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Running title: Mindfulness and lucid dreaming

**Meta-awareness during day and night: the relationship between
mindfulness and lucid dreaming**

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Abstract

The present study explored the relationship between lucidity in dreams (awareness of dreams while dreaming) and mindfulness during wakefulness, also considering meditation as a possible moderating variable. An online survey was completed by 528 respondents, of whom 386 (73.1%) had lucid dream experiences. The reported frequency of lucid dreams was found to be positively related to higher dispositional mindfulness in wakefulness. This relationship was only present in those participants who reported acquaintance with meditation. Regarding the dimensions of mindfulness, lucid dream frequency was more strongly associated with mindful presence rather than acceptance. The findings support the notion of an existing relationship between lucidity in dreams and mindfulness during wakefulness, yet it remains unclear whether the relationship is influenced by actual meditation practice or whether it reflects some natural predispositions. Future studies should examine the role of different meditation practices, investigate personality variables that might influence the relationship, and explore how different facets of mindfulness and lucidity interrelate.

Keywords: lucid dreaming; mindfulness; meditation

Introduction

Dreaming is often described as a state of cognitive deficiency, characterized by a loss of self-reflection, bizarre, illogical situations or a lack of directed thought (Hobson, Pace-Schott, & Stickgold, 2000). According to Hobson (2009), dreams have features of primary consciousness (simple awareness that includes perception and emotion), but usually lack secondary consciousness (self-reflective awareness, meta-cognition). In most of the dreams the dreamer is not aware of the current state of consciousness – we usually do not realize that we are dreaming while we are dreaming. However in some dreams – so called lucid dreams – the dreamer can get an insight into the present state of consciousness and become aware of the dream while dreaming (LaBerge, 1985). In the general population such dreams are quite infrequent. In random student samples only 0.3% to 0.7% of all dreams that were recalled and recorded in dream diaries were lucid (Barrett, 1991; Zadra, Donderi, & Pihl, 1992). Yet in specific samples, the percentage of lucid dreams can be considerably higher. For example, in German athletes 14.5% of all dreams were estimated to be lucid dreams (Erlacher, Stumbrys, & Schredl, 2011-12). Estimates of lucid dreaming incidence suggest that about half of the general population experience a lucid dream at least once in their lifetime and about 20% have lucid dreams regularly – once a month or more often (Schredl & Erlacher, 2011; Snyder & Gackenbach, 1988). Lucid dream frequency has been linked to various personality dimensions, such as internal locus of control, field independence, openness to experience, higher creativity and need for cognition (Blagrove & Hartnell, 2000; Blagrove & Tucker, 1994; Gruber, Steffen, & Vonderhaar, 1995; Patrick & Durndell, 2004; Schredl & Erlacher, 2004; Snyder & Gackenbach, 1988; Yu, 2012).

The dissociation between primary and secondary consciousness is not only characteristic of our nocturnal cognition, but also quite often occurs in our ordinary wakeful cognition, for example, during mind-wandering, affective emotional states or automatic behaviours, where people lack explicit recognition of their present experience (Schooler, 2002). In fact, research shows that our waking and dreaming cognitions have much in common (Kahan, LaBerge, Levitan, & Zimbardo, 1997; Kahan & LaBerge, 1996, 2011; Wolman & Kozmová, 2007). During wakefulness we are also often not explicitly and fully aware of the present state of awareness. In recent years psychologists have become increasingly interested in this issue. Employing smartphone technology Killingsworth and Gilbert (2010) used experience sampling methodology to provide evidence that the amount of mind-wandering is predictive of happiness. The more mind-wandering participants reported, the lower they evaluated their own happiness in a given situation. In a similar vein, growing

