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Measuring consciousness in dreams: The lucidity and consciousness in dreams scale

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ABSTRACT

In this article, we present results from an interdisciplinary research project aimed at assessing consciousness in dreams. For this purpose, we compared lucid dreams with normal non-lucid dreams from REM sleep. Both lucid and non-lucid dreams are an important contrast condition for theories of waking consciousness, giving valuable insights into the structure of conscious experience and its neural correlates during sleep. However, the precise differences between lucid and non-lucid dreams remain poorly understood. The construction of the Lucidity and Consciousness in Dreams scale (LuCiD) was based on theoretical considerations and empirical observations. Exploratory factor analysis of the data from the first survey identified eight factors that were validated in a second survey using confirmatory factor analysis: INSIGHT, CONTROL, THOUGHT, REALISM, MEMORY, DISSOCIATION, NEGATIVE EMOTION, and POSITIVE EMOTION. While all factors are involved in dream consciousness, realism and negative emotion do not differentiate between lucid and non-lucid dreams, suggesting that lucid insight is separable from both bizarreness in dreams and a change in the subjectively experienced realism of the dream.

1. Introduction

The current study is aimed at providing a reliable and valid tool to measure consciousness in dreams. In developing the Lucidity and Consciousness in Dreams scale (LuCiD), we contrasted different types of rapid eye movement (REM) sleep dreams varying in levels of consciousness: non-lucid and lucid dreams. Our research questions concern the defining properties of these distinct sub-states within the state of sleep. Which cognitive functions can our brain access in normal (non-lucid) dreaming? Do lucid dreams differ measurably from non-lucid dreams and if so, how much and in which respects?

1.1. Dream consciousness

Dreams are altered states of consciousness in which the brain constructs a virtual world of vivid images that we are unable to identify as hallucinogenic. The dream's hallucinatory or virtual nature goes unnoticed despite its utterly bizarre and inconsistent elements. Due to an attenuated activation of the prefrontal cortex during rapid eye movement sleep (REM sleep), the dreamer is deprived of his ability to think logically or to make meaningful decisions (cf. Dang-Vu et al., 2010; Voss,

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Holzmann, Tuin, & Hobson, 2009). Yet he often feels as if he was able to exploit his mental resources, and he is intensively engaged in the dream experience, which is often overwhelmingly emotional. Consequently, the dream world is taken to be real even though it is not. Moreover, the dreamer fails to notice the irrational quality of his own thoughts and actions, thus mistakenly taking himself to be a rational agent. In both respects, non-lucid dreams bear high similarity to delusions and hallucinations accompanying psychotic and delirious states (Freud, 1900/2011; Hobson, 1999).

According to our primary-secondary hypothesis (Hobson & Voss, 2010, 2011), the delusional character of dreams is caused by a predominance of the primary mode of consciousness, a distinct space in the consciousness continuum commonly referred to as lower-level consciousness. Primary consciousness is characterized by a fusion of past, present, and future. It is governed by what is immediately present. In the primary mode, the dreamer is deprived of the ability to control and influence the ongoing experience. His only choice is to cope with the immediate and constantly changing scenery. Upon awakening, the subject enters the secondary mode (higher-order consciousness), which enables him to plan ahead, to reflect on his past and to contemplate his future.

1.2. Lucid dreaming as a hybrid state of consciousness

In lucid dreams, part of the brain operates in the primary mode while another has access to secondary consciousness. On the phenomenological level, the dreamer is aware of the fact that he is dreaming while the dream continues. Sometimes, he can even gain some control of the dream plot and walk through walls, or purposefully engage in flying. Both lucid insight and plot control are functions of secondary consciousness. Lucid dreams occur naturally in the course of brain maturation and are susceptible to autosuggestion and training (Voss, Frenzel, Koppehele-Gossel, & Hobson, 2012). For this reason, both lucid and non-lucid dreams are important contrast conditions for theories of waking consciousness, giving valuable insights into the structure of conscious experience and its neural correlates during sleep (Windt & Noreika, 2011).

On an objective level, distinct patterns of brain activation have been identified by independent laboratories (Dresler et al., 2012; Voss et al., 2009), validating the existence of lucid dreams as hybrid states with elements of primary *and* secondary consciousness (adopted from Edelman (2005)). The core criterion of dream lucidity is the dreamer's insight into the virtual reality of the ongoing dream. In addition, lucid dreams are often described as being distinguished from non-lucid dreams along a number of dimensions involving a resurfacing of self-reflection, rational thought, memory, planning and behavioral control. This polarized definition is, of course, useful for laboratory investigations, and as indicated above, both the phenomenological description of lucid dreaming and the identification of distinct brain regions involved suggest that the distinction between primary and secondary consciousness maps onto the distinction between non-lucid and lucid dreams.

This assumption, however, is not as straightforward as one might assume. First, note that the distinction between primary and secondary consciousness was initially applied by Edelman (2003; Edelman, Baars, & Seth, 2005) to the problem of how to identify the hallmarks of consciousness in non-mammalian species. Assessing the presence or absence of primary and secondary (or higher-order) consciousness in animals, however, is importantly different from assessing their presence or absence in the conscious states of humans. In the latter case, but not in the former, it is already clear that humans possess both primary and secondary consciousness; what is not clear, however, is whether or to what extent they manifest during dreams.

Second, the application of primary and secondary consciousness to dreaming is rendered difficult by the fact that non-lucid dreams potentially blur their respective distinguishing features. According to Edelman (2003), animals with primary consciousness—whilst able to "integrate perceptual and motor events together with memory to construct a multimodal scene in the present" (Edelman, 2003, p. 5521), as well as to alter their behavior in an adaptive manner—are unable to go beyond the immediate scene in planning their behavior. By contrast, animals with higher-order (or secondary) consciousness, such as primates and humans, additionally have semantic or narrative capabilities and in virtue of these capabilities are able "to go beyond the limits of the remembered present of primary consciousness" (Edelman, 2003, p. 5522). Thus, self-awareness, metacognition, and the ability to reconstruct past and construct future scenes are all crucially tied to linguistic capabilities. Self-consciousness, in terms of consciousness of consciousness, only "becomes possible via the linguistic tokens that are meaningfully exchanged during speech acts in a community" (Edelman, 2003, p. 5523).

What, then, happens when the distinction between primary and secondary consciousness is applied to dreaming? As indicated above, non-lucid (as opposed to lucid) dreams are marked by their restriction to the immediate scene, as well as by an attenuation of both long- and short-term memory and an inability to engage in deliberate planning or behavioral control (Hobson, Pace-Schott, & Stickgold, 2000). The inability of the dream self to think or plan beyond the immediately unfolding dream events is a well-known feature of dreaming, often referred to as the single-mindedness of dreaming (Rechtschaffen, 1978). In this respect, then, non-lucid dreamers appear to fit the definition of primary consciousness introduced by Edelman. At the same time, however, it would be incorrect to assume that linguistic capabilities tied to the emergence of higher-order or secondary consciousness are completely lost in dreams. Language occurs in dreams quite frequently, namely when the dream self engages in conversations with other dream characters or thinks about the ongoing events in his dream. Kahan (2001) reviews a number of studies, showing that even non-lucid dreamers engage in a variety of different types of thinking, including thinking about their own behavior, intentions, or emotions. So while the scope of such dream thoughts may be limited to the present context of the dream—thus resembling primary consciousness—the linguistic capabilities involved in such thoughts resemble higher-order or secondary consciousness.

