Pre-sleep and post-sleep mood as a complementary evaluation of emotionally impactful dreams

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Summary. Impactful dreams are reported by the dreamer to have an effect on their waking mood. However, the time course relationship of negative and positive impactful dreams with pre-sleep and post-sleep mood has not been examined closely. A total of 32 participants (21 females) reported one dream self-rated as either very or extremely emotionally impactful and one dream self-rated as not at all emotionally impactful (mundane dream), totalling 64 dreams. Participants completed a dream diary as well as pre-sleep, dream, and post-sleep mood checklists. They also completed rating scales of the impact of their dreams. The Hall & Van de Castle method was used for dream coding and analysis. A dream containing more positive than negative emotions was classified as positively impactful and vice versa. The 2 x 3 analysis of variance demonstrated a significant difference between mundane dreams and both negative and positive impactful dreams. Overall, negative impactful dreams were associated with higher negative mood levels at pre-sleep, in dream, and at post-sleep, compared to mundane dreams. Conversely, positive impactful dreams were associated with more positive mood levels during the dream and at post-sleep, but not at pre-sleep. Correlational analyses demonstrated that in negative impactful dreams, negative dream mood strongly correlated with negative post-sleep mood. Similarly, in positive impactful dreams, positive dream mood strongly correlated with positive post-sleep mood. However, pre-sleep and dream mood, whether positive or negative, did not significantly correlate. Additionally, there was a significant correlation between pre-sleep and post-sleep positive mood in positive impactful dreams and mundane dreams. These results confirm that dream mood and post-sleep mood are positively related, further suggesting a potential effect of dreams on post-sleep mood. The absence of a relationship between pre-sleep and dream mood undermines the continuity theory as well as modern dream function theories for emotions. The threat simulation theory is also used to interpret results.

Keywords: Impactful dreams, emotions, mood

1. Introduction

1.1. Dreams and their Impacts

Dreams have often been of paramount importance. Although one typically dreams several times a night, most do not remember their dreams. Even when one does remember a dream, it is often quickly forgotten. This forgetfulness has been hypothesized to have an adaptive function. Specifically, if dreams were always remembered, they would take up mental space that could be otherwise used for the analysis of real-life events (Domhoff, 2000).

A particular category of dreams, known as impactful dreams, can have a lasting impression on the dreamer's waking feelings and thoughts. If one adheres to the evo-lutionary hypothesis that thinking is adaptive, then there is no reason to believe typical dreams serve an adaptive function (Domhoff, 2000). However, it would then appear that impactful dreams may serve a purpose from an adaptive standpoint since they are not as easily forgotten as mundane (non-impactful) dreams. This interpretation of impactful dreams certainly lends interest to their study and furthered understanding.

1.2. Impactful Dreams

First coined by Kuiken, impactful dreams are emotionally charged, can be spontaneously remembered, and influence the dreamer in some way (Kuiken & Sikora, 1993). They can have an influence on waking thoughts, emotions, or both. The present study investigates the affect of an emotionally impactful dream and its interplay with evening to morning mood. This affect, which is of particular interest in the present study, can be broken down into two categories: positive dreams, associated with positive emotions and oneiric events, and negative dreams, which are linked to negative emotions and oneiric events.

Impactful dreams are typically identified through asking the dreamer whether the dream had an influence on their emotions and thoughts in waking life (Kuiken & al., 2006). In this study, impactful dreams will be explored by focusing on

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the element of emotion, an overarching trait present in virtually all impactful dreams, according to both the dreamer and independent judges (Kuiken & Sikora, 1993).

1.3. Emotions and the Hall and Van de Castle Method

The Hall and Van de Castle (HVDC) method of content analysis (1966) was born out of a need to score and reliably measure dream content in a consistent manner across differing individuals and dreamer circumstances (Hall & Van de Castle, 1966). A widely used tool in dream studies, the HVDC method allows for almost all elements of a dream report to be classified (Schneider, 2015). For the purpose of this study, only the emotion category will be examined in order to compare positive and negative dreams and their relationship to experienced waking emotions.

1.4. Dream Emotion: Reports and Interpretation

It is not uncommon for theories of dream formation to cite emotions as one of the dominant forces behind oneiric creation (Davidson, Lee-Archer, & Sanders, 2005; Kramer & Glucksman, 2006). Emotions may even shape the narrative process of dreaming to begin with (Seligman & Yellin, 1987). Such an assertion is made biologically likely through the associations of limbic and para-limbic brain structures, which are instrumental in the treatment and manifestation of emotional content during REM sleep (Nir & Tononi, 2010). However, the issue of isolating emotions that have been felt by the dreamer, as opposed to emotions that might be inferred from dream content by judges, has been explored for decades. Even as they built their dream scoring system, Hall and Van de Castle noticed that written language allows for many variations of emotional states and that reducing those possibilities to only five inclusive coding subcategories was arduous (Hall & Van de Castle, 1966).

