

Lucid Dreaming: Exploring the Effects of Lucidity within Dreams on Emotion
Regulation, Positive Emotions, Interoceptive Awareness, and Mindfulness

by

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ABSTRACT

Lucid dreaming occurs in those who become aware they are dreaming, while still in the dreaming state. Although lucid dreaming has been studied with respect to personality characteristics and as a learned cognitive skill to enhance well-being via processes such as mindfulness, less research has been conducted on relationships between lucid dreaming and emotion. I collected self-reports from a college sample of 262 participants to examine the relationships between lucidity experienced in dreams and emotion regulation, dispositional positive emotions, interoceptive awareness, and mindfulness. Pearson correlations revealed that greater lucidity experienced within dreams was significantly related to more positive emotions, greater interoceptive awareness, and greater mindfulness; however, lucidity was not related to emotion regulation. Furthermore, regression analyses revealed that greater lucidity experienced within dreams predicted more dispositional positive emotions above and beyond emotion regulation and interoceptive awareness. It is important to note that these relationships were tested across people who self-identified as lucid dreamers as well as those who identified as non-lucid dreamers. Overall, lucidity may be beneficial for anyone who recalls his or her dreams, in that higher lucidity was associated with more positive affect during waking. Positive emotions experienced during waking also may translate into greater awareness during dreaming.

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TABLE OF CONTENTS

	Page
LIST OF TABLES.....	vi
INTRODUCTION	
Lucid Dreaming.....	1
REM sleep and Dreaming.....	2
Emotion regulation and Dreaming.....	4
Positive Emotions and Dreaming.....	5
Lucid Dreaming, Emotion Regulation, Emotions, and the Brain.....	6
Awareness and Dreaming.....	8
Current Study.....	9
METHODS	
Participants.....	10
Procedure.....	11
Measures.....	12
RESULTS	
Relationships between Lucidity and Emotion-related Measures.....	14
Persistence of Relationship between Lucidity and Positive Emotion after Controlling for Emotion Regulation and Interoceptive Awareness.....	15
DISCUSSION	
General Conclusions.....	17
Limitations and Future Research.....	20
REFERENCES.....	21

APPENDIX

Page

A	CORRELATION MATRIX OF LUCIDITY AMONG EMOTION-RELATED MEASURES.....	24
B	CORRELATION MATRIX AMONG LUCIDITY AND EMOTION REGULATION DIFFICULTIES SUBSCALES.....	26
C	CORRELATION AMONG LUCIDITY AND EMOTION-RELATED MEASURES.....	28
D	HIERACHICAL REGRESSION.....	30
E	LUCIDITY AND CONSCIOUSNESS IN DREAMS SCALE (LUCID).....	32
F	DIFFICULTIES IN EMOTION REGULATION SCALE (DERS).....	36
G	DISPOSITIONAL POSITIVE EMOTIONS SCALE (DPES).....	39
H	MULTIDEMINSIONAL ASSESSMENT OF INTEROCEPTIVE AWARENESS (MAIA).....	42
I	FREIBURG MINDFULNESS INVENTORY (FMI).....	44
J	INFORMED CONSENT.....	46
K	IRB EXEMPTION LETTER.....	49

LIST OF TABLES

Table	Page
1. Correlation Matrix of Lucidity among Emotion Regulation Difficulties, Positive Emotion, Interoceptive Awareness, and Mindfulness.....	25
2. Correlation Matrix of Lucidity among Emotion Regulation Difficulties subscales.....	27
3. Correlation Matrix of Lucidity Subscales among Emotion-Related Measures.....	29
4. Hierarchical Regression.....	31

INTRODUCTION

Lucid dreaming occurs during REM sleep in which one becomes aware that they are dreaming, while dreaming. With the awareness one experiences during lucid dreaming, one can observe and control the actions of one's dream or purposefully wake up (Erlacher, Schredl, Watanabe, Yamana, & Gantzert, 2008). Although lucid dreaming was known in earlier historical times, LaBerge was the first to investigate lucid dreaming physiologically through eye signals during REM sleep (Holzinger, 2009). Lucid dreaming is the only time when an individual becomes metacognitively aware of their current state of consciousness while in the dream state and allows individuals to experience during REM sleep the kinds of reflective capabilities typically only experienced during waking (Voss, Holzmann, Tuin, & Hobson, 2009). The consciousness experienced through dreaming can allow the dreamer to direct the course of the dream, and therefore create the dream they intend.

Lucid dreaming can occur spontaneously or can be a learned skill. Novice lucid dreamers may have spontaneous lucid events where lucid dreaming gets induced during an anxiety dream or a nightmare (Snyder & Gackenbach, 1988). Other emotions experienced in a dream such as delight or embarrassment may also initiate becoming lucid spontaneously within a dream. Spontaneous lucid dreams are often short and followed by an awakening soon after initiation.

Lucid dreaming is an obtainable learned skill in which one can practice particular techniques during the day and during sleep in order to induce the lucid dreams. Some techniques include dream journaling, meditating, and conducting reality checks throughout the day and before bed. Looking at your fingers, counting

them, and saying to oneself “I see I have ten fingers; I am not dreaming” is a common reality check. During dreaming, if you were to count your fingers most likely the hands and fingers will be distorted, or the number of fingers will be different than from reality. Conducting reality checks throughout the day can also help a person with “anomaly recognition,” another way to induce lucid dreaming while you are actually dreaming (DeGracia & LaBerge, 2000, p. 279). Anomaly recognition is when dreamers condition themselves to recognize when they are experiencing a bizarre dream. When they notice the dream is bizarre it is a cue for the onset of lucidity. During this time dreamers can conduct their own reality checks within their dreams and confirm to themselves they actually are dreaming.

