

# Lucid Dreaming Frequency and the Big Five Personality Factors

Gabriela Hess<sup>1</sup>, Michael Schredl<sup>1</sup>, and Anja S. Goritz<sup>2</sup>

Imagination, Cognition and Personality: Consciousness in Theory, Research, and Clinical Practice

2017, Vol. 36(3) 240–253

© The Author(s) 2016

Reprints and permissions:  
sagepub.com/journalsPermissions.nav  
DOI: 10.1177/0276236616648653  
journals.sagepub.com/home/ica



## Abstract

Lucid dreaming frequency varies strongly among individuals and, thus, research has focused on identifying what factors affect this phenomenon. The present study, an online survey ( $N = 2,492$ ), focused on the relationship between the Big Five personality dimensions and lucid dreaming frequency. Additionally, the personality correlates of the age of the first lucid dream were investigated. In our sample, a small but substantial portion of individual differences concerning lucid dreaming frequency was explained by the Big Five personality factors. Openness to experiences correlated positively with lucid dreaming frequency, whereas the correlation was negative for agreeableness. The relationship between neuroticism and lucid dreaming frequency disappeared when nightmare frequency was controlled. Future researchers should examine the relationship of the Big Five factors with the attitudes toward and the contents of lucid dreams. Moreover, longitudinal studies should investigate the lucid dream socialization of children and the effect of age on the course of interest in lucid dreaming.

## Keywords

lucid dreaming, personality, Big Five factors

<sup>1</sup>Central Institute of Mental Health, Medical Faculty Mannheim/Heidelberg University, Mannheim, Germany

<sup>2</sup>University of Freiburg, Freiburg, Germany

## Corresponding Author:

Michael Schredl, Central Institute of Mental Health, J 5, Mannheim 68259, Germany.

Email: Michael.Schredl@zi-mannheim.de

## Introduction

The term *lucid dream* is defined as a dream in which the dreamer—while dreaming—is aware that she or he is dreaming (LaBerge & Rheingold, 1990; Tholey & Utecht, 1987). The lucid dreamer can then consciously steer and control some of the events or content of the dream (Snyder & Gackenbach, 1988), such as flight, transmuting the body, summoning characters, and changing scenes (Gackenbach & Bosveld, 1989; LaBerge, 1985). In addition to being a fascinating experience, lucid dreaming can be a useful application for the training of complex activities (Erlacher & Schredl, 2010; Stumbrys, Erlacher, & Schredl, 2016) and nightmare treatment (Brylowski, 1990; Zadra & Pihl, 1997).

In a representative German sample ( $N=919$ ), 51% of the participants reported that they had experienced at least one lucid dream in their lives (Schredl & Erlacher, 2011). About 20% had lucid dreams regularly (once a month or more frequently; Schredl & Erlacher, 2011) and can, therefore, be considered as frequent lucid dreamers (Snyder & Gackenbach, 1988). According to self-reports, spontaneous lucid dreaming could start as early as 3 or 4 years, although it seems to originate most frequently in 12 to 14 year old adolescents (Stumbrys, Erlacher, Johnson, & Schredl, 2014). After the age of 25, a spontaneous onset of lucid dreaming appears to be very infrequent (Stumbrys et al., 2014).

The interindividual differences in lucid dreaming frequency are large (Schredl & Erlacher, 2011) and, thus, research focused on identifying what factors might affect the occurrence of lucid dreams would be of value. A variety of factors such as a need for cognition (Blagrove & Hartnell, 2000), internal locus of control (Blagrove & Hartnell, 2000), and parameters of the vestibular system (Gackenbach, Snyder, Rokes, & Sachau, 1986) have been studied. The following review focuses on the correlations between Big Five personality dimensions and lucid dreaming frequency (see Table 1).

The two studies (Schredl & Erlacher, 2004; Watson, 2001) failed to find a consistent pattern: In two samples, lucid dreaming frequency was negatively related to agreeableness and conscientiousness (see Table 1). A significant relationship between extraversion and openness to experiences and lucid dreaming was found in one sample, while neuroticism did not correlate with lucid dreaming frequency in any sample. Schredl and Erlacher (2004) found that two of the openness to experience facets (“fantasy,” “ideas”) showed small but significant correlation coefficients with lucid dream frequency.

