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# Exploring the effects of galantamine paired with meditation and dream reliving on recalled dreams: Toward an integrated protocol for lucid dream induction and nightmare resolution

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ABSTRACT

An experimental home study examined the impact of a pre-sleep protocol for enhancing self-awareness, lucidity, and responsiveness in dreams. It included ingesting the cholinesterase inhibitor galantamine—which is widely reported to increase the frequency of lucid dreaming—prior to engaging in middle-of-the-night meditation and the imaginary reliving of a distressing dream while exercising new responses. Thirty-five participants completed an eight-night study, which included pre- and post-baseline nights and six conditions: waking for 40 min before returning to bed, called Wake-Back-to-Bed (WBTB); Wake-Back-to-Bed plus placebo (WBTB + P); Wake-Back-to-Bed plus galantamine (WBTB + G); meditation and dream reliving (MDR); meditation and dream reliving plus placebo (MDR + P); and meditation and dream reliving plus galantamine (MDR + G). The outcome measures included lucidity, reflectiveness, interactive behavior, role change, constructive action, and fear and threat, as measured by the participants' self-ratings. The results support the use of this protocol in further studies of lucid dream induction and nightmare/trauma resolution.

## 1. Introduction

Lucid dreaming has been defined as the awareness that one is dreaming during a dream (Van Eeden, 1913). In a study of his own dreams, Van Eeden initially described a lucid dream as:

> ...the reintegration of the psychic functions...[such] that the sleeper remembers day-life and his own condition, reaches a state of perfect awareness, and is able to direct his attention, and to attempt different acts of free volition. (1913)

In spite of Van Eeden's introduction of the term "lucid dreaming," it went largely unused prior to the 1960s, even though awareness of the phenomenon is evident in the writings of Aquinas (1947) and Aristotle (1952). Fox (1939) referred to a lucid dream as a "dream of knowledge," and considered it an inferior form of astral projection, while Brown (1936) described his own lucid dreams as simply "dreams in which the dreamer knows he is asleep." Castaneda (1972) referred to the lucid dream experience as merely "dreaming," a presumed translation for the term used by Yaqui Indians of Mexico, and Tholey (1980) preferred the German word *Klartraüme* or "dream of clarity" to describe the phenomenon. However, publications in the late 60s (Green, 1968; Tart, 1969) helped awaken widespread interest in the now-accepted term, principally by drawing attention to the largely forgotten work of Van

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Eeden (1913). Ultimately, none of the terms that have been used effectively define, nor describe the phenomenon.

In the 70s and 80s, lucid dream research acquired legitimacy from a variety of perspectives. Laboratory experiments by Hearne (1978) and LaBerge (1980) established that lucid dreaming can occur within unambiguous REM sleep, thus challenging the notion that *lucidity* is a mere artifact of the awakening process. The concern that lucidity might signify psychological instability was allayed when Gackenbach (1978) demonstrated that lucid dreaming correlates with an array of healthy psychological attributes. Further, various anecdotal treatises provided testimony that lucid dreaming could support free-ranging experimentation in dreams (LaBerge, 1985; LaBerge and Rheingold, 1990), and could facilitate spiritually meaningful experiences (Kelzer, 1987; Sparrow, 1974, 1976) that had been recognized for centuries in Tibetan Buddhism (Evans-Wentz, 1935).

### 1.1. Lucidity vs. non-lucid reflectiveness

The initial focus on lucidity *per se* tended to overlook the non-lucid dimensions of dream ego reflectiveness and volition. Indeed, the preoccupation with lucidity stands in contrast to a seminal premise articulated by Rossi (1972, p. 163) that there is "a continuum of all possible balances of control between the autonomous process and the dreamer's self-awareness and consciously directed effort" in all dreams. Measuring success through the achievement of lucidity thus overlooks the possibility that non-lucid reflectiveness, volition, and other dream ego attributes can independently facilitate such processes as trauma integration (Hartmann, 1998), the and formation of new identity (Rossi, 1972). Only recently have researchers followed Rossi's approach to assessing dream ego awareness by adopting a continuous, rather than categorical approach to dream ego awareness, even though the efforts have thus far focused on the continuum of lucidity, rather than the continuum of dream ego awareness in general. For instance, Moss (1986) describes a continuum that begins with the non-lucid state:

"At the bottom of this range is non-lucidity. Even generally considered non-lucid dreams may have some minor awareness and this is the beginning of partial lucidity." While acknowledging that non-lucid dreams can reveal "minor awareness," Moss does not evidence any recognition of Rossi's observed continuum of non-lucid dream ego reflectiveness and development. Similarly, Barrett (1992) divides lucidity into four "corollary" awarenesses, but does not extend the same continuous approach into non-lucid dreams. Thus, while Moss and Barrett divide lucidity into component awarenesses, neither addresses Rossi's "self-awareness and consciously directed effort" (1972, p. 163) in non-lucid dreams. However, recent research supports Rossi's contention that the dreaming self exhibits reflectiveness and higher-order cognitive capacities comparable to the waking state (Kahan, 2001; Kahan and LaBerge, 1996, 2011). Similar to Sparrow (1983) and Purcell (1987), Kahan and her associates have also developed an instrument to measure heretofore overlooked aspects of "analytical processes" in dreams (Kozmová and Wolman, 2006; Wolman & Kozmová, 2007), called the Metacognitive, Affective, Cognitive Experiences scale (MACE) (Kahan, 2012; Kahan & LaBerge, 1996; Kahan et al., 1997).

Clinical anecdotes attest to the likelihood that subjective factors independent of lucidity—such as values and intention—may be more important than lucidity *per se* in resolving conflict, fostering dialogue, and achieving integration. For example, a 23-year-old female counseling client achieved the ability to become lucid almost every night (Sparrow, Thurston, & Carlson, 2013), but whenever she did, she avoided whatever was transpiring in the dream, regardless of whether it threatened her or not. Her pattern of using lucidity to avoid dreamer-dream engagement corresponded with waking avoidant behaviors, which became a central issue in her psychotherapeutic work. In contrast, another client reported a dream in which he was running from an armed assailant. Upon becoming lucid, the dreamer turned around and searched for the man. When the dreamer found him, the man shot him several times. Undeterred, he walked up to the man, reached up and touched his face. The would-be murderer looked shocked, and then reached up and touched the dreamer's face. These contrasting dream outcomes indicate that lucidity is a cognitive state which can produce disparate outcomes depending on one's intention.

There have been successful efforts influenced by Rossi's work that have assessed the impact of lucid dream induction by measuring the presence of continuous non-lucid dream ego attributes alongside the traditional categorical designation of lucidity/non-lucidity. Sparrow (1983) tested a lucid dream induction strategy called "dream reliving" against an active control condition (i.e. a pre-sleep motivational essay) and a delayed-treatment control group. Using Rossi (1972) for his theoretical rationale, Sparrow developed the Dreamer Development Scale (DDS) to assess four aspects of personality development derived from Rossi's work-- reflectiveness, interactive behavior, role change, and constructive action. He found that dream reliving was not only effective in increasing lucidity, but that the DDS subscales of reflectiveness and constructive engagement were significantly enhanced over the active placebo and no treatment conditions. Similarly, Purcell and her colleagues (Purcell, Mullington, Moffitt, Hoffmann & Pigeau, 1986; Purcell, 1987; Purcell, Moffitt & Hoffman, 1993) conducted studies of inducing self-reflectiveness (including lucidity) in dreams. To assess the outcome measures, she developed the Dream Awareness Scale based on Rossi (1972). The researchers found that self-reflectiveness could be enhanced through a process of daily lucidity training. Sparrow's and Purcell's studies indicate that efforts to induce lucidity exert a more generalized impact on dream ego awareness regardless of whether lucidity itself is achieved.

