a few laboratory studies investigated external triggers for lucid dream induction and the results for tactile stimulation seems unclear. Visual cues revealed good results, however, multiple trials with a single participant have been allowed and only one study was conducted in a sleep laboratory. Furthermore, all studies were administered by LaBerge and his colleges with their own products (DreamLight, NovaDeamer etc.) and an independent replication of the results would be desirable. The purpose of this exploratory study was to further explore the effectiveness of tactile and visual stimulation to induce lucid dreams utilizing a standardized procedure in a sleep laboratory setting. The aims were to test the feasibility to apply external stimuli during REM sleep and to replicate the findings of previous studies to trigger lucidity by external stimulation. We conducted two experiments with three different conditions: Visual stimulation with flashing lights, tactile stimulation at the index finger, and tactile stimulation at the wrist or ankle.

2. Method

2.1. Participants

The participants were students from Heidelberg University and took part in a weekly seminar about lucid dreaming and sports at the Institute of Sports and Sports Sciences given by one of the authors (D.E.) in summer semester 2008 and winter semester 2008/2009. Participants were self-selected by their interest in dreams and lucid dream research. No exclusion criteria were made. There was neither a frequent lucid dreamer among the sample nor did participants use any induction technique in the past on a regular basis (see also Table 1). Ten students (5 male, 5 female) with a lucid dream frequency of 0.8 per month participated in the first experiment and in the second study 14 students (7 male, 7 female) with a mean lucid dream frequency of 0.5 per month were included. Participation in the laboratory study was part of the seminar requirement.

2.2. Experimental conditions

The stimuli or stimulation devices of the three conditions were as follows:

Visual stimulation. The light stimuli were two flashing red LEDs mounted in a pair of self-made goggles. The flashing frequency was 1 Hz and one application lasted five seconds.

Tactile stimulation – index finger. A self-build vibration device made from a small vibrating motor typically build in mobile phones was applied to the index finger of the non-dominant hand. The sensation was comparable to the vibrating alert of a mobile phone. Simulation lasted for a maximum of two seconds.

Tactile stimulation – wrist or ankle. The vibration device described above was applied either to the wrist or ankle. Stimulation of wrist or ankle was done separately in randomized order for a maximum of two seconds.

Despite acoustic stimulation was also often used in past studies we followed the suggestion by Price, LaBerge, Bouchet, Ripert and Dane (1986) not to use auditory cues because they are more likely to produce arousals since the auditory system is more associated with monitoring the environment.

The stimulation was always carried out during REM sleep by an experimenter who monitored the overnight sleep recording. The experimenter was able to adjust the intensity and duration of the tactile stimulus within a small range. The first stimulation trial always started with one second at the lowest intensity. If participants did not wake up due to stimulation and if there was no incorporation in the dream report after REM awakening, the intensity was increased in the next REM period. If there was still no awakening or incorporation, the length of stimulation increased to two sec-

Table 1. Participant characteristics

Variable	Sample	Age (years)	Dream recall frequency[1] (dreams/week)	Lucid dream recall frequency[2] (lucid dreams/month)
Visual stimulation Tactile stimulation – index finger.	10 (5 male, 5 female)	24.4 ± 1.2	3.0 ± 1.7	0.8 ± 1.4
Tactile stimulation – wrist or ankle	14 (7 male, 7 female)	24.2 ± 2.2	3.2 ± 2.2	0.5 ± 1.1

[1]Dream recall frequency was assessed on a 7-point scale ranging from 0 - never to 6 - almost every morning (Schredl, 2004).
[2]Lucid dream frequency were assessed on a 8-point scale ranging from 0 - never, to 7 - several times a week (Stumbrys, Erlacher, Schredl, 2013a)

onds. Within each trail the intensity and duration stayed the same. The visual stimulation could not be altered in intensity or length.

2.3. Sleep recordings

An overnight polysomnography (PSG) according to Rechtschaffen and Kales (1968) was conducted to register sleep stages. PSG included two electroencephalogram (EEG) channels (C3-M2, C4-M1), two electrooculogram channels (EOG) (E1-M2, E2-M2), an electromyogram (EMG) with submental electrodes as well as an electrocardiogram (ECG). Sleep stages were scored according to Rechtschaffen and Kales (1968).