Other personality dimensions which can be conceptualized as subdimensions of the Big Five factor openness to experiences (McCrae, 1994) such as hypnotic suggestibility (Hoyt, Kihlstrom, & Nadon, 1992), thin boundaries (Galvin, 1990; Hicks, Bautista, & Hicks, 1999; Schredl & Erlacher, 2004), creativity (Blagrove & Hartnell, 2000; Zink & Pietrowsky, 2013), and absorption (Schredl & Erlacher, 2004) were related to lucid dreaming frequency.

**Table 1.** Correlations Between Lucid Dreaming Frequency and the Big Five Personality Dimensions.

Big Five Factors	Lucid dreaming frequency			
	Watson (2001)		Schredl and Erlacher (2004)	
	Sample 1 (N = 482)	Sample 2 (N = 466)	N = 439	Controlled for DRF
Neuroticism	.02	.03	.002	-.007
Extraversion	.01	.13*	.034	.028
Openness to experience	.14*	.08	.058	.013
Agreeableness	-.11**	-.09**	-.032	.005
Conscientiousness	-.10**	-.15*	.015	.012

Note. DRF = dream recall frequency.

\* $p < .01$ . \*\* $p < .05$ .

To summarize, the findings indicate that there might be small but significant correlations between some of the Big Five personality factors and lucid dreaming frequency. From a methodological viewpoint, it has to be mentioned that most of the studies (Schredl & Erlacher, 2004; Watson, 2001) recruited only students. So, the question arises whether these findings could be generalized to population-based samples.

Investigating the relationship between lucid dream frequency and personality has two aims: First, the simple question is whether interindividual differences in lucid dream frequency are related to waking-life interindividual differences. Second, this research can help to identify causal mechanisms, comparable with genetics (Papatheodorou, Oellrich, & Smedley, 2015): If a risk gene, for example, for schizophrenia, has been identified, research focuses on possible pathways how this gene affects the phenotype of schizophrenia. Similar, a positive finding between a personality dimension and lucid dream frequency can provide hints for possible causal mechanisms how waking-life behavior and thoughts can affect lucid dreaming frequency. An illustrative example is the relationship between video gaming and lucid dreaming with high end gamer report more lucid dreams (Gackenbach, 2006). This finding supports the idea that practicing controlling a virtual reality in which the gamer is very much immersed also increases lucid dreaming. The next logical step would be to conduct experimental studies, for example, to train unexperienced persons in video game playing and test whether lucid dreaming frequency is going up.

The aim of the following study is to examine the relationship between the Big Five personality dimensions and lucid dreaming frequency in a sample with a large age range and diverse social backgrounds. Additionally, the personality correlates of the age of the first lucid dream were investigated.

## Method

### Research Instruments

For eliciting the lucid dream frequency, an 8-point rating scale was presented (“How often do you experience so-called lucid dreams (see definition)?” 0 = *never*, 1 = *less than once a year*, 2 = *about once a year*, 3 = *about two to four times a year*, 4 = *about once a month*, 5 = *two to three times a month*, 6 = *about once a week*, 7 = *several times a week*). To ensure a clear understanding of the phenomenon, a short definition was given:

In a lucid dream, one is aware that one is dreaming during the dream. Thus it is possible to wake up deliberately, or to influence the action of the dream actively, or to observe the course of the dream passively.

The retest reliability of the lucid dreaming frequency scale was  $r = .717$  (Schredl, Berres, Klingauf, Schellhaas, & Göritz, 2014), in a sample of students  $r = .89$  (Stumbrys, Erlacher, & Schredl, 2013a). Furthermore, the age of the first lucid dream was measured (“If you have experienced lucid dreams, how old were you when they occurred the first time” “\_\_years”). To obtain the dream recall frequency, a 7-point scale (coded as 0 = *never*, 1 = *less than once a month*, 2 = *about once a month*, 3 = *about two to three times a month*, 4 = *about once a week*, 5 = *several times a week*, 6 = *almost every morning*) was presented. The retest reliability of this scale for an average interval of 8 weeks is high:  $r = .85$  (Schredl, 2004a). To assess nightmare frequency, an 8-point rating scale was presented (“How often do you experience nightmares?” 0 = *never*, 1 = *less than once a year*, 2 = *about once a year*, 3 = *about two to four times a year*, 4 = *about once a month*, 5 = *about two to three times a month*, 6 = *about once a week*, 7 = *several times a week*). Retest reliability of the nightmare frequency scale is high:  $r = .75$  (4 weeks retest interval; Stumbrys et al., 2013a).