Dream reliving was tested again (Sparrow et al., 2013) in conjunction with middle-of-the-night meditation in a study that again assessed the same four DDS subscales of "dreamer development" (Rossi, 1972), alongside lucidity measures. The combined treatment exhibited a similar effect of increasing levels of reflectiveness and constructive behavior, as well as lucidity.

## 2. The state of the art of lucid dream induction

Researchers have developed and tested a variety of induction strategies. Some methods involve daytime or pre-sleep cognitive rehearsal strategies intended to carry over into the dream state. These methods include the development of the "critical faculty" in the dream state (Fox, 1939), conducting "reality checks" during the day (Tholey, 1980, 1983) in hopes that the same critical awareness

will carry over into dreaming; repeating pre-sleep affirmations such as the Mneumonic Induction of Lucid Dreams (LaBerge, 1980) or MILD; reliving dreams in fantasy as if one is lucid, or "dream reliving" (Sparrow, 1983; Sparrow et al., 2013), middle-of-the-night meditation (Sparrow et al., 2013); committing to a physical activity, such looking at one's hands during the day with the intention of doing so during the dream, and becoming lucid (Castaneda, 1972); hypnosis (Dane and Van De Castle, 1987); and immersing oneself in a combination of induction strategies (Hurd, 2012; Johnson, 2017; Waggoner, 2008).

External stimulation during sleep has also played a role in lucid dream induction. LaBerge pioneered the use of masks that would emit light signals to the eyes during periods of REM sleep (LaBerge & Levitan, 1995), and several new products based on this strategy are currently available on the market, such as the Aurora Dream Enhancing Mask by iWinks LLC. More recently, smartphone apps for inducing lucid dreams use a potpourri of methods, such as binaural beats, sleep tracking, specialized alarms, or providing audible cues to the sleeping mind during dream sleep (Turner, 2017). Further, Voss and her associates (Voss et al., 2014) have concluded that the application of electrical stimulation to the scalp can reliably induce lucidity in inexperienced dreamers. These findings are controversial, given that the degree of self-awareness apparently induced by the stimulation was lower than the threshold originally established as a cutoff for the instrument used in the study (neurocritic.blogspot, 2018); however, additional light support can be found in Stumbrys, Erlacher and Schredl (2013). Regardless, Voss does not support or advocate for the use of this method in commercial devices until more research is completed (Hurd, 2015).

Finally, herbs, supplements and minerals are used to induce vivid and lucid dreams. Substances used to influence dreams are oneirogens, from the Greek *oneiros* [dream] + *gen* [create] (Toro & Thomas, 2007, p. 5). Contemporary practices for inducing lucid dreams with supplements has gained in popularity in the last decade as the lucid dream supplement technique (Yuscak, 2006), although many dream herbs and drugs have been described in indigenous contexts for generations. For example, *Calea zachatechici* is an herb from Oaxaca, Mexico, the dried leaves of which are smoked by Chontal shaman/dreamers as a cure-all and a "voyaging" aid (Diaz, 1979). Another traditional oneirogen is *Silene capsensis*, known today as "dream herb." Historically, the Xhosa people have used *Silene c*. during initiation rites to induce powerful dreams that are then interpreted by diviners (Hirst, 2000). The effectiveness of these dream-inducing herbs has not yet been empirically demonstrated.

As for the effectiveness of various lucid dream induction strategies, Stumbrys, Erlacher, Schädlich, and Schredl (2012) summarized the results of 37 studies, as follows:

> No single technique showed to be effective enough to facilitate lucid dreams with a high success rate and perhaps a more eclectic approach might be useful in lucid dream induction: To combine different techniques and advantages offered by them.

Further, the authors suggested that the inclusion of external stimulation and/or the ingestion of specific substances might boost the effectiveness of cognitive strategies. The current study represents such an eclectic approach, in which we combined two cognitive strategies—meditation and Dream Reliving—with the cholinesterase inhibitor galantamine.

### 2.1. Cholinesterase inhibitors for lucid dream induction

Research indicates that the cholinergic system is involved in dreaming. Since reports of lucid dreaming are mainly obtained during REM sleep (Kern, Appel, Schredl & Pipa, 2017), it stands to reason that substances that elevate the levels of acetylcholine should increase dream recall in general, and lucidity, in particular. In regard to the research supporting these claims, LaBerge unsuccessfully applied for exclusive rights to employ cholinesterase inhibitors in lucid dream induction (2004). In the patent application, LaBerge (2004) reports that Aricept™ (Donepezil) had catalyzed lucid dreams in nine out of 10 experienced subjects, as compared to only one out of the same subjects using a placebo on another night. In his brief summary, the context and methodology were not discussed. He also cites other informal studies in support of the effectiveness of cholinesterase inhibitors. Since then, La Marca & LaBerge (2012) conducted another unpublished study using the cholinesterase inhibitor galantamine—an extract of the snow drop lily available without prescription in the U.S. that is used in the treatment of mild to moderate Alzheimers Disease—and reported a fivefold increase in lucidity among experienced lucid dreamers over the use of a placebo.

Two additional peer-reviewed studies on cholinergic-enhancing supplements have been published since Stumbrys et al. (2012). In a retrospective survey of 17 advanced lucid dreamers who had used galantamine previously, Sparrow, Hurd, and Carlson (2016) found that subjects recollected that their post-galantamine lucid dreams were longer and more vivid than non-galantamine lucid dreams, and exhibited significantly less fear, threat, and violence, as measured on separate likert scales. However, apparently not all supplements that affect the cholinergic system are equally effective. For instance, in a recently published double-blind study of an acetylcholine precursor—L-alpha glycerylphosphorylcholine (α-GPC)–Kern et al. (2017) found no significant increase in lucid dreams over the levels obtained after ingesting a placebo. This tentatively suggests that the use of acetylcholine precursors may not have the same positive impact as cholinesterase inhibitors.

### 2.2. Galantamine as a unique cholinesterase inhibitor

Among the class of cholinesterase inhibitors, galantamine appears to have unique properties that sustain its effectiveness over time (Lilienfeld, 2002; Samochocki, Hoffle, & Fehrenbacher, 2003). Research with Alzheimer's patients indicates that the therapeutic effects of Aricept™ (Donepezil) and other cholinesterase inhibitors fall off within a few months (Lilienfeld, 2002), but that galantamine involves a dual mechanism that not only temporarily slows the breakdown of acetylcholine, but also facilitates the allosteric modulation of the nicotinic receptors in the hippocampus and frontal lobe, such that the therapeutic effects persist, even after 12 months of daily use. Citing galantamine's uniqueness among other substances in its class, Lilienfeld (2002) says,

The unique dual mode of action of galantamine could explain its impressive efficacy profile, and the potential for additional benefits with galantamine (over conventional cholinesterase inhibitors) has recently been recognized in recommendations arising from evidence-based medical assessments.

### 2.3. Galantamine's risks and contraindications

Galantamine's availability in the US without a prescription and its relative stability over time make it an obvious choice for research with human subjects. As stated previously, galantamine is well tolerated and considered safe due its wide use in treatment of Alzheimer's disease and related conditions of cognitive decline (Dengiz & Kershaw, 2004). It is currently sold over-the-counter in the U.S. as a supplement. Reported side effects are generally mild and transient, the most frequent adverse effects being nausea and gastrointestinal discomfort (Winblad et al., 2008). However, there are a number of contraindications of which to be aware. Naturally, anticholinergic drugs counteract the effects of galantamine. Muscle relaxants, such as succinylcholine, should not be used in conjunction with galantamine due to possible vagotonic effects on the heart, such as weak and irregular heartbeat, and the possibility of bronchospasm (Scott & Goa, 2000). For these reasons, those with a history of asthma, seizures, lung disease or heart problems should not ingest galantamine. Finally, galantamine should not be taken by those who have recently had bladder or gastrointestinal surgery or those with a history of liver or kidney disease.