REM Sleep and Dreaming

To understand the relationship between lucid dreaming and emotions, first it is important to consider the role of REM sleep in typical dreaming, and its relationship to emotional processing. REM sleep is characterized by rapid movement of the eyes. It is a distinct stage of sleep, referred to as paradoxical sleep, in which the electrical activity within the brain (measured by EEG) increases and resembles that of wakefulness (Gerrig, 2013). Muscle tone is inhibited during REM sleep and individuals at this time are unable to act on their dreams (Iranzo, & Aparicio, 2009; Lu, Sherman, Devor, & Saper, 2006). Although, typical dreaming occurs to a limited extent in stages of sleep other than REM sleep, the processes for dreaming are more activated during REM sleep compared to the other sleep stages (Takeuchi, Ogilvie, Murphy, & Ferrelli, 2003). Further, typical REM sleep dreams have higher rates of recall than those during non-REM sleep stages and contain more bizarre imagery, intensified emotions, and delusions (i.e., believing one is awake while asleep;

Dement & Kleitman, 1957; Hobson, Stickgold, Pace-Schott, 1998). Additionally, self-reflection is lacking during typical REM dreaming (Hobson et al., 1998; Vandekerckhove, & Cluydts, 2010).

While emotions are intensified during REM sleep, the emotions experienced during this sleep stage can also contribute to daily moods in waking. For example, subjects viewed a stressful film before they went to sleep and again upon awakening. After subjects viewed the stressful film upon awakening, more post-sleep anxiety was reported if the subject had experienced more stressful film elements within their dreams during the previous night (De Koninck & Koulack, 1975). Further, REM-deprived subjects showed more anxiety after viewing the stressful film than subjects who had fulfilled REM-sleep (De Koninck & Koulack, 1975). Similar theories have been tested regarding typical REM sleep. Cartwright, Luten, Young, Mercer, and Bears (1998) found that when there are no awakenings during REM sleep and sleep is intact, there are significant reductions in negative mood. Additionally, Cartwright and colleagues found that there were positive effects on mood for those individuals who reported their dreams upon awakening from REM-sleep rather than suppressing the dreams (Cartwright et al., 1998). These findings suggest that REM may underpin particular processes involved in shaping waking emotions.

Waking emotional events can affect REM sleep (Vandekerckhove & Cluydts, 2010). If emotional events affects our REM sleep, it could be assumed that our dreams would be affected too. Based on daily dream logs recording levels of unpleasantness during waking, Schredl (2003) found that unpleasantness during waking contributed to dreams that contained more negative emotions, failures and

misfortunes, and aggressive interactions as opposed to more positive emotions, successes and good fortunes and friendly interactions.

Typical dreaming may occur in both non-REM sleep and REM sleep, but lucid dreams are only present during REM sleep. Since quality of REM sleep and content of REM dreaming can contribute to our daily moods and emotional events can alter our dreams, it could be thought that emotional processes or emotional events could potentially be rehearsed during lucid dreaming and may also contribute in regulating our emotions during waking.

Emotion Regulation and Dreaming

Emotion regulation can be defined in many ways. Gross (1998) broadly defines emotion regulation as “the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions” (p. 275). Two aspects of emotion regulation have received the most empirical attention, reappraisal and suppression. Reappraisal is a strategy in which an emotional response can be redirected if the interpretation or meaning of the situation or stimulus is changed (Goldin, McRae, Ramel, & Gross, 2008). The second strategy is suppression, in which behaviors are inhibited, decreasing expressive behavior and hiding the external manifestations of internal feelings (Goldin et al., 2008).

The emotion regulation processes recruited in waking life may be reflected within dreams. For example, Cartwright, Lloyd, Knight, & Tenholme (1984) found that dreams of divorced women may start from negative emotions experienced within the dream earlier in the night and turn into positive emotions experienced later in the night. The positive emotions experienced within the dreams in turn,

predicted better functioning during waking. Cartwright's findings that emotional patterns experienced within dreams reflect shifts in emotion in waking life may suggest links between dreaming and emotion regulation.

Positive Emotions and Dreaming

Emotions that are experienced in dreaming can extend into our waking affect such that the emotions we experience during dreaming can be similar to those of our waking life. Gilchrist, Davidson, and Shakespeare-Finch (2007) theorized that there would be a positive relationship between waking and dream emotions. Participants kept a diary for 3 weeks in which they rated and reported their waking emotions and dreaming emotions. They found that dream emotions are strongly correlated to waking emotional experiences for both negative and positive emotions (Gilchrist, et al., 2007). It is not clear if the dream emotions are the prominent source of the emotions that are experienced during waking or if it is the emotions experienced during waking affecting the emotions that are experienced within dreams.

Exploratory studies have revealed that lucid dreamers show positive emotional characteristics such as self-reflection, mindfulness, insight and openness to experience (Schredl & Erlacher 2004; Hobson, 2009). Additionally, Schredl and colleagues (2004) investigated relationships with lucid dreaming frequency and various personality measures. Although the correlation was rather small, there was a relationship between lucid dreaming frequency and openness to experience, particularly fantasy and ideas (Schredl, 2004). Stumbrys, Erlacher, Malinowski (2015) conducted an online survey where they found dispositional mindfulness is positively associated with lucid dreaming frequency. Since lucid dreamers show positive emotional characteristics, it may be fitting that lucid dreamers are

experiencing positive emotions within their dreams which are extending the dream emotions into the waking life and in turn, the positive dreams experienced in those could be enhancing positive emotional characteristics in those during waking.

