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Impact of attachment styles on dream recall and dream content: a test of the attachment hypothesis of REM sleep

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SUMMARY We tested the hypothesis (McNamara 1996; Zborowski and McNamara 1998) that dream recall and dream content would pattern with interpersonal attachment styles. In study I, college student volunteers were assessed on measures of attachment, dream recall, dream content and other psychologic measures. Results showed that participants who were classified as 'high' on an 'insecure attachment' scale were significantly more likely to (a) report a dream, (b) dream 'frequently', and (c) evidence more intense images that contextualize strong emotions in their dreams as compared with participants who scored low on the insecure attachment scale. In study II, 76 community dwelling elderly volunteers completed measures of attachment, and dream recall. Participants whose attachment style was classified as 'preoccupied' were significantly more likely to report a dream and to report dreams with higher mean number of words per dream as compared with participants classified as 'securely' attached or as 'avoidant' or as 'dismissing.' Dream recall was lowest for the avoidant subjects and highest for the preoccupied subjects. These data support the view that rapid eye movement (REM) sleep and/or dreaming function, in part, to promote attachment.

KEYWORDS attachment status, dream content, dream recall

INTRODUCTION

Throughout the mammalian kingdom, attachment-related variables influence a large range of psychobiologic functions in both the infant and the adult including, hormonal levels, responses to stress, timing and intensity of vocalizations, health and sleep parameters (Belsky and Nezoworski 1988; Hofer 1987; Kalin and Carnes 1984; Kraemer 1992; Reite and Field 1985). The sleep-attachment status relation is interesting because the effect is relatively selective: separation of an infant rat or an infant monkey from a caregiver results in disrupted rapid eye movement (REM) sleep in the despair phase (Hofer 1987). Reviewing the literature on sleep and attachment, McNamara (1996) and Zborowski and McNamara (1998) concluded that REM sleep and dreams may function, in part, to selectively influence and perhaps even promote attachment in the developing organism and in unattached or insecurely attached adults. If this hypothesis is correct for adult persons then certain dream-related variables such as dream recall rates and dream content might be influenced by attachment status. Before detailing our results concerning this prediction we summarize some of the relevant literature that points to an attachment-related function for REM sleep.

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Overlap of anatomy and physiology of attachment and REM sleep

In their review of the neuroanatomic structures that mediate attachment, Steklis and Kling (1985) concluded that limbic system sites (especially the amygdala), the anterior temporal

cortex and the orbital-medial frontal cortex were critical for attachment. Lesioning any of these three sites produces profound disruption in attachment processes. As Steklis and Kling point out, anterior temporal, orbitofrontal and selected amygdaloid nuclei are all part of the basal forebrain region and all synthesize sensory information (multimodal sensory information) with emotional information. Interestingly, these same limbic and mediobasal frontal regions are among the sites which evidence the highest activation levels during REM sleep (Hobson *et al*. 1998). In their review of positron emission tomograph (PET) studies of sites exhibiting increased activation (relative to a control baseline) associated with REM sleep, Hobson *et al*. (1998), found that limbic sites and mediobasal frontal cortex were among the most consistently activated brain regions during REM sleep. Thus, there appears to be some (not perfect) overlap between the anatomy of attachment and the anatomy of REM sleep.

REM sleep and attachment in early development

Hofer (1987) has reviewed the psychobiology of early attachment in mammals. Maternal deprivation (prolonged separation of the infant from the mother) is associated with disrupted and decreased REM sleep in the 'despair phase' of the separation (protest then despair) process. Disruption of REM sleep after mother–infant separation is also known to occur in humans and in most primate species (see Kalin and Carnes 1984; Reite and Capitanio 1985; Reite and Field 1985 for recent reviews on sleep-related and other consequences of attachment disruption). Hofer and colleagues have also shown that nursing (the paradigmatic attachment behavior) in the rat is controlled by an elaborate set of cues all embedded in sleep. Infants sleep while they are nursing and suck while they are asleep. Their sucking induces milk ejections (via oxytocin release) to occur in the mother. However oxytocin release in the mother cannot occur unless she is in slow wave sleep (SWS). Presumably when oxytocin release occurs in SWS, levels will peak with the onset of REM. The infant is apparently in active sleep while nursing as it undergoes periodic 30 s awakenings while at the nipple. Thus, both mother and infant can nurse even when cues are passed from one to the other during the sleep state.

Following Stern (1985), Hofer (1987) calls the aforementioned exquisitely timed sleep interactions between mother and infant 'attunement behaviors' or examples of synchrony between the mother and infant. Presumably synchrony cannot occur unless the infant and mother are in near proximity or cosleep. Bowlby (1988) spoke of attachment as proximity seeking behavior. In any case, it appears that biological synchrony between mother and infant allows the infant to entrain its rhythms to the mother's cycles, thus, helping the infant to begin to regulate its internal physiologic processes (Bernieri *et al*. 1988; Field 1985; Isabella and Belsky 1991). Interestingly, cosleeping (where child and parent sleep in close proximity) apparently is a near universal mammalian practice and up until the last century cosleeping was also practiced in virtually every human culture (McKenna 1993; McKenna *et al*. 1993; Sagi *et al*. 1994).