## 3. Theoretical rationale for an integrated induction protocol

Repetitive and disturbing nightmares remain difficult to treat when in association with Post Traumatic Stress Disorder (PTSD). The PTSD-related nightmare is a distressing intrusion into an individual's life, but may represent an effort on the part of the dreaming brain to revisit, reprocess and integrate the original trauma (Hartmann, 1998). Hartman argues that the central metaphors in nightmares serve to "contexualize," or weave the emotion of distressing experiences into an associative array of related, successfully integrated experiences, in order to accelerate the incorporation of the traumatic outlier. Hartman's theory describes the process of integration, but does not explain the *pace* of integration. While many people apparently succeed in resolving traumatic memory over time, others report a chronic repetition of nightmares in which the emotion, if not the iconic content associated with the original trauma, repetitively disrupts sleep. Significantly, most trauma resolution cognitive interventions involve re-exposure and reprocessing of the original event. These methodologies include exposure therapy (Rothbaum and Mellman, 2001), logotherapy (Southwick, Gilmartin, McDonough, & Morrissey, 2006), Image Rehearsal Therapy or IRT (Forbes, Phelps, & McHugh, 2001; Forbes et al., 2003; Germain & Nielsen, 2003; Krakow et al., 2000), and Eye Movement Desensitization and Reprocessing or EMDR (Raboni, Tufik, & Suchecki, 2006). All of these methodologies revolve around the re-exposure to, and the reprocessing of the original traumatic memories and/or derivative nightmares.

Given that most evidence-based treatment modalities for trauma resolution involve (1) *re-exposure* to, and (2) *reprocessing* of the memory, the missing "accelerant" in attenuating frequency of nightmares could be a sufficient level of reflective awareness and volition needed to facilitate the reprocessing and integration of the distressing memory during the dream. Along these lines, researchers have turned to lucid dream induction as a way to increase the reflective and interactive capacity of nightmare sufferers (Spoormaker & van den Bout, 2006; Spoormaker, van den Bout, & Meijer, 2003; Holzinger, Klösch, & Saletu, 2015). Despite some positive results in this line of research, the relative difficulty of inducing lucid dreams among inexperienced dreamers can make lucid dream induction less desirable than waking state interventions designed to facilitate re-exposure and reprocessing.

### 3.1. Meditation and dream reliving as a tandem approach to dream-based trauma resolution

Punamaki (2007) has stated that the human response to trauma is bidirectional. That is, while the conscious ego endeavors to avoid the original memories, a mechanism in dreams repeatedly re-exposes the dreamer to them. Not surprisingly, the conscious self often feels haunted by nightmares and understandably tries to avoid them—even if the nightmares ultimately occur in response to an organismic need to reprocess and integrate the original memories (Hartmann, 1998).

#### 3.1.1. Meditation as an avenue to nonreactive witnessing

While a person normally reacts with avoidance to the resurgence of memory and emotion related to trauma, a heightened state of non-reactive, reflective awareness can support one's tolerance to the re-exposure to the original dream and related memories, and thus facilitate the reprocessing of undigested memory. Well established waking state treatments, such as EMDR, IRT, and group exposure therapy establish a safe environment and a clearly spelled-out methodology before guiding the patient in intentionally recollecting and reprocessing the distressing memory. By comparison, the dream state offers an autonomous emulation of the unresolved memory, but without providing any safeguards or preparation that will carry over into the dream.

Given that the prevailing therapeutic paradigm for trauma resolution involves a non-reactive, witnessing state of mind paired with re-exposure to the traumatic memory or nightmare, meditation can arguably facilitate the first goal. Goleman and Goleman (2002) reported that meditation has the dual effect of heightening higher cortical processing while attenuating the reactivity of the amygdala. Thus, it stands to reason that pre-sleep or middle-of-the-night meditation, if done just prior to periods of REM, should increase the dream ego's tolerance of nightmare content, thus accelerating the resolution of unresolved emotional content. There have been anecdotal reports attesting to the induction of lucid dreaming following middle-of-the-night meditation (Sparrow, 1976),

but only recently has research begun to confirm these claims and the connection between meditation and lucid dreaming in general (Sparrow et al., 2013; Pagel, 2014; Stumbrys, Erlacher & Malinowski, 2015).

*3.1.2. Dream reliving as a catalyst for engagement*

To increase the chances that a dreamer will achieve the second goal, that is, a willingness to engage and reprocess whatever trauma-related situations might arise in the dream state, we have recently combined meditation with Dream Reliving (Sparrow, 1983; Sparrow et al., 2013). Dream reliving involves reliving in fantasy a distressing dream while mentally practicing new "lucid" responses to the events as they unfold. This intervention, which preceded the development of IRT (Sparrow, 1983), is similar to IRT, which involves patients writing a new ending to the original nightmare, except that Sparrow and his associates (Sparrow, 1983; Sparrow et al., 2013) have emphasized the central importance of focusing on changing dreamer *responses,* rather than altering the outcome of the dream. While the end result of Dream Reliving is arguably the same as IRT—a more favorable dream outcome—focusing primarily on dream ego *response*, rather than dream *outcome,* could feasibly engender a higher sense of self-efficacy—defined by Bandura (1977) as one's perceived ability to "organize and execute courses of action required to attain designated types of performances." Bandura distinguishes between an *outcome* expectancy, which is "a person's estimate that a given behavior will lead to certain outcomes" (p. 193) and an *efficacy* expectation, which is "the conviction that one can successfully execute the behavior required to produce the outcomes" (p. 193). We believe that the emphasis on changing dreamer *response* may foster efficacy expectations, rather than merely outcome expectancies. Further research is, of course, necessary in order to establish if Dream Reliving produces better clinical outcomes than IRT.

In spite of the positive findings of using dream reliving (Sparrow, 1983; Sparrow et al., 2013), the absolute frequency of lucidity in the general population—even when using meditation and dream reliving (MDR) in tandem—would still be so low as to provide an impractical entry point for infrequent lucid dreamers for engaging and reprocessing distressing dream content. After all, while lucid dreaming may be a learnable skill, only half the population in one survey reported having had at a lucid dream (Schredl & Erlacher, 2011). Even when a person makes concerted efforts, success can still be minimal. For example, the early 20th century psychical researcher F.W.H. Meyers devoted himself to the task of having lucid dreams after learning of Van Eeden's success, but was able to recall *only three lucid dreams over the course 10 years* of effort (Brown, 1936)–a frequency much too low to harness in the service of intentional personal exploration, or nightmare resolution.

*3.1.3. Galantamine as a way to boost lucidity*

Given the potential impact of cholinesterase inhibitors on lucid dream frequency in general, and galantamine's unique dual mechanism that minimizes the attenuation of effect over time, the incorporation of galantamine into an integrated lucid dream induction protocol with meditation and Dream Reliving presents a theoretically justifiable approach to general lucid dream enhancement, as well as to nightmare resolution and PTSD treatment. As stated, the combination of meditation and Dream Reliving addresses the bidirectional response to trauma (Punamaki, 2007), whereas galantamine independently promises to raise the baseline frequency of lucidity.

However, in anticipation of concerns by the Institutional Review Board (IRB) of the University of Texas Rio Grande Valley (UTRGV) concerning the safety of galantamine, we felt we needed to ascertain if galantamine precipitates undesirable effects that would argue against its use. Galantamine, which is available without prescription in the US (but not in the UK, Canada and some other countries), is known to exert minor physical side effects such as nausea and headache (National Institute for Health and Clinical Excellence, 2011). In addition, anecdotal reports indicate that galantamine can trigger an increase in the frequency of sleep paralysis and dream bizarreness (Hurd, 2011). However, if galantamine exerts a generalized enhancement of lucidity without undue side effects, then we felt we could justifiably augment MDR with galantamine order to make lucid dreaming therapy a more practical consideration for those suffering from repetitive nightmares associated with post-traumatic stress.

