Evidence for the Preferential Incorporation of Emotional Waking-Life Experiences into Dreams

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The continuity hypothesis of dreaming states that waking life is continuous with dreams, but many of the factors that have been postulated to influence wake–dream continuity have rarely been studied. The present study investigated whether certain factors—emotional and stressfulness intensity, and certain types of experiences—influence the likelihood of a waking-life experience being incorporated into a dream. Participants (N = 32) kept dream diaries and waking-life experience logs for 14 consecutive days, and waking-life experiences were matched to dream reports. Waking-life experiences that were incorporated into dreams were significantly more emotional, but no more stressful, than those that were not incorporated into dreams. Major daily activities were incorporated significantly less than the combination of personally significant experiences, major concerns, and novel experiences. Results are discussed in terms of dream functionality, particularly in relation to a postulated emotional memory assimilation theory of dream function.

Keywords: dreaming, emotional memory, continuity hypothesis, dream function

The continuity hypothesis of dreaming states that waking-life experiences (which may include activities, thoughts, and emotions) are continued or carried over into dreams, and that dreams are continued into waking life (e.g., Hall & Nordby, 1972; Schredl, 2012; Schredl & Hoffman, 2003). It has been suggested that there are factors that may influence whether or not a waking-life experience is incorporated into a dream, such as the emotional intensity of the experience and the type of the waking-life experience (Schredl, 2002). The concept that there are certain factors that can influence wake–dream continuity has bearing on potential functions of dreaming of waking life. For example, if emotion is a factor that affects wake–dream continuity, it might be that dreaming has some role in processing or

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integrating waking-life emotions, as is thought by many current sleep and dream researchers (e.g., Desseilles et al., 2010; Payne, 2010; Walker, 2009; Wamsley & Stickgold, 2011). This paper presents the results of a study designed to investigate the question of whether certain factors—emotional intensity, stressfulness intensity, as well as certain types of experiences (everyday, personally significant, concerning, and novel)—influence the likelihood of a waking-life experience being incorporated into a dream.

Many studies indicate that the emotionality of a waking-life experience influences its incorporation into a dream. In early laboratory-based studies of dream research, it was found that directly influencing dream content by exposing participants to presleep stimuli, such as arousing films. was difficult to achieve, but that affecting the emotional tenor of dreams was relatively easy (e.g., Cartwright et al., 1969; Foulkes & Rechtschaffen, 1964; Goodenough et al., 1975; Kuiken et al., 1991; Lauer et al., 1987; Witkin, 1969), indicating that dream emotions are easier to influence than dream content directly. In addition, the fact that there is a well-documented effect of the experimental situation on dream content, and that this was particularly true in the early years of sleep research when the equipment used was less well-known and thus perhaps more anxiety-provoking for participants, may also illustrate the influence of emotionality on wake–dream continuity (Schredl, 2008). Further, the underrepresentation of cognitively focused activities (such as reading) and everyday concerns (such as finances), and the overrepresentation of activities such as talking with friends and other social interactions (Hartmann, 2000; McNamara et al., 2005; Roussy, 2000; Roussy et al., 1996; Schredl, 2000; Schredl & Erlacher, 2008; Schredl & Hoffman, 2003; Schredl et al., 2009), may also indicate that emotionally laden waking-life activities continue into dreams more than others (Schredl & Hoffman, 2003).

A study by Schredl (2006) provides strong evidence for this notion. Participants rated the emotional intensity and emotional valence of their waking-life experiences, and recorded their dreams, for two weeks. It was found that waking-life experiences that were incorporated into dreams were significantly more emotionally intense than those that were not incorporated, but that emotional valence did not differ. Thus, for both positive and negative waking-life experiences, emotional intensity influenced wake–dream continuity. Although this is good evidence for the emotionality of an experience being a factor that affects continuity, the paper acknowledges that effect size was small, perhaps due to the small sample (only 64 dreams), so this result requires replication.