Lucid Dreaming, Emotion Regulation, Emotions and the Brain

There is also neural evidence to suggest a possible link between lucid dreaming and emotion. While normal sleepers experience a decline in prefrontal cortical (PFC) activation during REM-sleep, EEG studies have found the opposite effect among lucid dreamers, whereby lucid dreaming is associated with increased PFC activation (Schredl & Erlacher, 2011; Filevich, Dresler, Brick, & Kühn, 2015). This brain region is also important for emotion and emotion regulation. For instance, in one study, participants were trained on specific emotion regulation strategies (reappraisal and suppression; Goldin et al., 2008). The authors found that, reappraisal was associated with left PFC activation and suppression was associated with bilateral PFC activation (Goldin et al., 2008). Furthermore, PFC brain regions contribute to lower levels of negative emotion when activated. fMRI studies by Wager, Davidson, Hughes, Lindquist, & Ochsner (2008) illustrated this relationship. They designed a study to identify linkages of prefrontal-subcortical pathways to reappraisal success. Results revealed two separate pathways for greater reappraisal success and reduced reappraisal success. Most importantly, the authors' findings provide evidence that PFC activity is associated with lower levels of negative emotion. Conversely, low activation of the PFC region is associated with difficulties in emotion regulation. Ball, Ramsawh, Campbell-Sills, Paulus, and Stein (2013) revealed that participants with generalized anxiety or panic disorders had less PFC activation during emotion regulation tasks compared to healthy participants. Thus,

it could be plausible that lucid dreamers experience less negative emotions and in turn experience more positive emotions, considering PFC activation is more prominent in lucid dreaming than in typical dreaming.

Certainly, PFC is not the only contributor to emotions and emotion regulation. The amygdala, hypothalamus and anterior cingulate cortex also help aid in the processing of emotions (Daggleish, 2004). Nevertheless, bridges between lucid dreaming and PFC brain regions are distinct and are the primary focus in mapping out the possible links between lucid dreaming and how it may be associated with emotion regulation.

In sum, decreased PFC activation is associated with emotion regulation difficulties and non-lucid dreaming is associated with lower levels of PFC activation. Moreover, PFC activation is associated with better emotion regulation strategies and lucid dreaming is associated with increased PFC activation. Since lucid dreamers have higher prefrontal region activity during dreaming, and prefrontal region activity is linked to emotion and emotion regulation, it could be expected that lucid dreaming aids in the processing of emotions during sleep.

Awareness and Dreaming

Interoceptive awareness is the awareness of the internal physiological sensations of the body (Seth, 2013; Dunn, Galton, Morgan, Evans, Oliver, Meyer, Cusack, Lawrence, & Daggleish, 2010). The construct of interoceptive awareness has become increasingly important in emotion research, as it includes how emotions arise from the changes in the body and how these changes are perceived (Seth, 2013). Such changes influence emotional behavior and subjective feeling states (Seth, 2013).

Self-reflective awareness, such as mindfulness, is another type of awareness that has become important to emotion research. Mindfulness is paying attention in the present moment and involves “remembering to reorient our attention and awareness to current experience in a whole-hearted, receptive manner” (Germer, 2004, p. 26). Mindfulness has been shown to predict better emotion regulation and psychological well-being (Lee & Kuiken, 2015). Mindfulness is not only induced during wakefulness, but can be a learned cognitive skill during dreaming. The development of attaining a self-reflective skill during dreaming may extend its effects upon the waking consciousness similar to that of dream emotions (Laughlin, 2011). Lucid dreamers have been found to be more mindful in waking (Stumbrys, Erlacher, & Malinowski, 2015).

Additionally, links have been found between mindfulness and interoceptive awareness. For example, Silverstein, Brown, Roth, & Britton (2011) conducted a study where females experiencing sexual dysfunction went through mindfulness training. After meditation training, the female meditators were able to register the changes experienced in their body more readily, indicating an improvement in interoceptive awareness. In conclusion, they found that mindfulness improves interoceptive awareness (Silverstein et. al., 2011).

If lucid dreamers are more mindful then it could be plausible that lucid dreamers are also high in interoceptive awareness. It seems logical that interoceptive awareness should be related to lucid dreaming, because it involves heightened awareness of one’s internal states, but to my knowledge this has not been studied previously.

Current Study

The current study examined lucidity within dreams and the relationship it has with emotion regulation, positive emotions, interoceptive awareness, and mindfulness. I examined lucidity within dreams not only for people who self-identify as lucid dreamers but also among people who do not identify as lucid dreamers. Across groups, it was hypothesized that 1) individuals who have higher lucidity within dreams will have better emotion regulation; 2) individuals who have higher lucidity within dreams will have more dispositional positive emotions; 3) individuals who have higher lucidity within dreams will have greater mindfulness; and 4) individuals who have higher lucidity within dreams will have greater interoceptive awareness. As an additional exploratory analysis, I tested whether 5) lucidity predicted dispositional positive emotion after controlling for emotion regulation and interoceptive awareness.

METHODS

Participants

Participants completed the survey through Arizona State University's online research participation credit system (SONA), with a minority of participants recruited through social media (i.e., Facebook). The survey was advertised as a "Dreaming Survey" for most participants (i.e., those recruited through the university) and as a "Lucid Dreaming Survey" for targeted social media sites. A total of 262 participated in this survey with 211 females, 50 males, and 1 transgendered. Their ages ranged from 18 to 50 with a mean age of 23.4 ($SD = 5.68$). With respect to the highest level of education attained, 3.8% reported having a high school diploma or GED, 46.9% reported some college, 34% reported having an associate's degree,

11.1% reported having a bachelor's degree, 1.9% reported some postgraduate college, .8% reported having a postgraduate degree, and 11.1% reported having some other education. Regarding financial status, 14.1 reported not having enough money for basic needs and relying on others, 16.4% reported can barely pay all bills each month but usually manage on their own, 62.2% reported having enough money for basic needs and usually have some extra money for savings and special purchases, and 6.9% reported having plenty of money for whatever they want. Ethnicity inadvertently was not measured in the study.