Neurohormonal processes in attachment and REM sleep

Attachment processes both in the developing organism and in the adult are mediated by specialized neurohormonal systems. Neurohypophysial hormones like oxytocin and vasopressin, as well as arginine vasotocin (AVT), seem to be especially important for attachment and other social and sexual behaviors (see individual chapters in Pedersen *et al*. 1992). The chemical composition of the three hormones differ in only a single amino acid. All three hormones promote sexual and social behaviors in a vast array of species. Oxytocin, for example, like REM sleep, is found exclusively in mammals (Insel 1992)[1]. It is synthesized in the hypothalamus and is released from the neurohypophysis to induce uterine contraction during labor and milk ejection during nursing. Oxytocin also functions as a neurotransmitter. Its synthesizing cells in the hypothalamus send efferents to widespread areas of the limbic system and frontal lobes making contact with specific receptors for oxytocin. When injected centrally it induces several of the behaviors associated with social bond formation in mammals (e.g. contact with young, care-taking behaviors, and species-typical reproductive behaviors) (Insel 1992). Oxytocin plays a central role in the expression of maternal behavior, sexual behavior, social bond formation, grooming, memory and learning, autonomic regulation, feeding and yawning (Argiolas and Gessa 1991). Interestingly, these are all behaviors that are noted to significantly change as a consequence of REM sleep deprivation (Ellman and Spielman 1991; Vogel 1993). Yawning is particularly interesting given its relation to sleep. When yawning is induced in rats via centrally administered oxytocin it is invariably associated with penile erection (Melis *et al*. 1992). Penile erections occur exclusively in the REM state during sleep (Hirshkowitz 1993). Oxytocin-induced erections can be prevented by depletion of oxytocin in the hypothalamic-hippocampal oxytocinergic pathway (Melis *et al*. 1992). This pathway, in turn, may play a role in regulation of the theta rhythm associated with REM sleep (Bohus *et al*. 1978). Finally, oxytocin appears to display a sleep-sensitive pattern of release in humans with peak levels occurring at about 04.00 am (when REM sleep begins to predominate over non-rapid eye movement (NREM) (Forsling 1993).

Arginine vasotocin is considered to be the evolutionary precursor to vasopressin (Pedersen *et al*. 1992). Both vasopressin and oxytocin promote various types of bonding behaviors in a range of mammalian species. Vasotocin promotes sexual behaviors in various nonmammalian species. Subcutaneous injection of AVT to human subjects causes a selective increase in REM sleep. Intranasal administration causes a dramatic enhancement of REM sleep indices. Lumbar cerebral spinal fluid (CSF) levels of AVT vary with REM sleep indices and AVT levels are abnormally high during REM sleep in narcoleptics (Borbely and Tobler 1989; Pavel *et al*. 1979). Finally, prolactin and testosterone levels vary with the stages

of sleep. Testosterone levels in males, for example, are highest at the transition from NREM stages to REM (see Borbely and Tobler 1989 for a review and critique of the literature on REM sleep-associated endogenous substances).

In summary, the physiologic processes that are known to regulate attachment behaviors are also implicated in regulation of REM sleep. We assume that REM sleep has several important physiologic functions. Our review of the literature on sleep and attachment suggests that one of these could be to promote or support attachment. In the infant REM sleep activation would do this by activation of behaviors (cooing, crying, smiling, suckling, etc.) that elicit care taking behaviors from the mother. In addition, REM sleep apparently activates physiologic structures important in nursing and proximity-seeking behaviors as well as synchrony and attunement behaviors more generally. In the adult, we suggest that activation of REM sleep may support attachment and affinity seeking behaviors by (a) sexual excitation (i.e. genital erection during REM sleep), (b) shaping of daytime behaviors through activation and processing of attachment-related emotional images when dreams are recalled, (c) construction of an 'internal working-model or search image' (Kraemer 1992) during dreaming and then shaping of affinity-seeking behaviors by this search image when dreams are recalled. In what follows, we investigate aspects of hypotheses b and c – the shaping of daytime behaviors through activation and processing of persistent attachment related images and content when dreams are recalled.

Measurement issues in attachment theory

A major feature of attachment theory is that close affectional bonds or attachment behavior is organized and regulated by means of a control system in the central nervous system. The developing infant uses the attachment system to orient its physiological responding to the caregiver. The caregiver acts as a kind of Zeitgeber for the infant until the infant begins to self-regulate its own biologic functions. Attachment also provides a protective function for the developing organism. Proximity to a caregiver reduces anxiety by protecting the juvenile from potentially hostile predators. The anxiety reducing function of secure attachment has been studied in the infant research of Ainsworth and colleagues. Using the separation and 'stranger paradigms', Ainsworth *et al*. (1978) defined three major patterns of attachment in the child. Secure children are able to use their caregivers as a secure base when faced with a stranger or separation from the caregiver. They have confidence that caregivers will be available if needed to attend to their protection and their needs. Anxious/ambivalent children respond to separation from the caregiver with intense distress and protest. These children do not have confidence that their caregivers will be available when needed. So-called avoidant children exhibit avoidance, apparent disinterest and detachment when separated from caregivers. These children expect little help from caregivers when in distress because of repeated past experiences of rejection and nonresponse from the caregiver.

On the basis of Ainsworth *et al*.'s descriptions of the behavioral and emotional characteristics of secure, ambivalent and avoidant-related attachment patterns in children, Hazan and Shaver (1987) developed a single item self-report measure of attachment style adapted to adult romantic relationships. Individuals are asked to indicate which one of the three attachment styles best describes their general orientation toward romantic involvements. Recent research on adult love relationships and attachments suggests strong similarities between adult attachment patterns and attachment patterns exhibited by children in response to separation from caregivers (Hazen and Shaver 1987; Shaver *et al*. 1988). During social development people presumably construct internal affective cognitive models of themselves, their target attachment figures and of the paradigmatic attachment patterns they experienced as children. According to this research secure individuals are comfortable with emotional closeness, and describe mental models of attachment figures as warm, accepting, affirming and responsive individuals. Anxious – ambivalent individuals desire extreme closeness to their partners and describe their mental models of attachment figures as inconsistent, unreliable, dependent and unsupportive individuals. Avoidant individuals are uncomfortable with closeness and describe rejecting, cold and unavailable attachment figures.