While this suggests that non-lucid and lucid dreams may be continuous in terms of the occurrence of different types of thinking, there is another core aspect of secondary consciousness that does not occur in non-lucid dreams. Non-lucid dreamers suffer the metacognitive deficit: they are unable to think about their current relation to the dream world in such a way as would enable them to realize that they are now dreaming (Metzinger, 2004). They may be able to reflect upon their own actions in response to the events occurring within the dream, but they fail to realize that these actions and events are taking place within a *dream* world, rather than in the real world. Note that this is necessarily true for all non-lucid dreams: by definition, dreams in which the dreamer fails to realize that he is currently dreaming can be classified as non-lucid. But this also means that thinking in non-lucid dreams necessarily has an element of irrationality, namely by failing to adequately take into account the relationship between the dream self and what is, in fact, a merely virtual dream world. If the dreamer were able to accurately reflect upon this relationship, he would thereby realize that he was dreaming and become lucid (Windt & Metzinger, 2007).

An important consequence is that at least in the case of dreaming, where the distinction between primary and secondary consciousness is applied not to creature consciousness but to conscious states, it may be misleading to assume that secondary consciousness can simply be reduced to reflective thought, or that primary consciousness can straightforwardly be described through the lack of reflective thought. If primary consciousness refers to the inability to go beyond the limits of the presently experienced scene, then non-lucid dreams typically manifest primary, but not secondary, consciousness. This would mean, however, that primary consciousness would potentially include such kinds of thoughts and self-reflection as take place within non-lucid dreams. If, on the other hand, primary consciousness refers to the absence of linguistic capabilities in general, then non-lucid dreams typically do not constitute an example of primary without secondary consciousness. On this second reading, it would only be a particular aspect of secondary consciousness, namely the ability to engage in the type of metacognition that allows one to (correctly) conceptualize one's ongoing conscious state (for instance *as* a dream), that would be missing in non-lucid dreams. In other respects, however, non-lucid dreams might be continuous with lucid dreams.

While these are primarily conceptual questions, they do, however, point to a deeper underlying uncertainty in the study of lucid and non-lucid dreaming: How exactly is lucid insight into the virtual character of the ongoing dream, which is the core criterion of dream lucidity, related to the resurfacing of self-reflection, rational thought, memory, planning and behavioral control in lucid dreams? To what extent are lucid and non-lucid dreams not only distinguished in terms of realizing, while dreaming, that you are dreaming, but also in terms of other types of reflective cognitive activity on the part of the dreamer? These are empirical questions, and answering them could pay an important contribution to charting the emergence of consciousness and self-consciousness in dreams.

What is needed to assess dream consciousness and the occurrence of primary and secondary consciousness in dreams is a reliable and precise scale that allows a qualification and quantification of its determinants. The fact that non-lucid and lucid dreams represent two distinct expressions of consciousness in dreams allows us to approach its conceptualization by defining commonalities and differences between the two. To lay the foundations of this approach, we made an interdisciplinary attempt involving neuroscientists, psychologists, and philosophers to provide a blueprint suited for empirical testing. The construction of the LuCiD scale underwent several stages, from theorizing about the constituents of higher-order (secondary) consciousness in dreams to a factor-analytic evaluation of a first sample of lucid and non-lucid dreams and a validated and shortened version of the first questionnaire. In the process of the scale validation we had to modify the theoretically proposed factors to better represent the reported impressions of our participating dreamers. To our knowledge, this is the first empirically-based approach to measure and define consciousness in different types of dreaming.

2. Material and methods

2.1. Scale construction

Item construction was theory-based and aimed at identifying differences between higher and lower levels of consciousness in dreams, as described by several authors (Edelman et al., 2005; Hobson & Voss, 2010, 2011; Kahn, 2007; LaBerge & DeGracia, 2000; Metzinger, 2009; Voss, Tuin, Schermelleh-Engel, & Hobson, 2011). Each statement was followed by a 6-point scale (0: strongly disagree, 5: strongly agree).

As shown in Fig. 1, scale construction began with the formulation of 50 items, based on reports from lucid dreamers and theoretical considerations. Some statements were expected to be experienced frequently in lucid dreams while others were expected to be associated negatively with lucidity. In a second step, the questionnaire was reduced to 24 items, based on results from factor analysis. Since – unexpectedly – the items supposed to measure emotion in dreams did not load on a distinct factor, we added 4 new items, asking for positive and negative emotion, specifically. The final and validated version, thus, consists of 28 items (see Fig. 2).

2.2. Theoretical factorial structure

Based on the literature (Green, 1994; LaBerge, 1985; LaBerge & DeGarcia, 2000; Kahn, 2007; LaBerge & Gackenbach, 2000; Tart, 1988; Tholey & Utecht, 2000/1995; Metzinger, 2004; Windt & Metzinger, 2007), especially the work of Kahn (2007) and

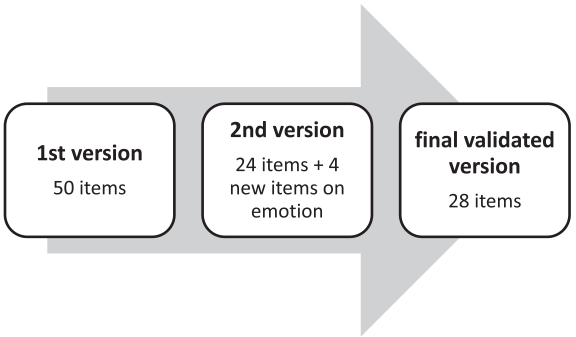

Fig. 1. Steps of scale construction. Step 1: Theory-based items to be tested in Survey No. 1. Step 2: Factor-analytically selected items suited to distinguish between lucid and non-lucid dreams. Step 3: Confirmatory factor analysis of selected items and extensive scale validation with data assessment from various sources (laboratory, paper and pencil, online).

LaBerge and DeGracia (2000), the following factors were proposed to differentiate between lower (primary) and higher (secondary) level consciousness in dreams (see also Fig. 3a):

(1) Lucid insight (INSIGHT), (2) Control over thought and actions in dreams (CONTROL), (3) Logical thought (THOUGHT), (4) Perceptual Realism (REALISM), (5) Memory access to elements of waking life (MEMORY), (6) Self-image (SELF), and (7) Emotion (EMOTION).

2.3. Participants

In Survey No. 1, we collected 160 dream reports relying mostly on paper and pencil questionnaires ($N = 126$). An online version of the questionnaire was preferred by 34 participants. All participants were recruited in class or through personal contacting. Two data sets had to be eliminated from analysis because of extreme answering style (all items were scored as 0 or 5). In total, data from 158 questionnaires (31 males, 118 females, mean age = 24.4 years, $SD = 0.7$ years) were analyzed for Survey No. 1. Of these, 50 dreams were reportedly lucid, and 108 non-lucid.

Survey No. 2 ($N_{\text{total dreams}} = 151$, 71 males, 80 females) was aimed at validating results from explorative factor analysis. Data were collected in a laboratory setting ($N_{\text{dreams}} = 117$) as well as paper and pencil testing ($N_{\text{dreams}} = 34$). Descriptive statistics are summarized in Table 1.