Overall, 90% of the participants reported recalling their dreams at least once a month. In order to determine who self-identified as a lucid dreamer, a definition was given to the participant and asked if they were a lucid dreamer based on the definition. The definition was as follows: "During lucid dreaming, one is—while dreaming—aware of the fact that one is dreaming. It is possible to deliberately wake up or to control the dream action or to observe passively the course of the dream with this awareness." Possible answers were *yes*, *no*, and *not sure*. Participants who reported that they were lucid dreamers (24% of the sample) were given instructions to fill out the lucidity questionnaire with respect to their *most recent lucid dream*. Participants who were not lucid dreamers or who were not sure filled out the questionnaire with respect to *their most recent dream*. Aside from this wording difference in the instructions, questionnaires were the same for all participants. Lucidity and dreamer status (lucid dreamer vs. non-lucid dreamer) largely overlapped, such that people who self-identified as a lucid dreamer reported higher lucidity within dreams than those who were not lucid dreamers, and vice versa. Extent of lucidity within dreams was used in the analyses (described below) rather

than lucid dreamer status, to capture its effects regardless of dreamer status. This also allowed for inclusion of participants who reported that they were “not sure” if they were lucid dreamers.

Procedure

Participants completed an online survey which was hosted by Qualtrics. As noted above, participants were recruited by Arizona State University’s research participation (SONA) system and were awarded 3 research credits in return for their participation, or were recruited via social media and were placed in a drawing for a \$25 gift card. Contact information for the drawing or to assign research credit was collected separately from participants’ data. The current study was exempt by Arizona State University’s institutional board, and participants marked “I consent” indicating they consented to participate in the study.

Measures

Lucidity and Consciousness in Dreams Scale (LuCid). The LuCid Scale was used to assess consciousness and lucidity within dreams (Voss, Holzmann, Tuin, & Hobson, 2009). The scale comprised 28-items with 8 subscales: insight, realism, control, memory, thought, positive emotions, negative emotions, and dissociation. Participants identifying as lucid dreamers (in response to the question that provided a definition of lucid dreaming) were asked to “Please think about your most recent lucid dream and rate how strongly you disagree or agree with each of the following statements.” Non-lucid dreamers were given the same instructions but were asked to think about their most recent recalled dream. Sample items include, “In my dream, I was able to manipulate or control other dream characters in a way that would be impossible in waking” and “The emotions I experienced in my dream were

exactly the same as those I would experience in such a situation during wakefulness.” Participants made their ratings using a 6-point scale from 0 (*strongly disagree*) to 5 (*strongly agree*). Cronbach's alpha in our sample was .91.

Difficulties in Emotion Regulation Scale (DERS). The DERS scale was used to assess emotion regulation difficulties (Gratz & Roemer, 2004). It is a self-report 36-item measure in which higher scores indicate greater emotion regulation difficulties. The scale consisted of 6-subscales: nonacceptance of emotional responses, difficulty in engaging in goal-directed behavior when distressed, impulse control difficulties when distressed, lack of awareness of emotions, limited access to strategies for regulation, and lack of emotional clarity. Participants rated how often each item applies, 1 = (*almost never, 0-10%*), 2 = (*sometimes, 11-25%*), 3 = (*about half the time, 36-65%*), 4 = (*most of the time, 60-90%*), 5 = (*almost always, 91-100%*). Sample items include, “When I’m upset, I feel out of control” and “I pay attention to how I feel” (reverse-scored). In our sample Cronbach’s alpha for this measure was .94.

Dispositional Positive Emotion Scale (DPES). The questionnaire was designed to assess dispositional positive emotions and was developed by Shiota, Keltner, and John (2006). The scale is composed of 38 items with 7 subscales: joy, contentment, pride, love, compassion, amusement, and awe. Ratings are made on a 7-point scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Sample items include, “When I think about my life I experience a deep feeling of contentment” and “It’s important to take care of people who are vulnerable.” Cronbach’s alpha for this measure was .96 in our sample.

Multidimensional Assessment of Interoceptive Awareness (MAIA). The MAIA was designed to evaluate aspects of the mind-body-awareness experience (Mehling, Price, Daubenmier, Acree, Bartmess, & Stewart, 2012). The questionnaire consisted of 8 items. Each item was rated on a 6-point scale from 0 (*never*) to 5 (*always*). Sample items include “I notice how my body changes when I am angry” and “I notice that my breathing becomes free and easy when I feel comfortable.” Cronbach’s alpha in our sample was .89.

Freiburg Mindfulness Inventory (FMI). This questionnaire was derived from Buddhist psychology. The questionnaire was designed to characterize experiences with mindfulness (Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006). The original questionnaire was a self-report instrument with 30 items; we used the shortened 14-item version. Participants were asked to use the last 30 days as a time frame to consider each item and rate how often each item applies: 1 = *rarely*, 2 = *occasionally*, 3 = *fairly often*, and 4 = *almost always*. Sample items include “When I notice an absence of mind, I gently return to the experience of here and now” and “I experience moments of inner peace and ease, even when things get hectic and stressful.” Cronbach’s alpha in this sample was .85.

RESULTS

Relationships between Lucidity and Emotion-related Measures

It was hypothesized that there would be significant positive relationships between lucidity and emotion regulation, lucidity and positive emotions, lucidity and interoceptive awareness, and lucidity and mindfulness. Pearson correlations were performed in order to examine the relationships among these study variables (see

Table 1). Results revealed that greater lucidity was associated with more dispositional positive emotion (H2), $r(236) = .26, p < .001$, greater interoceptive awareness (H3), $r(244) = .25, p < .001$, and greater mindfulness (H4), $r(236) = .21, p < .001$. Lucidity was not significantly related to emotion regulation difficulties (H1). Additionally, emotion regulation, positive emotion, interoceptive awareness, and mindfulness were all intercorrelated with the exception of emotion regulation and interoceptive awareness (see Table 1).

Exploratory correlations were conducted to determine whether the lucidity measure was associated with each of the six DERS subscales (see Table 2). Lucidity was related to acceptance of emotional responses $r(243) = .20, p = .002$, engaging in goal-directed behavior when distressed $r(243) = .16, p < .01$, impulse control when distressed $r(243) = .15, p < .01$, and awareness of emotions $r(243) = -.22, p < .001$.