The Big Five personality factors were measured with the German version of the NEO-FFI-30, which includes 30 Items (Körner, Drapeau, et al., 2008). Each personality factor (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness) were computed as the sum score of the six corresponding items. The internal consistencies (Cronbach’s alpha) of the five scales of the 30 item version were comparable to those of the 60 item version of the NEO-FFI and ranged from  $r = .67$  (openness to experience) to  $r = .81$  (neuroticism; Körner, Geyer, et al., 2008).

### Procedure and Participants

Overall, 2,492 persons (1,437 woman, 1,055 men) completed the online survey between March 23, 2015 and April 8, 2015. The mean age of the sample was  $47.75 \pm 14.41$  years (range: 17–93 years). The link of the study was posted on the

online panel [www.wisopanel.net](http://www.wisopanel.net). Within this panel, persons with an interest in online studies and with heterogenic demographic backgrounds are registered. The participation was voluntary and unpaid.

Statistical procedures were carried out with the SAS 9.4 software package for Windows. An ordinal regression was used for analyzing the effect of different predictors (the Big Five personality dimensions) on lucid dream recall frequency controlled for age, sex, and the dream recall frequency. To analyze the influence of the Big Five personality dimensions on the age of the first lucid dream, a linear regression was conducted using age, gender, and the lucid dream recall frequency as control variables. For both analyses, the variables were entered simultaneously.

## Results

The distribution of the lucid dream recall frequency scale is depicted in Table 2. Among the participants, 58.8% reported that they had experienced a lucid dream at least once in their lives. According to the terminology (Snyder & Gackenbach, 1988), 24.7% of the participants are considered to be frequent lucid dreamers (having a lucid dream once a month or more frequently). The correlation coefficient between lucid dreaming frequency and dream recall frequency was  $r = .420$  ( $p < .0001$ ). In Table 3, the means and standard deviations of the Big Five factors of our present study and the representative population sample of the NEO-FFI-30 (Körner, Geyer, et al., 2008) are depicted.

In Table 4, the ordinal regression for lucid dream recall frequency using the Big Five personality factors as predictors is depicted (adj.  $R^2 = .2129$ ;  $N = 2,491$ ). The Big Five personality dimension with the largest regression coefficient was openness to experience. Small but significant relationships were found for the agreeableness and neuroticism factors. Dream recall frequency showed a strong

**Table 2.** Lucid dreaming frequency.

Category	<i>f</i>	%
Several times a week	66	2.65
About once a week	111	4.46
Two or three times a month	194	7.79
About once a month	245	9.84
About two or four times a year	359	14.41
About once a year	193	7.75
Less than once a year	297	11.92
Never	1026	41.19

Note. *f* = frequency;  $N = 2,491$ .

**Table 3.** The Big Five Factors of the NEO-FFI Representative Population Sample (Körner, Geyer, et al., 2008) and Our Present Sample.

Scale	Körner, Geyer, et al. (2008)		Present sample <i>N</i> = 2,491	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Neuroticism	1.52	0.77	1.48	0.91
Extraversion	2.28	0.62	2.10	0.65
Openness to experience	2.04	0.64	2.44	0.74
Agreeableness	2.79	0.65	2.86	0.66
Conscientiousness	2.96	0.62	2.95	0.62

**Table 4.** Ordinal Regression for Lucid Dreaming Frequency.

Variable	Lucid dreaming frequency		
	<i>SS</i>	$\chi^2$	<i>p</i>
Age	-.0570	6.9	<.01
Gender	.0107	0.2	.6257
Dream recall frequency	.4555	370.9	<.0001
Neuroticism	.0608	5.8	<.05
Extraversion	.0167	0.5	.4664
Openness to experience	.1244	32.2	<.0001
Agreeableness	-.0833	13.5	.0002
Conscientiousness	-.0234	1.0	.3128

Note. Analysis includes age, gender, dream recall frequency, and all five personality factors entered simultaneously, *N* = 2,480, *R*<sup>2</sup> = .2129.

*SS* = standardized estimates.

correlation to lucid dream frequency. Nightmare frequency also correlated with lucid dreaming frequency (*r* = .365, *p* < .0001), but if controlled for dream recall frequency this correlation decreases (*r* = .202, *p* < .0001). The relationship between neuroticism and dream recall frequency vanishes when adding nightmare frequency to the regression analysis. Further, there was a significant decline of lucid dream frequency with age, but no significant gender effect.