2.4. Procedure

Lucid and non-lucid dreamers were asked to report a recent single dream and answer all questions pertaining to the dream. The scale was available as paper and pencil questionnaire and online (http://wp1011437.wp021.webpack.hosteurope.de/limesurvey/index.php?sid=92186&lang=de). The online version was prepared to provide enough privacy to encourage sharing even delicate dream reports. Survey No. 1 relied on paper and pencil tests and online data, Survey No. 2 included laboratory awakenings from REM-sleep and paper and pencil reports.

2.4.1. Paper and pencil (Surveys Nos. 1 and 2)

The LuCiD scale was advertised among students at Bonn University (Germany) and participants of the lucid dream group that meets weekly at Bonn University to train newcomers in lucid dreaming and to discuss dreams in general. To assure that dream reports referred to RECENT dreams, participants were asked to specify the time lag between the dream and the dream report. Only reports of recent dreams (less than 6 h since report) were included in the analysis. To increase the likelihood that the dream narratives were related to REM sleep, the minimum criterion of 40 words was applied, in accordance with previous research suggesting that reports exceeding 40 words have a high likelihood of referring to REM sleep dreams (Hobson et al., 2000). However, we consider this method only a rough approximation (see also McNamara et al., 2010).

2.4.2. Laboratory data (Survey No. 2)

For validation purposes, we also collected 117 dream reports after awakenings from REM sleep in the sleep laboratory at Bonn University. Sleep was monitored through standard polysomnography (somnomed, Germany). Participants reported to the sleep lab at 9:00 p.m. and were instrumented for PSG. Before going to bed, the LuCiD scale items were read out by an experimenter and ample time was allowed to ask questions and to clear up any misunderstandings. REM sleep awakenings were started at $\sim$ 3 a.m. Awakenings were made following approximately 5 min of REM sleep which was scored online. After participants narrated their dream, an experimenter read out the questionnaire items and marked the answers on the scale. All interactions and dream narratives were audiotaped. Following each awakening, participants were allowed to go back to sleep until the next REM period commenced. Sleep time was not restricted. Informed consent was obtained and subjects

		strongly disagree					strongly agree
1.	While dreaming, I was aware of the fact that the things I was experiencing in the dream were not real.	0	1	2	3	4	5
2.	While dreaming, I was able to remember my intention to do certain things in the dream.	0	1	2	3	4	5
3.	While dreaming, I was aware that the self I experienced in my dream wasn t the same as my waking self.	0	1	2	3	4	5
4.	In my dream, I was able to manipulate or control other dream characters in a way that would be impossible in waking.	0	1	2	3	4	5
5.	While dreaming, I thought about other dream characters.	0	1	2	3	4	5
6.	While dreaming I was able to successfully perform supernatural actions (like flying or passing through walls).	0	1	2	3	4	5
7.	The emotions I experienced in my dream were exactly the same as those I would experience in such a situation during wakefulness.	0	1	2	3	4	5
8.	While dreaming, I was aware of the fact that the body I experienced in the dream did not correspond to my real sleeping body.	0	1	2	3	4	5
9.	I was very certain that the things I was experiencing in my dream wouldn t have any consequences on the real world.	0	1	2	3	4	5
10	While dreaming I was able to successfully control or change the dream environment in a way that would be impossible during wakefulness).	0	1	2	3	4	5
11	While dreaming, I saw myself from outside.	0	1	2	3	4	5
12	While dreaming, I thought about my own actions.	0	1	2	3	4	5
13	While dreaming, I had the feeling that I had forgotten something important.	0	1	2	3	4	5
14	While dreaming, I was able to change or move objects (not persons) in a way that would be impossible in waking.	0	1	2	3	4	5
15	While dreaming I was not myself but a completely different person.	0	1	2	3	4	5
16	While dreaming, I often asked myself whether I was dreaming.	0	1	2	3	4	5
17	The thoughts I had in my dream were exactly the same as I would have in a similar situation during wakefulness.	0	1	2	3	4	5
18	While dreaming, I had the feeling that I could remember my waking life.	0	1	2	3	4	5
19	While dreaming, I was aware of the fact that other dream characters in my dream were not real.	0	1	2	3	4	5
20	Most things that happened in my dream could have also happened during wakefulness.	0	1	2	3	4	5
21	I watched the dream from the outside, as if on a screen.	0	1	2	3	4	5
22	While dreaming, I often thought about the things I was experiencing.	0	1	2	3	4	5
23	I was able to influence the story line of my dreams at will/at libitum.	0	1	2	3	4	5
24	While dreaming, I was able to remember certain plans for the future.	0	1	2	3	4	5
25	While dreaming, I felt euphoric/upbeat.	0	1	2	3	4	5
26	While dreaming, I had strong negative feelings.	0	1	2	3	4	5
27	While dreaming, I had strong positive feelings.	0	1	2	3	4	5
28	While dreaming, I felt very anxious.	0	1	2	3	4	5

Fig. 2. Final version of the LuCiD scale.

received a compensation of 50 Euro per night. Each subject spent up to three non-consecutive nights at the laboratory. Dreams were recorded from all three nights, since we had, in our earlier studies, often observed lucid dreams to occur during the first night in the laboratory (e.g. Voss et al., 2009).

2.5. Missing data

In Survey No. 1, the amount of missing data was very small (0.29%). It was simultaneously replaced when estimating model parameters using exploratory factor analysis based on the full information weighted least-squares mean and variance adjusted estimation method (WLSMV) of the M*plus* program (Muthén & Muthén, 1998–2010).

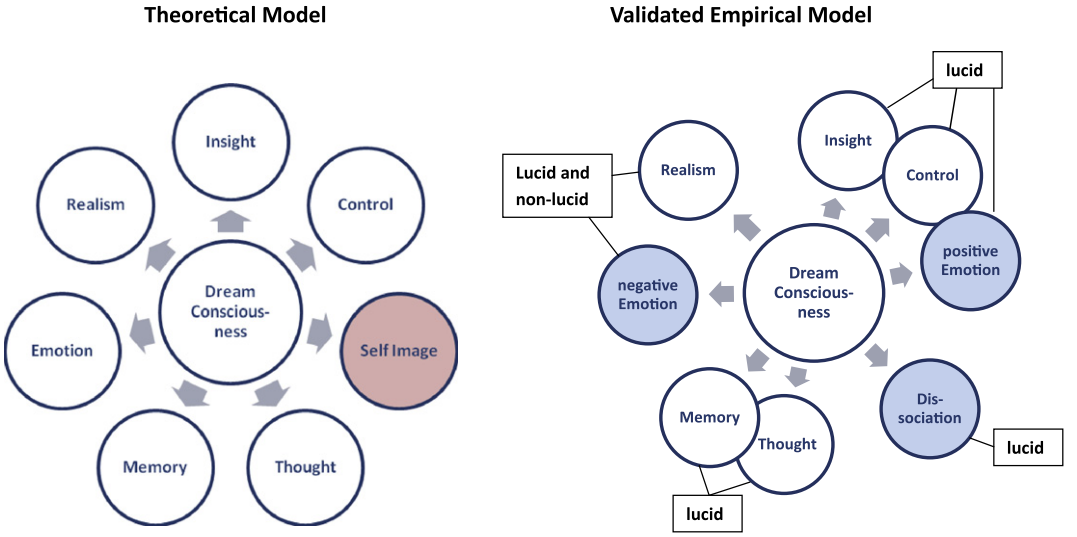

Fig. 3. Left: Initial model of the factors defining dream consciousness: Realism = Perceptual Realism, Insight = Lucid insight, Self Image, Thought = Logical thought, Memory = Memory access to elements of waking life, Control = Control over thought and actions in dreams, Emotion. Self Image (pink shading) was not confirmed through factor analysis. Right: Empirical model of dream consciousness: Realism, Insight, Control, Cognition = logical thought and memory, Dissociation = experiencing the dream from a third person perspective, Negative Emotion. Factors identified but not proposed initially are marked through light blue shading. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 1
Descriptive statistics and item contents (assignment of items to constructs).