Exploratory correlations also were conducted to determine whether the subscales of the lucidity measure were associated with the other study measures (see Table 3). Dissociation and negative emotions subscales were associated with emotion regulation difficulties (all $r_s > .67, p_s < .05$); control, thought, realism, memory, positive emotion, and insight subscales were associated with dispositional positive emotion (all $r_s > .15, p_s < .05$); thought, realism, memory, negative emotions, positive emotions, insight subscales were associated with interoceptive awareness (all $r_s > .13, p_s < .05$); and control, thought, memory, positive emotions, and insight subscales were associated with mindfulness (all $r_s > .15, p_s < .05$).

Persistence of Relationship between Lucidity and Positive Emotion after Controlling for Emotion Regulation and Interoceptive Awareness

In order to investigate the exploratory fifth research question, whether lucidity significantly predicts dispositional positive emotion after controlling for emotion regulation and interoceptive awareness, a hierarchical regression was performed with emotion regulation, interoceptive awareness, and lucidity entered as predictors of dispositional positive emotions. Emotion regulation was entered into step 1, interoceptive awareness step 2, and lucidity was entered in step 3. The hierarchical regression revealed that at step 1, emotion regulation significantly predicted positive emotions $b_1 = -0.46$, $SE_b = 0.09$, $t(236) = -5.22$ and accounted for 10.3% of the variance in positive emotions $F(1, 236) = 27.23$, $p < .001$, $R^2 = .10$. At step 2 emotion regulation significantly predicted positive emotions controlling for interoceptive awareness $b_1 = -0.43$, $SE_b = 0.09$, $t(235) = -5.22$, $p < .001$ and interoceptive awareness predicted positive emotions controlling for emotion regulation $b_2 = 0.19$, $SE_b = 0.05$, $t(235) = 3.89$, $p < .001$. Step 2 revealed that interoceptive awareness significantly enhanced the variance of the model over and beyond emotion regulation and accounted for an additional 5.4% of the variance, $F(1, 235) = 15.08$, $p < .001$, $\Delta R^2 = .054$. The overall model at step 2 accounted for a significant proportion of variance in positive emotions, $F(1, 235) = 21.97$, $p < .001$, $R^2 = .158$. At step 3 emotion regulation significantly predicted positive emotions controlling for interoceptive awareness and lucidity $b_1 = -0.48$, $SE_b = 0.08$, $t(234) = -5.78$, $p < .001$ and interoceptive awareness predicted positive emotions controlling for emotion regulation and lucidity $b_2 = 0.14$, $SE_b = 0.05$, $t(234) = 2.82$, $p < .001$. Finally, lucidity predicted positive emotion controlling for emotion regulation and

interoceptive awareness $b_3 = 0.27$, $SE_b = 0.063$, $t(234) = 4.32$, $p < .001$. Lucidity significantly enhanced the variance accounted for by the model over and beyond emotion regulation and interoceptive awareness, accounting for an additional 6.2% variance, $F(1, 234) = 18.63$, $p < .001$, $\Delta R^2 = .062$. Together all three of the predictors accounted for 22% of the variance in positive emotions, $F(1, 234) = 21.95$, $p < .001$, $R^2 = .22$. Consistent with expectations, lucidity significantly predicted dispositional positive emotions and made a substantial additional contribution in explaining the variance accounted for by the model with emotion regulation and interoceptive awareness.

DISCUSSION

It was predicted that lucid dreaming would significantly relate positively to emotion regulation, positive emotions, interoceptive awareness, and mindfulness. The results of this study supported the hypothesis that lucidity (as measured by the LuCid) is related to positive emotions (measured by the DPES), interoceptive awareness (measured by the MAIA), and mindfulness (measured by the FMI); however, lucidity and emotion regulation (as measured by the DERS) were not significantly related. Further, lucidity predicted positive emotions above and beyond emotion regulation and interoceptive awareness.

Lucidity predicting positive emotions was a key finding in this research, not to mention it predicted positive emotions above and beyond emotion regulation and interoceptive awareness. This raises a question about possible mechanisms through which lucidity and positive emotion are related. Being able to frame a problem and change a course of action could be contributing in developing a capacity that in turn

is associated with more positive emotions. This type of learning flexibility extends to greater cognitive and emotional flexibility more broadly.

Further, it could be thought lucid dreaming enables individuals to redirect their dreams into positive experiences and in turn the emotions extend into waking. Potentially, more positive emotions are being experienced within dreams, particularly the dreams with higher lucidity; because dream emotions can extend into waking life, the positive emotions experienced during dreaming may be translating into more positive affect during waking. On the other hand, it may be that not all lucid dreamers redirect their dreams into positive experiences but rather into a variety of other experiences that may be appealing to them. Perhaps those choose to have a good cry to help cope with grief over a lost one, or choose to be in a horror movie which could be an adventure to some. In addition, perhaps lucid dreaming could be used to help resolve emotional life events. This could include viewing emotional life events in a different perspective, or used for closure to emotional unfinished business which in turn may lead to more positive affect during waking life. It is arguable, though, that those high in positive emotion are more likely to become lucid during their dreams, rather than those high in lucidity having more positive emotions in waking. Those high in waking positive affect may be those who report more lucidity but also are those who choose to redirect their dreams into positive experiences. In sum, perhaps those who report experiencing higher lucidity in their dreams may tend to experience more positive emotions in daily life which could then be reflected in dreams.

Another interesting finding was among interoceptive awareness and mindfulness and their relationships with lucidity. Lucidity was correlated with

mindfulness, which is consistent with existing literature. The findings from this study also revealed that greater interoceptive awareness was related to greater lucidity and to more positive affect. The results contribute to previous literature showing that interoceptive awareness is related to more intensified emotions (Pollatos, Gramann, & Schandry, 2007). As mentioned previously, mindfulness can predict interoceptive awareness (Stumbrys et al., 2015). If mindfulness can predict interoceptive awareness and in this study mindfulness and interoceptive was interrelated and also related to lucidity, it could be hypothesized that lucidity is contributing to more interoceptive awareness through mindfulness.