evidence shows that interventions aimed at increasing levels of mindfulness improve mental well-being (Keng, Smoski, & Robins, 2011) and decrease mind-wandering and rumination (Evans & Segerstrom, 2010; Keune, Bostanov, Kotchoubey, & Hautzinger, 2012; Mrazek, Franklin, Phillips, Baird, & Schooler, 2013). Derived from Buddhist meditation traditions, psychological conceptualisations of mindfulness describe it as the ability to direct attention to the present moment and to ongoing experience with an open, curious and non-judging attitude (Baer, 2003; Malinowski, 2013a), an individual disposition that can be enhanced through mindfulness meditation practice (Brown & Ryan, 2003). Psychometrically, dispositional mindfulness has been operationalised as a one-dimensional construct (e.g. Brown & Ryan, 2003) or to consist of several dimensions, with either two (e.g. decentering and curiosity, Davis, Lau, & Cairns, 2009; awareness and acceptance, Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008), four (e.g. observing, describing, acting with awareness, and accepting without judgement, Baer, Smith, & Allen, 2004; attention, present focus, awareness, acceptance, Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007), or five factors (e.g. nonreacting, observing, acting with awareness, describing, and nonjudging, Baer et al., 2008). For the Freiburg Mindfulness Inventory (FMI) that was used in this study mindfulness has been conceived as uni-dimensional (Walach, Buchheld, Buttenmuller, Kleinknecht, & Schmidt, 2004) although more recently a two-dimensional structure has been proposed (Kohls, Sauer, & Walach, 2009). According to these authors mindfulness is better described by the two interrelated factors *Acceptance* and *Presence*. While Acceptance relates to a non-judging, accepting and appreciative attitude towards oneself and one's experiences (e.g. "I am friendly to myself when things go wrong"), Presence captures the ability to be fully aware of current internal and external experiences (e.g. "I am open to the experience of the present moment"). In line with this, Bishop et al. (2004, p. 233) defined mindfulness as a metacognitive process that requires "both control of cognitive processes (i.e., attention self-regulation) and monitoring the stream of consciousness". Supporting this view, a wide range of research provides evidence that mindfulness meditation training can increase cognitive abilities, such as cognitive flexibility, visio-spatial processing, working memory, executive functioning, and meta-awareness (Chiesa, Calati, & Serretti, 2011; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010; Malinowski, 2013b; Mrazek et al., 2013; Slagter, Davidson, & Lutz, 2011).

Interestingly, meditation practice not only improves the quality of secondary consciousness during waking hours but has also been linked to lucid dreaming (Gackenbach & Bosveld, 1990; Hunt & Ogilvie, 1988; Hunt, 1989). Lucid dreams are more likely to occur

following a day that included meditation practice than following a day without it (Reed, 1978). A middle-of-the-night meditation can also help to promote lucidity in dreams (Sparrow, Thurston, & Carlson, 2013). Meditators report more lucid dreams than non-meditators and the length of meditation practice seems to be positively associated with lucid dream frequency (Gackenbach, Cranson, & Alexander, 1986; Hunt & Ogilvie, 1988). Hunt (1989) even went as far as suggesting that lucid dreaming itself can be considered as a spontaneous meditative state that is sought in meditative practices. While it is difficult to ascertain this position and to fully determine how comparable states of awareness during dreaming and during meditation are, it is worth noting that several meditation traditions include practices that focus on sleep and dreaming. For instance, the advanced practice of Dream Yoga (Tib.: *mi-lam*), passed on in several Tibetan Buddhist traditions, includes developing the skill of lucid dreaming, where the practitioner recognises their dream as a dream (Norbu, 1992; Tenga, 1999). Further, self-reflectiveness in wakefulness and self-reflectiveness in dreams seem to be interrelated (Purcell, Mullington, Moffitt, Hoffmann, & Pigeau, 1986), corroborating the continuity hypothesis of dreaming, which states that waking experiences are reflected in dreams (Schredl, 2003), a view that is also held in Tibetan Buddhist meditation traditions (e.g. Nydahl, 2012). Attention to the present state of consciousness in wakefulness and contemplating whether the current experience might be a dream, is one of the core techniques both in modern lucid dream research and is also applied in Tibetan Dream Yoga (Stumbrys, Erlacher, Schädlich, & Schredl, 2012; Wangyal, 1998). Moreover, wakeful mindfulness seems to be inversely related to dream anxiety and negative dream quality (Simor, Köteles, Sándor, Petke, & Bódizs, 2011), whereas dream lucidity is directly associated with higher positive emotions and lower fear-related negative emotions in dreams (Thomas, Claudatos, & Kahan, 2013).

