

Laboratory references in dreams: Methodological problem and/or evidence for the continuity hypothesis of dreaming?

Michael Schredl

Central Institute of Mental Health, Mannheim, Germany

Summary. Incorporation of laboratory elements into dreams elicited in the sleep laboratory is a methodological problem, i.e., the measurement technique affects unwittingly the object of measurement (dream content). On a theoretical level, the occurrence of laboratory references, however, fits in the framework of the continuity hypothesis of dreaming. Reviewing the literature revealed that there is a strong effect of the experimental setting on dreams and that emotional involvement may explain inter-individual differences regarding the incorporation of laboratory elements. Investigating the effects of the laboratory setting on dream content seems to be a powerful tool for studying continuity between waking and dreaming in a detailed way.

Keywords: Dream content; Laboratory references; Continuity hypothesis

1. Introduction

Following the discovery of REM sleep (Aserinsky & Kleitman, 1953), the pro and cons of the laboratory paradigm for eliciting dream reports were often discussed in dream research (cf. Domhoff, 1969; Foulkes, 1996). The controversy about possible differences between laboratory and home dreams and which method is preferable is still not settled. A study (Weisz & Foulkes, 1970) using identical recording techniques (awakening at 6:30, dictating the dream into a tape recorder without interaction with the experimenter) found less sexual and aggressive elements in dreams elicited in the laboratory than in home dreams. These findings can be interpreted as an 'inhibitory effect of the laboratory' (cf. Schredl, 1999); an interpretation which is supported by the findings that nightmares tend to occur less often in a sleep laboratory than at home (cf. Hartmann, 1984). A recent study (Spoomaker et al., 2006) in PTSD patients indicated that even ambulatory polysomnography reduced nightmare frequency.

In addition to these differences regarding formal characteristics such as emotionality, research has shown that dream reports obtained in the sleep laboratory are often related to the experimental setting. From a methodological viewpoint, these effects are unwanted since the measurement technique should not alter the studied phenomenon in a marked way. On the other hand, the investigation of laboratory elements offers the opportunity to study the effect of waking-life experiences on dream content.

Most dream researchers (e. g. Domhoff, 1996; Strauch & Meier, 1996) take the view that the emotional concerns of the waking life are reflected in the person's dreams; this is the so-called continuity hypothesis of dreaming (cf. Schredl, 2003). A large variety of approaches to study the continuity between waking and dreaming have been reported in the literature, e.g., the experimental manipulation of the pre-sleep situation by films (e. g. Foulkes & Rechtschaffen, 1964) or guided imagination (De Koninck & Brunette, 1991), study-

ing the effect of stress on dreams (Breger, Hunter & Lane, 1971), correlational studies relating psychopathology (e.g., Kramer & Roth, 1978; Schredl & Engelhardt, 2001) or personality traits (e.g., Schredl et al., 1999a) to dream content. Less attention in this context was paid to the findings that dreams, especially laboratory dreams, are influenced by the experimental situation.

The present article reviews the major studies in this area and emphasizes possible influencing factors and the implication of these findings for the continuity hypothesis of dreaming.

2. Definition of "Laboratory reference"

The majority of the studies have applied the technique of dream content analysis to measure the percentage of dreams with laboratory references. Essentially, two kinds of measures are distinguished: direct references and indirect references. Direct references are dream elements which are directly related to the experimental setting such as laboratory surroundings, electrodes, EEG machine, and experimenter. For coding indirect references, the categories are broader, e.g., the occurrence of laboratories in general, elements related to sleep or dreaming or participating in an experiment. The following example is a dream with multiple direct and indirect laboratory references:

"You (the experimenter) had just come in, and I thought I was awake. And a second person stood at the door, but I don't know who it was. Next, you dragged a mechanical device into the room, and said it would help me sleep better. And then I said I did not want any special treatment. And the device was a box with switches and metal cables, to be fastened to the head, designed to sleep better, or sleep at last. (Strauch & Meier, 1996; pp. 166-167)"

Direct references in this dream example are: the experimenter, the setting. The device/box which should be attached to the person in order to induce sleep as a special treatment is an indirect reference to the experimental situation.

