

The public perception of lucid dreaming and its research

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Summary. A Lucid dream (LD) is a dream in which the dreaming person knows that he or she is dreaming. Being neglected by scientific researchers and viewed as esoteric or paranormal for many decades, nowadays LD is an acknowledged research field, which also has practical clinical implications. However, the public's perception of LD has not yet been studied. This online study investigates the public's perception and evaluation of LD and its research with respect to eventual paranormal features. The underlying research question was whether the popular view reflects the change from scientific ignorance to scientific acceptance. 270 participants took part, 55 of which were members in LD internet forums. Main findings: 1. Lucid dreaming is generally viewed as a positive, non-paranormal phenomenon. Lucid dreaming forum members have an especially positive view. 2. LD research is accepted as being scientific and no longer seen as esoteric. 3. Regarding exceptionality, LD is classified as a phenomenon comparable to hypnosis, and more exceptional than normal dreaming and meditation, but less exceptional than paranormal abilities such as telepathy. 4. Applications of LD are estimated differently regarding their possibility and provability. Generally, fewer applications are evaluated as being possible than LD research has already been able to show. Several significant effects of demographic variables such as age on several dependent variables were found. The present findings show a generally positive view of the public on LD and its research and support the use of LD for scientific, personal or therapeutic purposes.

Keywords: Lucid dreaming, science of lucid dreaming, perception of lucid dreaming

1. Introduction

A lucid dream (LD) is a dream in which the dreaming person knows that he or she is dreaming, and was first described in a scientific journal by (Van Eeden, 1913). Skepticism about this new research topic was large in the scientific community, and it was considered esoteric for a long time. In 1936, the *Journal of Abnormal [!] Psychology* published the essay "Dreams in Which the Dreamer Knows He is Asleep", in which the author argued against some fellow psychologists, who claimed that LDs were just daydreams (Brown, 1936). LaBerge summarized the scientific perception of LD research during the beginning and the middle of the 20th century as follows: "*Lucid dreams got into unjustified proximity to ghosts, telepathy, flying saucers and other things that are considered superstitious nonsense by traditional science.*" (LaBerge, 1987, p. 66).

At the end of the 1970s, Hearne and LaBerge independently of each other conducted scientific experiments in sleep laboratories about LD, in which they showed that lucid dreams exist and that a lucidly dreaming person can contact an observer by means of a previously appointed sequence of eye movements (Hearne, 1978; LaBerge, 1980). While Hearne's findings were not released by a scientific

journal, LaBerge's study was finally published in *Perceptual and Motor Skills* (LaBerge et al., 1981). Today, LD is content of modern science: several scientific institutions around the globe conduct LD research and high-ranked journals like *Nature Neuroscience* publish articles about LD (e.g. Payne, 2014; Voss et al., 2014).

People who dream lucidly use it for various purposes. In an online survey, 80% of participants use their LDs to fly, to have sex or for other hedonistic activities. 64% reported using LD to influence an unpleasant dream or nightmare (Schädlich and Erlacher, 2012). In addition, applications cover learning, athletic training, overcoming nightmares, problem solving, and personal development. LD has also been shown to be effective in psychotherapy, e.g. for the treatment of nightmares (Spoormaker and Van Den Bout, 2006; Spoormaker et al., 2003) and depression (Taitz, 2011). Moreover, LD is used as a research tool in various scientific disciplines (Appel et al., 2017), for example in neuroscience: Dresler et al. (2011) showed that dream contents can be visualized (fMRI) and mapped to neural activity.

While LD is nowadays an established field of study in academic research, it is unclear how LD is received in the social discourse. Therefore, the goal of the present study was to find out whether the public opinion mirrors the scientific view of LD as an acknowledged research field. Because LD has for a longtime been connected to parapsychology, we investigated how the phenomenon is valued by the public with respect to its eventual paranormal features. In this exploratory study, we assessed (1) the spread and awareness level of LD, (2) how the phenomenon of LD is viewed, (3) how the research on LD is estimated, (4) which properties are attributed to LD, and (5) how the phenomenon is seen in comparison to other states of consciousness.

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2. Method

2.1. Participants

Overall, 385 participants were recruited via the internet platform Facebook, email and via asking people in the city of Osnabrück in 2015. Students from the study program Cognitive Science in Osnabrück were excluded from participation, because they might have heard of the topic in class. Additionally, we asked for participation on three LD web pages: (1) www.klartraumforum.de, (2) www.kt-forum.de, and (3) www.facebook.com/Klartraumforum. The participants received no payment for participation. A total of 270 participants (162 females and 108 males, age 30.92 ± 13.31 , ranging from twelve to 82 years) completely filled out the questionnaire. All participants who did not finish the questionnaire were excluded from analyses. 55 members of LD forums completed the survey (40 males and 15 females, mean age 24.65 ± 10.11 , ranging from 12 to 54 years). Of the general group, meaning all participants besides the forum members, 215 completed the survey (147 females and 68 males, mean age 32.53 ± 13.58 , ranging from 17 to 82 years). The levels of education were distributed as follows: Certificate of Secondary Education (“Hauptschulabschluss”; $N = 3$), O-level (“Realschulab-

schluss”; $N = 17$), A-level (“Abitur/Fachabitur”; $N = 101$), university ($N = 86$), doctorate ($N = 5$), professorship ($N = 1$).

2.2. Questionnaire

After reading an instruction text which contained the definition of LD, the participants filled out an online survey consisting of 28 questions and taking about 20 minutes.