The attachment hypothesis of REM sleep would predict similar dream recall effects in securely attached vs. avoidant subjects. Securely attached subjects would not need to chronically activate neurobehavioral attachment circuits and avoidant subjects would attempt to inhibit activation of attachment systems. Thus, both groups of subjects should exhibit decreased rates of dream recall and emotional intensity within dreams relative to insecurely attached and/or preoccupied subjects who are interested in becoming attached. Insecurely attached (excluding avoidant subjects for purposes of study I) or *subjects preoccupied with attachment* should (a) dream more frequently or evidence better recall of dreams, (b) have more emotionally intense dreams, and (c) have more attachment-related themes in their dreams, than would their securely attached counterparts. To test these predictions, we compared securely attached subjects with insecurely attached or 'preoccupied' subjects on a number of dream variables. Avoidant subjects will be examined in study II.

STUDY I: ATTACHMENT STATUS, DREAM RECALL AND DREAM CONTENT

Methods

Subjects. Subjects were 300 undergraduate college students who participated for course credit and whose score on an infrequency scale was less than three, thereby eliminating those (2%) whose response style was unreliable. Mean age of the group was 19 years. Most were female (60%).

Procedures. Each participant completed a test battery consisting a demographic sheet, questions related to sleep and dream behaviors (e.g. dream recall frequency, nightmares, somnambulism, bruxism, night terrors, etc.), instructions for reporting a dream. The remainder of the battery was composed of scales that assessed 'object relations', including interpersonal dependency and depression.

Measures

Attachment status. Attachment status was measured with Bell's Object Relations and Reality Testing Inventory (BORRTI). The BORRTI is a 90-item, dichotomous, self-report inventory designed to provide an objective assessment of seven dimensions of ego functioning pertaining to object relations and reality testing (Bell *et al*. 1986). While factor analyses of this instrument have consistently yielded seven factors, four associated with object relations and three associated with reality testing, only the object relations dimensions were employed here. These are alienation (ALN), insecure attachment (IA), egocentricity (EGC) and social introversion (SI) factors. We used the IA factor to create two extreme attachment groups based on scores on the IA dimension: Subjects scoring high (2 SD above the group mean) on the factor were classified into the high IA group while those scoring low (2 SD below the mean) on the dimension were classified into the low IA group. We then randomly selected 50 individuals from each group to create the final two groups.

Dream recall frequency and dream length. Dream recall frequency was assessed by asking subjects to indicate how many dreams they recalled having each week. Dream length was counted as the number of relevant (nonextraneous) words used to describe the dream.

Dreaming and dream content measures. Dream content was scored by two bachelor's level research assistants who received extensive training in the scoring system. Following training and preliminary establishment of interrater reliability, the raters jointly rated an initial, intermediate and final subset of the dream protocols in order to ensure reliability throughout. Those variables with reliabilities of at least 0.65 were included in the analyses; those with lower reliabilities were excluded. The variables included were, dream length, emotional theme, emotional valence, ratings of aloneness, morbid content, bizarreness, intimacy, anxiety, pleasantness, sexualized content, and dreamer's involvement.

Emotional intensity. To derive a measure of the kind and intensity of emotional processing that occurred in the dreams of our subjects we used Hartmann's (1996, 1998) concept of the 'contextualizing image (CI)'. Following Hartmann (1998), we scored each dream report for images which appeared to contextualize strong emotions or current concerns of the dreamer. For example, a person attempting to integrate extremely powerful emotions such as terror, or rage or longing might use the image of a tidal wave that sweeps away all in its course as an initial attempt to cognize uncontrollable aspects of the emotion. As the integration process proceeds and the intensity of the emotion subsides other more controllable aspects of the emotion are contextualized and integrated. Translating concerns and emotions into more manageable images suggests a fairly intense amount of emotion occurring in the dream. Inter-rater reliabilities for these elements have been established and are fairly satisfactory (Hartmann 1998). CIs were scored for their presence and intensity (1 = least, 3 = most intense). We expected a greater number of CIs among insecurely attached subjects.

Emotion-related dream variables. Each dream was scored for the presence of 19 common emotions. The emotion types love and longing, were classified as attachment-related emotions. We expected that these emotion types would more often be found in the dreams of insecurely attached vs. securely attached subjects. Levels of aggression (1 = low, 5 = high), anxiety (1 = low, 6 = panic), and pleasantness (1 = very pleasant, 7 = very unpleasant) were scored separately. We also rated each dream for bizarreness: (1 = low, 5 = high), clarity of description: (1 = low, 5 = high) and morbid content: (1 = mild, 4 = severe). As re-activation of attachment related emotions and memories would more likely occur in the dreams of insecurely attached subjects we expected that dreams of insecurely attached subjects would evidence greater emotional lability than dreams of securely attached subjects.

Attachment-related content

Aloneness. Degree of aloneness (not at all = 1; very alone = 6) of the dream ego in the dream was scored. We applied a similar logic to ratings of connectedness (emotionally connected to others in dream: 1 = connected, 6 = not connected), dependency: (1 = low, 6 = high); intimacy: (1 = low, 6 = high), dreamer's involvement: (1 not present or observing, 2 present but…, 3 of primary importance), and sexual content (0 = none, 6 = strongly erotic behavior ascribed to self).