3. Frequencies of laboratory references

Several selected laboratory studies utilizing the REM-awakening technique are depicted in Table 1. The percentage of dreams with direct laboratory references varies from 6.2 % to 32.0 %; the weighted mean for all studies amounted to 19.4 % (N = 2464 dreams).

Corresponding address: Dr. Michael Schredl, Central Institute of Mental Health, Mannheim, Germany, email: Michael.Schredl@zi-mannheim.de

Submitted for publication: January 2008
Accepted for publication: March 2008

If indirect references were also measured, the incorporation rate nearly doubles (weighted mean for all studies: 38.4 %; N = 1753 dreams). These percentages reflect the number of dreams including at least one laboratory reference. Hall (1967) estimated the number of dreams which were strongly influenced by the experimental situation to 6.2 %, whereas Strauch and Meier (1996) reported that up to 16.1 % of the laboratory dreams were strongly affected by the laboratory setting (see example cited above). Domhoff and Kamiya (1964) analyzed 219 REM dreams elicited in the laboratory regarding the occurrence of different aspects of the experimental setting: 20.1 % referred to the experimental situation, 11.4 % to the experimenter, 5.9 %, to the laboratory, 1.8 % to the EEG machine, and 4.1 % to the electrodes.

Using a standardized report sheet on mornings after uninterrupted nights in the sleep laboratory to elicit dream reports, an incorporation rate of 14.4 % was found for direct laboratory references (N = 299; Schredl, 1998). Hall (1967) reported that only 0.8 % of the dream reports elicited by dream diaries include a reference to the experimental situation.

4. First-night effect

A first-night effect on sleep is frequently discussed in the literature, i.e., the participants have to adapt to the new sleep environment, the fact that their sleep was observed, the electrodes and so on. Rechtschaffen and Verdone (1964), for example, have shown that REM latency is prolonged in the first night, whereas sleep efficiency and percentage of REM sleep is often reduced. Regarding laboratory references in dreams, it was expected that they occur most often during the first night in the sleep laboratory because of the new situation which might be linked to worries, etc. Whereas Dement, Kahn and Roffwarg (1965) found the expected difference (43.5 % dreams with laboratory references in the first night vs. 21.9 % in the second night) and several subsequent studies (Strauch, 1965; Kramer & Roth, 1979; Browman & Cartwright, 1980) confirmed the finding, other extensive investigations (Domhoff & Kamiya, 1964; Hall, 1967; Piccione et al., 1976) have not detected any substantial first-night effect for the incorporation rate of laboratory references. Thus, the question as to whether the "first night" factor shows a marked effect on the incorporation rate is unresolved.

5. Influencing factors

Since both the variability of the incorporation rate between studies (cf. Table 1) as well as the differences between participants, e.g., 2.5% to 41.0% (Hall, 1967) or 0% to 44% (Dement, Kahn & Roffwarg, 1965) is very large, it will be worthwhile to look for possible influencing factors. A marked difference was reported by Whitman,

Kramer and Baldrige (1963) who carried out REM awakenings with patients and their psychotherapists. Whereas the incorporation rate of the laboratory setting amounted to 6.9 % (N = 29 dreams) for the patients, the rate for the therapists' dreams (N = 28) was much higher (53.6 %). Similar, Hall (1967) reported a higher incorporation rate for the participating psychologists (20.5 %) than for the student sample (10.6 %) and Fukuma (1969) found that psychiatrists (N = 14) incorporated the experimental setting more often into their dreams than students (N = 20). Fukuma (1969) interpreted his finding as reflecting more interest and more knowledge about sleep and dreaming. Another explanation for Fukuma's and Hall's data might be the closeness of the relationship between participant and experimenter because the psychiatrists were colleagues of the author and therefore closer related than the students who were investigated. The high percentage of laboratory references in the therapists (Whitman, Kramer and Baldrige, 1963) might reflect worries that the dreams might serve as evaluation of their therapeutic skills.

If one takes a close look at the figures depicted in Table 1, it is striking that the highest incorporation rates (direct references) were reported in the earlier studies. Indeed, Whitman et al. (1962), Domhoff and Kamiya (1964) and Strauch (1965) pointed out that some subjects reported fears regarding the laboratory procedure (EEG machine, electrodes etc.). One participant dreamed that "... a machine had been connected to her ears and mouth, and was squirting water into her (Domhoff & Kamiya, 1964, p. 526)". Although the example provided by Strauch and Meier (1996) (see "definition of laboratory references" section) also reflects worries, it can be hypothesized that worries about sleep recording techniques play a minor role in recently-performed sleep studies since common knowledge regarding sleep and dream research in the general public has increased considerably over the last decades.