Factor	Item no.	Item content	Mean	*SD*
INSIGHT	1	While dreaming, I was aware of the fact that the things I was experiencing in the dream were not real.	1.14	1.88
	3	While dreaming, I was aware that the self I experienced in my dream wasn't the same as my waking self.	0.87	1.58
	8	While dreaming, I was aware of the fact that the body I experienced in the dream did not correspond to my real sleeping body.	1.05	1.78
	9	I was very certain that the things I was experiencing in my dream wouldn't have any consequences on the real world.	1.09	1.83
	16	While dreaming, I often asked myself whether I was dreaming.	0.70	1.33
	19	While dreaming, I was aware of the fact that other dream characters in my dream were not real.	0.93	1.72
CONTROL	4	In my dream, I was able to manipulate or control other dream characters in a way that would be impossible in waking.	0.51	1.25
	6	While dreaming I was able to successfully perform supernatural actions (like flying or passing through walls).	0.58	1.38
	10	While dreaming I was able to successfully control or change the dream environment in a way that would be impossible during wakefulness).	0.59	1.36
	14	While dreaming, I was able to change or move objects (not persons) in a way that would be impossible in waking.	0.42	1.21
	23	I was able to influence the story line of my dreams at will/at libitum.	0.67	1.34
THOUGHT	5	While dreaming, I thought about other dream characters.	2.60	2.03
	12	While dreaming, I often thought about my own actions.	2.43	2.01
	22	While dreaming, I often thought about the things I was experiencing.	1.81	1.77
REALISM	7	The emotions I experienced in my dream were exactly the same as those I would experience in such a situation during wakefulness.	3.02	1.92
	17	The thoughts I had in my dream were exactly the same as I would have in a similar situation during wakefulness.	3.38	1.71
	20	Most things that happened in my dream could have also happened during wakefulness.	2.63	1.99
MEMORY	2	While dreaming, I was able to remember my intention to do certain things in the dream.	1.97	2.08
	13	While dreaming, I had the feeling that I had forgotten something important.	0.99	1.64
	18	While dreaming, I had the feeling that I could remember my waking life.	1.95	2.02
	24	While dreaming, I was able to remember certain plans for the future.	1.27	1.78
DISSOCIATION	11	While dreaming, I saw myself from outside.	0.94	1.70
	15	While dreaming I was not myself but a completely different person.	0.40	1.15
	21	I watched the dream from the outside, as if on a screen.	1.00	1.68
NEG.	26	While dreaming, I had strong negative feelings.	0.70	1.30
EMOTION	28	While dreaming, I felt very anxious.	0.24	0.85
POS.	25	While dreaming, I felt euphoric/upbeat.	1.17	1.53
EMOTION	27	While dreaming, I had strong positive feelings.	1.45	1.59

In Survey No. 2, 2.96% of the data were missing. Confirmatory factor analysis based on the WLSMV method with simultaneously replacing missing values together with parameter estimation was used. We physically replaced missing data only for analysis of variance in order to compute sum-score variables which were needed to analyze group differences. For this analysis, missing values were imputed using the estimation maximization algorithm of PRELIS 2.80, the pre-processor to the LISREL program (version 8.8, Joreskog & Sorbom, 2006).

2.6. Data analysis

2.6.1. Exploratory factor analysis

Construct validity of the questionnaire was investigated by both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA was performed on the data of Survey No. 1. As the items were ordered categorical (ordinal) variables, we used the default estimator for this type of analysis of the M*plus* program, version 6.11 (Muthén & Muthén, 1998–2010), the full information WLSMV estimator. Since we assumed that the factors were not completely independent of each other, we chose the oblique promax rotation procedure. Promax rotation starts out with an orthogonal rotation and transforms extracted factors into an oblique solution, maximizing primary factor loadings and minimizing secondary loadings.

Increasing numbers of factors were tested in order to decide how many different factors were needed to explain the pattern of relationships in the data. The examination of the likelihood-ratio χ^2 test and its p-value as well as two descriptive fit indices, the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR) were used to evaluate how well each of the solutions with increasing numbers of factors fit the data. The final number of factors was determined using cut-off values of model fit indexes: As suggested by Hu and Bentler (1999) as well as Schermelleh-Engel, Moosbrugger, and Müller (2003), good model fit was assumed when the χ^2 value was non-significant, RMSEA $\leqslant$ .06, and SRMR $\leqslant$ .08. We also examined conceptual plausibility.

2.6.2. Confirmatory factor analysis

Following EFA, a confirmatory factor analysis (CFA) was performed on the data of Survey No. 2 in order to validate the factorial structure of the questionnaire. The CFA was based on polychoric correlations. Again, we used WLSMV for parameter estimation and evaluated model fit using several goodness of fit statistics reported by the M*plus* program, the likelihood-ratio χ^2 test and its associated p-value, the RMSEA, the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the weighted root mean square residual (WRMR). Good model fit was indicated by a non-significant χ^2 value, RMSEA $\leqslant$ .06, CFI and TLI $\geqslant$ .95 (Hu & Bentler, 1999), and WRMR $\leqslant$ 1.00 (Yu, 2002). As the often recommended χ^2 test is known to be affected by sample size, $\chi^2/df \leqslant 2.0$ was used as a descriptive measure of model fit (cf. Schermelleh-Engel et al., 2003).

2.6.3. Mean differences between lucid and non-lucid dreams

Differences between lucid dream reports and non-lucid dream reports were determined using multivariate analysis of variance (MANOVA). One-way univariate analyses of variance (ANOVAs) were conducted following a significant MANOVA. As the assumption of variance homogeneity was violated, we also performed t-tests for independent samples corrected for unequal variances.

3. Results

3.1. Factorial structure

Evidence of construct validity was provided by both exploratory and confirmatory factor analyses.

3.1.1. EFA of Survey No. 1 data

A first exploratory factor analysis (EFA) revealed 7 factors, 3 of which had been proposed on the basis of theoretical considerations (see Fig. 2): INSIGHT (six items), REALISM (three items), and THOUGHT/MEMORY; a unified factor combining the two constructs THOUGHT (four items) and MEMORY (three items). Additional factors not proposed initially but identified via EFA were super-natural Control (“CONTROL”, five items), and DISSOCIATION (three items). The initially proposed factors SELF and EMOTION could not be detected in the data. Two additional factors were extracted but could not be interpreted because of too many cross loadings and low factor loadings. The fit of the model to the data was good with $\chi^2(df = 734; N = 158) = 884.12$, $p < .01$, RMSEA = .036, SRMR = .061, and $\chi^2/df < 2$.