In the sample, 1,082 participants filled out the relevant item on lucid dream onset and revealed an average age of their first lucid dream 18.85 ± 12.27 (range: 1–89). The results of the linear regression (adj. *R*<sup>2</sup> = .1814) for the age of the first lucid dream are shown in Table 5. The largest effect was found for age, showing that older participants reported an older age of their first lucid dream than younger participants. Gender was also a significant predictor, that is, women

**Table 5.** Linear Regression for the Age of the First Lucid Dream.

Variable	Age of the first lucid dream		
	SS	<i>t</i>	<i>p</i>
Age	.3811	13.25	<.0001
Gender	-.0852	-2.9	<.01
Dream recall frequency	.0427	1.5	.1245
Neuroticism	.0428	1.3	.2061
Extraversion	-.0355	-1.2	.2492
Openness to experience	-.0271	-1.0	.3401
Agreeableness	.0550	1.7	.0821
Conscientiousness	.1364	4.5	<.0001

Note. Analysis includes age, gender, dream recall frequency, and all five personality factors entered simultaneously.  $N = 1,076$ ,  $R^2 = .1814$ .

SS = standardized estimates.

report an earlier age onset of lucid dreaming than men. Furthermore, the Big Five conscientiousness factor correlated with the age of the first lucid dream which implies that the later a person experiences their first lucid dream the more conscientiousness they are.

## Discussion

The findings indicate that there are small but significant relationships between lucid dreaming frequency and several Big Five factors, such as neuroticism, openness to experiences, and agreeableness. This corroborates and also expands the previous findings in student samples (Schredl & Erlacher, 2004; Watson, 2001). Further, the age of the first lucid dream seems to be related to the Big Five conscientiousness factor. Possible pathways that might underlie these relationships are suggested.

From a methodological viewpoint, the means and standard deviations of the Big Five factors in the present sample were similar to the sample of the test authors (Körner, Geyer, et al., 2008), indicating that the present sample is comparable to a population-based sample. Only the scores of the openness to experiences factor were slightly higher in our sample, possibly due to the higher interest in participating in online surveys.

Another methodological issue is the lucid dreaming definition, presented to the participants. We focused on the basic feature of lucid dreaming (being aware while dreaming) which is widely accepted in the literature. On the basis of previous experiences of our research group, we added the possible implications of being lucid, like being able to wake up deliberately, control the action, or just

witness the dream as it unfolds because it was helpful for participants unfamiliar with the term lucid dreaming. In the present study, the personality correlates to lucid dreaming in general were studied. As there are also large interindividual differences what lucid dreamers do while been lucid (trying to control the dream action, just witnessing the unfolding dream, try to awaking themselves if the dream is too scary), it would be very interesting in future studies to investigate whether persons with different approaches to their lucid dreams might also differ in waking personality. Here, the continuity hypothesis of dreaming (Schredl, 2003) focusing on the thematic similarities between waking life and dream content might come into play, that is, persons who anxious about organizing their waking life (high conscientiousness scores) might also be more often try to control the dream action.

The openness to experiences factor showed a stronger positive relationship to lucid dreaming frequency than in one of the samples of Watson (2001), probably due to the higher variance—our sample included a larger age range and more diverse social backgrounds than Watson's student sample. Our result is in line with other studies (Blagrove & Hartnell, 2000; Galvin, 1990; Hicks et al., 1999; Hoyt et al., 1992; Schredl & Erlacher, 2004; Zink & Pietrowsky, 2013) showing that personality dimensions such as hypnotic suggestibility, thin boundaries, creativity, and absorption which can be conceptualized as subdimensions of the Big Five openness to experiences factor (McCrae, 1994) are related to lucid dreaming. A person with high scores at the openness to experiences factor is described as being imaginative, artistic, sensitive for their inner life, curious for new ideas and experiences, as well as adventurous and open-minded (Ostendorf & Angleitner, 2004) and is, therefore, more likely to find out about lucid dreaming and would eventually practice becoming lucid. Furthermore, sensitivity for the inner life and imagination could help trigger lucid dreams. In addition, openness to experience may also be related to an individual's more positive attitude toward lucid dreaming, which again would positively affect the lucid dreaming frequency. This hypothesis should be tested in future studies.

In our sample, the Big Five agreeableness factor was negatively related to lucid dreaming frequency, confirming previous results by Watson (2001). The straightforwardness and altruism facets might illuminate this relationship. Lucid dreamers are more likely to be focused on fulfilling their own needs (Stumbrys et al., 2014) and less likely to reflect on the needs of others; they might thus be less agreeable in waking life. To test this idea, future studies could investigate whether specific contents of lucid dreams are related to waking-life agreeableness.