2.4. Procedure

The participants slept two none-consecutive nights (experiment 1) or a single night (experiment 2) in a dark and quiet room at the Institute of Sports and Sports Sciences(Heidelberg University) with continuous PSG recording (from about 11:00 pm to about 8:00 am). Participants arrived at 9:00 pm and the experimenter familiarized them with the room and setting. Afterwards participants prepared themselves for the night and all electrodes were attached by the experimenter. Before going to sleep, all participants were instructed about the stimulus and the possibility of incorporation in their dreams. They got the following explanation in verbal and written form.

"The stimulus will be demonstrated before sleep. You should pay attention to the stimulus and its sensation and indicate us, whether you recognized it or not. Think about the stimulus before sleep and imagine its sensation. If you recognize the stimulus in your dream, you should get aware of dreaming. The stimulus can appear in different forms in your dream, be aware that any kind of the respective sensation could be a sign of dreaming. Signal lucidity by two consecutive left-to-right eye movements (LRLR). After a while, you will be awakened and have a chance to write down your dream report."

2.4.1 Stimulation and REM awakenings

The stimulation was carried out in each REM period, starting with the third REM period of the night because the first two REM periods are usually not long enough to guarantee stable REM sleep for stimulation (cf. Dement & Wolpert, 1958). Stimulation was started after five minutes of REM sleep in the third REM period and after ten minutes of REM sleep in all following REM periods. In each REM period five stimulations for the length of five seconds (light stimulation) or a maximum of two seconds (tactile stimulation) were conducted in one minute intervals (see Figure 1). After the fifth application the experimenter waited another minute before awakening participants through an intercom system. Stimulation was stopped if participants signaled lucidity by LRLR, REM sleep was discontinued, or participants woke up.
After every awakening the experimenter asked all participants whether they could recall a dream or not ('What was on your mind before you woke up?') through the intercom system. When the answer was affirmative, the experimenter went into the room and participants were asked to write down their dream and to evaluate the following questions: (1) Was the stimulus incorporated into the dream (yes or no)? (2)Where you awakened by the stimulation (yes or no)? On which part of the body did you perceive the stimulation in the dream (wrist or ankle; only condition 3)? (3) Did you become lucid (yes or no)? After the report had been completed participants continued sleeping.
For each REM period, the experimenter noted the onset of REM, the time of the stimulation, comments about the awakening and stimulus application and whether the EOG showed the respective eye movements indicating lucidity.

2.4.2 Statistical Analysis

Because this is an exploratory study, the main focus is on descriptive statistics. Effect size h was calculated for each condition according to Cohen (1992). For these calculations, the percentages of participants with successfully induced lucid dreams in each condition were compared to a sample of a study by Stumbrys, Erlacher and Schredl (2013b). In this study, a sham lucid dream condition with 19 participants and a mean of 3.2 awakenings in a single night led to no lucid dream. Cohen (1992) differentiated between small (h = 0.1-0.4), medium (h = 0.41-0.70) and large (h> 0.71) effect sizes. IBM SPSS Statistics 20 software was used for the descriptive statistical analysis.

3. Results

Table 2 depicts the number of stimulated REM periods, dream reports, incorporations and lucid dreams for all conditions.

3.1. Lucid dreams

For visual stimulation, one out of ten participants reported a lucid dream (10 % of participants; 5.6 % of all dream reports). This lucid dream was verified by LRLR eye signals. In the dream report the participant stated that light was incorporated in his dream and triggered lucidity ("Again, I was

Table 2. Main results of the three different stimulation techniques

Variable	N	Stimulated REM periods	Dream reports	Incorporation	Lucid dream
Visual stimulation[1]	10	24	18	7 (38.9 %)	1 (5.6 %)
Tactile stimulation (index finger)[1]	10	24	21	9 (42.9 %)	0 (0 %)
Tactile stimulation (wrist or ankle)	14	36 (20x wrist, 16x ankle)	27	13 (48.1 %)	2 (7.4 %)

Note. [1]Participants were the same.

at that party and saw those lights. This time I responded immediately with eye signals"). Two more participants reported a lucid dream but had to be dismissed because in the first case the participant was uncertain if she really had a lucid dream (no eye signal could be detected in EOG recording) and in the second case the participant was uncertain if she had been dreaming at all (PSG recording revealed that she had actually been awake). The effect size, in terms of the number of participants with successfully induced lucid dreams, was h = 0.64 compared to the above mentioned sham condition by Stumbrys et al. (2013b).