*3.1.4. Evaluating galantamine effects*

To assess galantamine's range of potential benefits and side effects, we previously conducted a study examining the retrospective, subjective impressions of 17 experienced lucid dreamers, all of whom had independently used galantamine in the past (Sparrow et al., 2016). Reponding to 14 likert scale questions designed to assess if galantamine use was associated with a variety of dream phenomena over its non-use, the respondents asserted that galantamine-preceded lucid dreams were significantly (1) longer, (2) more vivid, (3) less fearful, (4) less threatening, and (5) less violent. Interestingly, none of several possible negative side-effects were found to be significantly related with galantamine use.

On the basis of a sequence of studies (Sparrow, 1983; Sparrow et al., 2013; Sparrow et al., 2016), we felt justified in combining the treatments in a double-blind home-based study, which explored the effects of MDR and galantamine, both together and separately. The proposal was approved by the IRB (#907999-2) of the University of Texas Rio Grande Valley.

## 4. Purpose of this study

The purpose of this home-based study was to examine the impact of galantamine—alone and in tandem with MDR on subsequently recalled dreams. We were interested in assessing any increases in lucidity during subsequent dreams, as well as increases in non-lucid features of "dreamer development" described by Rossi (1972). Using a double-blind design with placebos that were indistinguishable from active capsules, we employed a research model that we believed would compare favorably to previous home-based induction studies on methodological rigor (Stumbrys et al., 2012).

Windt (2013) argues that dream reports should be considered as valid data for the purposes of empirical study, and Domhoff (2017) contends that home-based dream records are an acceptable, if not superior source of stable dream data. Add to that the recent practice of using participant self-ratings of metacognitive states by Kahan and LaBerge (2011) in order to assess features that may not be evident in dream narratives, we thus decided that a home-based study that included the collection of dream reports, along with participant self-ratings of their own dreams, was an acceptable data-collection protocol for the purposes of this study.

### 4.1. Research hypotheses

**Hypothesis 1.** *WBTB + G > WBTB + P. Wake-back-to-bed plus galantamine will differ from wake back to bed plus placebo.*

**Hypothesis 2.** *MDR + G > MDR + P. Meditation and dream reliving plus galantamine will differ from meditation and dream reliving plus placebo.*

**Hypothesis 3.** *MDR + G > WBTB + G. Meditation and dream reliving plus galantamine will differ from wake-back-to-bed plus galantamine.*

In addition to investigating these specific hypotheses, we included all pairwise comparisons for each variable in the respective tables in Section 6, in order to ascertain if there were unanticipated differences that could feasibly contribute to further research.

## 5. Method

### 5.1. Participants

Seventy-three volunteers were recruited from an announcement posted on three online dream-related sites: www.dreamstudies.org; www.dreamanalysistraining.com; and the Facebook group page of the International Association for the Study of Dreams at https://www.facebook.com/groups/5493995967/. The notice included a hyperlink to an online informed consent (IC) form, which also gathered basic demographic and contact information. The IC document also included an attestation that the respondent had used galantamine previously without any negative effects, a requirement imposed by the UTRGV IRB for its approval.

The IC document clearly spelled out the estimated time commitment required for completing the study, which involved eight nights of dream recording, six of which also involved awakening about four hours after sleep onset and engaging in various activities for about 40 min. Despite our presentation of the study's schedule, we anticipated that some of the participants would never begin the study once they reviewed the detailed instructions more carefully, and we also expected that some participants would drop out soon after beginning due to the difficulty of returning to sleep after completing the middle-of-the-night research-oriented tasks. Finally, we anticipated that some participants would record too few dreams to be included in the final analyses.

Out of the original 73 participants who were admitted into the study, only 44 opted to begin. Since the 31 respondents who quit before starting the study never ingested any of the galantamine provided in the research packets, the high non-start rate was clearly unrelated to the effects of galantamine. Instead, it was clearly attributable to the anticipated disruptive effects of the eight-night regimen. Indeed, many of those who chose not to participate sent their apologies, citing scheduling conflicts or anticipated sleep disruption, as the main reasons. While we encouraged participants to start later if necessary, as long as they could complete the eight-night regiment within two months, many still found it inconvenient to do so.

Of those who started, most completed the study without incident. Three dropped out after the first couple of nights, finding themselves unable to return to sleep after the middle-of-the-night awakenings, but only one of them attributed his decision to quit to the presumed effects of the galantamine. None of the other participants reported having negative side effects from the 8 mg dose of galantamine, perhaps because we urged them to eat and drink something before ingesting any of the galantamine and placebo capsules, alike. Of the 41 participants who completed the study, six of them reported dreams for fewer than five nights, and thus we eliminated them from the analyses due to the degree of missing data. The final data set included 35 participants.

#### 5.1.1. Demographic information

The final participants were evenly distributed in terms of age, with seventeen of them from 41 to 55 years old (M = 48.5, SD = 12.5), and an equal number (nine) of older and younger individuals. Sixteen participants were female, and nineteen were male. Over half of the group (nineteen) meditated at least twice per week, with thirteen reporting that they meditated almost every day. However, the group was not comprised of especially advanced lucid dreamers, with only four reporting having a lucid dream at least once a week, and seventeen reporting a lucid dream less than once a month. While everyone had ingested galantamine (as per the UTRGV IRB requirement) at least once previously, 23 had used the supplement less than once a month, and 13 had used it less than once a year. We did not inquire concerning the purpose for any prior galantamine use, but since the participants responded to announcements posted on three dream-related websites, we presumed that any prior use had been tied to lucid dream induction efforts.

### 5.2. Procedures

Each participant received a packet by mail that included instructions; their individualized eight-night schedule that included six randomized treatment conditions framed between two baseline collection nights; and six color-coded sealed envelopes paired with

their individualized schedule—one for each of the treatment nights—including capsules and instructions for the given night. (Packets were not included for the two baseline nights.) Participants did not know which capsules were active or placebo. They were also provided access to an online daily dream recording questionnaire that they filled out upon awakening on each of the eight mornings.

The study involved eight nights of dream collection. The first and eighth night involved a no-treatment dream recording condition (B1 & B2). In between were six conditions involving some kind of middle-of-the-night activity, which were randomly ordered for each participant. In order to counteract for possible fatigue and carryover effects of various treatments, we asked the participants to skip at least two, and no more than four nights between each of the eight conditions. The eight conditions involved the following activities:

(1) B1— involved waking approximately four hours after sleep onset, making note of any dreams that occurred before awakening, and discarding two empty capsules. Afterward, participants were asked to return to sleep without staying awake any longer.
(2) WBTB — involved waking approximately four hours after sleep onset, opening a color-coded sealed envelope, throwing away two empty capsules, and simply remaining awake for about 40 min before returning to sleep.
(3) WBTB + P — involved waking about four hours after sleep onset, opening a color-coded sealed envelope, and then eating a snack and drinking some liquid (to prevent any nausea that the galantamine could cause) before taking a placebo capsule that was identical in appearance to the galantamine capsules. Again, they remained awake for about 40 min before returning to sleep.
(4) WBTB + G — involved waking about four hours after sleep onset, opening a color-coded sealed envelope, and then eating a snack and drinking some liquid before taking a capsule containing galantamine. Again, they remained awake for about 40 min before returning to sleep.
(5) MDR — involved waking about four hours after sleep onset, opening a color-coded sealed envelope, throwing away two empty capsules and then practicing MDR for 20 min with an unpleasant dream chosen from their past memory. We did not specify the type of meditation they should use, but instead provided links to three sites where they could obtain instruction if they did not already have a preferred method. Since over half of them reported meditating at least twice a week, we believed it would be best to allow participants to choose their own methods. Again, they remained awake for about 40 min before returning to sleep.
(6) MDR + P — involved waking about four hours after sleep onset, opening a color-coded sealed envelope, and then eating a snack and drinking some liquid before ingesting a placebo capsule. Then they practiced MDR for 20 min and then remained awake for another 20 min before returning to sleep.
(7) MDR + G — involved waking about four hours after sleep onset, opening a color-coded sealed envelope, and then eating a snack and drinking some liquid before ingesting a capsule containing galantamine. Then they practiced MDR for 20 min and then remained awake for another 20 min before returning to sleep.
(8) B2 — involved following the same instructions as B1

Upon awakening in the morning, the participants recorded any dreams on the online dream recording questionnaire that had occurred during the period following the middle-of-the-night awakening. All dreams recollected on a given night were grouped together as a single unit (i.e. dream/night), and pasted or typed by the participants into the online questionnaire. Two self-administered rating scales were then used to evaluate each dream/night upon awakening each morning: (1) a lucid dreaming scale that assessed each dream/night as lucid, pre-lucid or non-lucid, and (2) the Dreamer Development Scale (the DDS) that evaluated each dream/night for levels of reflectiveness, interactive behavior, role change, and constructive behavior as measured on six-point likert scales. The online questionnaire also included a question pertaining to perceived levels of fear, threatening figures and situations, and violence.