Another factor which has not been studied systematically is the duration of other procedures (e.g., pre-sleep film, blood sampling, cognitive tests) also carried out in the laboratory setting. Schredl et al. (1999b) found that 33.3 % of N = 44 dream reports obtained by REM awakenings of sleep apnea patients included at least one direct laboratory reference. This elevated percentage (cf. 6.2%, Roussey et al., 1996) might be explained by the more extensive recording technique (including measures of nasal and oral airflow, chest and abdomen movements, blood oxygen saturation and anterior tibialis electromyogram) and possible worries associated with the diagnosis of their sleep complaints and daytime sleepiness.

Baekeland (1969) reported that the incorporation of laboratory references into dreams was related to a "field dependence" personality trait. This trait reflects, for example, the ability to focus on a stimuli without being distracted by distractors placed around the target stimuli (field independence). Dreams of low and high field

Table 1. Laboratory references in dreams elicited by REM awakenings.

Study	Dreams (N =)	Direct references	Direct + indirect references
Roussey et al. (1996)	64	6.2 %	---
Baekeland (1969b)	81	7.4 %	32.2 %
Hall (1967)	559	14.2 %	---
Cartwright et al. (1969)	179	16.8 %	---
Hauri (1970)	164	17.6 %	---
Corsi-Cabrera et al. (1986)	70	20.0 %	---
Fukuma (1969)	378	21.0 %	---
Piccione et al. (1976)	754	---	34.0 %
Dement, Kahn & Roffwarg (1965)	695	21.9 %	37.3 %
Domhoff & Kamiya (1964b)	163	30.0 %	---
Strauch & Meier (1996)	112	---	51.8 %
Whitman et al. (1962)	111	32.0 %	68.0 %

dependent participants included laboratory references more often than those of field intermediate participants. Whereas it seems plausible that field dependent persons incorporate the laboratory setting, it remained unclear why the same pattern was found for field independent persons.

6. Discussion

The review of the major studies investigating laboratory references in dreams indicates that the experimental setting strongly affects dream content. These findings, thus, support the continuity hypothesis of dreaming. In comparison to other approaches, the effect of the laboratory setting on dreams seems more pronounced than the effects of pre-sleep stimulation (films, guided imagination). Goodenough et al. (1975) and Lauer et al. (1987) found indirect effects of aversive films (more negatively-toned dreams) but direct incorporations of film elements were rarely present. Even six hours of physical or mental activity prior to bedtime scarcely affected subsequent dreams (Hauri, 1970). On the other hand, studies (e. g. Breger, Hunter & Lane, 1971) which have investigated "real" stress have revealed higher incorporations of the day-time stressors (worries about a major surgery, intense group therapy). I.e., the participation in a laboratory study can be viewed as "real" stress.

Similarly, the observed influencing factors (therapists vs. patients, psychologists/psychiatrists vs. students, patients vs. healthy controls, early vs. recent studies, personality factors) support the hypothesis that the person's emotional involvement modulates the incorporation rate. This parallels the more general formulation of the continuity hypothesis that emotional concerns are reflected in dreams (Domhoff, 1996) and confirms the more specific continuity model of Schredl (2003). The inhomogeneous findings regarding the first-night effect which may reflect the effect of novelty on the incorporation rate indicate that emotional concerns alone can not explain the variability in the occurrence of laboratory references.

Along similar lines, the measurement technique (REM awakenings vs. recording dreams after uninterrupted nights) seems to have little effect on the incorporation rate, although the rate was slightly reduced for the morning recording technique (Schredl, 1998).