Perhaps as a result of this difficulty, the Hall and Van de Castle method only takes an emotion into account when the dreamer explicitly designates it by name in his or her report (Hall & Van de Castle, 1966). An exception to this direct stating criterion can only be made if the dreamer provides a description of a typically emotional physical reaction accompanied by a clear emotional reason for such a physical display. The most commonly cited example in the HVDC training material is 'I cried because I knew my mother was dead' (Hall & Van de Castle, 1966). This may create an underrepresentation of emotions in scored dreams. Indeed, it would appear that dreamers, when prompted, will almost always choose an emotion for every segment of a reported dream, suggesting that little oneiric activity is utterly emotionless (Nielsen, Deslauriers & Bayor, 1991).

The HVDC method has also been claimed to specifically underestimate the prevalence of positive emotions (Schredl & Doll, 1998). Because the HVDC system presents only one unambiguously positive coding category for emotions, as compared with three unambiguously negative ones, it might conceivably limit coding opportunities for positive feelings. Schredl and Doll (1998) explored this possibility by asking participants to identify specific emotions as they described their dreams, and this without being exposed to emotional categories such as the ones that are found in the HVDC method. They found that positive and negative content was almost evenly found (1998) which contrasts with other findings indicating an increase in the presence of negative emotions, both in dream narratives and in dreamer self-evalua-

tions (Merritt, Stickgold, Pace-Scholl, Williams, & Hobson, 1994; Roussy, Raymond, & De Koninck, 2000).

What seems to differentiate monotonous dreams from those that truly impact the dreamer, however, is not the mere presence of emotion, but rather its degree of intensity and perceived significance upon waking.

1.5. Mood Shifts and Dreaming

The relationship between evening, sleep, and morning mood has yet to be clearly defined by existing literature. Multiple studies have attempted to elucidate this question by using self-rated mood checklists with adjectives such as 'angry', 'afraid', or 'elated' for evening, dream, and morning mood (De Koninck and Koulack, 1975; Antunes-Alves & De Koninck, 2012; Schultz & Koulack, 1980; Sirois-Berliss & De Koninck, 1982).

Mood checklists have progressively revealed that the relationship between evening, dream, and morning mood is not a straightforward process. In his comprehensive chapter on the biology of dreaming, Kramer elaborates that evening and morning mood are rarely linked in a predictive manner, whereas pre-sleep mood does indeed seem to influence dream mood, which in turn may influence morning mood (Kramer, 2005). This indirect relationship has been supported by research on specific characteristics that appear to influence both dream content and morning mood. As an example, it has been hypothesized that frequent nightmare sufferers experiencing a negative mood before going to bed may be predisposed to negative mood within dreams, which in turn creates negative and stressful states upon waking (Antunes-Alves & De Koninck, 2012). Studies on menstrual stress and aggressiveness have found that pre-sleep menstrual stress is correlated with in-dream anxiety and fear (Sirois-Berliss & De Koninck, 1982), whereas those same emotions are not represented in morning mood (Schultz & Koulack, 1980). Since impactful dreams usually have strong emotional content, they are a promising contender for the study of such a layered relationship.

Particularly relevant to this project is the general observation that dream content and emotions tend to be negative (Dale, Lortie-Lussier, Wong, & De Koninck, 2016), especially in comparison with waking experience (e.g. Sirois-Berliss, 1982; reviewed by De Koninck, 2012). It would be of interest to further document the transition between pre-sleep and post-sleep mood by considering the varying emotional levels in dreams.

1.6. Theoretical Implications

This current study examines the relationship between dreams and the pre-sleep to post-sleep emotional state. In doing so, this study draws from the continuity theory, which states that dreams are a reflection of waking life. According to this theory of dream formation, objects, individuals, feelings, and situations experienced in real life find themselves creatively incorporated into dream fabric. In the theory's broadest form, it is presumed that dreams and waking life have an influence on each other that may manifest itself through dream content, themes, and emotionality. However, it has also been proposed that continuity is principally manifested through cognitive experiences and concerns (e.g. Domhoff, 2011). This being said, the continuity theory has been supported by numerous studies (e.g. Nielsen & Levin, 2007; Stewart & Koulack, 1993), and is compatible