3.1.2. Item trimming and final factor extraction through CFA

Because of insufficient factor loadings we had to eliminate a major part (26 items) of the original item pool: All items that loaded on more than two factors and items with low factor loadings (<.30) were discarded. The remaining 24 items were distributed across five factors: INSIGHT, CONTROL, THOUGHT/MEMORY, REALISM, and DISSOCIATION.

In order to test whether the items loading on the unified factor THOUGHT/MEMORY were indeed indicators of two (possibly) correlated factors, we performed a χ^2-difference test on two nested CFA models. In the constrained CFA model the correlation between THOUGHT and MEMORY was fixed to one and the correlations of INSIGHT, CONTROL, REALISM, and DISSOCIATION with THOUGHT were constrained to be equal to the correlations of these factors with MEMORY, while in

the unconstrained CFA model the correlations between all factors were freely estimated. The difference in χ^2 values with degrees of freedom equal to the difference between the nested models was estimated using the Satorra-Bentler correction (Asparouhov & Muthén, 2006; Satorra & Bentler, 1994).

The χ^2 difference test revealed that THOUGHT and MEMORY were indeed distinct but correlated factors ($r = .76$). The constrained model with $\chi^2(df = 242;\ N = 158) = 424.77$ fitted the data significantly worse than the unconstrained model with freely estimated correlations and $\chi^2(df = 237;\ N = 158) = 361.04$, as was evaluated by the significant Satorra-Bentler corrected χ^2 difference $\Delta\chi^2(\Delta df = 5;\ N = 158) = 50.42$, $p < .01$. The factor analyses for Survey No. 1 therefore revealed 6 factors: (1) INSIGHT, (2) CONTROL, (3) THOUGHT, (4) REALISM, (5) MEMORY, and (6) DISSOCIATION.

3.1.3. CFA of Survey No. 2 data

Unexpectedly, the items supposed to assess emotion in dreams did not yield a specific factor for EMOTION using EFA on Survey No. 1 data but loaded on multiple factors, instead. To follow up on this result, we designed four new items that specifically assessed positive and negative emotions in dreams. The revised questionnaire for Survey No. 2 therefore consisted of 28 items.

The factorial structure was then validated by means of a CFA using the full information WLSMV estimator for categorical variables. We analyzed a model with 6 + 1 = 7 factors, i.e., the six factors extracted through EFA and CFA from Survey No. 1 (INSIGHT, CONTROL, THOUGHT, REALISM, MEMORY, and DISSOCIATION) plus one new factor, EMOTION. In this model, all items relating to emotions were allowed to load on a single factor. Unfortunately, parameter estimation of this model caused estimation problems (a negative error variance), so that the factor EMOTION had to be divided up into a positive and a negative emotion factor. As both factors had only two indicators each, we had to assume tau-equivalence and constrained the factor loadings to be equal. This model fits the data quite well with $\chi^2(df = 324;\ N = 151) = 480.34$, $p < .01$, RMSEA = .057, CFI = .97, TLI = .96, WRMR = .90, and $\chi^2/df < 2$.

Table 1 shows descriptive statistics for the items and Table 2 lists factor loadings. As can be seen from Table 1, means are quite small for some items, especially those loading on the factors CONTROL and NEGATIVE EMOTION. Low mean scores indicate that these items were selected less often than others, suggesting higher item difficulty. However, we did not eliminate these items because they are important in differentiating between lucid and non-lucid dreams. Table 2 reveals sufficiently high factor loadings for all included items, ranging from .390 (item 13) to .956 (item 17).

The correlation matrix (Table 3) shows noticeable correlations between CONTROL and INSIGHT, MEMORY, and THOUGHT, as well as between POSITIVE EMOTION and CONTROL. We consider these correlations meaningful. Regarding CONTROL and INSIGHT, a recent study (Voss et al., 2012) revealed that both factors are defining characteristics of lucid dreams. However, control is subordinate to lucid insight because it is normally only experienced in the presence of lucid insight. As for

Table 2
Factor loadings from CFA for items of Survey No. 2.

ITEM	INSIGHT	CONTROL	THOUGHT	REALISM	MEMORY	DISSOCIATION	NEGATIVE EMOTION	POSITIVE EMOTION
1	.910	–	–	–	–	–	–	–
3	.920	–	–	–	–	–	–	–
8	.908	–	–	–	–	–	–	–
9	.930	–	–	–	–	–	–	–
16	.737	–	–	–	–	–	–	–
19	.911	–	–	–	–	–	–	–
4	–	.862	–	–	–	–	–	–
6	–	.856	–	–	–	–	–	–
10	–	.930	–	–	–	–	–	–
14	–	.914	–	–	–	–	–	–
23	–	.937	–	–	–	–	–	–
5	–	–	.702	–	–	–	–	–
12	–	–	.916	–	–	–	–	–
22	–	–	.827	–	–	–	–	–
7	–	–	–	.891	–	–	–	–
17	–	–	–	.956	–	–	–	–
20	–	–	–	.659	–	–	–	–
2	–	–	–	–	.839			
13	–	–	–	–	.390			
18	–	–	–	–	.725			
24	–	–	–	–	.697			
11	–	–	–	–	–	.703	–	–
15	–	–	–	–	–	.739	–	–
21	–	–	–	–	–	.748	–	–
26	–	–	–	–	–	–	.831	–
28	–	–	–	–	–	–	.831	–
25	–	–	–	–	–	–	–	.921
27	–	–	–	–	–	–	–	.921

Note. In CFA, all cross loadings are fixed to zero.

Table 3
Factor correlation matrix for Survey No. 2.

	1	2	3	4	5	6	7	8
1 INSIGHT	1.000							
2 CONTROL	.777**	1.000						
3 THOUGHT	.466**	.616**	1.000					
4 REALISM	−.143	−.286**	.577**	1.000				
5 MEMORY	.566**	.569**	.867**	.434**	1.000			
6 DISSOCIATION	.359**	.070	.076	−.014	.076	1.000		
7 NEGATIVE EMOTION	.026	−.077	.533**	.542**	.139	.151	1.000	
8 POSITIVE EMOTION	.463**	.718**	.477**	.181*	.471**	−.073	−.129	1.000

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

MEMORY and THOUGHT, the two constructs are related and difficult to separate (cf. Süllwold, 1960; Weiler, Boris, & Daum, 2011). The high correlation of .867 raises doubt about their discriminability, however. Finally, the relationship between POSITIVE EMOTION and CONTROL appears almost trivial since lucid dreaming has been reported useful in the treatment of nightmares and children often report to be able to control their frightening dreams through lucid dreaming, in an effort to master negative emotions (Voss et al., 2012).

Descriptive statistics and reliability scores for each subscale are listed in Table 4. Mean values for NEGATIVE EMOTION (0.47) and THOUGHT (0.55) are low, followed by CONTROL (0.78), INSIGHT (0.96), and POSITIVE EMOTION (0.96), thus reflecting the high difficulty of the items loading on these factors.