Fabricated dreams. The two dream content scorers scored each dream on whether or not the dream was real or made up on the spot to comply with the request to report a dream. The dream received a '1' (yes) if the scorer felt it was fabricated and a '0' (no) if it was not fabricated. The dreams that received a '1' from either scorer were omitted from any further analyses.

Sleep variables. Subjects indicated the average number of hours they slept each night, whether they had ever sleepwalked, whether tooth grinding was a problem, and whether and how often they had nightmares.

RESULTS

Dream length and dream recall. Mean length of dream report for low IA subjects was 91.5 words, for insecure subjects: 87.2 words ($t < 1$). High IA subjects reported recalling more dreams per week (M = 3.5 (2.0) than did low IA subjects (M = 2.7 (1.5) ($t(96) = 2.32$, $P = 0.024$ two-sided). Twenty-six percent (13/49) of high IA subjects recalled one or fewer dreams each week while only 16.6% (8/48) of low IA subjects reported recalling one or fewer dreams per week. Conversely, 28.5% (14/49) of low IA subjects recalled four or more dreams per week and 45.8% (22/48) of high IA or insecurely attached subjects recalled four or more dreams each week.

Dream content

Emotional intensity/contextualizing images. Mean intensity ratings on CIs were significantly higher among the high IA subjects (M = 0.87 (1.0)) than the low IA subjects (M = 0.50 (.72); $t(91) = -1.98$, $P < 0.05$ two-sided). Nevertheless, CIs were relatively rare in reports: only 25% of high IA dream reports and 14% of low IA subjects reports contained two or more CI (the frequency difference, however, was not statistically reliable).

Emotion-related dream content. Dream-related aggression levels (low IA: 1.44; high IA: 1.60; $t < 1$), anxiety levels (low IA: 2.51; high IA: 2.85; $t < 1$) or pleasantness ratings (low IA: 4.16; high IA: 4.67; $t < 1$) did not significantly vary by attachment status. There were no significant differences in ratings of clarity of description of dream content (low IA: 2.64; high IA: 2.60; $t < 1$); or in bizarreness ratings (low IA: 1.51; high IA: 1.72; $t < 1$), between the two groups. Dream reports of high IA Ss, however, were more likely to evidence morbid content than were reports of low IA Ss. Nineteen percent (9/47) of the dream reports of high IA subjects and only 2.2% (1/45) of the dream reports of low IA subjects received ratings of three or higher on the morbid content scale. The attachment-related emotion types of love and longing, were identified only infrequently in dream reports (only 10 of 97 reports) so no statistical test was conducted. Nevertheless mentions of love and longing occurred in 17.7% (8/45) of the dreams of insecurely attached and only 4.1% (2/48) of the dreams of low IA subjects.

Attachment-related content. There were no significant differences between the two attachment groups on aloneness ratings ($t < 1$), connectedness ratings ($t < 1$), dependency ratings ($t < 1$), dreamer involvement ($t < 1$) or sexualized content ($t < 1$).

Sleep behaviors. There were no significant differences between the two attachments groups on self-reported average number of hours of sleep per night (roughly 6.9 h; $t < 1$). IA subjects, however, evidenced higher mean numbers of sleepwalking episodes ($t(96) = -2.58$, $P = 0.03$, two sided); higher nightmare frequency ($t(96) = 2.53$, $P = 0.013$, two sided) and higher mean numbers of tooth grinding episodes ($t(96) = -2.58$, $P = 0.011$ two-sided).

DISCUSSION

Attachment status appears to have a significant effect on self-report measures of sleep and dreams. Insecurely attached subjects were more likely to recall a dream, more likely to evidence emotional intensity in the dream (as measured by the presence and intensity of CI), and more likely to express regressive or 'morbid' emotional content than their more securely attached counterparts. High IA subjects, were also more likely to report sleepwalking episodes, nightmares, and higher numbers of tooth grinding episodes as compared with their 'secure' counterparts. Nevertheless, we found no differences between high IA and low IA subjects on attachment-related dream content measures such as love and longing and aloneness ratings, connectedness ratings, dependency ratings, dreamer involvement or sexualized content.

We believe that these findings provide only mixed support for the attachment hypothesis on dream sleep. If dream sleep helps to promote attachment behaviors then insecurely attached subjects who want to become attached should utilize it more often than securely attached subjects. Thus, in line with the hypothesis unattached subjects were more likely to recall their dreams and more likely to reactivate regressive (morbid) infantile longings, and emotionally intense or charged images in their dreams. On the other hand, the attachment hypothesis also predicted that dream content for high IA subjects would be organized around promotion of attachment behaviors. Thus we expected to find greater numbers of attachment-related emotions and themes in dream reports of unattached subjects but, in the event, we did not. There were no differences between low and high IA subjects on content measures such as attachment related emotions like sexualized content or love and longing or similar interpersonal interactions. In summary, while the dream recall results and some of the intensity ratings support the attachment hypothesis, the content analyses do not support the hypothesis.