7. Future directions

The systematic investigation of the effects of the laboratory setting on dream content offers interesting opportunities to determine a more exact formula for the continuity between waking and dreaming. For example, emotional involvement, worries about the laboratory procedure, knowledge about sleep and dream research can be elicited explicitly and can be correlated with the individual's incorporation rate. In addition, it will be interesting to measure personality traits in relation to the occurrence of laboratory references in dreams, especially personality traits such as thin vs. thick boundaries (Hartmann, 1991) or absorption (Tellegen & Atkinson, 1974) for which a connection with dream content has been demonstrated (e.g., Schredl et al., 1999a). For persons with thin boundaries and high absorption higher incorporation rates are expected. Similarly, the comparison of patients' dreams with those of healthy controls can shed light on which factors affect the incorporation rate of laboratory references. It seems plausible that patients who think about their sleep behavior and the diagnostic procedure concerning their disturbed sleep will dream more often about the laboratory setting than healthy persons participating in a dream study.

It may also be possible to apply experimental approaches, e.g., the amount of information about sleep in general, sleep recording, etc. or the time spent in the laboratory (including, for example, cognitive tests) can be varied systematically in order to test their effect on the incorporation rate of laboratory element into subsequent dreams. Lastly, dream studies applying ambulant polysomnographic recordings will be very interesting because these findings will show whether the recording procedure (electrodes, video camera) or the sleep laboratory setting is more potent in affecting dream content.

Acknowledging the fact that the setting strongly affects dream content, Winget and Kramer (1979) have suggested that research-

ers should describe the utilized procedure as exact as possible and standardize very carefully the setting for all participants. For eliciting dreams in a natural setting, the diary procedure seems more suitable, whereas laboratory studies are a good policy for studying the relationship between physiological parameters and dream content. The general preference of one method over the others, e. g. home dreams (Domhoff, 1969) or laboratory dreams (Foulkes, 1996) seems not to be appropriate.

To summarize, the investigation of laboratory references in dreams seems to be a powerful tool to study the intimate relationship between waking and dreaming.

References

- Aserinsky, E., & Kleitman, N. (1953). Regularly occurring periods of eye motility and concomitant phenomena during sleep. *Science*, 118, 273-274.
- Baekeland, F. (1969). Dreams with laboratory references: effects of cognitive style and the time of the night. *Psychophysiology*, 6, 251.
- Breger, L., Hunter, I., & Lane, R. W. (1971). *The effect of stress on dreams*. New York: International Universities Press.
- Browman, C. P., & Cartwright, R. D. (1980). The first-night effect on sleep and dreams. *Biological Psychiatry*, 15, 809-812.
- Cartwright, R. D., Bernick, N., Borowitz, G., & Kling, A. (1969). Effect of an erotic on the sleep and dreams of young men. *Archives of General Psychiatry*, 20, 262-271.
- Corsi-Cabrera, M., Becker, J., Garcia, L., Ibara, R., Morales, M., & Souza, M. (1986). Dream content after using visual inverting prisms. *Perceptual and Motor Skills*, 63, 415-423.
- De Koninck, J., & Brunette, R. (1991). Presleep suggestion related to a phobic object: successful manipulation of reported dream affect. *Journal of General Psychology*, 118, 185-200.
- Dement, W. C., Kahn, E., & Roffwarg, H. P. (1965). The influence of the laboratory situation on the dreams of the experimental subject. *Journal of Nervous and Mental Disease*, 140, 119-131.
- Domhoff, B. (1969). Home dreams versus laboratory dreams - home dreams are better. In M. Kramer, R. M. Whitman, B. J. Baldrige, & P. H. Ornstein (Eds.), *Dream psychology and the new biology of dreaming* (pp. 199-217). Springfield: Charles C. Thomas.
- Domhoff, B., & Kamiya, J. (1964b). Problems in dream content study with objective indicators: II. appearance of experimental situation in laboratory dream narratives. *Archives of General Psychiatry*, 11, 525-528.
- Domhoff, G. W. (1996). *Finding meaning in dreams: a quantitative approach*. New York: Plenum Press.
- Foulkes, D. (1996). *Sleep and dreams - Dream research: 1953 - 1993*. Sleep, 19, 609-624.
- Foulkes, D., & Rechtschaffen, A. (1964). Presleep determinants of dream content. *Perceptual and Motor Skills*, 19, 983-1005.
- Fukuma, E. (1969). A study of dreams by using „REMP-awakening technique“ - Psychophysiological study of dreams in normal subjects: The first report (English summary). *Psychiatria et Neurologia Japonica*, 71, 1026-1027.
- Goodenough, D. R., Witkin, H. A., Koulack, D., & Cohen, H. (1975). The effects of stress films on dream affect and on respiration and eye movement activity during rapid-eye-movement sleep. *Psychophysiology*, 12, 313-320.
- Hall, C. S. (1967). Representation of the laboratory setting in dreams. *Journal of Nervous and Mental Disease*, 144, 198-206.
- Hartmann, E. (1984). *The nightmare: the psychology and biology of terrifying dreams*. New York: Basic Books.
- Hartmann, E. (1991). *Boundaries in the mind*. New York: Basic Books.
- Hauri, P. (1970). Evening activity, sleep mentation and subjective sleep quality. *Journal of Abnormal Psychology*, 76, 270-275.
- Kramer, M., & Roth, T. (1978). Dreams in psychopathologic patient groups. In R. L. Williams & I. Karacan (Eds.), *Sleep disorders: diagnosis and treatment* (pp. 323-349). New York: John Wiley & Sons.
- Kramer, M., & Roth, T. (1979). The stability and variability of dreaming. *Sleep*, 1, 319-325.
- Lauer, C., Riemann, D., Lund, R., & Berger, M. (1987). Shortened REM latency: a consequence of psychological strain? *Psychophysiology*, 24, 263-271.
- Piccione, P., Thomas, S., Roth, Th., & Kramer, M. (1976). Incorporation of the laboratory situation in dreams. *Sleep Research*, 5, 120.
- Rechtschaffen, A., & Verdone, P. (1964). Amount of dreaming: effect of incentive, adaption to laboratory and individual differences. *Perceptual and Motor Skills*, 19, 947-958.
- Roussy, F., Camirand, C., Foulkes, D., De Koninck, J., Loftis, M., & Kerr, N. H. (1996). Does early-night REM dream content reliably reflect presleep state of mind? *Dreaming*, 6, 121-130.
- Schredl, M. (1998). *Träume und Schlafstörungen: Empirische Studie zur Traumerinnerungshäufigkeit und zum Trauminhalt schlafgestörter*