#### *5.2.1. Establishing the dosage of galantamine*

To arrive at a dosage of galantamine for the study, we took into account various sources. When used to treat Alzheimer's, physicians start their patients with four or eight mg, and then gradually increase it until the patient is taking 16–24 mg. per day (Lilienfeld, 2002). When used to induce lucid dreams, Esser (2004) encourages individuals to start with eight mg. of galantamine, and increase it if there are no desired effects. He states that individuals can increase the amount to 48 mg. per day over time, but that there is diminishing return above that dosage. He also says that there is a "flattening effect" after two to four weeks of daily use, and that it is often necessary to cease using it for a few days in order to regain its effect.

La Marca and LaBerge (2012) also used an eight mg. dose in their unpublished study. Since galantamine is known to produce nausea in larger amounts if a person is unaccustomed to it, we thus opted to use the 8 mg. dose. We thought that it would provide a high-enough dose to achieve positive results without causing undue side effects.

The transparent galantamine capsules were visually indistinguishable from the placebo capsules, both of which were filled with pulverized alfalfa. Since 8 mg. of galantamine comprises a tiny amount of odorless white powder, it was completely masked by the dull green alfalfa filler. By requiring participants to ingest a beverage and a snack before taking any of the capsules, we hoped to insure that they would suffer no ill effects from the galantamine, nor discern the differences between the active and placebo capsules.

#### *5.2.2. Instrument one: the dreamer development scale (DDS)*

The DDS (Sparrow, 1983; Sparrow et al., 2013) is based on Rossi (1972) and measures the presence of reflectiveness, interactive Behavior, role change, and constructive behaviors on 6-point likert scales. We justified having the participants score their own dreams, first of all because the dreamers themselves are arguably better at assessing subjective features of their dreams, and current research into dream metacognition supports this approach to assessment (Kahan & LaBerge, 2011). Also, the lead researcher had previously conducted inter-judge reliability tests of the DDS (Sparrow, 1983) that produced high (above .80) correlations on all

subscales after two training periods, so the DDS has been shown to have reliability among independently trained judges. In the current study, The Cronbach's alpha reliability coefficients were: Reflectiveness = .80; Interactive Behavior = .72; Role Change = .76; Constructive Behaviors = .76.

Another reason to have participants rate their own dreams is that it is impossible to assign positive or negative value to particular dream ego attributes and behaviors (i.e. on the constructive behavior subscale) without understanding the life context to which such behaviors might relate (Sparrow, 2013). For example, killing a dream figure might not seem constructive, but if the dreamer is a victim of childhood abuse, such behavior can represent a necessary developmental step (e.g. developing personal power). In addition, the presence of fear in a dream—the sixth outcome measure that we assessed—is difficult to ascertain without soliciting the dreamer's input.

Before having them rate their own dreams, we asked the participants to review a set of instructions that included several sample dreams with ratings. Despite the informal nature of this approach, we believed that any idiosyncratic distortions in self-scoring would carry over to all conditions in a repeated measures analysis.

The DDS asked the participants to respond to four likert scale questions, as follows:

1. *On a scale of 1–6, where "1" is "not at all," and "6" is "very much," how much did you engage in* ***self-reflection*** *during your dreams following your nighttime awakening, where self-reflection is defined by asking questions, considering alternatives, thinking about what was happening, or being puzzled by something.*
2. *On a scale of 1–6, where "1" is "not at all," and "6" is "very much," how much did you engage in* ***interacting with dream characters or situations*** *during your dreams following your nighttime awakening, where interactive behavior is defined as having conversation, making love, touching, fighting with, trying to fix or destroy, or any other activity involving engagement with some person, object, or situation in the dream.*
3. *On a scale of 1–5, where "1" is "not at all," and "6" is "very much," how much did your* ***role or status change*** *during your dreams following your nighttime awakening, where role or status change is defined as moving from one role or status in the dream to another, such as from student to teacher, victim to powerful agent, man to woman, worker to boss, parent to child.*
4. *On a scale of 1–6, where "1" is "not at all," and "6" is "very much," how much did you engage in* ***constructive or creative behavior*** *during your dreams following your nighttime awakening, where constructive or creative behavior is defined as doing something that brings about a desirable change in the immediate context of the dream scenario.*

#### *5.2.3. The inclusion of a scale for the presence of fear and threat*

In Sparrow et al. (2016), the researchers asked a series of questions concerning the recalled effects of galantamine on lucid dreams. These questions included three six-point likert scale questions pertaining to the perception of fear, perceived threat, and violence. These questions were included in that survey in order to provide data on whether galantamine mine eventually be used for the attenuation of nightmares and PTSD-related symptoms. Participants reported that the three measures were significantly lower in post-galantamine lucid dreams. Instead of including all three questions in the current study, we decided to collapse the three questions into the single question, for the purpose of brevity. The Cronbach's alpha coefficient for the Fear/Threat likert scale was .69, and the wording for the question was:

> *On a scale of 1 to 6, where "1" is "not at all," and "6" is "very much,"* ***how much threat, fear, or violence*** *occurred in your dreams following your nighttime awakening?*

#### *5.2.4. Instrument two: the dream lucidity scale (DLS)*

There have been recent efforts to devise multi-dimensional assessment approaches to lucidity (Voss, Schermelleh-Engel, Windt, Frenzel, & Hobson, 2013), but since we decided to have the participants rate their own dreams, we believed that a simpler approach, more aligned with traditional lucid, pre-lucid, and non-lucid designations would be more appropriate for our study.

The categories of lucid and non-lucid are relatively easy to define on the basis of dreamer self-statements, but the pre-lucid category is more difficult to determine (Green, 1968; Sparrow, 1983; Sparrow et al., 2013), given that one can assign pre-lucidity on the basis of *awareness* features (e.g. asking onself if the experience is a dream), *content* features (e.g. dreams of flying, meeting deceased relatives, having a "false awakening"), or a *combination* of the two (i.e. "I am flying, but I wonder how it's possible"). In Sparrow's dissertation study (1983), he was concerned that Green's conservative definition of pre-lucidity overlooked other types of recognized pre-lucid phenomenology. Green herself provided several phenomenological scenarios that tended to provoke the dream ego to question the reality dream. Given that these content features appear to be well-recognized precursors for the arousal of lucidity, Sparrow believed they belonged on the continuum of lucidity, and thus he established a separate category of "incipient lucid dream" in the Dream Lucidity Scale (DLS) to set these dreams apart from pre-lucid and non-lucid dreams. Thus, the original DLS involved four categories: lucid, pre-lucid, incipient pre-lucid, and non-lucid dream.