Intensely emotional waking-life experiences, particularly those that are negative, may also be expected to be 'stressful,' where stress is a negative and aversive state (Kasl, 1995), with both physiological components such as raised heart rate and psychological components such as anxiety (Levi, 1995). Several researchers have suggested that stressful waking-life experiences are also preferentially incorporated into dreams, indicating that stressfulness, as well as emotionality, may be a factor that influences continuity (e.g., Breger, 1967; Koulack, 1993; Picchioni et al., 2002; Wright & Koulack, 1987). For example, dreams are very clearly affected by traumatic experiences (see reviews by, e.g., Barrett (1996) and Punamäki (2007)), and other more common stressful waking-life experiences such as surgery (Breger, Hunter, & Lane, 1971) and divorce (Cartwright, 1991, 2011; Cartwright et al., 1984; Cartwright et al., 2001; Cartwright et al., 2006). However, although some experi-

mental studies have found measurable effects of stressful experiences on dreams, mostly in terms of dream affect (de Koninck & Brunette, 1991; de Koninck & Koulack, 1975; Koulack et al., 1985), a naturalistic study found no effect either in terms of direct or indirect incorporations, or changes to dream affect (Delorme et al., 2002). The authors of the latter study suggested that the stress created by examinations (the stressor) may not have been great enough to elicit direct incorporations. They did find, however, that students who did not dream of their examinations used problem-solving in waking life most frequently, and that students who used positive reappraisal in waking life used problem-solving in dreams. This, it was suggested, may mean that the problem-solving strategy "worked" in waking life, negating the need for incorporation in dreams, whereas the positive reappraisal strategy simply made the problem seem less distressing but did not actually solve it, necessitating the need for problem-solving incorporations in dreams.

Negative emotion and stress can be experienced independently. Negative emotion can be conceived of as a negative mood, feeling or state encompassing of which the dreamer is aware, and can be identifiable individually (such as sadness, anger, apprehension, confusion), although stress can be conceived of as a negative and aversive state of arousal with both psychological components such as feelings of anxiety and physical components such as raised heart rate.

In addition to the potential for the emotionality and stressfulness of a waking-life experience being factors of influence in wake–dream continuity, there is evidence to suggest that other aspects of the type of the waking-life experience may influence its incorporation into a dream. For example, de Koninck and Brunette (1991) suggested that the lack of direct effect on dreams of the stressor in their study may be explained by the stressor being less relevant in participants' lives than their other real-life concerns. Indeed, studies have demonstrated that both with and without presleep suggestion, participants dream of their waking-life concerns (Hoelscher et al., 1981; Nikles et al., 1998; Saredi et al., 1997), and a vast body of research utilizing the content analysis of dream series has illustrated that dreams reflect waking-life concerns (e.g., Domhoff, 1996, 2003, 2011; Hall, 1953; Hall & Nordby, 1972). Many researchers have, on the basis of such results, suggested that waking-life concerns may be preferentially incorporated into dreams (e.g., Davidson, Lee-Archer & Sanders, 2005; Domhoff, Meyer-Gomes & Schredl, 2006; Hartmann, 1996). On the other hand, other studies have found that independent judges were not able to match either presleep thoughts or significant concerns to dream material (Roussy, 2000; Roussy et al., 1996), and some aspects of dreams in content analysis studies do not relate to participants' concerns, such as guns and kittens for one participant (Domhoff, 2003). Thus, there is some evidence for concern being an influence on continuity, but it is not conclusive.

Two other factors of potential influence on wake–dream continuity, both of which were investigated in the present study, are the novelty of the waking-life experience and the personal significance of the waking-life experience. Fosse et al. (2003) investigated the presence of episodic memories in dreams, and found that very few dreams (<2%) contained intact episodic memories, but that 65% of the dreams contained episodic memory *entries*, suggesting that episodic memory elements may be fragmentarily incorporated during sleep. Schwartz (2003) postulated that the fragments may be preferentially incorporated due to their novelty or