Considering the evidence on meditation, mindfulness and lucid dreaming, Stumbrys (2011) hypothesized an association between lucidity in dreams and mindfulness in wakefulness. Initial findings regarding such an association are, however, inconclusive. In a recent study 44 participants completed mindfulness questionnaires and kept a dream log for 7 days rating their dream experiences (Rider, 2012). Waking mindfulness did not appear to be a predictor of dream lucidity, but did account for a significant amount of the variance in dream mindfulness, operationally defined as “concurrently high ratings of dream attention, reflection, self-awareness, volition, and control” (Rider, 2012, p. 87), which, on the other hand, showed marginal associations with dream lucidity. These findings are somewhat inconclusive and prone to type II error, especially considering the low prevalence of lucid

dreaming in the sample: only 10.6% were frequent lucid dreamers (twice as low as in general population) and only 3 of 209 collected dream reports (1.4%) were unambiguously lucid. To further elucidate the hypothesized relationship between mindfulness while awake and lucid dreaming the present study aimed to overcome previous limitations by exploring this relationship in a sub-population with a high likelihood of lucid dreams (cf. Stumbrys, Erlacher, Johnson, & Schredl, 2014). Furthermore, we investigated the moderating influence of meditation practice in the relationship between mindfulness and dream lucidity.

Methods

Participants

Five hundred and twenty eight individuals (290 men and 238 women) completed an online questionnaire. Their ages ranged from 11 to 67 years, with the mean age of 26.4 ± 10.6 years. There were 161 working professionals, 152 students, 125 schoolchildren, 34 in vocational training, 8 housewives/-husbands, 4 retired, 20 unemployed and 5 at military or civilian service (18 participants marked “other occupation” and 1 participant did not provide information).

Material

In addition to biographical data (age, gender, occupation), the questionnaire included items about dreaming, meditation and mindfulness. The participants were asked to estimate their dream recall frequency on a seven-point rating scale developed by Schredl (2004): 0 – never; 1 - less than once a month; 2 - about once a month; 3 – twice or three times a month; 4 - about once a week; 5 – several times a week; 6 – almost every morning. Re-test reliability for the scale was found to be high ($r=.85$; $p<.001$; $N=198$; 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. Similarly, on an eight-point scale (0 – never; 1 - less than once a year; 2 - about once a year; 3 - about 2 to 4 times a year; 4 - about once a month; 5 - about 2 to 3 times a month; 6 - about once a week; 7 - several times a week), they evaluated their frequency of lucid dreams. Re-test reliability for this scale was also found to be high ($r=.89$; $p<.001$; $N=93$; Stumbrys, Erlacher, & Schredl, 2013a). In order to obtain units in frequency per month, the scale was likewise 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. To ensure a clear understanding of lucid dreaming, a short definition was provided: “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” (for importance of a clear definition see Snyder & Gackenbach, 1988). Further, participants were asked to indicate if they had any meditation experience (yes/no) and, if they had, they were asked for how many years they have been meditating (meditation expertise in years) and for how many hours per week recently (meditation practice in hours per week). They were also asked to name or describe the type of meditation practice they engage with. Mindfulness was assessed with a short form of Freiburg Mindfulness Inventory (FMI; Walach et al., 2004). It consists of 14 items (one reversed item), scored on a 4-point scale (1 – rarely; 2 – occasionally; 3 – fairly often; 4 – almost always). The internal consistency of the FMI in this study was good (Cronbach’s $\alpha=.82$) and comparable to previous reports (Cronbach’s $\alpha=.86$; $N=246$; Walach et al., 2004). Generally, a single-factor solution is suggested for FMI (Walach et al., 2004), however an alternative two-factor FMI solution (Kohls et al., 2009) with subscales *Presence* (6 items) and *Acceptance* (8 items) was also considered in the present study. The internal consistency for both Presence and Acceptance subscales was acceptable (Cronbach’s α : .68 and .75, respectively) and similar to previous reports (.69 and .77, respectively; $N=241$; Kohls et al., 2009).

Procedure

The study was conducted in German. The online questionnaire was posted on the German website on lucid dreaming <http://www.klartraum.de> between August 22, 2007, and January 8, 2008. The newsletter with an explicit reference to the study was sent by email to approx. 1500 registered users of the website. The survey was anonymous, however participants were asked to provide their email address in order to minimize the risk of multiple responses to the questionnaire. To answer the questionnaire, the participants had as much time as they needed.