In Sparrow et al. (2013), trained judges employed the DLS in the rating of home-study-based dreams. They found, however, that the number of pre-lucid dreams, as defined by Green, was exceedingly small. Since the absolute number of pre-lucid dreams precluded statistical analyses, the researcher combined incipient pre-lucid dreams with pre-lucid dreams. Thus, for the purposes of the current study, as well, the criterion for a pre-lucid dream reflects a combination of Green's original criteria with Sparrow's criteria for incipient lucidity.

For the purposes of the study, pre-lucidity was defined as *"questioning things in the dream without actually concluding that you were dreaming (*i.e. *Green's criterion); noticing incongruities (*e.g. *things different or out of place, people who have died, etc.) without concluding*

*that you were dreaming; or doing things that are ordinarily impossible to do (*e.g. *going back in time, flying without any assistance) without concluding that you were dreaming."*

Lucidity was defined simply as "becoming aware during the dream that you were dreaming, if only momentarily." Finally, non-lucidity was defined simply as a dream in which the dreamer was neither lucid nor pre-lucid.

## 6. Data analyses

### 6.1. Imputation of missing values

Missing data is an unavoidable consequence of any dream recall study, especially when conducted in a naturalistic setting—that is, not involving forced awakenings by researchers. In addition, drawing the line between a scoreable dream report, and one that is so brief that scoring it will skew the results downward, or so long that any outcome measure is more likely to be found within it, is another problem that has to be dealt with.

We arbitrarily eliminated any participant who recalled dreams on less than five of eight nights, but that still left a considerable number of empty cells in the data matrix. There are various ways of imputing missing values, but we elected to use the mean of the column (condition) averages.

As for dealing with the impact of dream length on outcome measures, we encouraged participants to score any dream that they could recall. Although we realized that dream length could skew the scores, we concluded that the effect would extend in both directions. That is, fragments would skew the scores downward, and lengthy dreams including brief instances of high levels of a particular outcome measure would be rated highly on that measure. Since short and long dreams would skew the ratings in both directions, and since the double-blind model would conceivably extend these bidirectional effects to every condition, we thus concluded that allowing dream narratives regardless of length should not threaten the validity of the results.

### 6.2. Statistical analyses

A one-way repeated measures/within subjects analysis of variance was used to compare the eight conditions/trials for each of the six outcomes/measures – lucidity, reflectiveness, interactive behavior, role change, constructive behavior, and fear/threat. The null hypothesis in each of the six outcomes/measures was rejected ($p < .05$), and pairwise comparisons were computed between each condition/trials, using the Bonferroni method. Cohen's *d* values are also presented for significant pairwise differences. Only the role change measure failed to produce significant ($p > .05$) pairwise differences, so comparisons were not computed. The assumptions of this study were normality of distribution and sphericity. If sphericity could not be assumed, conservative degrees of freedom (Greenhouse-Gessier) were used.

Following the computation of pairwise comparisons of individual conditions for each outcome variable, a post-hoc analysis was conducted between the galantamine conditions combined and the placebo conditions combined, since the Bonferroni pairwise comparisons indicated no differences between the galantamine trials (4 & 7) and the placebo trials (3 and 6). They were then compared using the Scheffé test (see Section 7.2.7).

## 7. Results

### 7.1. Means and standard deviations

The means and standard deviations for each variable by condition are reported in Table 1.

**Table 1**
Means and standard errors for variables by conditions.

| | Lucidity | | Reflectiveness | | Interactive behavior | | Role change | | Constructive action | | Fear/threat | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Range 0–2 | | Range 1–6 | | Range 1–6 | | Range 1–6 | | Range 1–6 | | Range 1–6 | |
| | *M* | *SE* | *M* | *SE* | *M* | *SE* | *M* | *SE* | *M* | *SE* | *M* | *SE* |
| (B1) | 0.26 | 0.08 | 2.23 | 0.19 | 2.4 | 0.22 | 2.03 | 0.21 | 1.4 | 0.16 | 1.77 | 0.24 |
| (WBTB) | 0.69 | 0.18 | 2.6 | 0.21 | 3.17 | 0.25 | 1.94 | 0.22 | 2.17 | 0.22 | 1.85 | 0.21 |
| (WBTB + P) | 0.4 | 0.11 | 2.65 | 0.28 | 3.14 | 0.22 | 1.77 | 0.24 | 2.14 | 0.25 | 2.25 | 0.27 |
| (WBTB + G) | 1 | 0.15 | 3.63 | 0.32 | 3.94 | 0.22 | 2.11 | 0.29 | 3.14 | 0.31 | 2.43 | 0.27 |
| (MDR) | 0.4 | 0.09 | 2.91 | 0.3 | 3.66 | 0.23 | 2.17 | 0.25 | 2.54 | 0.27 | 2.03 | 0.25 |
| (MDR + P) | 0.37 | 0.117 | 3 | 0.28 | 3.51 | 0.24 | 1.88 | 0.26 | 2.29 | 0.24 | 2 | 0.22 |
| (MDR + G) | 1.03 | 0.139 | 4.2 | 0.29 | 4 | 0.18 | 2.54 | 0.32 | 2.8 | 0.28 | 2.94 | 0.25 |
| (B2) | 0.31 | 0.11 | 3.14 | 0.28 | 3.4 | 0.23 | 2.57 | 0.29 | 3.03 | 0.28 | 1.8 | 0.22 |

(B1) = Pre-study baseline; (WBTB) = Wake back to bed; (WBTB + P) = Wake back to bed + placebo; (WBTB + G) = Wake back to bed + galantamine; (MDR) = Meditation and Dream Reliving; (MDR + P) = Meditation and Dream Reliving + placebo; (MDR + G) = Meditation and Dream Reliving + galantamine; (B2) = Post-Study Baseline.

**Table 2**
Bonferroni pairwise comparisons and cohen *d* effect sizes.

| | (B1) | (WBTB) | (WBTB + P) | (WBTB + G) | (MDR) | (MDR + P) | (MDR + G) | (B2) |
|---|---|---|---|---|---|---|---|---|
| (B1) | | | | $L^2$ *d = 1.12*<br>$R^3$ *d = 1.01*<br>$I^3$ *d = 1.23*<br>$C^3$ *d = 1.27* | $I^2$ *d = 1.00*<br>$C^2$ *d = .84* | $I^2$ *d = .89*<br>$C^2$ *d = .43* | $L^2$ *d = 1.17*<br>$R^3$ *d = 1.40*<br>$I^3$ *d = 1.27*<br>$C^3$ *d = 1.00*<br>$F^2$ *d = .77* | $R^2$ *d = .66*<br>$I^2$ *d = .81*<br>$C^2$ *d = 1.14* |
| (WBTB) | | | | | | | $R^2$ *d = 1.05*<br>$F^1$ *d = .85* | |
| (WBTB + P) | | | | $L^1$ *d = .91** | | | $R^2$ *d = 1.01* | |
| (WBTB + G) | | | | | $L^1$ *d = .91** | $L^1$ *d = .95** | | $L^2$ *d = 1.05* |
| (MDR) | | | | | | | $L^1$ *d = .96*<br>$R^2$ *d = .87* | |
| (MDR + P) | | | | | | | $L^1$ *d = 1.00*<br>$R^1$ *d = .87* | |
| (MDR + G) | | | | | | | | $L^2$ *d = 1.15*<br>$F^1$ *d = .90* |
| (B2) | | | | | | | | |

(B1) = Pre-study baseline; (WBTB) = Wake back to bed; (WBTB + P) = Wake back to bed + placebo.
(WBTB + G) = Wake back to bed + galantamine; (MDR) = Meditation and Dream Reliving.
(MDR + P) = Meditation and Dream Reliving + placebo; (MDR + G) = Meditation and Dream Reliving + galantamine.
(B2) = Post-Study Baseline.
*L* = lucidity, *R* = reflectiveness, *I* = interactive behavior, *C* = constructive action, *F* = fear/threat, *d* = Cohen's *d* values.
[1] $p < .05$.
[2] $p < .01$.
[3] $p < .001$.