Reliability can be regarded as good for most factors (cf. Nunnally & Bernstein, 1994). It is slightly lower than desired for MEMORY and NEGATIVE EMOTION, and too low for DISSOCIATION. We attribute this to the heterogeneity of the constructs. As mentioned before, DISSOCIATION is of high discriminative power with regard to lucid and non-lucid dreams and can therefore considered to be valid (cf. Moosbrugger & Kelava, 2011).

3.2. Lucid vs. non-lucid dreams

Dreams were treated as lucid dreams if they were rated as such by the participants. The MANOVA revealed a significant overall effect for group differences in lucid vs. non-lucid dreams in all questionnaire scales [$F(8,142) = 43.58$, $p < .01$]. Between-subjects effects show a significant difference in all scales but REALISM and NEGATIVE EMOTION ($p < .01$) (see Table 5 and Fig. 2). Ratings of reported lucid dreams were significantly higher than those for non-lucid dreams.

As variances were not homogeneous, we also tested mean differences with *t*-tests for independent samples correcting for unequal variances. The same pattern of results emerged, confirming the results from univariate ANOVAs: Again a significant difference in INSIGHT, THOUGHT, MEMORY, DISSOCIATION, CONTROL, and POSITIVE EMOTION was found while the differences in NEGATIVE EMOTION and MEMORY were not statistically significant. All differences were again significant at the 1% level with the exception of DISSOCIATON ($p < .05$).

3.3. Source of information

In general, reports from the laboratory were less pronounced than those from home diaries, both online and paper and pencil. The online data appeared the least dependable so we decided to not include this source of information for the validation of Survey No. 2. Fig. 4 contrasts mean values for laboratory and paper and pencil reports of lucid and non-lucid dreams. Home diaries of non-lucid dream reports show higher mean ratings for CONTROL ($t = 2.71$, $df = 23.91$, $p < .05$) only. By contrast, those of lucid dreams are significantly larger for several factors: CONTROL ($t = 4.20$, $df = 27$, $p < .01$), THOUGHT ($t = 4.75$, $df = 27$, $p < .01$), MEMORY ($t = 3.46$, $df = 27$, $p < .01$), and POSITIVE EMOTION ($t = 3.90$, $df = 27$, $p < .01$). Since many

Table 4
Mean, standard deviations, and reliability (Cronbach's alpha) of the subscales (Survey No. 2).

	No. of items	Mean	*SD*	Reliability
INSIGHT	6	0.96	1.41	0.91
THOUGHT	3	0.55	1.11	0.82
REALISM	3	2.28	1.66	0.79
MEMORY	4	3.01	1.58	0.66
DISSOCIATION	3	1.55	1.33	0.56
CONTROL	5	0.78	1.12	0.90
NEGATIVE EMOTION	2	0.47	0.95	0.68
POSITIVE EMOTION	2	0.96	1.41	0.87

Table 5
Between group analyses (ANOVA) for each scale ($N = 151$) comparing lucid vs. non-lucid dream reports.

Scale	Mean difference (*SE*)	*F*	*df*	*p*
INSIGHT	2.93 (.16)	308.89	1, 149	<.01
THOUGHT	−0.95 (.33)	72.51	1, 149	<.01
REALISM	−0.31(.33)	.92	1, 149	n.s.
MEMORY	0.80 (.27)	8.02	1, 149	<.01
DISSOCIATION	0.59 (.23)	8.81	1, 149	<.01
CONTROL	1.60 (.18)	6.96	1, 149	<.01
NEGATIVE EMOTION	0.20 (.20)	0.16	1, 149	n.s.
POSITIVE EMOTION	0.68 (.26)	17.92	1, 149	<.01

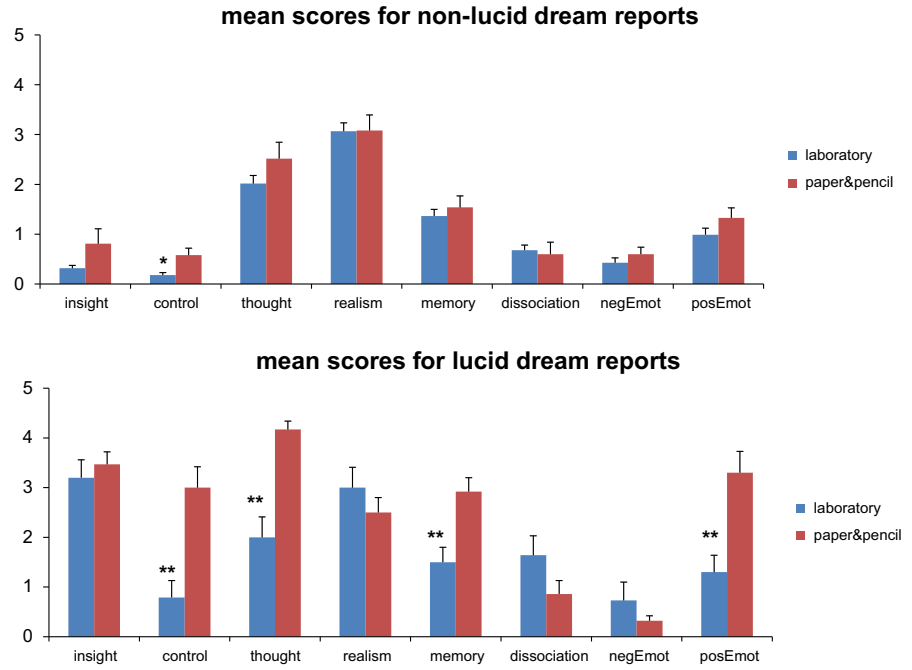

Fig. 4. Contrasts between laboratory and paper and pencil reports in Survey No. 2 ($N = 151$) for non-lucid and lucid dream reports.

laboratory subjects have reported that they are better able to immerse themselves in a lucid dream when sleeping at home, we can presently not judge whether the higher ratings in home diaries reflect true differences in lucid dream intensity and duration or memory biases.

3.4. Sex differences in Survey No. 2

In this survey, men reported more lucid dreams than women ($\chi^2 = 7.62$, $df = 2$, $p < .05$). Accordingly, we observed sex-related differences in mean scores of several factors concerning lucid dreams but no differences regarding non-lucid dreams. We report these differences but will refrain from interpretation because the sample was not a representative one: CONTROL ($t = 3.70$, $df = 75$, $p < .01$), THOUGHT ($t = 2.84$, $df = 75$, $p < .01$), NEGATIVE EMOTION ($t = 4.37$, $df = 29.21$, $p < .01$). Men reported higher scores for CONTROL in lucid dreams than women ($M_{men} = 4.98$, $SE = .14$; $M_{women} = 4.01$, $SE = .27$) and lower scores for THOUGHT ($M_{men} = 2.37$, $SE = .17$; $M_{women} = 3.17$, $SE = .24$) and NEGATIVE EMOTION ($M_{men} = .63$, $SE = .16$; $M_{women} = 3.57$, $SE = .65$).

4. Discussion

Our analyses identified eight factors involved in dream consciousness. In six factors we observed systematic differences between lucid and non-lucid dreams. While it is of course possible that our initial item pool did not exhaust all theoretically possible elements, we consider these results a first step in the search for an empirical definition of consciousness in dreams.