The neuroticism factor correlated with lucid dreaming frequency in the present sample. This finding goes along with a study by Taitz (2011) who reported lucid dreaming frequency to be related to depression, which is a facet of neuroticism. As the effect of neuroticism disappears when nightmare frequency is included in the regression analysis, the relationship of neuroticism and lucid



dreaming frequency is probably mediated by nightmare frequency. The positive relationship between lucid dreaming frequency and nightmare frequency (Schredl & Erlacher, 2004; Spadafora & Hunt, 1990; Stepansky et al., 1998) might be explained by nightmares triggering lucidity (Schredl & Erlacher, 2004). It will thus be necessary to control for nightmare frequency in the relationship between lucid dreaming frequency and neuroticism in future studies.

As has been reported several times (Belicki, Hunt, & Belicki, 1978; Blackmore, 1982; Hearne, 1978; Schredl & Erlacher, 2004, 2007; Watson, 2001; Wolpin, Marston, Randolph, & Clothies, 1992), dream recall frequency was also highly correlated with lucid dreaming frequency in the present study. This makes sense because the chance of recalling a lucid dream could be heightened by overall higher dream recall (Schredl & Erlacher, 2004) or lucid dreams could be more likely to be recalled (Zink & Pietrowsky, 2013). Thus, the ability to recall more dreams can be part of the ability to have lucid dreams or vice versa (Zink & Pietrowsky, 2013). Since dream recall frequency is related to openness to experience (Aumann, Lahl, & Pietrowsky, 2012; Hill, Diemer, & Heaton, 1997; Schredl, 2004b; Watson, 2003), future research concerning lucid dream frequency and personality should, therefore, control for dream recall frequency.

In our sample, as well as in previous studies (Schredl et al., 2014; Schredl & Erlacher, 2011; Schredl & Göritz, 2015), lucid dreaming frequency declined with age. One possible explanation might be a decline in interest in lucid dreams with age, but this hypothesis has still to be tested empirically. As personality factors cannot explain this decline (those factors were statistically controlled for), another alternative explanation might be age-related changes in prefrontal cortex activation (Maillet & Rajah, 2013), because the prefrontal cortex plays an important role in lucid dreaming (Dresler et al., 2012; Stumbrys, Erlacher, & Schredl, 2013b; Voss, Holzmann, Tuin, & Hobson, 2009). Another possible explanation might be video gaming and computer gaming which is related to lucid dream frequency (Gackenbach, 2006), as younger persons are more likely to be engaged in such activities. As meditation experience is also related to lucid dream frequency (Hunt & Ogilvie, 1988), this might also serve as an explanation as younger persons are more likely to meditate (Pollack & Pickel, 2007).

A gender effect on lucid dreaming frequency was not found, confirming previous findings (Gruber, Steffen, & Vonderhaar, 1995; Schredl et al., 2014; Schredl & Erlacher, 2004; Stepansky et al., 1998; Watson, 2001; Zink & Pietrowsky, 2013). Since women tend to recall dreams more often than men (Schredl & Reinhard, 2008) and dream recall frequency correlates highly with lucid dreaming frequency (Belicki et al., 1978; Blackmore, 1982; Hearne, 1978; Schredl & Erlacher, 2004, 2007; Watson, 2001; Wolpin et al., 1992), the question arises as to why the gender effect is not found for lucid dreaming frequency. The effect of gender on dream recall frequency disappeared when controlled for the “engagement in dreams” variable (Schredl, 2002–2003), suggesting that the

gender difference might be neutralized by an increased engagement in dreams in male lucid dreamers. Still, studies have to be conducted to confirm that male lucid dreamers exhibit an especially high interest in dreams.

Regarding our exploratory research of the relationship between the Big Five factors and the age of the first lucid dream, we found a positive relationship between conscientiousness and lucid dreaming frequency. As Stumbrys et al. (2014) found that the mean age of the first lucid dream is lower for spontaneous lucid dreamers compared with trained lucid dreamers, the increase of the onset age of lucid dreaming with conscientiousness may be explained with conscientious individuals being more likely to use induction techniques (Stumbrys, Erlacher, Schädlich, & Schredl, 2012) to induce their first lucid dream. Most of these induction techniques like reality checks require diligent training (LaBerge & Rheingold, 1990). For future research, it would be interesting to elicit whether the first lucid dream was spontaneous or the result of using induction techniques.