We obtained several demographic variables (age, sex, degree of education). Moreover, we asked for scientific activity (“Are you currently working or studying at a university or other scientific institution?”; possible answers were “yes” and “no”), as well as spirituality (“Would you consider yourself being religious or spiritual in any kind?”; answer options ranged from 1 = not at all to 6 = totally). To capture the awareness level of LD, we assessed the previous knowledge using the following questions: “Have you ever heard about LD before this study?”; “If you have ever heard about LD before, where did you hear from it?” (Possible answers were 1: Report of acquaintance, 2: Scientific literature, 3: Esoteric literature, 4: Other literature, 5: Other) and “Did you ever experience a LD?”. For capturing lucid dream frequency (LDF), participants chose between five options (never, less than once a year, at least once per year, at least once a month, at least once a week). Additionally, the participants

Table 1. Situations presented to the subjects

Situation acronym	Short description	Formulation seen by participants (translated from German)
Reported_lucid_dream	Whether a LD is possible at all	An acquaintance tells you she had a LD last night. She reports on being aware of the dream state while sleeping.
Evidence_in_laboratory	Whether the occurrence of a LD can be proven in a sleep laboratory	Person A works as a sleep researcher in a sleep laboratory and is able to show that a sleeping person is having a lucid dream.
Sending_signals	Whether a lucidly dreaming person can communicate with a wake observer	Person B sleeps. Person C observes Person B. Person B has a lucid dream and can communicate with Person C.
Sending_signals_detailed	The communication from the last item is specified by explaining how the sleeper can move his eyes and thereby send a signal to the waking world	Person B from the preceding question now explains how she can communicate with a wake observer C while sleeping. By means of eye signals, person B can communicate with the wake world. She consciously performs alternating left and right eye movements under the closed eye lids, which can be measured by an observer.
Receiving_signals	Whether an observer can send information into the LD of a test person	An awake person D believes she can send signals to a sleeping, lucidly dreaming person.
Receiving_signals_detailed	The sleep communication is explained further: the observer sends auditory signals standing for letters, similar to Morse code	Person D from the preceding question now explains how she can, while being awake, send signals to a sleeping, lucidly dreaming person: By means of beeps in specific combinations, person D can send arbitrary messages to the lucidly dreaming person (like in Morse code: for example, the combination of a short and a long beep for the letter “A”).
Dream_of_deceased	Whether a non-lucid dream, in which somebody talks to a deceased person, can occur	Person E sleeps and has a normal (non-lucid) dream. She dreams that she is talking to a deceased relative.
Lucid_dream_of_deceased2	Whether a LD with the conscious decision to talk to a deceased person can occur	Person F often dreams of her deceased mother. One night, she has a lucid dream and talks to her mother in the dream. She asks questions like “Do you remember our holiday at the sea?”. Person F likes this because she keeps her mother in good memory.
Information_of_deceased	Whether a LD, in which somebody receives information from a deceased person, which the dreamer could not receive without the dream, can occur	Person G often dreams of a deceased aunt, who left a suitcase behind of which no one can find the key. One night, person G has a lucid dream. She takes the chance and asks the aunt where to find the key to the suitcase and the aunt tells her the place. The next day, person G actually finds the key at the place described by the aunt.
Learning	Whether learning effects in LDs can occur (by consciously practicing a task during LDs and performing better the next day)	Person H plays a game in which one must throw a table tennis ball into a cup 1 meter away. She does not hit the cup often. That night, she has a lucid dream and decides to take the chance and practice the game. The next day, Person H is better in the game and hits the cup more often.
Astral_journey	Whether it is possible to have an out-of-body experience and enter another world during a LD	Person I is able to decide in a lucid dream to leave the perceivable world and make a journey into the beyond / into another reality. After waking up, person I says she actually was in the beyond.

should indicate how they think they would react if they had a LD: On a scale from 1 = not at all to 10 = totally, they had to estimate how astonishing, how normal, how extraordinary and how natural they would find the situation. Those participants who had never experienced a LD before, were additionally asked whether they would like to have a LD.

To investigate the attitude towards LD, we constructed a word rating task in which the participants had to rate, on a scale from 1 = not at all to 5 = totally, how well adjectives fit to the phenomenon of LD. The following adjectives were presented (in order of presentation): *usual, morbid, desirable, verifiable, nice, abstruse, insane, insightful, bad, supernatural, meaningful, unnormal, esoteric, measurable, good, dangerous*. We chose words with varying (positive and negative) connotations and also included words aiming at paranormal interpretations. Similarly, to investigate the attitude towards the research on LD, we constructed another word rating task in which the participants had to rate how well adjectives fit to research on LD (same rating scale). Here, these adjectives were presented: *worthwhile, stupid, weird, scientific, unnecessary, good, esoteric, important, abstruse, unscientific, objectively provable, relevant, bad*.

In order to compare LD to other (partly paranormal) states of consciousness or mental activities, the participants had to decide for six items (non-lucid dreaming, meditation, hypnosis, spook, telepathy and clairvoyance) whether they think they are less, equally or more extraordinary than LD.

To assess which applications of LD are considered possible, the participants were presented eleven situations for which they had to estimate, on a scale from 1 = not at all to 10 = totally, whether they are possible and whether they are provable. The situations covered several possible applications of LD (such as practicing skills), as well as presumably impossible, hypothetical applications such as getting in contact with deceased people via a LD (see Table 1).

2.3. Statistical analysis

For several dependent variables, we explored effects of the independent variables age, sex, degree of education, scientific activity, spirituality, LDF and forum membership.

In order to categorize adjectives of the word rating tasks concerning LD and the research, we performed exploratory factor analyses. The adjectives could not be grouped in advance, because some words allow for various interpretations and connotations depending on the participants' individual attitudes. In order to capture possible effects of age, sex, degree of education, scientific activity, spirituality, LDF and forum membership on the resulting factors, we subsequently performed regression analyses with these factor variables. Similarly, for the situation rating task concerning different applications of LD, a factor analysis was performed.