with a number of dream function theories exploring the possible role of dreaming. One such theory, known as the mastery hypothesis, stipulates that the goal of dreaming is to increase mastery in real life (Adler, 1931; Breger, 1967). This mastery process is accomplished through the representation of problematic events within dream narratives. These events are typically disguised in appearance. This may occur in order to avoid triggering the dreamer into feeling the full weft of the disturbing situation's negative emotional charge (Hall & Norby, 1972). This contextual difference allows the dreamer to experiment with various techniques aimed at resolving a problem without the real-life consequences of a clumsy waking attempt. The mastery hypothesis may in turn be understood through one of its specific variants, the threat simulation theory. This theory states that throughout evolution, dreams may have provided a stage onto which it became possible to safely rehearse threats to one's survival (Revonsuo, 2000). According to the threat simulation theory, dreamers who actively integrated possible waking-life threats within oneiric content were more likely to react appropriately when faced with such threats upon waking, and as a result, were also more likely to survive. While this theory does not propose that the incorporation of threats in dream serves a contemporary function, it remains of related interest to observe mood variations linked to dreams that are considered negative. More closely related to the emotional dimension of dreams, Malinovski and Horton (2014; 2015) recently proposed that dreaming reflects the processes of emotional assimilation attributed to sleep, and that dreams are correspondingly linked to waking emotionality, especially in the case of highly emotional waking events. While the authors do not claim that dreaming contributes directly to emotional assimilation, examining the relationship between emotional levels in dreams and during the following morning through this perspective may provide a relevant conceptual context.

1.7. Purpose

The aim of this study is to use the context of impactful dreams, narrowed down to its emotional content or valence, to further examine the relationship between evening mood, dream mood, and morning mood. According to the continuity theory, mood from evening, dream, and morning should all be correlated. However, in the case of impactful dreams, this may not be the case. Specifically, impactful dreams may not necessarily find their source from immediate pre-sleep mood but perhaps from a distant past, thus perhaps explaining their emotional resonance. But in order to have an impact on the dreamers, there should still be a relationship between dream and morning mood. This study will consequently explore negative and positive impactful dreams, compared with each other and with non-impactful dreams. Self-rated emotional patterns surrounding the dream will also be examined across time from evening to morning.

1.8. Hypotheses

The global hypothesis is that evening, dream, and morning mood will follow differing patterns depending on whether they are associated with a non-impactful dream, positive impactful dream, or negative impactful dream.
Giving rise to more specific predictions, and assuming that dreams tend to be generally more negative than positive:

1) The main effect of dream type will be significantly different if the dream is impactful, as compared to non-impactful; it will also differ between positively impactful and negatively impactful dreams.
2) There will be a significant main effect of time across evening, dream, and morning mood for positive impactul dreams and negative impactful dreams, in contrast to mundane dreams. More specifically when correlations are calculated,
3) In the case of positive impactful dreams, positive evening and dream mood will be significantly positively correlated with positive morning mood, and negatively correlated with negative morning mood.
4) In the case of negative impactful dreams, negative evening and dream mood will be significantly positively correlated with negative morning mood, and negatively correlated with positive morning mood.

2. Method

2.1. Participants

The population from which the sample was drawn comes from a normative dream study led through the University of Ottawa's Sleep laboratory. The sample was drawn uniquely from the survey's young adult and adult categories, which includes 566 individuals between 18 and 39 years of age. Participants meeting the inclusion criteria were those who had experienced both an impactful dream and a non-impactful dream on different nights. The sample included all participants meeting inclusion criteria and was composed of 32 participants, including 21 females, for a total of 64 separate dreams.

2.2. Measurement instruments

Dream Questionnaire. This involved the detailed description of one's dream. The questionnaire was specifically adapted from that proposed by Kuiken's Post-Dream Questionnaire or PDQ (2006). The first PDQ-adapted statement, "My mood in the dream affected my mood in the morning", was used to identify emotionally impactful dreams. A similar version of this statement is still used in recent research (such as Lee & Kuiken, 2015). Participants would rate how true they believed the statement was on a four-point scale, from "not at all" to "extremely".

In the present study, the dreamer was not directly asked whether the dream was "impactful", which has been done in previous studies on the topic (Kuiken & Sikora, 1993; Kuiken, Lee, Eng, & Singh, 2006). Instead, a dream would be classified as impactful if the dreamer judged that the dream had had an impact on their morning mood through a rating of either "a lot" or "extremely". This dichotomous approach to categorizing impactful dreams was utilized with the goal of ensuring only highly emotionally charged dreams would be selected, especially considering the limited presence of impactful dreams in general. A non-impactful dream was judged as such if the participant rated the dream as "not at all" influencing morning mood.

Mood Checklists. Every evening before going to sleep, and again every morning upon waking, participants filled out a four-point mood checklist. For each proposed emotion, they would rate the degree of its saliency from "not at all" to "extremely". A very similar mood checklist was also used in the main questionnaire for self-reporting emotions

during the dream. Those emotions were happy/happiness, afraid/fear, sad/sadness, and angry/anger. For statistical purposes, the score for the three negative emotions were averaged, whereas for happiness, the actual score was used. The emotion of confusion, found in both the HVDC scale and the mood checklist, was not included in these analyses due to its ambiguous tone.