For tactile stimulation at the index finger, no lucid dream was reported by the 10 participants.

In the second tactile experiment, the stimulus was applied 36 times (20 stimulations at the ankle and 16 at the wrist). Two out of 14 participants reported a lucid dream triggered by stimulation at the ankle (14.3 % of participants; 7.4 % of all dream reports). Both lucid dreams were verified by LRLR eye signals. In the first lucid dream the participant reported explicitly that the vibration at the ankle triggered lucidity ("I run up the hill, when a vibration at the ankle let me realize that I was only dreaming"). The same participant reported a second lucid dream, but PSG recordings indicated that he was awake. In the second case the vibration was not explicitly stated in the dream report ("In the restaurant was no seat for me and I had to get a coffee-to-go. In the hallway, I started the lucidity task and counted the steps."), but in the protocol she confirmed that a vibration occurred in the dream. In this condition, the effect size in terms of the number of participants where lucid dreams were successfully induced, was h = 0.78 compared to the sham condition by Stumbrys et al. (2013b).

3.2. Incorporation rates and awakenings

In the case of visual stimulation, 18 dreams out of 24 awakenings were reported. Incorporation was self-reported in seven dreams (38.9 %). In eight stimulations (33.3 %) the participant was awakened by the procedure (five times after the first stimulation and three times after the fourth stimulation; see Table 3) and six times no dream was recalled.

For tactile stimulation at the index finger, 21 dreams were reported (out of 24 awakenings). Incorporation was self-reported in nine dreams (42.9 %). In 13 stimulations (54.2 %) participants were awakened by the procedure (five times after the first stimulation, two times each after the second and third stimulation, and four times after the fourth stimulation; see Table 3) and three times no dream was recalled.

For tactile stimulation at the ankle or wrist, 36 awakenings yielded in 27 dreams reports. Incorporation was self-reported in 13 dreams (48.1 %). In 15 stimulations (41.7 %) participants were awakened by the procedure and nine times no dream was recalled. Regarding the question at which part of the body the stimulation had been perceived, the correct answer was given in 16 stimulations and in two trials the wrong part was reported. In the remaining three trials participants perceived the vibration in different forms (e.g. the whole body was vibrating).

4. Discussion

In this study, external visual and tactile stimulation was investigated with the objective to induce lucidity during REM sleep. Induction rates related to the number of awakenings were comparable to earlier studies; however, the total number of participants who achieved lucidity was rather low.

Figure 1. Example for one stimulation trial

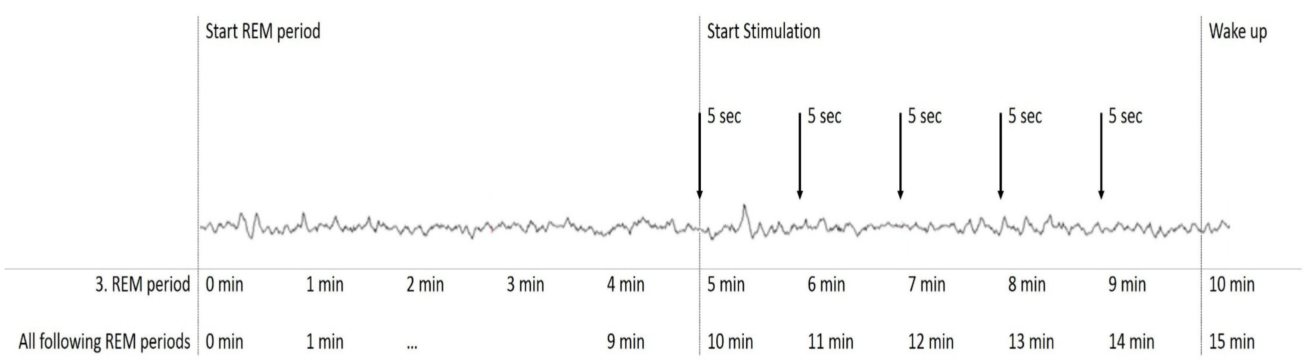

Table 3. Number of stimulus applications before participants were awakened by stimulation or experimenter