### 7.2. Pairwise comparisons, effect sizes, and hypothesis testing

#### 7.2.1. Lucidity

The null hypothesis was rejected ($F = 7.91$, $p < .01$, $\eta^2 = .19$), and pairwise comparisons and effect sizes are shown in Table 2 (*L* = Lucidity). In regard to the research hypotheses in Section 4.1, Hypothesis 1: WBTB + G > WBTB + P was supported ($p < .05$); Hypothesis 2: MDR + G > MDR + P was supported ($p < .05$), and Hypothesis 3: MDR + G > WBTB + G was not supported.

#### 7.2.2. Reflectiveness

The null hypothesis was rejected ($F = 7.54$, $p < .01$, $\eta^2 = .18$), and pairwise comparisons and effect sizes are shown in Table 2 (*R* = Reflectiveness). The ratings on reflectiveness revealed significant differences between MDR + G and every other condition except WBTB + G and B2, indicating that MDR + G worked synergistically to elevate levels of reflective awareness over non-galantamine conditions. It is also intriguing that B2 shows a possible carryover effect from the previous treatments by differing from B1. In regard to the research, Hypothesis 1: WBTB + G > WBTB + P. was not supported; Hypothesis 2: MDR + G > MDR + P was supported ($p < .01$); Hypothesis 3: MDR + G > WBTB + G was not supported.

#### 7.2.3. Interactive behavior

The null hypothesis was rejected ($F = 6.85$, $p < .01$, $\eta^2 = .17$), and pairwise comparisons and effect sizes are shown in Table 2 (*I* = Interactive Behavior). In summary, all of the conditions except WBTB and WBTB + P exceeded the levels of interactive iehavior over the initial baseline measure. This included the final baseline measure, suggesting a carryover effect, or an "adjustment effect" for the first night. In regard to the research hypotheses, Hypothesis 1: WBTB + G > WBTB + P was not supported; Hypothesis 2: MDR + G > MDR + P was not supported; Hypothesis 3: MDR + G > WBTB + G was not supported.

#### 7.2.4. Role change

The null hypothesis was rejected ($F = 2.31$, $p < .05$, $\eta^2 = .06$) However, none of the pairwise comparisons reached significance. In previous studies, this variable has figured least prominently in the measured effects, perhaps because judges have reported that this measure seems to be a dichotomous, categorical measure; that is, either present or not. Although the reliability coefficients for Role Change reached above .80 after two training sessions in one study (Sparrow, 1983), unless raters are afforded sufficient practice, feedback, and retraining, it seems to be a difficult variable to discern reliably.

#### 7.2.5. Constructive behavior

The null hypothesis was rejected ($F = 6.91$, $p < .01$, $\eta^2 = .17$), and pairwise comparisons and effect sizes are shown in Table 2 (*C* = Constructive Action). Mirroring the results of the Interactive Behavior scores, all of the conditions except WBTB and WBTB + P exceeded the levels of Constructive Behavior over the initial baseline condition (B1). This included the final baseline measure (B2), again suggesting a carryover effect, or an "adjustment effect" for the first night. In regard to the research hypotheses, Hypothesis 1:

**Table 3**
Combined galantamine conditions[1] vs. combined placebo conditions[2] on outcome measures.

| Outcome Measures | *M* difference | *SD* | df | t | Cohen's *d* |
|---|---|---|---|---|---|
| Lucidity | −1.25 | 1.7 | 34 | −4.65*** | 1.02 |
| Reflectiveness | −2.17 | 3.05 | 34 | −4.21*** | .80 |
| Interactive | −1.28 | 2.40 | 34 | −3.16** | .66 |
| Role Change | −1.00 | 3.55 | 34 | −1.66 | .36 |
| Constructive | −1.57 | 2.55 | 34 | −3.63* | .68 |
| Fear/Threat | −1.11 | 3.05 | 34 | −2.15* | .48 |

* $p < .05$.
** $p < .01$.
*** $p < .001$.
[1] WBTB + G and MDR + G.
[2] WBTB + P and MDR + P.

WBTB + G > WBTB + P was not supported; Hypothesis 2: MDR + G > MDR + P was not supported; Hypothesis 3: MDR + G > WBTB + G was not supported.

*7.2.6. Fear/threat/violence*

The null hypothesis was rejected ($F = 3.36$, $p < .01$, $\eta^2 = .09$), and pairwise comparisons and effect sizes are shown in Table 2 (*F* = Fear/Threat). Intriguingly, MDR + G alone showed significantly *higher* levels of this outcome measure when compared with three other conditions: B1, WBTB, and B2, indicating that the combination of meditation, dream reliving and galantamine carried over into the dream state as increased exposure, or re-exposure to distressing psychic content. This suggests that the use of MDR + G did not so much suppress past distressing content as activate a process of engagement with the distressing memory that could, in time, result in resolution, based on the paradigm of trauma resolution that currently prevails. In regard to the research hypotheses, Hypothesis 1: WBTB + G > WBTB + P was not supported; Hypothesis 2: MDR + G > MDR + P was not supported; Hypothesis 3: MDR + G > WBTB + G was not supported.

*7.2.7. Galantamine conditions v. placebo conditions*

As stated, there were no significant differences between the two galantamine conditions (4&7), and the two placebo conditions (3 &6) on all variables. Thus, we were justified in combining 4&7 and 3&6 and comparing them using Scheffé. We arrived at the following comparisons in Table 3. Differences were found on all outcome measures, except on Role Change ($p < .059$) indicating that galantamine has a broad-based impact on dream ego cognition and volition. The *increase* in fear/threat alongside these elevated levels of lucidity, reflectiveness, interactive behavior, and constructive behavior suggests, intriguingly, that galantamine may activate an awareness of unresolved conflict alongside the awareness and intentionality needed to reprocess it.

*7.2.8. Narrative data*

We collected all dreams recalled upon awakening for the eight nights of the study, thus creating a rich body of qualitative data that can be further examined using content analyses. While it is beyond the scope of this initial report to present and analyze this narrative data, isolated reports can provide a basis for generating hypotheses in future studies, as well as giving substance to the statistical findings. Clearly, the discovery that MDR + G enhances reflectiveness *and* increases the levels of fear/threat in subsequent dreams bears further examination. One might ask, How does this juxtaposition play out in the dream experience itself? Does it support the premise that heightened reflectiveness paired with increased exposure leads to resolution, or only re-exposure? While we cannot make any conclusions on the basis of isolated examples, the following dream, which occurred after MDR + G illustrates that this juxtaposition of awareness and perceived threat may facilitate integration, even while arousing initial discomfort in the dreamer. This dream also illustrates the influence of *pre-sleep intention* in setting the stage for voluntary exposure to the perceived threat.

> ...Now a few voices are raised and it gets loud with some people now are getting up off their chairs. About 10 or so people are now fighting in front of me and it's a bit of mess. The fight breaks up and they all wander away. I get up and move to the table where the fight was and see a lady's head on the table. It is a dark-skinned head and bald with gentle features. I pick the head up with two hands and place it mid-chest at my heart level and look to the corridor at the end of the room. The presence that has haunted me for a lifetime is lurking there. I have asked for it prior to dreaming and can feel the slightest tingle in my dream body as I look in that direction. Holding the head to my chest I start to walk into the corridor and into the darkness. The feeling starts to get stronger and stronger and my body is starting to get the feeling of dread that comes with it. Now the head is starting to heat up in my hands and is also going into my chest. It gets hotter and hotter and is now fully inside me and the feelings have changed to a hot radiant warmth that floods my body. I bask in this for a while as I slowly gain awareness and allow myself to wake up. I am now fully awake in my bed and still have this feeling flooding my body.