Table 2. Lucid Dream Frequency (LDF)

Category	General group N = 215		Forum members N = 55		Total N = 270	
	N	%	N	%	N	%
weekly	8	3.72%	9	16.36%	17	6.30%
monthly	38	17.67%	24	43.64%	62	22.96%
yearly	60	27.91%	11	20.00%	71	26.30%
< yearly	33	15.35%	5	0.09%	38	14.07%
never	76	35.35%	6	10.91%	82	30.37%

Subsequently, new scales were derived including all items with factor loading of about .60 and higher, and effects of the above mentioned variables on the resulting factors were assessed via regression analysis. For the comparison task, the Wilcoxon signed rank test was applied in order to test for a significant directed difference of the participants' estimations.

3. Results

3.1. Awareness Level of LD

The majority of participants of the general group had at least one LD in their lifetime. Almost a third of the general group reported having LDs at least once a year. Among the forum members, there are more frequent lucid dreamers (See Table 2).

Multiple regression analysis revealed that only one of the variables taken into account (age, sex, forum membership, education, spirituality and scientific activity) effects LDF: forum members have LDs (Standardized estimate = .4239, $X^2 = 31.1$, $p < .0001$, see Table 3) significantly more often.

3.2. Having heard of LD

54.42% of the general group had heard of LD before taking part in this survey. Of the forum members, of course, 100% had heard of LD before.

For the general group, a multiple regression analysis revealed no significant effects of age, sex, education, spirituality and scientific activity (see Table 4) on having heard of LD.

3.3. Sources of information

In order to grasp how the topic is spread, we asked the participants where they had heard of LD. The most frequent answer was "Report by acquaintance" (multiple answers were possible, see Table 5). The participants reported scientific literature as a source of information more often than esoteric literature. About one third chose "other", many of which indicated in a comment that their source of information was TV, internet or own experiences.

3.4. Estimated reactions to LDs

We asked those participants, who reported not having experienced a LD before, whether they would like to be able to dream lucidly. 59.76% answered with "yes", 13.41% with "no", and 26.83% with "It does not matter to me". Regarding the estimated reactions to the experience of a LD, (see

Table 3. Multiple regression analysis for LDF

Variable	SE	X^2	p
Age	.0417	0.3	.5970
Sex	-.0109	0.0	.8722
Forum membership	.4239	31.1	<.0001
Education	.0429	0.4	.5127
Spirituality	.1024	2.6	.1084
Scientific activity	-.0745	0.9	.3392

Note. N = 251. The variables accounted for 16.28% of the total variance. SE = Standardized estimates

Table 4. Multiple regression analysis for having heard of LD

Variable	SE	X ²	p
Age	-.1283	1.6	.2107
Sex	.0355	0.2	.6559
Forum membership	-.0064	0.0	.9361
Education	-.1436	3.2	.0736
Spirituality	-.1407	7.9	.1629
Scientific activity	-.0745	0.9	.3392

Note. N = 210. The variables accounted for 7.78% of the total variance. SE = Standardized estimates

Table 6), the factor analysis revealed one factor (*Astonishment*) indicating how much one would be astonished about finding oneself in a LD.

Multiple regression analysis (see Table 7) revealed that frequent lucid dreamers would be less astonished about having LDs. Older people estimate their reaction to a LD as not as astonished as younger persons.

3.5. Evaluation of the phenomenon: Positive or negative

The 16 adjectives regarding the evaluation of LD are depicted in Table 8. A factor analysis revealed four factors which together explain 59% of the variance. The factors were named according to the congruence between the rated items in each factor as follows:

Factor 1: *LD_Positivity*; items: *desirable, nice, insightful*, (inverse) *bad, meaningful, good*; total mean of these items: 3.77 ± 0.80 .

Factor 2: *LD_Esotericism*; items: *supernatural, unnormal, esoteric, dangerous*; total mean of these items: 1.67 ± 0.68 .

Factor 3: *LD_Insanity*; items: *abstruse, insane*; total mean of these items: 2.12 ± 1.01 .

Factor 4: *LD_Measurability*; items: *verifiable, measurable*; total mean of these items: 3.07 ± 1.10 .

Overall, positive words were rated higher than rather negative words: Factor *LD_Positivity* is rated the highest, followed by *LD_Measurability*. *LD_Insanity* is rated rather low and *LD_Esotericism* is the factor with the lowest evaluation.

We tested for effects of age, sex, education, scientific activity, spirituality, LDF and forum membership via multiple regressions (See Table 9).

We found no effects of age, sex or education on any of the factors. But frequent lucid dreamers significantly consider LD as not *esoteric, supernatural or dangerous*. Also forum

Table 6. Estimated reactions to a LD (factor analysis)

Reactions to a LD	Mean ± SD	Astonishment (factor loading)
Being astonished about LD (N=269)	4.42 ± 2.78	.79
Finding a LD extraordinary (N=268)	4.78 ± 2.71	.89
Finding a LD normal (N=268)	5.46 ± 2.66	-.86
Finding a LD to be self-evident (N=265)	4.85 ± 2.84	-.77

Note: Question: Imagine you are asleep and you notice that you are dreaming. How would you find the situation? The *Astonishment* factor explained 68.4% of the total variance.

Table 5. Sources of Information. Corresponding question: "Where have you heard of LD?"

Category	General group N = 117		Forum mem- bers N = 55		Total N = 172	
	N	%	N	%	N	%
Report of acquaintance	65	55.56%	17	30.91%	82	47.67%
Scientific literature	31	26.50%	17	30.91%	48	27.91%
Esoteric literature	11	9.40%	8	14.55%	19	11.05%
Other literature	27	23.08%	15	27.27%	42	24.42%
Other	34	29.06%	30	55.55%	64	37.21%
Answers to "Other"	TV (N = 7) Internet (N = 6) Experience (N = 7)		TV (N = 4) Internet (N = 16) Experience (N = 4)		TV (N = 11) Internet (N = 22) Experience (N = 11)	

members seem to have a highly positive opinion and to consider the phenomenon as measurable. Furthermore, scientifically active people tend to evaluate the factor *LD_Insanity* especially low. Spiritual people have an especially esoteric view: a significant effect on *LD_Esotericism* was detected.