Number of applications	*Study 1 Light*	*Study 2 Vibration*
One	5 (20.8%)	5 (20.8%)
Two	0	2 (8.3%)
Three	0	2 (8.3%)
Four	3 (12.5%)	4 (16.7%)
Five	16 (66.7%)	11 (45.8%)

Taken the three studies together, lucid dream rates were about 4.3 % and incorporation rates about 43.3 %. In almost half of the trials participants were awakened by the stimulation in the tactile stimulation conditions (54.2 % and 41.7 %)and in one third of the cases during visual stimulation (39%).

4.1. Limitations

Before discussing the results, some limitations of the present study should be acknowledged. There was no control group or condition in our experiment. Data from another lucid dream induction study by a member of our research group was used to compare our results with (Stumbrys et al., 2013b). In this study, transcranial direct current stimulation (tDCS) was applied in REM sleep to induce lucidity. Eleven of the 19 participants could be described as frequent lucid dreamers (at least once a month according to Snyder and Gackenbach, 1988). In the sham night (without any stimulation), no lucid dream was reported. The problem with this comparison is that participant's characteristics (in terms of lucid dream frequency, interest in lucid dreams, regularity and method of practice etc.) of each investigation differ more or less. In a study by LaBerge and Levitan (1995) for example, the lucid dream rate in a control condition without any stimulation was 12.35 %. Their participants were described as highly interested in lucid dreams with previous experience in lucid dreaming. We suggest that future studies should always include control conditions and evaluate the previous experience of their participants very precisely. Otherwise, general conclusions could not be drawn.

There are some general methodological problems which have to be addressed. One issue refers to the measurement of dream lucidity. For example, in Kueny's (1985) study 22 participants reported a lucid dream, but after examining the PSG recordings, she was able to confirm only five of them in terms of correct stage (REM) and the presence of eye movements (to indicate lucidity). When only dreams are classified as lucid in which clearly detectable eye signals are present (in stage REM), the definition of lucid dreams is disregarded. Lucid dreams are not defined as a dream where volitional eye signals are present. Most of the past studies, especially those using visual stimulation and generally all field experiments did not use volitional eye signals to evaluate dream reports. On the other hand, it is important to have an objective measure of lucidity in comparison to the subjective dream reports by examining the PSG recordings at the time of the eye signals,. We utilized the more stringent condition to determine lucidity by evaluating sleep stages and eye signals like Kueny (1985). Thus, we were able to confirm three of the six reported lucid dreams.

The same problem applies to the rating of awakenings. We asked participants (subjective perception) and experimenters (judging PSG recordings) whether the stimulations caused an awakening or not. Both, experimenters and participants were sometimes insecure or their judgments were contradictory. In some cases it was difficult to clearly differentiate between light sleep, REM sleep and waking state. This problem will be even more severe when experimenters with little experience in sleep stage scoring have to judge about the awakenings. The classification of lucidity and sleep stages can be optimized by asking several experienced blind judges to rate dream reports, eye signals and sleep stages independently.

Another methodological issue deals with the question whether the stimulation triggered lucidity or a lucid dream occurred by chance or even triggered by other cues (e.g. the sleep laboratory environment or bizarre dream features). Therefore, we recommend using control conditions.

Further limitations of our study are the small sample size and the (self) selection of participants.