salience. For example, the experimental situation, which, as noted, is often incorporated into participants' dreams and was speculated by Schredl (2008) to be due to the emotionality of the situation, may rather be due to the novelty of the situation (Schwartz & Maquet, 2002). Similarly, Desseilles et al. (2010) postulated that the novel and/or "individually relevant" (p.1000) features of waking-life experiences may be selectively incorporated for consolidation and integration into the memory system. Likewise, other researchers have hypothesized that dreams may reflect the consolidation of novel information: for example, Payne and Nadel (2004) suggested that dreams reflect the memory integration processes of weaving in new information into old material, and Stickgold et al. (2001) suggested that dreams reflect the process of novel cortical associations being identified and evaluated in the brain. These ideas all indicate that novel and/or personally significant experiences may be preferentially incorporated into dreams to be assimilated into and/or evaluated by the wider memory system.

The evidence presented above indicates that the emotional intensity and the stressfulness intensity of a waking-life experience may affect its incorporation into a dream, and that concerns, novel experiences, and/or personally significant experiences may be preferentially incorporated into dreams over other kinds of experiences. Concomitantly, it may be expected that experiences that do not stand out (and may be deemed "everyday") are less likely to be incorporated into dreams than those that do. These hypotheses were all tested in the present study.

METHOD

Participants

Participants were recruited from the participation credit scheme at Leeds Metropolitan University, England (in which undergraduate psychology students participate for course credits) and via opportunity sample. Participants (26 women, 6 men) ~~and~~ 16 Leeds Metropolitan University undergraduates who were acquaintances of the researchers) ~~were recruited,~~ with an age range of 19 to 55 years of age (M = 26.44, SD = 9.40). The number of dreams collected in total was 328, with a mean of 9.91 dreams per participant (SD = 4.87). AQ: 1

Design

The dream-diary paradigm was employed over 14 consecutive days. Participants were requested to record as many of their dreams as possible, in as much detail as possible but without post hoc elaboration, upon awakening from sleep at any part of the night or in the morning. In addition, waking-life experiences were collected in a daily activity log. For this, participants were requested to record up to five each of the following waking-life experiences: major daily activities (MDAs), that is, everyday experiences that take up much of the day (such as working, eating, and traveling); personally significant experiences (PSEs); major concerns (MCs); and novel experiences (NEs), for each day of the study. Participants were given instructions on what each of the types of activities constituted. This design followed

that of Fosse et al. (2003), with the exception of NEs, which was added for the purposes of the present study. For each waking-life experience and dream, participants were requested to rate the emotional intensity and stressfulness intensity on a scale of 0 (*not at all intense*) to 9 (*very intense*). Participants were also requested to provide a report of how each dream related to their waking life, and rate the individual waking-life elements that appeared in the dream, such as characters or objects, for wake–dream similarity on a scale of 1 (*no similarity*) to 5 (*identical*).

Waking-life experiences were then categorized as "incorporated into a dream" or "not incorporated into a dream." A waking experience was deemed to be incorporated if there was an unambiguous match between the waking-life associations the participant made to the dream and the waking-life experience reported in the log. For example, a participant reported a phone call with her mother as a PSE, and in the waking-life report following a dream from that night, she wrote: "I think the phone conversation with my mum had much to do with the worry, turned it into a report of death in the brief dream." Thus, this was scored as an incorporation.

Materials

Participants were given a booklet in which to record their dreams and waking-life experiences for 14 consecutive days. The front page contained the instructions on how to record dreams, waking-life experiences, and wake–dream relations. The remainder of the booklet comprised one daily activity log and three dream logs for each day of the study (14 days in total, a total of 14 daily activity and 42 dream logs). Each dream log contained one A4 page for participants to describe the dream and rate it for emotionality and stressfulness on a scale of 0 (*not at all intense*) to 9 (*very intense*). On the back of this page was space for participants to identify up to 20 elements (characters, objects, actions, locations, emotions, and themes) of the dream that seemed to them to relate to a waking-life experience, and record the degree of similarity between the dream and the waking experience on a scale of 1 (*no similarity*) to 5 (*identical*). Finally, space was provided for participants to describe the waking-life experience(s) to which they believed the dream was related.