This study surprisingly did not reveal any relationships between lucidity and emotion regulation. Although they were not related, there could be indirect relationships, such that perhaps implementing emotion regulation strategies may be related to higher overall positive emotions and in turn higher lucidity. There also could be potential effects in the other direction such that the higher lucidity the more positive emotions experienced and in turn better emotion regulation.

Overall, the results suggest that lucid dreaming may enhance emotional processes and most importantly the results accounted for not only those who identify as a lucid dreamer but across lucid dreamers and non-lucid dreamers.

Lucid dreaming has already begun to be implemented as a technique used in psychotherapy among clinical populations, particularly, those who experience nightmares. In a review by Gavie & Revonsuo (2010) post-traumatic nightmares are a prevalent symptom among those with post-traumatic stress disorder (PTSD), ranging from 60%-80% who suffer from such nightmares. Reductions in nightmare frequencies have been exhibited when lucid dreaming is implemented in those with

PTSD (Schädlich & Erlacher, 2012). There seem to be many underlying mechanisms of lucid dreaming that are in turn benefiting those individuals. Lucidity has been found to be related to positive affect, internal awareness, and reductions in nightmare frequencies. An understanding of lucid dreaming may provide a better understanding of the functions of sleep, emotion, and dreaming more broadly.

Limitations and Future Research

This study was self-report in nature and the majority of participants were college students. Future studies should replicate the findings in alternate settings in order to find consistencies among the results. Further, it is important to note that emotion regulation was only measured using the DERS. Although the relationship between lucidity and emotion regulation overall was not significant, this is not to say lucid dreaming does not serve an emotion regulatory function. Specific facets of emotion regulation were associated with greater lucidity during dreaming, particularly acceptance and awareness of emotions, and ability to control impulses and engage in goal directed behavior when distressed. Experimental paradigms could further research on any potential processes of emotion regulation among lucid dreaming.

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APPENDIX A

CORRELATION MATRIX OF LUCIDITY AND EMOTION-RELATED MEASURES

Table 1.

Descriptives and Pearson Correlations among Lucidity, Emotion Regulation Difficulties, Positive Emotions, Interoceptive Awareness, and Mindfulness

	<i>M</i>	<i>SD</i>	1	2	3	4
1. Lucidity	1.84	.84	-			
2. Emotion Regulation Difficulties	2.37	.63	.10	-		
3. Positive Emotions	4.84	.88	.26*	-.30*	-	
4. Interoceptive Awareness	4.11	1.07	.25*	-.08	.26*	-
5. Mindfulness	2.69	0.50	.21*	-.44*	.57*	.31*

* $p < .001$.

APPENDIX B
CORRELATIONS AMONG LUCIDITY AND EMOTION REGULATION
DIFFICULTIES SUBSCALES

Table 2.

<i>Pearson Correlations among Lucidity and Emotion Regulation Difficulties Subscales</i>							
	1	2	3	4	5	6	7
1. Lucidity	-						
2. Non-acceptance of Emotional Responses	.20*	-					
3. Difficulty Engaging in Goal-Directed Behavior when Distressed	.16*	.50*	-				
4. Impulse Control	.15*	.54*	.52*	-			
5. Lack of Awareness of Emotions	-.22*	.03	-.03	.23*	-		
6. Limited Access to Strategies for Regulation	.09	.71*	.59*	.74*	.18*	-	
7. Lack of Emotional Clarity	.01	.41*	.32*	.51*	.56*	.25	-

* $p < .001$.

APPENDIX C
CORRELATION MATRIX OF LUCIDITY SUBSCALES AMONG EMOTION-
RELATED MEASURES

Table 3.

Pearson Correlations among Lucidity Subscales, Emotion Regulation Difficulties, Interoceptive Awareness, and Mindfulness

	1	2	3	4	5	6	7	8	9	10	11	12
1. Lucidity Control	-											
2. Lucidity Thought	.47*	-										
3. Lucidity Realism	.06*	.48*	-									
4. Lucidity Memory	.59*	.67*	.34*	-								
5. Lucidity Dissociation	.41*	.38*	.07	.42*	-							
6. Lucidity Negative Emotion	.03	.17*	.38*	.21*	.17*	-						
7. Lucidity Positive Emotion	.52*	.42*	.04	.38*	.22*	-.24*	-					
8. Lucidity Insight	.69*	.51*	.20*	.58*	.40*	.09	.37*	-				
9. Emotion Regulation Difficulties	.02	.02	.03	.09	.17*	.29*	-.09	.03	-			
10. Positive Emotions	.15*	.33*	.25*	.21*	.12	-.03	.24*	.16*	-.30*	-		
11. Interoceptive Awareness	.08	.27*	.22*	.20*	.10	.13*	.17*	.22*	-.08	.26	-	
12. Mindfulness	.18*	.21*	.10	.15*	.03	-.01	.22*	.20*	-.44*	.57*	.31*	-

* $p < .001$.

APPENDIX D
HIERARCHICAL REGRESSION

Table 4.

Hierarchical Regression Model with Emotion Regulation Difficulties, Interoceptive Awareness and Lucidity as Predictors of Dispositional Positive Emotions (N = 262)

Variable	<i>B</i>	<i>SE B</i>	β
Step 1			
Emotion regulation difficulties	-.46	.09	-.32*
Step 2			
Emotion regulation difficulties	-.43	.09	-.30*
Interoceptive awareness	.19	.05	.23*
Step 3			
Emotion regulation difficulties	-.48	.08	-.39*
Interoceptive awareness	.14	.05	.17*
Lucidity	.27	.06	.26
Model R^2		.22*	

Note: $R^2 = .10^*$ for Step 1; $\Delta R^2 = .16^*$ for Step 2; $\Delta R^2 = .06^*$ for Step 3. * $p < .001$

APPENDIX E

LUCIDITY AND CONSCIOUSNESS IN DREAM SCALE (LUCID)

Please think about your MOST RECENT (lucid) dream and rate how strongly you disagree or agree with each of the following statements.