The age of the first lucid dream correlated positively with the age of the individual. As lucid dreams are quite common in childhood and adolescence (Schredl, Henley-Einion, & Blagrove, 2012; Voss, Frenzel, Koppehele-Gossel, & Hobson, 2012), one might speculate that lucid dreams that were experienced a long time previously have been forgotten and, thus, the correlation is a methodological artifact. To avoid this retrospective recall bias, longitudinal studies are necessary.

In our sample, there was a gender effect on the age of the first lucid dream, showing the trend of women reporting an earlier age of their first lucid dream than men. This finding might be explained by the dream socialization: Compared with boys, girls share their dreams more often with their peers (Schredl, Buscher, Haaß, Scheuermann, & Uhrig, 2015), suggesting that girls are more likely to hear about lucid dreaming which could have induced lucidity. For future studies, it seems interesting to look specifically how boy and girls learn about lucid dreaming.

In summary, a small but substantial portion of individual differences concerning lucid dreaming frequency in our sample was explained by the Big Five personality factors and, thus, provided hints about possible pathways between waking life and lucid dreaming. Future research should elicit the nature of the first lucid dream (spontaneous or trained) in order to clarify the relationship between conscientiousness and the age of the first lucid dream. Further, we suggest exploring the relationship of the Big Five factors with the attitude toward lucid dreams and the content of lucid dreams. Moreover, longitudinal studies should be conducted to investigate when children first find out about lucid dreams, if the interest on lucid dreaming declines with age and if the reported onset of the first lucid dream underlies a retrospective recall bias. The speculation that men show more interest in lucid dreams could also be tested in subsequent studies. Finally, it would be interesting to study whether

personality traits, for example, conscientiousness are related to the success of applying induction techniques like carrying out reality checks in waking.

### Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### References

- Aumann, C., Lahl, O., & Pietrowsky, R. (2012). Relationship between dream structure, boundary structure and the Big Five personality dimensions. *Dreaming, 22*(2), 124–135.
- Belicki, D., Hunt, H., & Belicki, K. (1978). An exploratory study comparing self-reported lucid and non-lucid dreams. *Sleep Research, 7*, 166.
- Blackmore, S. J. (1982). Have you ever had an OBE? The wording of the question. *Journal of the Society for Psychical Research, 51*, 292–302.
- Blagrove, M., & Hartnell, S. J. (2000). Lucid dreaming: Associations with internal locus of control, need for cognition and creativity. *Personality and Individual Differences, 28*, 41–47.
- Brylowski, A. (1990). Nightmares in crisis: Clinical applications of lucid dreaming techniques. *Psychiatric Journal of the University of Ottawa, 15*, 79–84.
- Dresler, M., Wehrle, R., Spoormaker, V. I., Koch, S. P., Holsboer, F., Steiger, A., . . . Czisch, M. (2012). Neural correlates of dream lucidity obtained from contrasting lucid versus non-lucid REM sleep: A combined EEG/fMRI case study. *Sleep, 35*, 1017–1020.
- Erlacher, D., & Schredl, M. (2010). Practicing a motor task in a lucid dream enhances subsequent performance: A pilot study. *Sport Psychologist, 24*, 157–167.
- Gackenbach, J. (2006). Video game play and lucid dreams: Implications for the development of consciousness. *Dreaming, 16*, 96–110.
- Gackenbach, J., & Bosveld, J. (1989). *Control your dreams: How lucid dreaming can help you*. New York, NY: Harper + Row.
- Gackenbach, J., Snyder, T. J., Rokes, L. M., & Sachau, D. (1986). Lucid dream frequency in relation to vestibular sensitivity as measured by caloric simulation. *Journal of Mind and Behavior, 7*, 277–298.
- Galvin, F. (1990). The boundary characteristics of lucid dreamers. *Psychiatric Journal of the University of Ottawa, 15*, 73–78.
- Gruber, R. E., Steffen, J. J., & Vonderhaar, S. P. (1995). Lucid dreaming, waking personality and cognitive development. *Dreaming, 5*, 1–12.
- Hearne, K. M. T. (1978). *Lucid dreams: An electrophysiological and psychological study* (Doctoral dissertation). University of Liverpool, England.
- Hicks, R. A., Bautista, J., & Hicks, G. J. (1999). Boundaries and the level of experience with six types of dreams. *Perceptual and Motor Skills, 89*, 760–762.