Procedure

Each participant met with the researcher and was given the booklet. Participants were requested to follow the instructions within the booklet and return them after they had completed the 14 consecutive days of the study. Each day, participants completed their daily activity logs in the evening before they went to bed, reported their dreams upon awakening in the morning, and then considered the relationship between the dream elements and their waking lives.

The study abided by British Psychological Society ethical guidelines, and received local approval from an institutional panel at Leeds Metropolitan University.

Analyses

Analyses aimed to test the predictions of the two areas of study: the effect of the emotional intensity and the stressfulness intensity of the waking-life experience and the effect of the type of waking-life experience (in terms of concern, personal significance, novelty, and "everydayness").

For the emotionality and stressfulness analysis, average emotionality and stressfulness ratings for incorporated and unincorporated waking-life experiences were calculated for each participant, and the means for the incorporated experiences were compared against the means for the unincorporated experiences. It was hypothesized that waking-life experiences that were incorporated into dreams would have significantly higher emotionality and stressfulness ratings than waking-life experiences that were not incorporated into dreams.

For the type of waking-life experience analyses, a proportion of incorporation for each of the four types of experience was first calculated for each participant by summing the number of times a type of experience was incorporated into a dream, and dividing by the total number of that type of experience. For example, if a participant incorporated 10 of the 50 major daily activities (MDAs) they reported into a dream, their MDA incorporation rate would be 1/5 = 0.2 (20%). If a certain activity was repeated more than once across the 14 days, specific incorporations were included only once, although all incidents of the activity were included in the activities denominator. For example, if on one night a participant dreamt of something to do with making the previous night's dinner, and a total of five activities were recorded to do with making dinner, this would be counted as one incorporation, and five activities in the denominator. This calculation was performed on the other three types of experience also. It was hypothesized that PSEs, MCs, and NEs would each be incorporated into dreams more than MDAs, and that MDAs would be incorporated less than the three other experiences, both individually and all together.

RESULTS

Emotionality and Stressfulness Analyses

Three participants' data were excluded from these analyses because they did not report emotionality and/or stressfulness for their waking-life experiences; therefore the *N* was reduced to 29. Average emotionality and stressfulness scores were calculated for each participant for incorporated experiences and unincorporated experiences. These means across participants (rather than across individual dreams) are given in Table 1. T1

As can be seen from Table 1, emotionality for incorporated experiences was rated the highest on average. Stressfulness of unincorporated experiences was rated much lower on average. All four sets of data (emotionality and stressfulness of incorporated and unincorporated activities) were normally distributed, so repeated-measures *t* tests were used: Emotionality stressfulness ratings for incorporated and unincorporated experiences were compared. Because two tests were being performed, the alpha level was Bonferroni-corrected to .025. As predicted,

Table 1. Average Participant Ratings for Emotionality and Stressfulness of Waking-Life Experiences

Experience	Mean (*SD*)
Emotionality of all waking-life experiences	4.50 (1.92)
Emotionality of incorporated waking-life experiences	4.97 (2.00)
Emotionality of non-incorporated waking-life experiences	4.03 (1.17)
Stressfulness of all waking-life experiences	3.08 (1.63)
Stressfulness of incorporated waking-life experiences	3.25 (2.00)
Stressfulness of non-incorporated waking-life experiences	2.91 (1.17)

waking-life experiences that were incorporated into dreams were significantly more emotionally intense ($M = 4.97$, $SD = 2.00$) than waking experiences that were not incorporated into dreams ($M = 4.03$, $SD = 1.17$), $t(28) = 3.45$, $p < .01$, $r = .55$. This is a large effect, according to ~~Cohen (1988), (1992), and~~ Field, (2009). However, AQ: 2 contrary to the hypothesis, there was no significant difference between stressfulness ratings of waking experiences that were incorporated into dreams ($M = 3.25$, $SD = 2.00$) and those that were not incorporated ($M = 2.91$, $SD = 1.17$), $t(28) = 1.02$, $p > .025$.