The 'reflective' vs. the 'compensatory' versions of the attachment hypothesis. We can go further and add that a simple version of the attachment hypothesis-namely that dream recall promotes attachment by directly reflecting the attachment status of the dreamer (the reflective hypothesis) was not supported. Nor do our data support a simple compensatory hypothesis-namely that dream recall promotes attachment by compensating for the waking status of the dreamer (an unattached subject would dream of being attached). If dreaming performs a compensatory function for dreamers then it might be expected that insecurely attached subjects would be rated as less alone than securely attached subjects. But we found no differences on aloneness ratings between the high and low IA groups. If on

the other hand dreams reflected current attachment status of the dreamer as part of the activation of attachment related motivational circuits then insecurely attached subjects would be rated as more alone than their securely attached counterparts. But again we found no such differences. In any case we do not argue for a compensatory hypothesis in this paper. Rather we claim that preoccupied or unattached subjects evidence better dream recall because they are activating attachment-related REM circuits and these higher REM activation levels spill over into waking life. Dream recall may be just an epiphenomenon of greater REM activation. Even if dream content per se was able to promote affinity seeking behaviors this need not be compensatory in nature. For example, it may be that the dreamer constructs a search image of a desired object in the dream and when dreams are recalled aspects of this search image guide or shape waking behavior. Dream content need not be compensatory (i.e. images of a happy attachment) or reflective (images of an unhappy dreamer) in order for dream content (a search image) to shape behavior. We therefore turn our attention to the attachment status by dream recall relation and will not discuss further the role of dream content.

Expanding the attachment measure and replicating the dream recall result. Given the supportive findings for the attachment hypothesis on dream recall and the nonsupportive findings on most dream content measures, we wanted to replicate the dream recall result using a more direct approach to categorizing attachment styles that aimed specifically at capturing adult attachment patterns. Bowlby (1988) had proposed that individuals internalize their experiences with caretakers such that they form internal working models of their own self-worth and of their expectations of care and support from significant others. Bartholomew (see Griffin and Bartholomew 1994) systematized Bowlby's conception of internal working models of self and colleagues by defining individual differences in adult attachment in terms of four underlying dimensions: positive vs. negative self image and positive vs. negative other image. Bartholomew's research has confirmed that these dimensions yield four corresponding adult attachment categories that can be reliably measured: secure (positive self and other), preoccupied (negative self – positive other), fearful or avoidant (negative of self and other), and dismissing (positive of self and negative of other). In our next study we used Griffin and Bartholomew's attachment classification system in order to examine dream recall rates as a function of these attachment categories. Based on results of study I the attachment hypothesis predicts that dream recall would be highest among the preoccupied subjects and lowest among the fearful/avoidant subjects with the other two groups falling between these two extremes. Pre-occupied subjects would be more likely to recall their dreams because they are unattached and want to become attached and so would experience greater REM sleep activation and therefore greater dream recall. Fearful/avoidant subjects, on the other hand, want to avoid attachments and so they would inhibit REM activation and report fewer recalled dreams. The secure subjects have already attained what REM sleep activation is designed to promote so REM sleep activation levels would be relatively low but not as low as avoidant subjects who actively inhibit REM and dream recall. Dismissing subjects (who dismiss others as worthy attachment objects) may experience normal levels of REM activation and dream recall but then would elaborate reasons for not pursuing objects.

Role of the frontal lobes in dream recall. We also wanted to collect pilot data on neuropsychologic mediators of dream recall. Some investigators have claimed that episodic memory recall is mediated by right frontal sites (Nyberg *et al.* 1996; Wheeler *et al.* 1997). Similarly, some aspects of dream recall appear to be influenced by frontal systems as well (Solms 1997). In addition, attachment behaviors appear to be mediated by limbic-frontal sites in both the infant and the adult (Davidson 1995). Davidson and colleagues found that right frontal activation is associated with separation distress and left-frontal activation with inhibition of the right frontal response. When an infant sleeps under solitary conditions he or she experiences right frontal activation (i.e. separation distress). If left-frontal regions are underdeveloped or unable to inhibit right frontal activation then the mother is needed to allay the attachment needs or the separation distress. In order to explore possible relationships between attachment status, dream recall and frontal lobe function we collected data on these factors from a group of adult volunteers.

STUDY II: REPLICATION AND EXTENSION

Methods

Participants. As part of an ongoing study of religiosity patterns and health we administered a series of psychological, health and religiosity measures to 76 volunteers recruited from Unitarian Universalist congregations across the United States (religiosity measures/findings will not be discussed here). Participants were between the ages of 50 and 82 (mean age = 68.7 (6.97)). Respondents rated their general health (GENHEALT) as quite good [7.5 (1.3) on a scale from 1 (very poor health) to 9 (no problems)]. None of the respondents were depressed according to self-report, or as measured by the depression subscale (DASSD mean = 4.75 compared with 5.28 in a nondepressed normative sample of persons aged 50–59 reported by Lovibond and Lovibond (1995; higher score = greater depression) of the Depression, Anxiety and Stress Scale (DASS). Similarly mean stress scores (DASSS: 22.8(7.9)) and mean anxiety scores (DASSA 18.4(5.9)) were within normal limits.

Measures

Attachment status. Griffin and Bartholomew (1994) describe the Relationship Scales Questionnaire (RSQ) designed to assess the four attachment patterns described above (secure,

dismissing, fearful/avoidant and preoccupied). The RSQ consists of 30 phrases describing relationship styles and preferences. For example, 'I am comfortable having other people depend on me,' or 'I am somewhat uncomfortable being close to others.' Participants rate themselves on a 5-point scale how well each items describes their characteristic style in close relationships. RSQ scores for each of the four attachment categories are derived by computing the mean of the items representing each prototype. Group membership is defined by taking the highest score on the four attachment ratings.

Dream recall. Subjects were instructed to: 'Please write down the last dream you remember having and describe it in as much detail as you can. Use the back of this sheet if necessary. At the end of the report feel free to tell us anything you think we need to know to understand the dream such as the general emotional tone (positive or negative) of the dream.'