- Hill, C. E., Diemer, R. A., & Heaton, K. J. (1997). Dream interpretation sessions: Who volunteers, who benefits, and what volunteer clients view as most and least helpful. *Journal of Counseling Psychology, 44*, 53–62.
- Hoyt, I. P., Kihlstrom, J. F., & Nadon, R. (1992). Hypnotic, proclucid, lucid and night dreaming: Individual differences. *Journal of Mental Imagery, 16*, 147–153.
- Hunt, H. T., & Ogilvie, R. D. (1988). Lucid dreams in their natural series—Phenomenological and psychophysiological findings in relation to meditative states. In J. Gackenbach & S. LaBerge (Eds.), *Conscious mind, sleeping brain—Perspectives on lucid dreaming* (pp. 389–417). New York, NY: Plenum Press.
- Körner, A., Drapeau, M., Albani, C., Geyer, M., Schmutzer, G., & Brähler, E. (2008). Deutsche Normierung des NEO-Fünf-Faktoren-Inventars (NEO-FFI) [German norms of the NEO-Five-Factor-Inventory (NEO-FFI)]. *Zeitschrift für Medizinische Psychologie, 17*, 133–144.
- Körner, A., Geyer, M., Roth, M., Drapeau, M., Schmutzer, G., Albani, C., . . . Brahler, E. (2008). Persönlichkeitsdiagnostik mit dem NEO-Fünf-Faktoren-Inventar: Die 30-Item-Kurzversion (NEO-FFI-30) [Personality diagnostic using the NEO-Five-Factor-Inventory: The 30-Item short version (NEO-FFI-30)]. *Psychotherapie, Psychosomatik und Medizinische Psychologie, 58*(6), 238–245.
- LaBerge, S. P. (1985). *Lucid dreaming*. Los Angeles, CA: Jeremy P. Tarcher.
- LaBerge, S. P., & Rheingold, H. (1990). *Exploring the world of lucid dreaming*. New York, NY: Ballentine Books.
- Maillet, D., & Rajah, M. N. (2013). Association between prefrontal activity and volume change in prefrontal and medial temporal lobes in aging and dementia: A review. *Ageing Research Reviews, 12*(2), 479–489.
- McCrae, R. R. (1994). Openness to experience: Expanding the boundaries of factor V. *European Journal of Personality, 8*, 251–272.
- Ostendorf, F., & Angleitner, A. (2004). *NEO-PI-R—NEO Persönlichkeitsinventar nach Costa und McCrae—Revidierte Fassung* [NEO-PI-R—NEO Personality Inventory of Costa and McCrae—revised edition] (Vol. 44). Göttingen, Germany: Hogrefe.
- Papatheodorou, I., Oellrich, A., & Smedley, D. (2015). Linking gene expression to phenotypes via pathway information. *Journal of Biomedical Semantics, 6*, 17.
- Pollack, D., & Pickel, G. (2007). Religious individualization or secularization? Testing hypotheses of religious change – The case of Eastern and Western Germany. *The British Journal of Sociology, 58*(4), 603–632.
- Schredl, M. (2002–2003). Factors influencing the gender difference in dream recall frequency. *Imagination, Cognition and Personality, 22*, 33–39.
- Schredl, M. (2003). Continuity between waking and dreaming: A proposal for a mathematical model. *Sleep and Hypnosis, 5*, 38–52.
- Schredl, M. (2004a). Reliability and stability of a dream recall frequency scale. *Perceptual and Motor Skills, 98*, 1422–1426.
- Schredl, M. (2004b). *Traumerinnerung: Modelle und empirische Untersuchungen* [Dream recall: Models and empirical studies]. Marburg, Germany: Tectum.
- Schredl, M., Berres, S., Klingauf, A., Schellhaas, S., & Göritz, A. S. (2014). The Mannheim Dream questionnaire (MADRE): Retest reliability, age and gender effects. *International Journal of Dream Research, 7*, 141–147.