Statistical analysis

IBM SPSS (Version 20) was used for statistical analysis. As several variables did not fulfil the requirements for parametric testing, inter-variable correlations were assessed with the more conservative Spearman Rho test. Moderation analysis was carried out according to Hayes (2013) using the PROCESS SPSS script (Model 1), based on OLS regression analysis.

Results

On average, participants estimated they recalled 3.58 ± 2.42 (Mean \pm SD) dreams per week (527 responses) and 2.93 ± 5.40 lucid dreams per month (521 responses). 386 respondents

(73.1%) reported that they had at least one lucid dream. 263 respondents (49.8%) had at least one lucid dream per month and following Snyder and Gackenbach (1988) are classed frequent lucid dreamers. Out of 524 responses, 118 participants (22.3%) reported that they had meditation experience. Meditation expertise (86 responses) ranged from 0 to 28 years (median: 3 years) and median meditation practice (83 responses) was 2 hours per week. To an open-ended question about types of meditation practice employed, many participants reported that they used a diverse range or unspecific types or did not provide details; therefore no further analysis was possible. The FMI questionnaire was completed by 495 participants (93.8%). The average FMI score was 39.0 ± 6.3 . No gender differences were found for lucid dream frequency (Mann-Whitney U test: $Z=0.46$; $p=.648$) or for mindfulness scores ($t(493)=0.84$; $p=.399$).

Table 1. Spearman *rho* correlations between the main study variables

	LDF	DRF	MPr	MEx	Age
Mindfulness (FMI)	.152***	.065	.243*	.303**	.141**
Lucid dream frequency (LDF)		.516***	.141	.159	-.017
Dream recall frequency (DRF)			.068	-.074	-.004
Meditation practice (hrs/week)				.297**	-.014
Meditation expertise (years)					.544***

Notes: * $p<.05$; ** $p<.01$, *** $p<.001$; FMI - Freiburg Mindfulness Inventory total score; LDF – lucid dream frequency; DRF – dream recall frequency; MPr – meditation practice; MEx – meditation expertise.

The results (see Table 1) show that age was not associated with the lucid dream frequency but had a weak positive association with mindfulness. Further, lucid dream frequency was positively related to total dream recall frequency and, importantly, to mindfulness: Participants who scored higher on dispositional mindfulness tended to recall more lucid dreams, and participants who recalled more dreams overall also tended to report more lucid dreams.

The role of meditation

Respondents, who reported meditation experience, reported higher lucid dream frequency (Mann-Whitney U test: $Z=3.17$; $p=.002$; number of lucid dreams per month: 4.28 ± 6.57 vs. 2.55 ± 4.97) and had higher FMI scores (41.7 ± 6.3 vs. 38.3 ± 6.1 , $t(490)=5.23$, $p<.001$) than respondents without meditation experience. As can be seen from Table 1 neither meditation expertise (in years) nor meditation practice (in hours per week) were associated with lucid dreaming frequency or total dream frequency. On the other hand, both years of meditation

expertise and amount of current meditation practice were positively related to mindfulness. The positive association between higher dispositional mindfulness and meditation expertise in years remained significant when controlled for age ($\rho=.223, p=.045$).



Figure 1: Visual representation of the moderating effect of meditation experience (yes/no) on the relationship between mindfulness and lucid dream frequency. Associations between (statistically: conditional effects) mindfulness and lucid dream frequency are depicted (for mindfulness mean \pm SD).

To further assess the moderating influence of meditation experience (yes/no) on the relationship between dispositional mindfulness and lucid dream frequency we carried out a simple moderation analysis by means of regression analysis. The results yielded a significant interaction between meditation experience (yes/no) and mindfulness ($B=.10; p<.05; 95\%$ Confidence Interval $=.015$ to $.179$), confirming that meditation experience significantly moderated the relationship between mindfulness and lucid dream frequency. As depicted in Figure 1 mindfulness only had a significant statistical influence on lucid dream frequency in the group of participants with meditation experience but not in those without meditation experience, as indicated by a simple slope analysis of the association between mindfulness and lucid dream frequency (statistically: the conditional effects) for participants with meditation experience ($\theta_{(X \rightarrow Y)} = .132; p<.001; 95\%$ Confidence Interval from $.060$ to $.204$).

but not in the group without meditation experience ($\theta_{(X \rightarrow Y)}=.04$; $p=.09$; Lower 95% Confidence Interval $=-.01$; Upper 95% Confidence Interval $=.08$). The same pattern of results emerged when age was included as covariate in the moderation analysis. Reflecting the same effect, Spearman correlations between mindfulness and lucid dream frequency were only significant for participants with meditation experience ($\rho=.371$; $p<.001$) but not participants without meditation experience ($\rho=.066$; $p=.202$).