- PatientInnen. Marburg: Tectum.
- Schredl, M. (1999). *Die nächtliche Traumwelt: Eine Einführung in die psychologische Traumforschung*. Stuttgart: Kohlhammer.
- Schredl, M. (2003). Continuity between waking and dreaming: A proposal for a mathematical model. *Sleep and Hypnosis*, 5, 38-52.
- Schredl, M., & Engelhardt, H. (2001). Dreaming and psychopathology: Dream recall and dream content of psychiatric inpatients. *Sleep and Hypnosis*, 3, 44-54.
- Schredl, M., Kraft-Schneider, B., Kröger, H., & Heuser, I. (1999b). Dream content of patients with sleep apnea. *Somnologie*, 3, 319-323.
- Schredl, M., Schäfer, G., Hofmann, F., & Jacob, S. (1999a). Dream content and personality: thick vs. thin boundaries. *Dreaming*, 9, 257-263.
- Spoormaker, V. I., Schreuder, B. J. N., de Weerd, A. W., Kleijn, W. C., & Kamphuisen, H. A. C. (2006). Polysomnography reduces nightmare frequency. *Sleep-Wake Research in the Netherlands*, 17, 113-116.
- Strauch, I. (1965). Der Einfluß der Versuchssituation auf experimentell kontrollierte Träume. Bericht über den 14. Kongreß der Deutschen Gesellschaft für Psychologie, pp. 270-274.
- Strauch, I., & Meier, B. (1996). *In search of dreams: results of experimental dream research*. Albany: State University of New York Press.
- Tellegen, A., & Atkinson, G. (1974). Openness to absorbing and self-altering experiences („absorption“), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology*, 83, 268-277.
- Weisz, R., & Foulkes, D. (1970). Home and laboratory dreams collected under uniform sampling conditions. *Psychophysiology*, 6, 588-596.
- Whitman, R. M., Kramer, M., & Baldrige, B. J. (1963). Experimental study of supervision of psychotherapy. *Archives of General Psychiatry*, 9, 529-535.
- Whitman, R. M., Pierce, C. M., Maas, J. W., & Baldrige, B. J. (1962). The dreams of the experimental subject. *Journal of Mental and Nervous Disease*, 134, 431-439.
- Winget, C., & Kramer, M. (1979). *Dimensions of dreams*. Gainesville: University of Florida Press.