In the following, we will discuss our findings with regard to dreams in general and with regard to the difference between lucid and non-lucid dreams, in particular.

4.1. Consciousness in dreams

According to the performed factor analyses, dream consciousness can best be described through the factors (1) INSIGHT, (2) REALISM, (3) CONTROL, (4) MEMORY, (5) THOUGHT, (6) POSITIVE EMOTION, (7) NEGATIVE EMOTION, and (8) DISSOCIATION. When we interpret mean scores, we must distinguish between absolute values and differences between lucid and non-lucid dreams. We consider a mean score for a given factor as high in absolute terms when it lies above the scale mean (2.5).

According to our analyses, non-lucid or "normal" dreams are characterized by low absolute values in all factors except REALISM. They seem to almost completely lack INSIGHT, CONTROL, and DISSOCIATION (see Fig. 5). Although mean scores for THOUGHT are higher than those for MEMORY, both are – in absolute terms – not pronounced. Results also show relatively low mean values for NEGATIVE EMOTION. However, our sample was not representative for the general population and quite homogeneous in age distribution. Furthermore, most of the data were collected in a laboratory setting, known to increase positive emotionality in dream imagery (e.g. Hartmann, Zborowski, & Kunzendorf, 2001).

4.2. Lucid dreams

An important goal of our survey was to explore the phenomenological correlates of primary and secondary consciousness in dreams. In this regard, the data suggest that secondary consciousness adds cognitive functions and positive emotionality onto primary consciousness. The leading factor in lucid dreams is obviously INSIGHT, followed by THOUGHT, CONTROL, POSITIVE EMOTION, and DISSOCIATION.

With regard to the distinction between primary and secondary consciousness in dreams, this means that INSIGHT as a defining feature of lucidity and core aspect of secondary consciousness is related to the emergence of other features of secondary consciousness, namely generally being able to reflect not only upon the fact that one is currently dreaming, but more generally upon the unfolding dream events. The relationship between INSIGHT and CONTROL is equally clear, as realizing that one is dreaming is an important condition for trying to control not only one's own behavior in the dream, but the dream itself. This suggests that lucidity is indeed characterized not only by lucid insight, but that this also facilitates the emergence of other aspects of secondary consciousness in dreams. At the same time, while our study found non-lucid dreams to lack INSIGHT, CONTROL and DISSOCIATION almost completely, THOUGHT, though significantly less frequent than in lucid dreams, was not completely absent in non-lucid dreams.

Does this mean that certain aspects of secondary consciousness occur in non-lucid dreams? On the one hand, the occurrence of thoughts and self-reflection in non-lucid dreams can be classified as belonging to secondary consciousness because of their dependence on linguistic capacities. On the other hand, the thoughts of non-lucid dreamers are likely restricted to the immediately unfolding dream events. In particular, non-lucid dreamers lack the ability to correctly think about their current relation to the dream world in such a way as would enable them to become lucid. In this respect, thinking in non-lucid dreams resembles primary consciousness. Future studies should assess the similarities and differences between various kinds of thinking and self-reflection in non-lucid and lucid dreams in more detail. Yet, our results suggest both that there is an interesting relationship between INSIGHT, CONTROL and THOUGHT more generally, and that different aspect of secondary consciousness may be dissociated from each other, as in certain non-lucid dreams. Studying the similarities and differences between non-lucid and lucid dreams thus may be an ideal way to chart the gradual emergence of secondary consciousness in dreams, as well as, more generally, the complex relationship between different aspects of primary and secondary consciousness in humans. Through the development of the LuCiD scale, we hope to contribute a statistically validated instrument for the measurement of different forms of consciousness in dreams to future research.

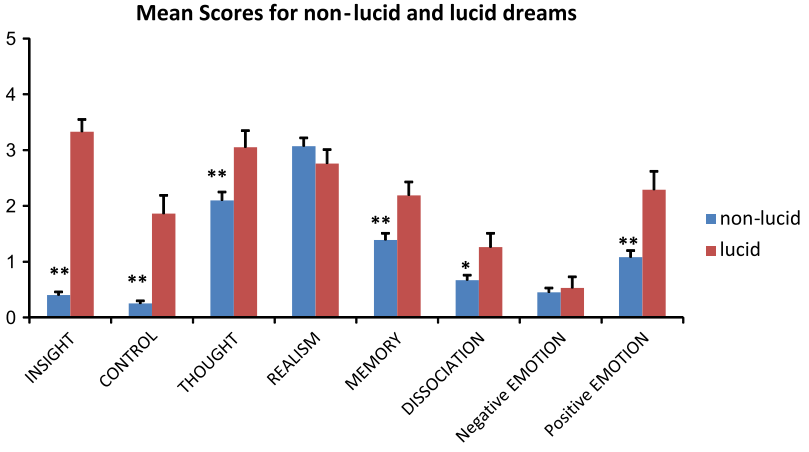

Fig. 5. Mean scores for LuCiD scales for non-lucid vs. lucid dream reports.

Another important finding of our study was that lucid and non-lucid dreams were not distinguished by the factor REALISM. By contrast, in our study, REALISM, which must be thought of as lack of bizarreness, was equally pronounced in non-lucid and lucid dreams. This may be interpreted as evidence that dreams are generally less bizarre than previously thought or that lucid dreams are equally bizarre as non-lucid dreams, whatever their level of bizarreness turns out to be. We favor the latter, more neutral interpretation because our items were not laid out to identify either bizarre or realistic elements of the dream. Rather, the sleeper was asked to provide a summarized rating of his/her dream experience, assessing the degree to which the events experienced in the dream, but also his thoughts and emotions regarding dream events would have been the same in wakefulness.

Our findings on REALISM in dreams are interesting for two reasons. One, the lack of a significant difference in REALISM between lucid and non-lucid dreams suggests that the events in lucid and non-lucid dreams are equally realistic – or equally lacking in bizarre features – when judged by waking standards. If this interpretation is correct, then lucid insight into the fact that one is currently dreaming as in lucid dreams, as well as the delusional belief in the reality of dream events as in non-lucid dreams, has to be understood as arising *independently* of the realistic quality of the dream. Put differently, if the degree of REALISM is indeed the same in lucid and in non-lucid dreams, then the difference between lucid insight and failure to attain such insight (as in non-lucid dreams) cannot be explained with reference to the realistic or bizarre quality of dream events. This is in keeping with existing studies suggesting that lucidity only rarely arises from the recognition of bizarre elements in dreams (Gackenbach, 1988). Moreover, our study confirms that while lucidity involves cognitive insight into the fact that one is dreaming, this insight is not necessarily the outcome of a reasoning process. If it were, a much stronger correlation between THOUGHT and INSIGHT in lucid dreams would be expected. Similarly, the failure of non-lucid dreamers to realize that they are dreaming is not necessarily attributable to an oversight or to faulty reasoning abilities. If the events experienced in one's dream are realistic in the sense that they could have occurred in wakefulness, then assuming oneself to be awake might actually be rational. This raises the question of how such non-lucid dreams, in which the lack of insight into the fact that one is currently dreaming is not reducible to deficient reasoning, are related to delusions in psychotic patients. Future studies should assess the relationship between bizarre versus realistic dream content, delusions, and cognitive insight in non-lucid and lucid dreams in more detail.