Facets of mindfulness

When considering the two-factor FMI model, Presence and Acceptance correlated with each other ($\rho=.557$; $p<.001$). Both subscales were also weakly associated with age (Presence: $\rho=.117$, $p=.009$; Acceptance: $\rho=.144$, $p=.001$) and lucid dream frequency (Presence: $\rho=.170$, $p<.001$; Acceptance: $\rho=.120$, $p=.007$). To evaluate the selective influence of Acceptance and Presence, we conducted a regression analysis with FMI subscales and age as predictors and lucid dream frequency as criterion, which showed that only FMI Presence significantly predicted lucid dream frequency (Table 2).

Table 2. Regression analysis for lucid dream frequency

	Estimate	Wald	p-value
FMI – Presence	0.11	10.03	.002
FMI – Acceptance	0.02	0.84	.360
Age	-0.01	2.55	.111

Discussion

The present findings corroborate the idea of a relationship between mindfulness in wakefulness and lucidity in dreams. The relationship, however, was present only in those participants who reported some experience with meditation practice. Furthermore, these participants reported more lucid dreams and higher mindfulness scores than people without meditation experience. Neither frequency of current meditation practice (hours per week) nor meditation expertise (in years) were related to lucid dream frequency, but both were positively related to higher mindfulness scores. In terms of mindfulness dimensions, both Presence and Acceptance seemed to be related to lucid dream frequency, although the regression analysis indicates that mindful presence is more strongly associated with lucid dream frequency than mindful acceptance. This pattern of results suggests that mindfulness is positively linked to the frequency of lucid dreaming and supports the continuity idea (cf.

Schredl, 2003) that higher awareness cultivated during daytime is also reflected in higher awareness of one's mental states while dreaming.

Before discussing the findings, several methodological issues have to be acknowledged. Firstly, in the present sample, the majority of our respondents (73%) reported having had a lucid dream at least once and about half of them were frequent lucid dreamers – proportions that are much higher than in the general population (cf. Schredl & Erlacher, 2011), most likely reflecting the fact that the participants were self-selected due to their interest in lucid dreams. Therefore further generalisation of our findings should be cautious. Secondly, data were collected via online questionnaire, which might have had some effect on the quality of the responses, although comparative analyses show that data gathered via Internet are at least comparable to data gathered via traditional methods, and do not appear to be particularly affected by false responses (Gosling, Vazire, Srivastava, & John, 2004). Thirdly, no specific definition was provided for meditation and the respondents reported that they were engaged in a variety of diverse techniques, some of which may or may not be considered as practices that facilitate the cultivation of mindfulness or meta-awareness. For example, Lutz, Slagter, Dunne, and Davidson (2008) make a distinction between two main styles of meditation: focused attention and open monitoring. Whereas the open monitoring type meditations aim to cultivate meta-awareness by the monitoring of awareness, the aim of the focused attention type meditations is narrowing the field of focus (as a result of which, the ability to identify stimuli outside that field of focus might be reduced). Therefore no conclusions can be drawn about the specific effects of meditation practice on the relationship between mindfulness and lucidity. Fourthly, the present study did not measure actual levels of meta-awareness in waking and sleeping, but included self-reported lucid dream frequency and dispositional mindfulness as assessed by the FMI scale. Lucid dreams differ in their degrees of lucidity (Barrett, 1992) and meta-cognition can be also present in non-lucid dreams (Kahan et al., 1997; Kahan & LaBerge, 1996, 2011). Only some items of FMI are related to meta-cognition in wakefulness (namely, from the Presence subscale), whereas others are assessing other aspects of mindfulness, such as non-judgement and acceptance. Fifthly, the age range in the present sample was rather broad and included 125 schoolchildren from the age of 11, which raises the question as to whether these younger participants were developmentally advanced enough to achieve mindful presence and acceptance in wakefulness and lucidity in dreams. Regarding lucid dreaming, previous findings suggest that lucid dreams are quite pronounced in children, even at the age of 6 (Schredl, Henley-Einion, & Blagrove, 2012; Voss, Frenzel, Koppehele-Gossel, & Hobson, 2012). No association was found in the present