## 8. Discussion

The hypothesized advantage of galantamine over non-galantamine conditions was clearly evident in the Scheffé paired sample *t*-tests. However, the hypothesized effect of MDR + G over galantamine alone (MDR + G vs. WBTB + G) was not evident. In absolute terms, MDR + G produced higher scores on lucidity, reflectiveness, interactive behavior/engagement, and fear/threat/violence than all the other treatment and baseline conditions. As for statistical significance, it outperformed five out of seven of the other conditions on reflectiveness, and three out of seven conditions on fear/threat other conditions (while none of the other conditions rose to the level of significance). The two galantamine conditions were almost equal in facilitating lucidity, indicating that MDR did not significantly enhance the benefits of galantamine alone on lucidity scores, even though the increase due to MDR apparently boosted galantamine's levels over non-galantamine conditions on Reflectiveness and Fear/Threat, in particular.

It is intriguing that the placebo conditions (WBTB + P and MDR + P) showed no significant deviations from the baseline conditions, indicating that the placebo effect was nonexistent. Further, the B2 condition was significantly higher than placebo conditions in constructive behavior measures, and significantly higher than B1 on three out of four of the DDS subscale measures, as if to indicate that the study activities exerted a carryover effect during the second baseline night, or that the B1 condition represented an adjustment or transition night.

While there was enough of a placebo effect to prevent the individual galantamine conditions from significantly exceeding their respective placebo condition measures (except in the case of MDR + G exceeding the reflectiveness levels of both placebo conditions), the Sheffé t-tests comparing combined galantamine conditions against combined placebo conditions were significant on lucidity, reflectiveness, interactive behavior, and constructive behavior, and fear/threat (higher)—and nearly significant ($p = .059$) on role change. This is a robust finding, and supports the idea that galantamine facilitates lucidity and non-lucid positive dream ego attributes, alike, as well as arousing a sense of fear/threat over the course of the dream.

We did not expect that the level of fear/threat would be elevated in post-galantamine dreams, especially since our preliminary study on the recalled effects of galantamine (Sparrow et al., 2016) indicated that dreamers retrospectively recalled *lower* levels of fear, threat, and violence, as measured on three separate likert scales. On the surface, this contrast is puzzling, and might suggest that the subjects in the preliminary study may have been skewing their responses to justify or defend their practice of having used galantamine before. But since the current study involved scoring dream narratives immediately after experiencing them, it is possible that the subjects in the earlier study would have come to similar conclusions if they had analyzed their actual dream reports, rather than basing their responses on memory. Given the passage of time, the participants may have forgotten the actual dream content and remembered only the global impact of galantamine. Given the positive effects of galantamine on lucidity and the DDS subscale measures, it is possible that the participants in Sparrow et al. (2016) may have recalled an overall positive impact of galantamine, and forgotten the heightened levels of fear, threat, and violence. If so, then post-galantamine "negative" dream content may coincide with some degree of reprocessing and integration, leading perhaps to an amelioration of dream distress, and thus an overall positive assessment upon awakening.

### 8.1. Validity

This study included a variety of methodological features to address validity concerns, including a double-blind design, identical sealed packets for the six conditions, and efforts (snack and beverage) to mitigate the possible side effects of galantamine. Also, since the literature (Stumbrys et al., 2012) suggests that mere wakefulness (WBTB) may be a significant lucid dream induction strategy in itself, we included WBTB and WBTB + P conditions alongside a pre- and post-baseline condition, enabling us to assess the independent effect of wakefulness over baseline scores. As it turned out, wakefulness had no significant effect on outcome measures, and actually produced significantly lower ratings that the final baseline night (B2) on two measures. However, it should be noted that the WBTB period was only 40 min long, which may have been too brief to assess the independent impact of wakefulness on the outcome measures.

By randomizing the order of treatment conditions, we guarded against several validity threats, and by including capsules in all of the sealed treatment envelopes—whether empty, filled with an inert substance identical to the galantamine capsules, or containing galantamine—subjects had no way of anticipating the order of conditions on the basis of appearance and feel alone.

### 8.2. Limitations

The small sample size (n = 35) prevented sufficient cell size to conduct a multifactorial analysis that would have examined the Interactive Behavior of sex, prior meditation frequency, and prior lucid dream frequency. Ideally, this study would have been longer, have more subjects, and featured more than one night per condition. However, we took into account the sheer amount of work involved in an eight-night home-based regimen using uncompensated volunteers, and thus refrained from scheduling multiple trials of our six interventions. Consequently, there is no way to know if some of the absolute differences that occurred might have continued across multiple trials and become statistically significant, and whether preexisting factors of sex, prior meditation frequency, and prior lucid dream frequency would have shown a significant impact on the outcome measures.

Also, this study employed a self-selected sample, many of whom dropped out before beginning the study. Of those who started, most of them finished, even though eight did not recall enough dreams to justify inclusion according to our arbitrary cut-off of a minimum of four nights of dream recall. Thus, the final data set included less than half of the original group of people who originally expressed interest in participating. Further, the imputation of missing values in our final dataset introduced a degree of imprecision

that is undesirable, but necessary from the standpoint that we had only sixteen participants recall dreams on all eight nights.

Our decision to have participants score their own dreams can be considered a weakness, depending on your view what constitutes "ideal conditions" for the collection of dream reports (Windt, 2013). While we have previously involved independent judges (Sparrow, 1983; Sparrow et al., 2013) in assessing DDS and lucidity measures, we believed that only the actual participants could accurately assess, in particular, the presence of fear/threat/violence in their dreams—a highly subjective dimension that we did not include in the two earlier studies. Further, constructive behavior is difficult to assess, unless you understand a person's history and unique challenges. One person's constructive behavior can be another person's chronic reaction, and only an awareness of a person's psychological and interpersonal history can accurately make this discrimination. Again, leaving it up to the participants to determine whether a particular action was constructive seemed to represent the best approach to assessing this variable. Further, since the conditions were randomly assigned, and the participants remained blind to the study hypotheses as well, we believed that their self-ratings would not vary significantly by condition.

There is also the possibility that some of the participants were able to tell which capsules contained galantamine on the basis of side effects, or from observing the impact on their recalled dreams. Given that galantamine is known to produce nausea and headaches in some people, we should have ideally included an active placebo with noticeable, innocuous side effects to create the impression of active effects. Instead, we decided to mask galantamine's possible side effects by asking everyone to have a light snack and beverage before taking the active and placebo capsules, alike. Still, we had no way of knowing the degree to which participants were able to tell the difference between the placebo and galantamine capsules before returning sleep, or upon awakening as they considered any deviations from their normal dream experiences. Future galantamine studies could possibly include active placebos with similar side effect profiles, in order to prevent participants from discerning the active treatment condition before returning to sleep.

## 9. Conclusions

In summary, we conducted a double-blind study of the independent and combined impact of galantamine and Middle-of-the-night meditation + Dream Reliving, on subsequent dreams. Our findings indicate that further studies involving a combination of cognitive strategies with cholinesterase inhibitors may provide a way for the general population to achieve lucidity and the heightening of non-lucid desirable attributes in their dreams. While MDR paired with galantamine demonstrated insignificant increases on desirable outcome measures over galantamine alone, the absolute boost that MDR contributed to the galantamine effect resulted in significant differences between MDR + G and some non-galantamine conditions, especially on reflectiveness and fear/threat.

The integrated MDR + G protocol apparently produced heightened reflectiveness alongside an awareness of fear and threat. This "paradoxical" juxtaposition supports the idea that MDR + G may establish a dream-based context in which facilitative awareness can confront and reprocess unfinished business – a veritable "table in the presence of mine enemies." Our findings support the further exploration of this integrated protocol as a way to make greater dreamer awareness and responsiveness more accessible to the general population and to those who suffer from distressing dreams, for whom an integrative protocol such as MDR + G may finally bring dream-based nightmare and trauma resolution within reach of relatively inexperienced dreamers. Further studies with a clinical population seems warranted on the basis of these findings.

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