	Not at all like me					Very much like me
	0	1	2	3	4	5
1. While dreaming, I was aware of the fact that the things I was experiencing in the dream were not real.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. While dreaming, I was able to remember my intention to do certain things in the dream.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. While dreaming, I was aware that the self I experienced in my dream wasn't the same as my waking self.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. While dreaming, I was able to manipulate or control other dream characters in a way that would be impossible in waking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. While dreaming, I thought about other dream characters.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. While dreaming, I was able to successfully perform supernatural actions (like flying or passing through walls).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. The emotions I experienced in my dream were exactly the same as those I would experience in such a situation during wakefulness.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. While dreaming, I was aware of the fact that the body experienced in the dream did not correspond to my real sleeping body.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. I was very certain that the things I was experiencing in my dream wouldn't have any consequences on the real world.
10. While dreaming, I was able to successfully control or change the dream environment in a way that would be impossible during wakefulness.
11. While dreaming, I saw myself from outside.
12. While dreaming, I thought about my own actions.
13. While dreaming, I had the feeling that I had forgotten something important.
14. While dreaming, I was able to change or move objects (not persons) in a way that would be impossible during waking.
15. While dreaming, I was not myself but a completely different person.
16. While dreaming, I often asked myself whether I was dreaming.
17. The thoughts I had in my dreams were exactly the same as I would have in a similar situation during wakefulness.
18. While dreaming, I had the feeling that I could remember my waking life.
19. While dreaming, I was aware of the fact that other dream characters in my dream were not real.
20. Most things that happened in my dream could have also happened during wakefulness.

- | | | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 21. I watched the dream from the outside, as if on a screen.body. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22. While dreaming, I often thought about the things I was experiencing. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23. I was able to influence the story line of my dreams at will/at one's pleasure. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. While dreaming, I was able to remember certain plans for the future. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. While dreaming, I felt euphoric/upbeat. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26. While dreaming, I had strong negative feelings. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27. While dreaming, I had strong positive feelings. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28. While dreaming, I had strong positive feelings. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

APPENDIX F

DIFFICULTIES IN EMOTION REGUALTION SCALE (DERS)

How often do these statements apply to you?

- 1 Almost never
- 2 Sometimes
- 3 About half the time
- 4 Most of the time
- 4 Almost always

- 1. I am clear about my feelings.
- 2. I pay attention to how I feel.
- 3. I experience my emotions as overwhelming and out of control.
- 4. I have no idea how I am feeling.
- 5. I have difficulty making sense out of my feelings.
- 6. I am attentive to my feelings.
- 7. I know exactly how I am feeling
- 8. I care about what I am feeling.
- 9. I am confused about how I feel.
- 10. When I'm upset, I acknowledge my emotions.
- 11. When I'm upset, I become angry with myself for feeling that way.
- 12. When I'm upset, I become embarrassed for feeling that way.
- 13. When I'm upset, I have difficulty getting work done.
- 14. When I'm upset, I become out of control.
- 15. When I'm upset, I believe that I will remain that way for a long time.
- 16. When I'm upset, I believe that I'll end up feeling very depressed.
- 17. When I'm upset, I believe that my feelings are valid and important.
- 18. When I'm upset, I have difficulty focusing on other things.
- 19. When I'm upset, I feel out of control.
- 20. When I'm upset, I can still get things done.
- 21. When I'm upset, I feel ashamed with myself for feeling that way.

22. When I'm upset, I know that I can find a way to eventually feel better.
23. When I'm upset, I feel like I am weak.
24. When I'm upset, I feel like I can remain in control of my behaviors.
25. When I'm upset, I feel guilty for feeling that way.
26. When I'm upset, I have difficulty concentrating.
27. When I'm upset, I have difficulty controlling my behaviors.
28. When I'm upset, I believe that there is nothing I can do to make myself feel better.
29. When I'm upset, I become irritated with myself for feeling that way.
30. When I'm upset, I start to feel very bad about myself..
31. When I'm upset, I believe that wallowing in it is all I can do.
32. When I'm upset, I lose control over my behaviors.
33. When I'm upset, I have difficulty thinking about anything else.
34. When I'm upset, I take time to figure out what I'm really feeling.
35. When I'm upset, it takes me a long time to feel better.
36. When I'm upset, my emotions feel overwhelming.

APPENDIX G

DISPOSITIONAL POSITIVE EMOTION SCALE (DPES)

How often do these statements apply to you?

- 1 Strongly agree
- 2 Disagree
- 3 Somewhat disagree
- 4 Neither agree or disagree
- 5 Somewhat agree
- 6 Agree
- 7 Strongly agree

1. I often feel bursts of joy.
2. I am an intensely cheerful person.
3. I am often completely overjoyed when something good happens.
4. On a typical day, many events make me happy.
5. Good things happen to me all the time.
6. My life is always improving.
7. I am generally a contented person.
8. I am at peace with my life.
9. When I think about my life I experience a deep feeling of contentment.
10. I feel satisfied more often than most people.
11. My life is very fulfilling.
12. I feel good about myself.
13. I am proud of myself and my accomplishments.
14. Many people respect me.
15. I always stand up for what I believe.
16. People usually recognize my authority.
17. Other people are generally trustworthy.
18. I develop strong feelings of closeness to people easily.

19. I find it easy to trust others.
20. I can depend on people when I need help.
21. People are usually considerate of my needs and feelings.
22. I love many people.
23. It's important to take care of people who are vulnerable.
24. When I see someone hurt or in need, I feel a powerful urge to take care of them.
25. Taking care of others gives me a warm feeling inside.
26. I often notice people who need help.
27. I am a very compassionate person.
28. I find humor in almost everything.
29. I really enjoy teasing people I care about.
30. I am very easily amused.
31. The people around me make a lot of jokes.
32. I make jokes about everything.
33. I often feel awe.
34. I see beauty all around me.
35. I feel wonder almost every day.
36. I often look for patterns in the objects around me.
37. I have many opportunities to see the beauty of nature.
38. I seek out experiences that challenge my understanding of the world.