Since forum membership effects three of four factors, and since we were interested in the view of the general population, it is interesting to see the word evaluations for the general group only, and compare the order to the means of the total sample given in Table 8. Here, almost the same order of evaluation remains: (1) *good*, 3.62 ± 0.98 (2) *nice*, 3.60 ± 1.02 (3) *insightful*, 3.48 ± 1.20 (4) *desirable*, 3.24 ± 1.21 (5) *verifiable*, 3.05 ± 1.11 (6) *meaningful*, 2.86 ± 1.17 (7) *usual*, 2.66 ± 1.28 (8) *abstruse*, 2.54 ± 1.26 (9) *measurable*, 2.51 ± 1.03 (10) *insane*, 1.83 ± 1.07 (11) *not normal*, 1.74 ± 1.01 (12) *supernatural*, 1.73 ± 0.99 (13) *esoteric*, 1.67 ± 0.97 (14) *dangerous*, 1.60 ± 0.89 (15) *bad*, 1.41 ± 0.78 (16) *morbid*, 1.21 ± 0.56 (In comparison to the total data set, the order of evaluated adjectives remains, with the exceptions that measurable moves down by 2, *abstruse* and *usual* move up by one, *supernatural* and *not normal* are reversed).

3.6. Evaluation of the research: scientific or unscientific

Table 10 depicts the average evaluations of 14 rated adjectives in descending order of evaluation. Another factor

Table 7. Parametric regression analysis for factor Astonishment as a reaction to a LD

Variable	SE	t	p
Age	-.1827	-2.6	.0113
Sex	-.1008	-1.6	.1029
Education	.0527	0.9	.3771
Scientific activity	.0446	0.6	.5284
Spirituality	.0321	0.6	.5815
LD frequency	-.4438	-7.1	<.0001
Forum membership	.0339	0.5	.6181
Scientific activity	-.0745	0.9	.3392

Note. N = 250. The variables accounted for 17.96% of the total variance. SE = Standardized estimates

Table 8. Evaluation and factor loadings for 16 adjectives about LD

Rated Adjectives	Mean ± SD	LD_Positivity (Factor 1)	LD_Esotericism (Factor 2)	LD_Insanity (Factor 3)	LD_Measurability (Factor 4)
good	3.84 ± 1.02	.85	-.05	-.05	.12
nice	3.83 ± 1.06	.80	-.09	-.05	.19
insightful	3.64 ± 1.20	.57	.24	-.27	.20
desirable	3.55 ± 1.27	.78	-.01	-.01	.25
verifiable	3.35 ± 1.22	.39	-.08	-.09	.74
meaningful	3.08 ± 1.24	.59	.46	-.15	.03
measurable	2.80 ± 1.21	.26	-.11	-.05	.82
usual	2.61 ± 1.28	-.16	-.36	-.13	-.07
abstruse	2.47 ± 1.22	-.05	.09	.85	-.16
insane	1.77 ± 1.05	-.17	.22	.82	.07
supernatural	1.76 ± 1.03	.21	.71	.05	-.31
not normal	1.72 ± 0.99	-.21	.56	.22	.08
esoteric	1.69 ± 0.96	.02	.69	.12	-.06
dangerous	1.53 ± 0.86	-.31	.66	-.11	.04
bad	1.34 ± 0.72	-.57	.42	.07	-.01
morbid	1.17 ± 0.51	-.39	.41	.25	.32
Explained variance		22.4%	16.1%	10.4%	10.1%

Note. N = 270. Mean evaluations are listed in descending order of average evaluation. The four factors together explain 59.0% of the total variance.

analysis was done and revealed three factors explaining in total 67.2% of the variance. We named the factors according to the connotation of the words that were evaluated:

Factor 1: *Research_Positivity*; items: *reasonable, worthwhile, scientific, good, important, relevant*; total mean of these items: 3.81 ± 0.87.

Factor 2: *Research_Negativity*; items: *stupid, weird, unscientific, bad*; total mean of these items: 1.30 ± 0.57.

Factor 3: *Research_Esotericism*; items: *esoteric, abstruse, (reverse) objectively provable*; total mean of these items: 2.02 ± 0.74.

Similar to the evaluation of the phenomenon, the respective research is evaluated rather positively than negatively: The mean evaluation of factor *Research_Positivity* is by far higher than *Research_negativity*, which is close to the end point of the scale.

Table 11 shows the effects of demographic variables on the factors. Here, older people are less convinced of

LD research. Frequent lucid dreamers gave especially low estimations for factor *Research_Esotericism*. The forum members show an especially positive evaluation, while *Research_Negativity* and *Research_Esotericism* are effected negatively.

Without the forum members, almost the same order of evaluation from positive to negative words remains: (1) *reasonable*, 3.93 ± 1.07 (2) *scientific*, 3.89 ± 1.07 (3) *good*, 3.87 ± 0.91 (4) *worthwhile*, 3.72 ± 1.07 (5) *important*, 3.31 ± 1.12 (6) *relevant*, 3.24 ± 1.04 (7) *objectively provable*, 2.91 ± 0.99 (8) *esoteric*, 1.76 ± 1.01 (9) *unnecessary*, 1.71 ± 0.99 (10) *unscientific*, 1.55 ± 0.94 (11) *abstruse*, 1.54 ± 0.88 (12) *stupid*, 1.30 ± 0.70 (13) *weird* 1.29 ± 0.70 (14) *bad*, 1.27 ± 0.56. The order of evaluated adjectives remains, with the exceptions of good and scientific being exchanged, as well as abstruse and unscientific being reversed.