4.2. Comparison to earlier studies

Concerning visual stimulation, our induction rate of 5.6% reflects LaBerge's (1988) finding of 5.5 % of lucid dreams when only the DreamLight was used. Both studies did not utilize other induction techniques like for example verbal suggestion. Consequentially, it could be argued that visual stimulation seems to be inferior compared to other external cues. In the present study tactile stimulation yielded in a 7.4 % lucid dream rate. In the single tactile stimulation study (Hearne, 1978) with untrained participants (spraying water) no lucid dreams were reported. Later, Hearne (1983) used electrical impulses to induce lucidity and 8 out of 12 participants reported lucid dreams. However, her 8.3 % of lucid dreams without stimulation suggest that the participants were more or less frequent lucid dreamers. Other investigations with tactile stimulation could not be compared with our study because other/multiple training methods have been used.

Although a combination of different training methods (e.g. intention technique, autosuggestion, wake back to bed) cannot reveal effects of external stimulation as a single technique, this approach should be considered, especially with participants who are unfamiliar with lucid dreaming. Concerning visual stimulation, findings of LaBerge (1988) and Levitan and LaBerge (1994) indeed suggest that light stimuli in combination with cognitive techniques (e.g. MILD) seem to be more effective.

Motivational factors are often discussed to be important for achieving lucidity too (e.g. Price & Cohen, 1988). We did not collect data about the attitude towards dreaming or other motivational factors.

4.3. Location of stimulation

Concerning the location of tactile stimulation, we induced two lucid dreams by stimulating the ankle in comparison to no lucid dream when the stimulus was applied at the wrist or index finger. Because of the overall small amount of lucid dreams induced in each condition, no general conclusion could be drawn here. It is possible that body parts which are not as sensitive to touch as fingers or hands are more likely to induce lucidity rather than awaken the person. In western societies feet are not that important for tactile sensation, hence, tactile stimulation at the feet might lead to fewer awakenings. This assumption should be examined in future research.

4.4. Incorporation rate

We further wanted to investigate whether visual and tactile stimuli are incorporated into participant's dreams and whether they trigger wakening responses. In our study the incorporation rate was 39 % in the visual condition and about 45 % in the tactile conditions, which almost reflects the results of earlier investigations: 23 % with light flashes and about 48.2 % with tactile stimulation (see Schredl & Stuck, 2009). It should be noticed that stimulations led to high awakening rates of about 48 % in the tactile stimulation conditions and 39% when using flashing lights. Compared to previous incorporation and induction studies these rates are rather high. The reason for this may be specific features of our devices as well as other influences of the lab environment. We suggest conducting pilot studies to test the incorporation qualities and awakening responses for certain (features of) stimuli. For future induction studies it is advisable to schedule an adaptation night in which the participant can get used to the surrounding and devices and during which individual awakening thresholds could be determined to adjust the intensity and timing of the stimuli.

4.5. Unfamiliarity with lucid dreaming

It should be considered that external stimulation in general might not work well for participants unfamiliar with lucid dreaming. For example, Price et al. (1986) suggested that external stimulation might be more effective for enhancing the lucid dream frequency of experienced lucid dreamers than using it for beginners. Future studies should compare external stimulation in frequent and non-frequent lucid dreamers to further investigate this assumption.

Many studies contain no or only scarce information about the sample; neither in terms of lucid dream experience nor with respect to preceding training of participants (e.g. intentions or suggestion). For comparison purposes, that information would be desirable.

4.6. Time of stimulation

Moreover, the time of stimulus application, e.g. straight after a REM burst, might influence induction rates as well (Price et al.,1986). In the present study the only criteria for stimulation were to wait at least 5 minutes after REM onset before starting stimulation and even longer when REMs stopped between the 3rd and 5th minute of the REM period.

5. Conclusion

The results suggest that lucid dreams can be triggered by visual or tactile stimulation. However, the frequencies of the induced lucid dreams are – in comparison to earlier studies – quite low. Furthermore, for tactile stimulation it seems important at which part of the body the stimulation is applied. In general, the intensity of stimulation needs to be adjusted because stimulation often led to an awakening of participants. Thus it seems important for future studies to focus on factors like waking thresholds and preparation of participants in order to minimize awakenings and to maximize lucid dream induction.

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