study between the age and lucid dream frequency, although the age was related to higher mindfulness scores, showing greater dispositional mindfulness capacity in older participants. Similar associations between trait mindfulness and age have been observed in previous studies (Baer et al., 2008; Hansen, Lundh, Homman, & Wångby-Lundh, 2009), yet emerging research shows that mindfulness-based approaches can be successfully implemented in children and adolescents (review: Burke, 2009) and dispositional mindfulness can be reliably and validly assessed via self-reported questionnaires from the age of 10 (Greco, Baer, & Smith, 2011). Furthermore, when included in the regression analysis together with the mindfulness dimensions, age did not appear to be a predictor of lucid dream frequency (Table 2), indicating that age does not significantly influence the mindfulness – lucidity relationship.

Our results are congruent with previous studies which showed that meditators report both higher lucid dream frequency (Gackenbach et al., 1986) and higher mindfulness (e.g. Moore & Malinowski, 2009) than non-meditators. Additionally, we found that higher mindfulness scores were positively associated with years of meditation expertise and hours of current meditation practice which also corroborates previous findings (e.g. Carmody & Baer, 2008; Walach, Buchheld, Buttenmuller, Kleinknecht, & Schmidt, 2006) and shows that mindfulness can be cultivated through meditation practice. Our findings, however, differ from a previous study that showed positive associations between lucidity and years of meditation expertise (e.g. Hunt & Ogilvie, 1988). One possible explanation is that in the present study the participants were selected due to their interest in lucid dreams, while in the study by Hunt and Ogilvie (1988) the participants were selected due to their long-term meditation practice. Therefore our sample was rather heterogeneous in terms of frequency and regularity of meditation practice. Many participants may not have been committed to a specific regular day-to-day meditation practice, which may lead to increased mindfulness and, arguably, to increased lucid dreaming ability. In addition, our participants reported being engaged in a diverse range of meditation techniques which might have somewhat different effects on mindfulness and lucidity. To overcome such limitations, future research should explore the effects of specific meditation practices in greater detail. Longitudinal experimental or quasi-experimental studies would be especially warranted: Individuals could be randomly assigned to attentional training or meditative practice conditions (versus a comparison group) and actually engage in these practices over a period of time while recording and assessing the qualities of their dreams. Changes in mindfulness, lucidity, and related constructs can then be assessed and causal relationships established.

Conversely, the present findings could suggest that it might not be the meditation practice per se that moderates the relationship, but individual predispositions, for example, the attitude to focus attention on the present moment and ongoing experience. Mind-wandering in wakefulness and ordinary non-lucid dreaming share a lot of similarities including both phenomenological aspects (e.g. lack of meta-cognition and cognitive control) and overlapping cortical activity; therefore dreaming may even be considered as an “intensified form” of mind-wandering (Fox, Nijeboer, Solomonova, Domhoff, & Christoff, 2013). Thus, if a person has a low tendency towards mind-wandering during daytime, they may also have higher dispositional meta-cognition during the dream state which could promote lucid dreaming. Moreover, in different surveys both reports of lucid dreaming and meditation have been shown to be associated with reports of various types of paranormal experiences (Alvarado & Zingrone, 2007-2008; Kohr, 1980; Palmer, 1979). This might be related to personality factors such as thin boundaries (Galvin, 1990; Hicks, Bautista, & Hicks, 1999; Schredl & Erlacher, 2004), transliminality (Lange, Thalbourne, Houran, & Storm, 2000) and openness to experience (Giluk, 2009; Schredl & Erlacher, 2004; Yu, 2012). It is conceivable that individuals who are more open to experience, have “thinner” boundaries between their mental states and higher sensitivity to inner psychological material are more likely to try meditation and report more lucid dreams and higher mindfulness in wakefulness. Personality variables, as moderating factors of the relationship, could be explored in future studies.