Health index. Poor health may be associated with poor dream recall in the elderly. Respondents were asked to list number of recent doctor visits, number of recent illnesses and whether they were diagnosed by a doctor, number of chronic illnesses and whether these were diagnosed, level of discomfort for each illness, and number, type and dosage for each medication they take. For each respondent we quantified health status by creating a health index score that combined this health history information according to a set rules devised by the research team. Each protocol was scored by a physician according to the following rules: Each illness was given one or two points according to severity of illness (two points for more severe life threatening illnesses); an additional point if the illness was diagnosed (indicating that the subject had been seen by a doctor to treat the illness); and an additional point for each type of medication the subject was taking. After these points were summed the resultant was multiplied by mean level of discomfort (as indicated by the subject for each illness the subject listed). Mean health index score for the entire sample was 10.76 (10.46) and ranged from 0 to 37.0.

Neuropsychologic measures

Frontal tests. Dream recall may be related to frontal function (Solms 1997). In addition, Nyberg *et al*. (1996) and Wheeler *et al*. (1997) have shown that left frontal activation patterns (as measured by PET scan) are related to episodic memory encoding while right frontal activity is related to episodic memory retrieval. Frontal function was assessed with fluency tasks: the Design Fluency (DESFLU) task and the verbal alternating Category-letter Fluency (CATFLU2) task. These are standard, easy to administer frontal measures that index ability to initiate a response and to resist interference when implementing a response (Elfgren and Risberg 1998; Lezak 1995). For design fluency, participants are asked to draw as many simple line designs (that do not represent actual objects) as they can within the time allowed (1 min). The score is the total number of novel designs produced within the minute time limit. For the alternating fluency task participants are instructed to produce as many words as possible for a given letter and then category (in this case animals) and then to alternate between letter and category tasks. If any repetitions of items (perseverations) occur on the second category fluency task they are subtracted from the total score. We used the second category fluency score (after one alternation) as this would have captured the tendency to perseverate. Higher scores indicate less frontal impairment. An overall frontal function score was derived from a composite measure of the category fluency and design fluency scores.

Temporal lobe index. We assessed temporal lobe function using a Temporal Lobe signs Inventory (TLI, Persinger and Marakec 1991) that had been developed to work with patients with temporal lobe epilepsy. We used a 30-item version of the inventory where higher scores indicate greater temporal lobe activity. Scores could range between 30 and 120. Mean TLI score for this sample of persons was 53.0 (15.2).

Laterality quotient. We used the Edinburgh Handedness Inventory (Oldfield 1971), a 10-item questionnaire assessing lateral preferences for activities such as writing, throwing, drawing, striking a match, etc. to measure strength of hand preference. Scores (laterality quotients) could range between −100 (extreme left-handedness −100–0 (ambidexterity) and from 0 to +100 increasing right handedness. We follow McNamara *et al*. (1998) in defining 'nonright-handedness' as any participant with a score of 70 or below. McNamara *et al*. (1998) had found that nonright-handers were more likely to recall their dreams as compared with right handers and this dream recall effect had been 'partially' replicated by Hicks *et al*. (1999).

RESULTS

Attachment status and dream recall. Thirty-seven percent ($n = 29$) of participants were classified as 'dismissing', 31.2% ($n = 24$) as fearful/avoidant, 14.3% ($n = 11$) as 'preoccupied' and 13.0% ($n = 10$) as 'secure' (2 persons were not classifiable). Participants whose attachment style was classified as 'preoccupied' were significantly more likely to report a dream as compared with participants classified as 'securely' attached or as 'avoidant' or as 'dismissing.' 81.8% of 'preoccupied' participants recalled a dream while only 40.0% of 'secure'; 45.8% of 'dismissing' and 34.5% of 'avoidant' participants recalled a dream ($\chi^2 = 32.47$, d.f. $= 3$, $P < 0.0001$). Although 'preoccupied' participants evidenced a higher mean number of words per dream (66.2(49.6)) as compared with 'secure' (27.4(53.3)), 'fearful/avoidant' (30.3(50.9)), or 'dismissing' (34.6(63.4)) participants, there was great variability around these means and the differences were not statistically significant ($F < 1$) (Table 1). Mean number of words per dream was, however, inversely correlated with age ($r = -31$, $P = 0.006$), and positively correlated with score on the temporal lobe

activity index ($r = 0.26$, $P = 0.024$). There were no significant differences (F-tests all < 1) among the four attachment groups in terms of age, frontal scores (CATFLU2, DESFLU), mean words per dream (WDSDREAM), temporal lobe index (TLI), depression score (DASSD), stress score (DASSS), anxiety score (DASSA) and Health index score (HEALTHI) (See Table 1).

Neuropsychologic measures and dream recall. Non-recallers were significantly older ($t(74) = -3.30$, $P = 0.001$, two-sided); and evidenced a significantly higher mean laterality score ($t(74) = -2.04$, $P = 0.045$, two-sided). While there was a marginal effect ($t(71), = 1.86$, $P = 0.067$) for the temporal lobe index (TLI), there were no significant differences (by Bonferroni-corrected t-tests) between the dream recall groups on frontal scores (CATFLU2, DESFLU), depression score (DASSD), stress score (DASSS), anxiety score (DASSA) and Health index score (HEALTHI) (see Table 2). Inspection of the means in Table 2 reveal that dream recallers were slightly younger than nonrecallers and more strongly left-handed than nonrecallers. Dream recallers did not differ from nonrecallers in terms of depression, stress, anxiety levels, frontal lobe function or general health.