- Schredl, M., Buscher, A., Haaß, C., Scheuermann, M., & Uhrig, K. (2015). Gender differences in dream socialisation in children and adolescents. *International Journal of Adolescence and Youth*, 20, 61–68.
- Schredl, M., & Erlacher, D. (2004). Lucid dreaming frequency and personality. *Personality and Individual Differences*, 37, 1463–1473.
- Schredl, M., & Erlacher, D. (2007). Self-reported effects of dreams on waking-life creativity: An empirical study. *Journal of Psychology*, 141, 35–46.
- Schredl, M., & Erlacher, D. (2011). Frequency of lucid dreaming in a representative German sample. *Perceptual and Motor Skills*, 111, 60–64.
- Schredl, M., & Göritz, A. S. (2015). Changes in dream recall frequency, nightmare frequency, and lucid dream frequency over a 3-year period. *Dreaming*, 25(2), 81–87.
- Schredl, M., Henley-Einion, J., & Blagrove, M. (2012). Lucid dreaming in children: The UK library study. *International Journal of Dream Research*, 5, 94–98.
- Schredl, M., & Reinhard, I. (2008). Gender differences in dream recall: A meta-analysis. *Journal of Sleep Research*, 17, 125–131.
- Snyder, T. J., & Gackenbach, J. (1988). Individual differences associated with lucid dreaming. In J. Gackenbach & S. LaBerge (Eds.), *Conscious mind, sleeping brain—Perspectives on lucid dreaming* (pp. 221–259). New York, NY: Plenum Press.
- Spadafora, A., & Hunt, H. T. (1990). The multiplicity of dreams: Cognitive-affective correlates of lucid, archetypal and nightmare dreaming. *Perceptual and Motor Skills*, 71, 627–644.
- Stepansky, R., Holzinger, B., Schmeiser-Rieder, A., Saletu, B., Kunze, M., & Zeitlhofer, J. (1998). Austrian dream behavior: Results of a representative population survey. *Dreaming*, 8, 23–30.
- Stumbrys, T., Erlacher, D., Johnson, M., & Schredl, M. (2014). The phenomenology of lucid dreaming: An online survey. *The American Journal of Psychology*, 127(2), 191–204.
- Stumbrys, T., Erlacher, D., Schädlich, M., & Schredl, M. (2012). Induction of lucid dreams: A systematic review of evidence. *Consciousness and Cognition*, 21(3), 1456–1475.
- Stumbrys, T., Erlacher, D., & Schredl, M. (2013a). Reliability and stability of lucid dream and nightmare frequency scales. *International Journal of Dream Research*, 6, 123–126.
- Stumbrys, T., Erlacher, D., & Schredl, M. (2013b). Testing the involvement of the prefrontal cortex in lucid dreaming: A tDCS study. *Consciousness and Cognition*, 22(4), 1214–1222.
- Stumbrys, T., Erlacher, D., & Schredl, M. (2016). Effectiveness of motor practice in lucid dreams: A comparison with physical and mental practice. *Journal of Sports Sciences*, 34(1), 27–34. doi: 10.1080/02640414.2015.1030342
- Taitz, I. Y. (2011). Learning lucid dreaming and its effect on depression in undergraduates. *International Journal of Dream Research*, 4, 117–126.
- Tholey, P., & Utecht, K. (1987). *Schöpferisch träumen—Der Klartraum als Lebenshilfe* [Creative dreaming—Lucid dreams as counselling resource]. Niedernhausen, Germany: Falken.
- Voss, U., Frenzel, C., Koppehele-Gossel, J., & Hobson, A. (2012). Lucid dreaming: An age-dependent brain dissociation. *Journal of Sleep Research*, 21, 634–642.

- Voss, U., Holzmann, R., Tuin, I., & Hobson, J. A. (2009). Lucid dreaming: A state of consciousness with features of both waking and non-lucid dreaming. *Sleep, 32*, 1191–1200.
- Watson, D. (2001). Dissociations of the night: Individual differences in sleep-related experiences and their relation to dissociation and schizotypy. *Journal of Abnormal Psychology, 110*, 526–535.
- Watson, D. (2003). To dream, perchance to remember: Individual differences in dream recall. *Personality and Individual Differences, 34*, 1271–1286.
- Wolpin, M., Marston, A., Randolph, C., & Clothies, A. (1992). Individual differences correlates of reported lucid dreaming frequency and control. *Journal of Mental Imagery, 16*, 231–236.
- Zadra, A. L., & Pihl, R. O. (1997). Lucid dreaming as a treatment for recurrent nightmares. *Psychotherapy and Psychosomatics, 66*, 50–55.
- Zink, N., & Pietrowsky, R. (2013). Relationship between lucid dreaming, creativity and dream characteristics. *International Journal of Dream Research, 6*, 98–103.

### Author Biographies

**Gabriela Hess** is a bachelor student of psychology at the University of Salzburg, Austria and worked as an intern of the sleep lab on the project “Lucid dreaming and personality”.

**Michael Schredl** has been a dream researcher since 1990 and head of research of the sleep laboratory of the Central Institute of Mental Health, Mannheim, Germany. He teaches at the University of Mannheim and is also the editor of the online journal *International Journal of Dream Research*.

**Anja S. Goritz** is a full professor of Occupational and Consumer Psychology at the University of Freiburg in Germany.