APPENDIX H
MULTIDIMENSIONAL ASSESSMENT OF INTEROCEPTIVE AWARENESS
(MAIA)

Below you will find a list of statements. Please indicate how often each statement applies to you generally in daily life.

	Never					Always
	0	1	2	3	4	5
1. I notice how my body changes when I am angry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. When something is wrong in my life I can feel it in my body.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I notice that my body feels different after a peaceful experience.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I notice that my breathing becomes free and easy when I feel comfortable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I notice how my body changes when I feel happy/joyful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I listen for information from my body about my emotional state.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. When I am upset, I take time to explore how my body feels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I listen to my body inform me about what to do.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX I
FREIBURG MINDFULNESS INVENTORY (FMI)

The purpose of this inventory is to characterize your experience of mindfulness. Please use the last 30 days as the time-frame to consider each item. Provide an answer for every statement as best you can. Please answer as honestly and spontaneously as possible. There are neither 'right' nor 'wrong' answers, nor 'good' or 'bad' responses. What is important to us is your own personal experience.

- 1 Rarely
- 2 Occasionally
- 3 Fairly often
- 4 Almost always

1. I am open to the experience of the present moment.
2. I sense my body, whether eating, cooking, cleaning or talking.
3. When I notice an absence of mind, I gently return to the experience of the here and now.
4. I am able to appreciate myself.
5. I pay attention to what's behind my actions.
6. I see my mistakes and difficulties without judging them.
7. I feel connected to my experience in the here-and-now.
8. I accept unpleasant experiences.
9. I am friendly to myself when things go wrong.
10. I watch my feelings without getting lost in them.
11. In difficult situations, I can pause without immediately reacting.
12. I experience moments of inner peace and ease, even when things get hectic and stressful.
13. I am impatient with myself and with others.
14. I am able to smile when I notice how I sometimes make life difficult.

APPENDIX J
INFORMED CONSENT

Consent Letter
Arizona State University – Study of Dreaming

Dear Participant:

My name is Kaylee Rosenbusch and I am a master's student in psychology in the School of Social and Behavioral Sciences at Arizona State University. My faculty advisor Nicole A. Roberts (Associate Professor) and I are conducting a research study to learn more about dreamers.

This research involves filling out an online survey. For this survey, we are interested in learning about your thoughts and feelings. There are no right or wrong answers. Your participation in this study is voluntary. Some of the questions may be sensitive in nature, as they ask about your background, feelings, relationships, energy levels, general health, moods, dreams, and sleeping habits. Some questions ask about affectionate touch, sex, mental health, and alcohol and drug use. We will have no way to connect your responses to these questions to your name or any other identifying information. You have the right not to answer any question, and to stop participating at any time. If you choose not to participate or to withdraw from the study, there will be no penalty. Please note that you must be 18 years or older to participate.

If you decide to participate, we expect the survey will take approximately 65 minutes or less. You can fill out the survey online via Qualtrics.com. You will NOT be able to go back in and finish the survey once you have exited, so please make sure you have allotted enough time to take the survey. If you do need to stop the survey but want to re-enter to continue taking it, please contact us (see below). You will have the opportunity to provide a passcode phrase (not related to your identifying information) in the event that you exit and need to re-enter the survey.

All of your survey responses will remain completely anonymous. They will be stored on a password protected computer that only the research team can access. If results of this study are used in reports, presentations, or publications, results will be presented in group form only.

If you participate in this study, you can choose to be entered into a drawing for a chance to win a \$25 gift card, OR, you can receive research participation credit if you are taking a course at ASU where research participation credit is offered. Credits will be administered in the amount of one credit per 30 min (or less) of participation. This study is worth 2 credits. If you stop the survey early, you will need to contact us to assign partial credit, as the link to a separate contact information page for assigning credit is at the end of the survey.

If you specify that you would (a) like to be entered into the drawing for a chance to win a \$25 gift card or would like to receive research participation credit, (b) like to receive a copy of the findings, and/or (c) be interested in participating in future studies or follow-up studies, you can provide your contact information and it will be

used for these specific purposes only. Your contact information will be downloaded into a separate spreadsheet and therefore will not be connected to your responses.

Should you experience problems or have questions while completing this survey, please leave a confidential message on our 24-hour lab voice mail: 602-543-4524.

If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Filling out the questionnaires will be considered your consent to participate in this study.

Thank you, and we look forward to learning from your experiences!

Kaylee M. Rosenbusch, B.S. and Nicole A. Roberts, Ph.D.

Marking “I consent” below indicates that you consent to participate in the study.

I consent

APPENDIX K
IRB EXEMPTION LETTER



EXEMPTION GRANTED

Nicole Roberts
 Social and Behavioral Sciences, School of
 602/543-3911
 Nicole.A.Roberts@asu.edu

Dear Nicole Roberts:

On 10/6/2015 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Lucid Dreaming
Investigator:	Nicole Roberts
IRB ID:	STUDY00003168
Funding:	Name: Social and Behavioral Sciences, School of
Grant Title:	
Grant ID:	
Documents Reviewed:	<ul style="list-style-type: none"> • Separate link to collect contact information.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Cayla Jessica Duncan_CITI.pdf, Category: Other (to reflect anything not captured above); • LucidDreamingSurvey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • LucidDreaming_IRBprotocol10-5-15.docx, Category: IRB Protocol; • RecruitmentScript_LucidDreamingSurvey, Category: Recruitment Materials; • Roberts_CITI_3-8-2013.pdf, Category: Other (to reflect anything not captured above); • Lucid_Dreaming_Consent_Letter, Category: Consent Form;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 10/5/2015.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Kaylee Rosenbusch
 Nicole Roberts
 Laura Phrasavath
 Cayla Duncan
 Kaylee Rosenbusch
 Taylor Boggio
 Amal Fakhouri