Table 9. Multiple Regression analysis for four factors concerning LD

Variables	LD_Positivity			LD_Esotericism			LD_Insanity			LD_Measurability		
	SE	t	p	SE	t	p	SE	t	p	SE	t	p
Age	.0102	0.2	.8841	-.0795	-1.0	.2993	-.1219	-1.6	.1125	.0714	1.1	.2956
Sex	.0263	0.4	.6610	-.0929	-1.4	.1583	-.0501	-0.8	.4465	-.0205	-0.4	.7266
Education	-.0940	-1.6	.1062	.0072	0.1	.9104	.0112	0.2	.8600	-.0023	-0.1	.9671
Scientific activity	-.0277	-0.4	.6876	-.0836	-1.1	.2682	-.1714	-2.3	.0240	-.0814	-1.2	.2266
Spirituality	.0380	0.7	.5026	.1294	2.1	.0381	.0083	0.1	.8936	-.0025	-0.1	.9643
LD frequency	.0820	1.4	.1778	-.2414	-3.6	.0004	-.0475	-0.7	.4771	-.0578	-0.8	.4414
Forum membership	.4374	6.6	<.0001	-.0116	-0.2	.8732	-.1386	-1.9	.0571	.5434	8.4	<.0001
	R² = .2204			R² = .0616			R² = .0592			R² = .2537		

Note: N=251, SE = Standardized estimates

Table 10. Evaluation and factor loading for 14 adjectives regarding research on LD

Rated Adjectives	Mean ± SD	Research_Positivity (Factor 1)	Research_Negativity (Factor 2)	Research_Esotericism (Factor 3)
reasonable	4.07 ± 1.05	.81	-.35	.03
good	4.03 ± 0.92	.76	-.28	-.05
scientific	4.02 ± 1.03	.64	-.27	-.27
worthwhile	3.90 ± 1.07	.78	-.35	.07
important	3.46 ± 1.15	.81	-.20	-.11
relevant	3.40 ± 1.10	.77	-.13	-.31
objectively provable	3.11 ± 1.10	.54	.08	-.58
esoteric	1.70 ± 0.98	.00	.22	.81
unnecessary	1.60 ± 0.95	-.48	.51	.13
abstruse	1.49 ± 0.84	-.12	.52	.64
unscientific	1.49 ± 0.89	-.29	.64	.28
stupid	1.26 ± 0.67	-.27	.82	-.04
weird	1.23 ± 0.64	-.22	.79	.16
bad	1.21 ± 0.54	-.24	.74	.31
Explained variance		30.8%	23.5%	12.9%

Note. N = 270. Mean evaluations are listed in descending order of average evaluation. The four factors together explain 67.2% of the total variance.

Regarding the basis on which the participants justified their answers in the word rating task, the option chosen most by the general group was gut feeling (N=170) followed by scientific literature (N=13, see Table 12). The forum members relied on scientific literature (33%) almost as often as on gut feeling (36%).

3.7. Features of LD

Generally, there is a trend from high evaluations to low evaluations in the order of presentation, which is roughly from rather basic or natural situations (such as the mere experience of a LD) to more extraordinary situations (such as learning in a LD). For the average evaluation, see Table 13 and for the description of the situations, see Table 1. Factorization revealed four factors explaining in total 67.25% of the variance. We named the factors, according to the content of the situations, as follows:

Factor 1: *Communication_and_learning*; items: Evidence_laboratory, Sending_signals (possible), Sending_signals

(provable), Sending_signals_detailed (possible), Sending_signals_detailed (provable), Receiving_signals (possible), Receiving_signals (provable), Receiving_signals_detailed (possible), Receiving_signals_detailed (provable), Learning (possible) and Learning (provable) (N = 248, total mean of these items: 5.78 ± 2.50)

Factor 2: *Supernatural_lucid_dreams*; items: Information_of_deceased (possible), Information_of_deceased (provable), Astral_journey (possible) and Astral_journey (provable) (N = 240, total mean of these items: 4.12 ± 2.46)

Factor 3: *Provable_dream_content*; items: Dream_of_deceased (provable), Lucid_dream_of_deceased (provable) (N = 235, mean over items: 4.95 ± 2.85)

Factor 4: *LD_exists*, items: LD_report, dream_of_deceased (possible), lucid_dream_of_deceased (possible) (N = 267, total mean of these items: 8.80 ± 1.59).

The highest-ranked factor is *LD_exists*, followed by the moderately evaluated factor *Communication_and_learning* and *Provable_dream_content*. The lowest-ranked factor is *Supernatural_lucid_dreams*.

Table 11. Multiple Regression analysis for three factors concerning Research on LD

Variables	Research_Positivity			Research_Negativity			Research_Esotericism		
	SE	t	p	SE	t	p	SE	t	p
Age	-.0325	-0.4	.6587	.1700	2.2	.0281	-.1031	-1.4	.1571
Sex	.1105	1.8	.0812	-.1059	-1.6	.1103	-.0941	-1.5	.1329
Education	-.0475	-0.8	.4378	-.0112	-0.2	.8611	-.0612	-1.0	.3124
Scientific activity	.0757	1.0	.2974	-.1112	-1.5	.1420	-.0133	-0.2	.8528
Spirituality	-.0378	-0.6	.5271	.0186	0.3	.7663	.1509	2.6	.1509
LD frequency	.0790	1.2	.2183	-.1139	-1.7	.0906	-.2277	-3.6	.0004
Forum membership	.3546	5.1	<.0001	-.1436	-2.0	.0500	-.2825	-4.1	<.0001
Percentage of variance explained by factor			R ² = .1322			R ² = .0480			R ² = .1518

Note: N=251, SE = Standardized estimates

Table 12. Basis for evaluating research on LD

Category	General group N = 215		Forum members N = 55		Total N = 270	
	N	%	N	%	N	%
Gut feeling	170	79%	20	36%	190	70%
Scientific literature	13	6%	18	33%	31	11%
Other literature	4	2%	0	0%	4	1%
Reports by acquaintances	8	4%	0	0%	8	3%
Other	29	13%	17	31%	37	14%

Note: N = 270. Of the 37 respondents who chose "other", 26 reported in a free comment mostly "own experience".