DISCUSSION

As the attachment hypothesis predicted, dream recall was lowest for the avoidant subjects and highest for the preoccupied subjects. Secure and dismissing subjects fell between these two extremes, again as predicted. These findings replicate a similar set of results from study I. These dream recall patterns were probably not because of differences in levels of health, depression, anxiety and stress among the four attachment groups as there were no such differences. Results were also probably not due to some special disposition of the preoccupied subjects to be more introspective and thus more inclined to remember their dreams. The dream recall data documented here patterned with interpersonal attachment status. Avoidant subjects were unlikely to recall their dreams while preoccupied subjects did recall their dreams. If a more fundamental disposition towards introspection were driving these results we would have expected that disposition to occur among secure, avoidant and dismissing subjects as well as preoccupied Ss.

Similarly, we believe it is unlikely that unwillingness to engage in self-revelation can account for low dream recall patterns among avoidant subjects. Avoidant subjects produced intermediate means on the health index and the depression scale indicating that they were just as willing as other subjects to share personal and health information. In addition, the length of dream reports obtained from avoidant subjects were no different from those obtained from secure subjects. Rather we believe these dream recall results may reflect the tendency of avoidant subjects to experience increased inhibition levels within REM sleep circuits. The low REM activation levels in turn make it more difficult to recall dreams during the waking state. Conversely, the attachment hypothesis suggests an explanation for high REM activation levels in preoccupied subjects – namely attachment promotion and regulation. Preoccupied subjects over-activate REM because REM functions as the attachment system in mammals. High REM activation levels spill over into waking cognition resulting in greater dream recall.

Laterality effect. Finally, in study II we found that, nonright handers were more likely to recall a dream as well but we found no interaction between attachment status and laterality

Table 1 Means by attachment status

Attachstatus		*Age*	*CATFLU2*	*DESFLU*	*WDSDREAM*	*TLI*	*DASSD*	*DASSS*	*DASSA*	*HEALTHI*
Dismissing	Mean	68.27	21.90	9.51	34.59	49.96	20.79	22.90	18.48	18.17
	n	29	29	29	29	29	29	29	29	29
	SD	7.88	9.91	5.48	63.39	13.17	8.87	7.32	5.90	22.03
Fearful	Mean	68.92	19.08	9.43	30.33	53.83	18.83	22.37	18.62	13.96
	n	24	24	23	24	23	24	24	24	24
	SD	6.12	5.49	4.90	50.98	19.01	6.46	9.60	6.53	21.08
Preoccupied	Mean	66.36	17.09	10.18	66.18	54.80	17.00	21.64	16.73	10.36
	n	11	11	11	11	10	11	11	11	11
	SD	7.54	5.77	8.13	89.67	11.48	4.27	7.49	4.43	8.44
Secure	Mean	70.00	23.50	9.70	27.40	55.30	17.90	20.00	18.50	24.07
	n	10	10	10	10	10	10	10	10	10
	SD	5.14	13.17	3.65	53.26	12.82	5.53	4.99	5.89	20.18
Incomplete data	Mean	73.50	28.00	8.00	8.00	44.00	16.00	24.00	18.00	14.50
	n	2	2	2	2	1	1	1	1	2
	SD	7.78	0.0000	0.0000	0.0000	0.	0.	0.	0.	10.60
Total	Mean	68.56	20.68	9.57	36.17	52.49	19.16	22.17	18.27	16.39
	n	76	76	75	76	73	75	75	75	76
	SD	6.93	8.77	5.40	62.33	14.86	7.14	7.78	5.80	19.84

CATFLU2, category fluency; DESFLU, design fluency; WDSDREAM, words per dream; TLI, temporal lobe inventory; DASSD, depression score; DASSS, stress score; DASSA, anxiety score; HEALTHI, health index.

Table 2 Neuropsychologic measures by dream recall

Group statistics	*Dream recall*	*n*	*Mean*	*SD*
Age	Yes	35	65.88	6.71
	No	41	70.85	6.32
CATFLU2	Yes	35	20.60	6.49
	No	41	20.75	10.40
DESFLU	Yes	34	10.47	5.56
	No	41	8.82	5.21
TLI	Yes	33	56.00	13.85
	No	40	49.6	15.20
HEALTHI	Yes	35	16.17	19.79
	No	41	16.57	20.12
DASSD	Yes	34	20.08	8.44
	No	41	18.39	5.85
DASSS	Yes	34	22.35	8.74
	No	41	22.02	6.98
DASSA	Yes	34	18.70	6.70
	No	41	17.90	4.99
LQ	Yes	35	77.71	34.47
	No	41	91.34	23.29

CATFLU2, category fluency; DESFLU, design fluency; TLI, temporal lobe index; HEALTHI, health index; DASSD, depression score; DASSS, stress score; DASSA, anxiety score; LQ, laterality quotient.

status. This laterality effect on dream recall, while not related to attachment status, replicates a similar finding published by McNamara *et al*. in 1998 and Hicks *et al*. in 1999.

OVERALL DISCUSSION

In two studies of dream recall and dream content from two separate populations and using different measures of attachment style and dream recall, we tested the attachment hypothesis of REM sleep and dreaming (McNamara 1996; Zborowski and McNamara 1998). That hypothesis predicts that dream recall and dream content would pattern with interpersonal attachment styles. In study I, two groups of college student volunteers who scored at the extremes of an attachment scale were assessed on measures of dream recall, dream content and other psychologic measures. Results showed that participants who were classified as 'high' on the 'insecure attachment' scale were significantly more likely to (a) report a dream, (b) dream 'frequently', and (c) evidence emotional intensity in their dreams as compared with participants who scored low on the insecure attachment scale. In study II, 76 community dwelling elderly volunteers completed measures of attachment, dream recall, and frontal function. Participants whose attachment style was classified as 'preoccupied' were significantly more likely to report a dream and tended to report dreams with higher mean number of words per dream as compared with participants classified as 'securely' attached or as 'avoidant' or as 'dismissing'. Dream recall was lowest for the avoidant subjects and highest for the preoccupied subjects. These data support the view that REM sleep and dreaming functions, in part, to promote attachment.