Type of Waking-Life Experience Analyses

A proportion of incorporation for each waking-life experience was calculated, as described in the Method section. The distribution of each type of activity is shown in Table 2. T2

As Table 2 shows, MDAs were overrepresented among participants, with a mean of almost 40 MDAs reported per participant. MCs were much less common, with a mean of almost 14 MCs reported per participant. NEs and PSEs were comparatively underrepresented, with means of 5 and 3 per participant, respectively. NEs and PSEs also had minimums of 0, indicating that some participants did not record any NEs or PSEs over the course of the 2 weeks. However, although more MDAs were reported than the other types of experience, they were less incorporated: a 5% incorporation rate, compared with NEs, PSEs, and MCs, which had incorporation rates between 11% and 12%. The emotional intensity of the four experiences differed little, with only NEs displaying a clear difference in emotionality, in that they were less emotionally intense, on average, than the other three experiences, which were all similar in their emotional intensity.

Because the data for PSEs, MCs, and NEs were non-normal, a Friedman's ANOVA by rank was performed on the data to examine whether there was a

Table 2. Distribution of Each Type of Experience

Experience type	Mean number reported (*SD*); max 70	Mean proportion of incorporation (*SD*)	Mean emotional intensity (*SD*)
Major daily activities	39.5 (16.56)	0.05 (0.04)	5.93 (2.16)
Personally significant experiences	3.36 (2.38)	0.12 (0.19)	5.45 (2.49)
Major concerns	13.89 (9.42)	0.11 (0.13)	5.55 (2.31)
Novel experiences	5.43 (5.51)	0.11 (0.19)	4.23 (2.33)

difference in the frequency with which the four types of waking-life experiences were incorporated into dreams. It was found that there was no significant difference in the proportion of incorporations of MDAs, PSEs, MCs, and NEs, $\chi^2(3) = 3.70$, $p > .05$.

It was also tested whether there was a difference in frequency of incorporation between MDAs and the other three types of experience combined. For this analysis, the data (MDAs and (PSEs + MCs + NEs)/3) were normally distributed, so a repeated-measures t test was used to compare the proportion of MDAs that were incorporated into a dream with the proportion non-MDAs (PSEs + MCs + NEs)/3) that were incorporated into a dream. MDAs ($M = 0.05$, $SD = 0.04$) were incorporated into dreams significantly less frequently than non-MDAs ($M = 0.11$, $SD = 0.09$), $t(22) = -3.10$, $p < .01$, $r = .51$. This is a large effect size according to Cohen (1988), (1992), and Field, (2009). AQ: 3 AQ: 4

In addition, for a complete understanding of the data, each type of experience was compared against the combination of the other three also. There were no significant differences in the proportion of incorporation of PSEs and the others, (MDAs + MCs + NEs)/3, MCs and the others, (MDAs + PSEs + NEs)/3 and NEs and the others, (MDAs + PSEs + MCs)/3; all ps $> .05$). AQ: 5

DISCUSSION

The study found that waking-life experiences that were incorporated into dreams were significantly more emotional, but not more stressful, than waking-life experiences that were not incorporated into dreams, and that there was no significant difference in the proportion with which major daily activities, personally significant experiences, major concerns, and novel experiences each were incorporated into dreams, but when the latter three were combined, major daily activities were incorporated significantly less than the others. From these results, three main questions require consideration. First, why were emotional waking-life experiences preferentially incorporated into dreams? Second, why were stressful waking-life experiences *not* preferentially incorporated into dreams? And third, why were major daily activities incorporated less frequently than other types of experiences combined, but none of the others were incorporated more frequently than major daily activities?