Multiple regression analysis (see Table 14) revealed that older people are less sure that LD exists. Spiritual people tend to a rather metaphysical estimation. Especially frequent lucid dreamers consider both the mere existence of LD and the metaphysical experiences as highly possible. People with a higher education, as well as forum members, consider the situations dealing with communication and learning as especially possible. Forum members also show a significant effect on *LD_exists*. We found neither gender effects nor effects of scientific activity on any factor.

3.8. Comparison of LD with other phenomena

Table 15 displays the evaluations of six mental states or phenomena. The respective task was to estimate whether

the items are less, more and similarly extraordinary in comparison to LD. Hypnosis was considered being as extraordinary as LD, while all other mental states or phenomena were rated either less or more extraordinary than LD: Meditation and regular (non-lucid) dreaming were estimated less extraordinary; telepathy, spook and clairvoyance were estimated more extraordinary than LD. The Wilcoxon signed-rank test showed that only hypnosis does not significantly differ from LD.

4. Discussion

LD is known and has been experienced by more than half of the sample before the survey. But previous knowledge about LD and science on LD seems to be low. LD is evaluated as a positive, non-esoteric phenomenon. Research on LD is evaluated as being scientific rather than unscientific. Fewer applications are estimated as being possible than LD research has already been able to show. LD is estimated as being less extraordinary than paranormal abilities such as telepathy.

4.1. LD and the corresponding research are estimated positively

This study revealed a very positive attitude towards LD in general: The majority of participants who have never experienced LD before would like to be able to dream lucidly, while only few participants denied this. The clearest mark for attitude towards LD in this study is the word rating task. It revealed that participants associate LD more with positive

Table 13. Mean evaluation and factor charges for the situation rating task

Rated Adjectives	Mean ± SD	Communication_ and_learning (Factor 1)	Supernatural_lucid_dreams (Factor 2)	Provable_dream_content (Factor 3)	LD_exists (Factor 4)
Reported_lucid_dream	9.19 ± 1.70 (N=268)	.20	.14	-.20	.66
Evidence_in_laboratory	7.88 ± 2.35 (N=262)	.66	-.03	.19	.23
Sending_signals (possible)	5.84 ± 3.25 (N=262)	.70	-.01	.19	.23
sending_signals (provable)	5.70 ± 3.08 (N=252)	.76	.03	.28	.04
Sending_signals_detailed (possible)	6.00 ± 3.27 (N=259)	.86	.03	.03	.14
Sending_signals_detailed (provable)	6.23 ± 3.21 (N=252)	.87	.09	.16	.04
Receiving_signals (possible)	5.11 ± 3.07 (N=254)	.76	.22	.01	.19
Receiving_signals (provable)	5.12 ± 3.18 (N=243)	.78	.26	.13	.00
Receiving_signals_detailed (possible)	4.87 ± 3.09 (N=254)	.81	.18	.02	.15
Receiving_signals_detailed (provable)	5.17 ± 3.28 (N=244)	.84	.22	.08	-.02
Dream_of_deceased (possible)	9.15 ± 2.07 (N=265)	-.09	-.09	.41	.65
Dream_of_deceased (provable)	4.91 ± 3.21 (N=243)	.15	.11	.86	.04
Lucid_dream_of_deceased (possible)	8.03 ± 2.74 (N=262)	.40	.16	.16	.67
Lucid_dream_of_deceased (provable)	4.95 ± 2.95 (N=241)	.38	.23	.78	.05
Information_of_deceased (possible)	4.92 ± 2.95 (N=266)	.23	.56	-.05	.48
Information_of_deceased (provable)	3.34 ± 2.77 (N=247)	.29	.60	.40	.06
Learning (possible)	6.28 ± 3.33 (N=269)	.65	.29	.01	.41
Learning (provable)	5.39 ± 3.39 (N=253)	.71	.29	.21	.14
Astral_journey (possible)	4.05 ± 3.21 (N=258)	.08	.82	-.05	.21
Astral_journey (provable)	2.62 ± 2.44 (N=248)	.11	.73	.39	-.13
Explained variance		35.04%	11.84%	10.55%	9.82%

Note. Depicted are all 20 items of the situation rating task in the order of presentation. The number of participants varies between subquestions, since the respondents had the option "I cannot answer this question". Eleven situations were evaluated, nine of which have two subquestions: (a) whether this is possible and (b) whether this is provable. Total explained variance was 67.25%.

Table 14. Multiple regression analysis for four factors concerning the situation rating task

Variables	Communication and learning			Supernatural lucid dreams			Provable dream content			LD exists		
	SE	t	p	SE	t	p	SE	t	p	SE	t	p
Age	-.0920	-1.4	.1758	.0154	0.2	.8441	-.0122	-0.2	.8834	-.1579	-2.1	.0357
Sex	-.0137	-0.2	.8189	.0608	0.9	.3712	.0636	0.9	.3840	.0283	0.4	.6590
Education	.1192	2.1	.0391	.0271	0.4	.6839	.0423	0.6	.5470	.0132	0.2	.8328
Scientific activity	-.0197	-0.3	.7684	-.0275	-0.4	.7208	-.0675	-0.8	.4139	-.0103	-0.1	.8893
Spirituality	-.0532	-0.9	.3461	.2535	3.9	.0001	-.0253	-0.4	.7152	-.0402	-0.7	.5096
LD frequency	.0419	0.7	.4895	.1536	2.2	.0278	-.0705	-0.9	.3540	.2180	3.3	.0010
Forum membership	.5322	8.0	<.0001	.1271	1.7	.0944	.0578	0.7	.4806	.1587	2.2	.0260
Explained variance	R ² = .2953 (N = 230)			R ² = .0968 (N = 226)			R ² = .0160 (N = 219)			R ² = .1060 (N = 249)		

Note: SE = Standardized Estimates

words such as good or desirable, than with negative words such as dangerous, and clearly not with words pointing towards esotericism such as supernatural or esoteric. Thus, we conclude that LD is not viewed as a paranormal ability.