The findings of the present study support the hypothesis that mindfulness in wakefulness and lucidity in dreams are positively related, yet the relationship does not appear to be strong and is pronounced only in the participants who report meditation experience. Furthermore, dream lucidity seems to be more closely related to certain aspects of wakeful mindfulness: While lucid dream frequency positively correlated with both FMI subscales – Presence and Acceptance – only the former appeared to be a significant predictor of lucid dream frequency. Rider (2012) suggests that wakeful mindfulness and dream lucidity might not be corresponding categories and perhaps it is worth including the notion of “dream mindfulness” that would more closely correspond to its wakeful counterpart. Mindfulness indeed differs from lucidity in the sense that mindfulness is non-judgemental and non-reactive (Malinowski, 2008). A mindful person does not have explicit intention to control his or her experience but rather to observe it, while in lucid dreams the dreamer is usually active – spontaneously sets new goals for actions and tries to execute them (Stumbrys et al., 2014). The present findings corroborate this difference: Dream lucidity was more related to dispositional mindful presence than to (non-judgemental) acceptance. Mindfulness is a

complex construct which, as already noted, can be conceptualised both uni-dimensionally and multi-dimensionally, depending on the assessment measure. With FMI, Walach et al. (2006) suggest mindfulness is considered as a general construct that has some interrelated factors, although a two-factor solution maybe used for a shorter 14-item version (cf. Kohls et al., 2009) or a four-factor solution (mindful presence, non-judgemental acceptance, openness to experiences, insight) for a longer 30-item version (cf. Buchheld, Grossmann, & Walach, 2001). Among other dispositional mindfulness measures, both uni-dimensional (e.g. Mindful Attention Awareness Scale, Brown & Ryan, 2003) and multi-dimensional with two-factor (e.g. Toronto Mindfulness Scale, Davis, et al., 2009; Philadelphia Mindfulness Scale, Cardaciotto et al., 2008), four-factor (e.g. Kentucky Inventory of Mindfulness Scale, Baer et al., 2004; Cognitive and Affective Mindfulness Scale-Revised, Feldman et al., 2007), or five-factor (e.g. Five Facet Mindfulness Questionnaire, Baer et al., 2008) approaches have been used. For dream lucidity, several dimensions can also be assessed, such as insight, control, dissociation and others (Voss, Schermelleh-Engel, Windt, Frenzel, & Hobson, 2013). Future research should explore how these different dimensions of mindfulness and lucidity interrelate.

On a neurophysiological level, both lucid dreaming (Dresler et al., 2012; Stumbrys, Erlacher, & Schredl, 2013b; Voss, Holzmann, Tuin, & Hobson, 2009) and mindfulness (Creswell, Way, Eisenberger, & Lieberman, 2007; Farb et al., 2007) seem to be associated with an increased activity within the prefrontal brain regions. The prefrontal cortex is associated with attention regulation, executive function and top-down control of behaviour (Arnsten & Li, 2005; Miller & Cohen, 2001). Indeed, better attentional performance on the Stroop task (a canonical measure of executive function) was found to be related both to higher frequency of lucid dreaming (Blagrove, Bell, & Wilkinson, 2010) and higher mindfulness (Moore & Malinowski, 2009).

In summary, the findings of the present study support the notion of an existing relationship between mindfulness in wakefulness and lucidity in dreams. This relationship seems to be moderated by the acquaintance with meditation practice: It was present only in those participants who reported meditation experience. Yet the nature of the relationship remains unclear: Is the relationship is influenced by actual meditation practice or does it reflect natural predispositions. Future studies should examine the effects of different types of meditation practices, for example, to compare focused attention and open monitoring type meditations (Lutz et al., 2008) and explore personality variables (e.g. thin boundaries, openness to experience) that might be moderating factors of this relationship. Longitudinal

experimental or quasi-experimental studies examining the effects of meditative practice interventions on the dream quality would be especially useful in establishing causal connections. In addition, studying individuals engaged in meditation practices particularly aimed at increasing awareness of dreaming, such as Tibetan Buddhist Dream Yoga practices, may shed further light on the issue. Given, dream lucidity appears to be more strongly associated with certain aspects of wakeful mindfulness (e.g. Presence rather than Acceptance, as it was found in the present study), further research exploring how different facets of these two modes of awareness interrelate would be also encouraged.

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