On the matter of why intensely emotional experiences were preferentially incorporated into dreams (a replication with a larger sample of Schredl's (2006) results), it can be suggested that one of the many emotion-processing theories of dreaming may be able to account for the findings. For example, evidence suggests that dreams facilitate "mastery" over affectively arousing memories (Breger, 1967; Koulack, 1993; Wright & Koulack, 1987); emotional experiences are dreamt of repetitively until they are resolved (Hartmann, 1998); and dreams may enable the amelioration of emotions attached to waking-life experiences (Hartmann, 1996; Walker & van der Helm, 2009), perhaps particularly for fear emotions (Levin & Nielsen, 2007, 2009; Levin et al., 2010; Nielsen & Lara-Carrasco, 2007). Another interpretation of the results could come from the emotional memory consolidation theory of sleep and dreaming, which is related to, but slightly different from, the emotion-processing theory. Consolidation may refer more specifically to the

strengthening of the emotional memory, rather than processing or ameliorating it, during sleep (Franzen et al., 2009; Hu et al., 2006; Wagner et al., 2001), and dreams may be a reflection of this sleep-dependent memory consolidation process (Wamsley & Stickgold, 2011).

An alternative possible interpretation of the findings is that it is simply easier to recall intensely emotional dreams than less emotional ones (Meier et al., 1968), so the finding could be interpreted as a memory bias for more intensely emotional dreams, which may relate to more intensely emotional waking-life experiences.

Another possibility is that the results were affected by the method (dreams collected via spontaneous awakenings) and may not have been found with a systematic awakenings method, because morning dreams have been found to be more emotional than those earlier in the night (Baylor & Cavallero, 2001; Hobson et al., 2000; Wamsley et al., 2007). Thus, the study should be replicated in future utilizing a systematic-awakenings method.

The evidence presented in the introduction for the incorporation of stressful waking-life experiences into dreams led to the hypothesis that incorporated waking-life experiences would be more intensely stressful than unincorporated experiences, as was found for emotionality. However, this was not found. An examination of the correlation between waking-life experience emotionality and waking-life experience stressfulness in the study illustrated that the relationship was fairly strong (.41), but weak enough for the concepts to be demonstrably different. Although emotions can be positive, negative, or neutral, and the intensity of emotion is not related to the valence (nor does valence mediate incorporations: Schredl, 2006), the psychological concept of stress is a negative, aversive state (Kasl, 1995). As such, a waking-life experience can be intensely emotional without being intensely stressful, perhaps especially if the emotion is a positive one. Thus, it may be that all (or at least most) highly stressful experiences are highly emotional, but not all highly emotional experiences are highly stressful, and so the two variables can (and do) act differently in relation to wake–dream continuity. However, participants' own meaning of "stress" was not elicited and it may be that stress was not always negative to all participants. We are exploring effects of valence as well as emotional intensity and stressful in another study.

Nevertheless, it was surprising that stressfulness was not also found to be a factor, as some research has illustrated that experiencing stressful situations leads to dreaming of those situations, such as surgery (Breger, Hunter, & Lane, 1971) and divorce (Cartwright, 1991, 2011; Cartwright et al., 1984; Cartwright et al., 2001; Cartwright et al., 2006), and many researchers have concluded that dreams reflect waking-life stressors (e.g., Breger, 1967; Koulack, 1993; Picchioni et al., 2002; Schredl, 2002; Wright & Koulack, 1987).

Regarding studies that have found little or no direct effect of waking-life stressors on dreams, even if there is some effect on dream tone (e.g., de Koninck & Brunette, 1991; de Koninck & Koulack, 1975; Koulack et al., 1985; Delorme et al., 2002), some researchers have suggested that the stressors being measured were simply not important enough in participants' lives to elicit a measurable effect (see also Hartmann, 1996). This is in line with Wright and Koulack's (1987) theory that benign stressors can be mastered before sleep and therefore do not need to be dreamt of, and it is only potent stressors that are incorporated. Perhaps in the present study the "real" or most potent stressors in participants' lives were not

effectively elicited by the instructions of the study; or perhaps participants simply did not experience stressful enough life events like surgery or divorce for stressfulness to be detectable as an effect. The difference between the average waking-life experience emotionality rating (4.50) and the average waking-life experience stressfulness rating (3.08) was significant, potentially supporting this interpretation.