How exactly would dreaming support or promote attachment-seeking behaviors in the adult? As discussed in the introduction one possibility is that REM sleep involves activation of brain and neurohormonal systems implicated in emotional and attachment systems. While we believe that REM does in fact do this it is not clear how such activation during sleep would translate into daytime attachment seeking behaviors. Also REM deprivation experiments suggest that REM sleep involves a dampening or regulation of drive states rather than enhancement of such states (Dement 1960; Goodenough 1991). Another possibility is that dreaming shapes daytime behaviors through activation and processing of persistent attachment related themes in dream content. Certainly 'relationship' themes are quite frequent in dreams. Domhoff (1996) found that dream reports were typically fairly representative of waking thoughts and concerns of the dreamer and that people in dreams were generally relatives or close friends, etc. Here are two randomly chosen dream reports from study I (college students) that illustrate the presence of attachment-related themes:

> The most recent dream I had was last night. In my dream, it was night time and I was at a crowded party, and I only knew a few people there. This guy from my psychology class then walks up to me (who in reality I have never met before, only seen) and asks me to be his date for the evening. The rest of the night we just walked up and down the street, and there was a party at every house, and that's all we did was go party-hopping…

> My dream took place last night. I had a dream, that this girl, Shannon I know was in the store, across from where I work, and I don't like her. She noticed I was in the store and began running down the street. I was chasing her. Then all of a sudden her sister was walking toward me with another girl with a picture in her hand. The picture was of my steady boyfriend of 2½ years and a couple of his friend(s), also about five girls, one of which my boyfriend was kissing on the cheek. The picture was recent, so I asked him and he said he wasn't cheating on me and I was crazy. I told him that he had been lying because he was wearing a sweatshirt his mother bought him this past Christmas. I was very hurt in the dream.

It is, of course, not surprising that attachment related themes should occur in the dreams of young female college students, but we find it unsurprising because we all assume, since Freud (1900, 1953), that dreaming has some function to perform with regard to emotional adjustment and sexual wish-fulfillment. The attachment hypothesis makes these assumptions more explicit and testable. As these examples also illustrate and as our negative results with the dream content data in study I showed: dreams do not generally provide a picture of the desired end-state, i.e. of 'successful attachment' – at least not in avoidant or preoccupied persons. They are not compensatory with respect to attachment status. Indeed, most studies of

dream emotional content show that most of dreams are classified as negative (Domhoff 1996). This consistently negative emotional atmosphere suggests that dreaming promotes attachment by doing unpleasant 'cognitive and emotional work' around attachment issues for these individuals. In study I we did find evidence that high insecure or unattached subjects evidenced higher levels of emotional intensity in their dreams. Hartmann (1998) has suggested a similar kind of 'therapeutic' function for dreams. There is fairly abundant evidence that dreams do involve serious emotional work (Cartwright 1991, 1993; Cartwright *et al*. 1991; and see papers in Moffitt *et al*. 1993). We have seen that part of this emotional work accomplished in the dream may involve the contextualizing of emotional stress via specialized images. Here is a dream containing a CI from a subject classified as 'avoidant':

> I was 17 again. I had a stepfather that physically and mentally abused my mother and I.
>
> I had a dream about 3 weeks ago that I had to run over shards of glass barefoot to get away from my stepfather. I could see and feel the glass bloodying up my feet but I just kept running. It was like a big garbage dump with dwellings around it. It was very weird and realistic.

The CI here is the running over shards of glass to escape an abusing stepfather. The attempts to free oneself from such a past are no doubt painful and 'bloodying.' The dream provides the dreamer with an image that can be worked with to change the emotional climate the dreamer must cope with. If we followed this dreamer longitudinally we would expect those shards of glass to change into stones perhaps and then diminish and disappear as she arrived at a safe place away from the abusing stepfather.

Although it is far from clear that dream content functions to promote attachment, it is clear from our studies that attachment status is related to the tendency to recall a dream. This is, to our knowledge, an entirely new empirical finding in the literature on dream recall – a finding predicted by the attachment hypothesis.

In conclusion, we wish to emphasize the fact that we do not believe attachment is the only function of dreaming. Rather dreaming probably has several functions (Moffitt *et al*. 1993). The importance of attachment-related functions of REM sleep and/or dreaming, however, should not be underestimated.

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[1] Some species of birds experience REM-like episodes. Interestingly, some species of birds are, like mammals, born in an immature state, but it is not yet known whether these are the same species who demonstrate signs of REM. In the mammalian kingdom proportion of time spent in REM sleep varies with altriciality of the species (Siegel 1993; Zepelin 1989). Opossums and ferrets, for example, are born in an extremely immature state. These animals devote about 30% of their total sleep time to REM (Siegel 1993). In terms of altriciality humans are intermediate between opossums/ferrets and horses/elephants. Not surprisingly therefore adult humans spend a little less time (24% of total sleep time) in REM sleep relative to opossums/ferrets, and a little more time in REM than horses/elephants (who spend approximately 22% of their total sleep time in REM). Thus, REM sleep seems to be critically important for some aspect of development in altricial species.