People who experienced LD themselves have an especially positive and non-esoteric view on LD. We found a significant negative effect of LDF on *LD_Esotericism*. For forum members, i.e. people who show very high interest in LD, we found significant positive effects on *LD_Positivity* and *LD_Measurability*— even though LDF was statistically controlled. It is plausible that the forum members have a very positive attitude towards LD, otherwise they would not participate in discussions, experiments, etc.

Not only LD as a phenomenon but also the research on LD is evaluated positively: rather scientific than unscientific. Overall, we find high evaluations of the words that point towards a positive view and scientificity (items such as *reasonable*, *scientific*, *good* and *important*). For words pointing into an unscientific direction (items such as *unscientific*, *esoteric* and *abstruse*), we find lower evaluations. The word *esoteric* has – from a scientific point of view – a negative connotation: In recent literature, esoteric is often contrasted with scientific (Coghill, 2014; Alyushin, 2014; Herbst, 2014). Therefore, we conclude that research on LD is seen as scientific, and hence not seen as para-, pseudo- or unscientific (in the present data).

Frequent lucid dreamers have an especially non-esoteric view on LD research: We found a significant negative effect of LDF on *Research_Esotericism*. Forum members have an especially positive attitude towards research on LD: We found a significant effect on *Research_Positivity*, as well as significant negative effects on *Research_Esotericism* and

Research_Negativity. But also the general group, which is closer to the general population, evaluates the phenomenon and the research as positive: In both cases, the order of evaluations descends from positive words to negative words.

Another finding indicates a non-paranormal view on LD: The results of the comparison task imply that LD can be classified as moderately exceptional, but not as a paranormal ability: LD is ranked more remarkable than non-lucid dreaming and meditation, as remarkable as hypnosis, and less remarkable than telepathy, spook and clairvoyance. Thus, we infer that LD is not viewed as a parapsychological phenomenon.

The latter is plausible from a science-theoretical perspective: Whether LD research can be understood as *parapsychology* depends on the interpretation of the term *parapsychology*: One could interpret parapsychology as “*already/ still partly represented at universities or content of research and/or teaching performed by few university employees*” (Bauer, 1991, p. 8). This interpretation might include LD research because it is a relatively new research field. But here, we interpret parapsychology as research on paranormal abilities, which can be defined as “[...] *interactions between an organism and its surrounding (or between two organisms) that are suggestive of an effect that seems to reach beyond our current understanding of the scope and function of sensorimotor channels*” (Bauer, 1991, p. 138). This does not include LD research, because LD does not fall under the definition of paranormal abilities: The mental state of LD is either an interaction within one organism, or in the case of interactions with an experimenter, these interactions are fully explicable with the function of sensorimotor channels.

Table 15. Evaluation of mental states and other phenomena in the comparison task

Types of mental state/phenomena	Less extraordinary than LD	As extraordinary as LD	More extraordinary than LD	Missing	Wilcoxon signed-rank test	
					S	p
Reported_lucid_dream	67	97	71	35	139	.7348
Learning (possible)	19	33	182	36	8231.5	<.0001
Learning (provable)	188	55	13	14	-8837.5	<.0001
Astral_journey (possible)	211	36	8	15	-11165	<.0001
Astral_journey (provable)	48	20	128	74	3540	<.0001
Explained variance	29	21	168	52	6880.5	<.0001

Note. N = 270

Therefore, LD does not fall under the definition of paranormal effects and the research hence not under the definition of parapsychology.

4.2. Applications of LD are not well-estimated

The underlying results also imply that, on the one hand, fewer applications of LD are considered possible than scientific studies have been able to show: Many of the 11 presented situations mirror scientific experiments conducted in the past years, e.g. practicing skills in LD (Erlacher and Schredl, 2010; Stumbrys et al., 2016), or communication between a sleeping, dreaming person and an experimenter (LaBerge, 1980; Hearne, 1978; Appel 2013). Therefore, high estimations for the latter type of situations would reflect the current state of LD research. However, the respective situations formulated in the survey were not estimated as highly possible. For example, learning through practicing skills in a LD has been estimated only moderately possible by the participants. The findings indicate that this specific research area in the field of LD is not well known to the public.

One the other hand, some applications, which have not yet been experimentally shown, are considered as possible by some participants: Hypothetical situations implying supernatural abilities such as getting in contact with deceased people or leaving the physical world and entering the beyond. As far as we know, low estimations for this type of situations would reflect the current state of LD research. But the respective situations were estimated surprisingly high. For example, receiving information from a deceased person through a LD was estimated moderately possible.

The highest-ranked factor is *LD_exists*. Since it contains situations that describe the mere occurrence of a LD, it is highly understandable that the participants believe that this is possible to a high extent. Being the second highest-ranked factor, *Communication_and_learning* contains the transfer of signals from a dreamer to an experimenter, and from an experimenter to a dreamer, as well as learning in LDs. All situations in this factor are possible, and have been shown in several studies as cited above. Contrasting the scientific state of affairs, an only moderate estimation of the factor *Communication_and_learning* was found. Here, the estimation of participants might be low, because LD is a quite new and not widely known research field. The second lowest-ranked factor *Provable_dream_content* contains the proof of dream content, which is, to our knowledge, not possible. Dream content itself cannot be measured, but only the physiological correlates such as eye movements, heart rate and brain activity. Even though initial success has been achieved in mapping dream content to measurable neural activity (Dresler et al., 2011), dream content as such remains a purely subjective experience. Therefore, the moderate estimation of this factor was still surprisingly high. The factor *Supernatural_lucid_dreams* was ranked lowest, but also still surprisingly high, since an average of over 4 is still almost in the middle on the rating scale, implying that some people believe in paranormal abilities through LD. Here, we found a significant effect of spirituality on the factor *Supernatural_lucid_dreams*, fitting the effect of spirituality on factor *Research_Esotericism* in the word rating task. Also LDF significantly effects *Supernatural_lucid_dreams*, which, at first sight, seems to be incongruent with the finding that LDF has a significant negative effect on both factors *LD_Esotericism* and *Research_Esotericism*. Seemingly, LDF on the one hand goes along with a non-metaphysical or non-esoteric

estimation of LD (word rating task), but on the other hand LDF goes along with considering metaphysical experiences as possible (situation rating task). But this complexity is not necessarily contradictory: People with a high LDF might believe that it is possible to have different kinds of experience with LD – even metaphysical experiences, but they would not designate the phenomenon as such as something esoteric, or LD research in general as unscientific.