The preferential incorporation of intensely emotional waking-life experiences may be best explained by an emotional memory assimilation theory (Malinowski & Horton, 2014): emotions may provide unconscious information about which experiences from waking life are important to be stored in the memory system, and so we may preferentially incorporate emotional memories to assimilate important information. Support for this idea comes from emotional memory research, which has shown that emotional stimuli are better recalled than neutral ones (Anderson et al., 2006; Atienza & Cantero, 2008), and that emotions facilitate recall even more than the purposeful effort to recall (Heuer & Reisberg, 1990). Moreover, in relation to the point that it is the intensity and not the valence of emotions that is crucial, Walker and van der Helm (2009) noted that memory encoding is facilitated by emotional arousal in a similar way in the brain in relation both to negative *and* positive stimuli. In addition, it has been shown that sleep "unbinds" the emotional elements of memories for selective consolidation (Payne et al., 2008), again demonstrating how emotions seem to guide the process of determining which memories are chosen for encoding during sleep. The widespread evidence for the role of emotion in memory has led to one dream researcher suggesting that emotion "tells" us what is important to recall and that this is why dreams selectively incorporate emotional experiences (Hartmann, 2010). It is not suggested that dreams selectively incorporate emotional experiences simply for the strengthening and enhanced recall of those experiences; rather, with many modern memory consolidation theories, it is suggested that emotional memories are incorporated into dreams to be integrated or assimilated into the wider memory system (Payne, 2010; Wamsley & Stickgold, 2011).

Regarding the "types of experience" part of the study, it was found that there was no difference in the proportion with which major daily activities, personally significant experiences, major concerns, and novel experiences were incorporated into dreams individually, but that when the latter three were combined, major daily activities were incorporated significantly less than the others. These results do not support the hypotheses, in that it was anticipated, for example, that major concerns would be incorporated more than the combination of the other three. Although the hypothesis for novelty and personal significance was speculative and based mostly on theory, the hypothesis for concern was based on a wealth of literature that has shown that concerns are frequently dreamt of (e.g., Domhoff. 1996, 2003, 2011; Hall, 1953; Hall & Nordby, 1972; Hoelscher et al., 1981; Nikles et al., 1998; Saredi et al., 1997), and so this null finding in particular was unexpected. It may be due to the paucity of participant recordings of personally significant experiences, novel experiences, and major concerns (an average of about 3, 5, and 14, respectively, out of a maximum of 70). The number of major daily activities, conversely, was much larger (almost 40 per participant). Personal significance, novelty, and concern thus need to be tested as factors again, with a larger sample of experiences. The finding that major daily activities were incorporated less than the combination of the other

three, however, provides a tentative indication that waking-life experiences may be preferentially incorporated due to their *not* being the experiences that take up most of the day, such as traveling, working, eating, and so on, but those experiences that may be of short duration but stand out for some reason (such as personal significance, concern, or novelty): in other words, are 'important.' As has been shown in the past, time spent on activities does not necessarily relate to dreaming of them, as in the studies on cognitively focused activities (Hartmann, 2000; Schredl, 2000; Schredl & Erlacher, 2008; Schredl & Hoffman, 2003; Schredl et al., 2009). In a similar vein, in the present study on average 40 major daily activities were reported, almost double the combination of personally significant experiences, major concerns, and novel experiences, yet they were incorporated significantly less than the combination of the other three. Thus, perhaps time spent on activities is less influential for continuity than the importance of those activities, although how "importance" is defined is not clear from the results of the study. The notion of dreaming of what is important to us accords with the above hypothesis of emotional memory assimilation: it was suggested there that emotions may "tell" us what is important to be assimilated. This postulation is also in line with the suggestion of Schwartz (2003) and Desseilles et al. (2010), as mentioned in the introduction, that it is salient or relevant waking-life information that may be preferentially incorporated for memory assimilation during sleep.

In conclusion, we suggest that emotional waking-life experiences may be incorporated into dreams preferentially over other less emotional experiences, because emotions provide an automatic and unconscious way of deciding which waking-life experiences to incorporate into sleep for assimilation into the memory system. Similarly, it may be that important waking-life experiences may be preferentially incorporated, but the definition and understanding of importance requires further research.

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AUTHOR QUERIES

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