Two, our findings suggest that the degree of *subjectively* experienced realism is similar in lucid and in non-lucid dreams. Many authors suggest that the onset of lucidity is often accompanied by a change in the overall experiential quality of the dream, noting that lucid dreams are often described as taking on a surreal, dreamlike quality (cf. Brooks & Vogelsong, 1999; LaBerge, 1985; Tholey & Utecht, 2000). By contrast, our study suggests that lucid insight need not be accompanied by such a change in the subjectively experienced realism of the dream. This means that the experienced realism of the dream is not cognitively penetrable, i.e. that it can persist independently of concomitant insight into the fact that you are currently dreaming. Consequently, models describing lucidity as an all-pervasive experiential phenomenon may require revision. Lucidity involves the cognitive realization that you are currently dreaming or the ability to conceptualize ongoing experience *as* a dream, not necessarily *experiencing* your dreams as unreal or as a merely virtual reality. This may also explain why lucid dreamers are prone to lucid lapses, e.g. why they may think, despite knowing that they are dreaming, that other characters in their dream are real or that their actions within the dream have real-world consequences (Levitan, 1994). In sum, our study suggests that lucid insight is separable from both bizarreness in dreams and from a change in the subjectively experienced realism of the dream.

4.3. Dreams, lucid dreams, and the self

Existing work on lucid dreams has suggested that dream lucidity is related to a change on the level of self-related processing (Metzinger, 2004; Windt & Metzinger, 2007) and more specifically that lucidity is often accompanied by a change in the type of self-representation. For instance, Cicogna and Bosinelli (2001) as well as Occhionero, Cicogna, Natale, Esposito, and Bosinelli (2005) suggest that lucid dreaming often involves a double-awareness of the self. By contrast, our results suggest that the onset of lucidity does not typically involve a change in the type of self-representation. According to our study, the most important factors distinguishing lucid and non-lucid dreams are lucid insight and dream control. Although the factor DISSOCIATION differentiates between lucid and non-lucid dreams, mean scores in lucid dreams are relatively low. This suggests that DISSOCIATION is not usually present in non-lucid dreams, but may emerge in lucid dreams. Given this complex relationship between changes in self-representation in dream lucidity, as well as our findings on REALISM in lucid and non-lucid dreams, future studies should explore the relationship between dream lucidity and dissociative phenomena such as depersonalization and derealization (Ratcliffe, 2008; Simeon & Abugel, 2006) in more detail.

Though our results are highly preliminary, we would nevertheless like to offer a tentative hypothesis. First, note that dissociation in wakefulness, at least insofar as it is not associated with traumatic experiences, is often a preliminary stage before the emergence of full-fledged psychosis (Dalle Luche, 2002; Frewen & Lanius, 2006; Perona-Garcelan et al., 2012). Second, recall that non-lucid dreams are sometimes compared to psychotic wake states and indeed may be regarded as a model of psychosis (Hobson, 1999; but see Windt & Noreika, 2011). If lucid dreams are indeed a hybrid state between non-lucid dreaming and wakefulness, then the prediction would seem to follow that lucid dreaming, as an intermediate stage between psychotic-like non-lucid dreaming and standard, non-psychotic wakefulness should involve dissociative phenomena more frequently than either of these states. It is not clear, however, whether dissociative phenomena in lucid dreams should be regarded as a preliminary stage of psychosis, as is often the case in waking patients, or rather as fulfilling a positive function

in restoring higher-order consciousness and a stable sense of self. Because the majority of lucid dreams emerges from non-lucid ones (rather than being initiated directly from wakefulness; LaBerge & DeGracia, 2000), we tentatively favor the latter interpretation.

Finally, this interpretation is also in keeping with the view that lucidity involves a change in self-related processing: insight into the fact that one is dreaming and dream control are related to the emergence of a *cognitive subject* capable of metacognition and reflection, of an *agentive self* capable of engaging in deliberate dream control, as well as the integration of autobiographic memory sources (as suggested by Metzinger (2004) and Windt and Metzinger (2007)). In other words, lucidity is related to the emergence of a subject that manifests all of the features associated with secondary consciousness—and with standard waking consciousness in humans—in a strong and conceptually interesting sense. The present study confirms that in *this* sense, the onset of dream lucidity indeed involves a profound change on the level of self-related processing.

4.4. Limitations

In spite of the methodological advantages of our study, we would also like to point out its methodological limitations. Our factor analyses were based on the WLSMV estimator, an estimator regarded as valid when sample size equals approximately $N = 200$ (Beauducel & Herzberg, 2006). As our samples were relatively small, model fit indices may have been biased. Although Beauducel and Herzberg (2006) found that Type I error rates of the χ^2 test were not inflated across several investigated conditions, there seems to be a bias when sample size is small, variables are not normally distributed, and rating scales with more than four categories are used, conditions found in our study. Nevertheless, the consistently high factor loadings seem to support the good model fit as indicated by several fit indices. Furthermore, we were able to replicate the factorial structure of the EFA using CFA. Further studies using larger sample sizes should investigate whether our results can be confirmed.

Our experience with lucid dreamers led us to suspect that at least some of the controversial definitions of lucid dreaming were related to dreams occurring in different states of consciousness. To clarify these potential differences, we included reports from different sources: laboratory awakenings from REM sleep, self-reported paper and pencil questionnaires, and online data (only in Survey No. 1). Of those, we consider the laboratory data the most valid because dream narratives are confirmedly from REM sleep awakenings. Second in validity are the paper and pencil reports because they stem from well informed subjects who have worked with the principal investigator for years and are acquainted with the definition of lucid dreaming. The online data are the least dependable. However, lucid dreams are difficult to collect in the laboratory (see Voss et al., 2009) which would make the online data a valuable source of information, nonetheless.

Although we adhered to the rule of thumb introduced by Hobson et al. (2000), including only reports longer than 40 words and thus increasing the likelihood of relating to REM-sleep dreams, we cannot exclude the possibility that participants reporting their dreams online and those submitting a paper and pencil report may have shared a NREM instead of a REM sleep dream. The distinction between NREM and REM sleep dreams is important because these sleep phases constitute different states of consciousness, accompanied by distinct neurobiological modulators as well as psychological/cognitive processes (Hobson & Pace-Schott, 2002; Suzuki et al., 2004). As we have shown, the data of the current survey confirm these reservations. Dream reports from REM awakenings in the laboratory differ from those collected in paper and pencil form or online. Reported elements of cognition and conscious awareness are especially discrepant for online reports.

5. Conclusions

The goal of this study was to identify the phenomenological correlates of primary and secondary consciousness in dreams and to introduce the LuCiD scale as a reliable means for the measurement of lucidity and consciousness in dreams. According to our findings, dream consciousness can best be described through the factors (1) INSIGHT, (2) CONTROL, (3) THOUGHT, (4) REALISM, (5) MEMORY, (6) DISSOCIATION, (7) NEGATIVE EMOTION, and (8) POSITIVE EMOTION. Whereas normal REM sleep dreams lack those factors requiring secondary consciousness, lucid dreams are defined through those, namely insight, thought, control, and dissociation. In addition, lucid dreaming seems to be accompanied by positive emotion, suggesting that secondary consciousness adds cognitive functions and positive emotionality onto primary consciousness.

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