4.3. Forum members are better informed than the general group

The relatively low estimation of *Communication_and_learning* and the relatively high estimation of *Supernatural_lucid_dreams* and *Provable_Content* lead us to the conclusion that, on average, the participants do not have much knowledge about LD. Comprehensively, forum membership and LDF have significant effects on factor *LD_exists*. The factor *Communication_and_learning* is also significantly effected by forum membership, indicating that forum members are quite well informed about scientific experiments. Fittingly, forum members based their answers by far more often on scientific literature (33%), compared to the general group (6%).

4.4. Other findings

Participants differentiated between possibility and provability: In accordance to the current state of LD research, the participants gave different estimations for the subquestions *possible* and *provable* for some of the situations: For example, dreaming of a deceased person and lucidly dreaming of a deceased person were estimated highly possible, but less provable. Since dreams are assessed by subjective dream reports, it is not yet possible to objectively verify dream content, as mentioned above. But dreaming and LD as such are clearly possible events. Thus, this answer pattern is in coherence with the state of LD research. In several other cases, the participants gave similar estimations for the subquestions *possible* and *provable*: The situations concerning communication are possible and provable, since they take place in a sleep laboratory where eye signals can be seen in the EOG data while the person is sleeping (LaBerge 1980, Hearne 1978), and acoustic signals can be heard by lucid dreamers (Appel, 2013). For example, receiving signals from an experimenter was estimated as possible and as provable. Therefore, the participants' answer pattern reflects the current status of experimental research in lucid dreaming.

One finding for which we have no clear interpretation is a significant effect of age on factor *Research_Negativity*, as well as a significant negative effect of age on the factor *LD_exists*. This indicates that older participants not only tend to be skeptical concerning LD research but are also less convinced that LD is possible at all. What seems to contradict this finding is that older participants estimated their reaction to a LD as rather not astonished. The majority of participants had a LD at least once in their lives. Therefore, older people probably have already experienced a LD and would possibly be hardly astonished if that occurred again (in coherence with the intuitive finding that people with a high LDF react less astonished to a LD). The latter would explain the negative effect of age on astonishment, but remains contradictory with the effects on the factors *LD_exists* and *Research_Negativity*. One possibility might be that older persons are less informed about LD research, as many

findings are reported in the internet, and/or are part of movies like 'Inception'.

Scientifically active people seem to be especially open towards LD, indicated by the significant negative effect of scientific activity on the factor *LD_Insanity*. We can exclude that this effect has its origin in previous experience, since scientifically active participants have neither a significantly higher LD frequency, nor have they significantly heard of LD more often before taking part in this survey. Possibly pointing into a similar direction, education has a significant effect on the factor *Communication_and_Learning*.

4.5. Spread and awareness level of LDs

In the present data, the percentage of people who have experienced at least one LD in their lives is slightly higher (64.65%) than in a representative sample (51%) assessed by Schredl and Erlacher (2011). This indicates a small selection bias, i.e., persons with lucid dreams were more likely to participate in the present study.

An interesting finding is that the percentage of participants who have heard of LD is lower (54.42%) than the percentage of those who have experienced a LD (64.65%), which means that there are some people who have experienced a LD without knowing that this type of dreaming has a name. In the present study, LD is not known especially well by a certain demographic group such as age, sex, education, spirituality or scientific activity. Moreover, these variables do not effect the LDF, which is only partially in line with previous studies which report no effect of gender on LDF, too, but describe a decline of LDF with advancing age in contrast to our results (Hess et al., 2017). In the present study, the forum membership correlates with LD frequency, which was expected, since these people are very interested in the topic and exchange information and experiences.

4.6. Limitations

Since no representative sample was drawn from the population, no precise inferences from the current sample to the population can be made. Based on the higher percentage of lucid dreamers and the low mean age of the sample, we would expect that the figures are smaller in a representative sample.

5. Conclusion

To summarize, the findings indicate that LD is accepted within the scientific discourse, and we take the present results of this survey as an implication for a similar acceptance of LD in the general population. We found that our participants' opinions reflect the scientific acceptance and that LD is not seen as a paranormal ability, but rather as an existent and testable ability of the mind. However, it seems to be a quite new and special type of experience about which the majority of people has not much knowledge, especially regarding scientific experiments showing applications, such as the possibility to communicate with a wakeful experimenter or to practice skills in a LD. The overall positive opinion of LD has practical implications: The applications of LD, which cover nightmare therapy and other therapeutic purposes, scientific exploration, health and inner growth, skill rehearsal and decision-making, among many others (LaBerge, 1985; Schädlich and Erlacher, 2012), can be reinforced in view of the very positive attitude towards LD assessed in the pres-

ent study.

Future steps following this first study in assessing the attitude towards LD and LD research could be studies in which participants are informed about LD research in order to see what such information would lead to. The mismatch between knowledge and experience of LD would also be of interest for further investigation. In studies addressing the prevalence of LD, participants who experience LDs should also be asked whether they can influence the course of action of a LD. This distinction is relevant, as Schredl and Göritz (2018) pointed out, because despite LD being helpful for overcoming nightmares (Spoormaker and Van Den Bout, 2006; Spoormaker et al., 2003), lucidity alone sometimes does not help overcoming nightmares, when the concept of controlling the course of action is not known to the dreamer.

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