2.3. Procedure

Every time participants experienced a dream at home, they would describe the dream and complete the dream questionnaire, as well as three mood checklists. The first mood checklist was in regards to evening mood; this was completed in the evening before falling asleep. The other two checklists, which were completed in the morning after a dream, measured in-dream and morning mood. The study lasted until two dreams were experienced by the participant, or until three weeks had passed.

Once a dream was identified as impactful, it was analyzed in order to determine whether it was a positive or negative dream. This process involved a variant of the HVDC scoring system. Impactful dreams were scored according to standard criteria, and were selected as negative if they contained more stated negative emotions than positive ones, and vice versa. If no emotion was mentioned, dreams would be scored as negative if they contained more failures and misfortunes than successes and good fortunes, and vice versa. Representative examples of positive and negative impactful dreams, in addition to a representative example of a mundane dream, have been included in Appendix A. The final sample included 22 negative impactful dreams (M = 202 words), 10 positive impactful dreams (M = 133 words) and 32 mundane dreams (M = 161 words).

This study's approach to categorizing the main emotional valence of an impactful dream may straighforwardly classify dreams with elements of mixed emotionality, thus possibly obscuring emotional elements of interest. However, additional classification methods were used in order to ensure the chosen valence category would best represent the dream's emotional content.

The HVDC scoring method for emotions was validated by assessing all impactful dreams individually with three different additional approaches. The first approach compared the summation of both successes and good fortunes (positive) to the total number of failures and misfortunes (negative); dreams with more negative elements were coded as negative, and vice versa. After determining the tone of each impactful dream, all but one dream corresponded to the original HVDC emotion coding score. The second validation approach used the pleasantness self-rating scores from the dream diary. If the dream had been rated as more pleasant

Table 2. Raw Count Frequency of Dream Content Elements Implying Valence for Impactful Dreams

	Misfor-tunes	Good Fortunes	Failures	Successes
Negative Impactful Dreams	14	2	12	0
Positive Impactful Dreams	1	0	1	2

Table 1. Mean Stated Emotion Frequency and Self-Rated Pleasantness/Unpleasantness Scores for Impactful Dreams

	Mean Negative Emotions Frequency	Mean Positive Emotion Frequency	Mean Pleasant-ness Score (out of 4)	Mean Un-pleasant-ness Score (out of 4)
Negative Impactful Dreams	1.18	0.08	1.47	3.47
Positive Impactful Dreams	0.27	0.45	3.18	1.3

than unpleasant, it was considered a positively toned dream, and vice versa. Using this method, all dreams except three were scored with the same tone as the HVDC emotion coding score. Finally, the third validation method compared the self-rated dream emotion score from the post-sleep dream diary to the HVDC emotion score. Only two self-rated dream emotion scores were found to differ with the HVDC dream emotion score. Overall, one individual dream was found to be an exception across two validation methods; all other exceptions differed from method to method. Therefore, since all classifications based on HVDC were validated by at least one other criterion, all dreams were kept for the analysis.

Table 1 displays the mean stated emotion frequency scored through the HVDC method for negative and positive impactful dreams. For comparison purposes, it also displays the mean self-rated pleasantness and unpleasantness ratings of those same dreams. With the same aim, Table 2 shows the raw count of elements implying valence in emotionally impactful dreams. Finally, Table 3 provides the mean self-rated in-dream emotion intensity for anger, fear, sadness, and happiness, as provided by the dreamer upon waking.

The self-rated scores of the four emotions used in this study (happiness, fear, sadness, and anger) were collected before, during, and after sleep, for both the impactful dream and the non-impactful dream of each participant.

2.4. Statistics

Statistical analyses were accomplished using SPSS (version 23). Four 2 x 3 repeated ANOVAs were conducted to compare the effects of dream type (mundane and impactful) across time (evening, dream and morning) for both negative and positive impactful dreams. This was completed

Table 3. Mean Self-Rated Emotion Intensity in Dreams for Impactful and Mundane Dreams

Emotion	Negative Impactful Dreams	Positive Impactful Dreams	Mundane Dreams
Joy	1.38	2.60	1.74
Anger	2.50	1.90	1.45
Sadness	3.19	0.48	1.51
Fear	2.85	1.30	1.84

Figure 1. In the left panel, mundane and negative impactful dreams have a main effect of time, $F_{(2, 42)} = 15.999$, $p < .0001$, dream type, $F_{(1, 21)} = 34.935$, $p < .0001$, as well as a significant interaction, $F_{(2, 42)} = 12.078$, $p < .0001$, when average negative mood scores (anger, sadness, fear) are compared across time (evening, dream, morning). In the right panel, mundane and negative impactful dreams have a main effect of time, $F_{(2, 42)} = 12.696$, $p < .0001$, when positive mood (happiness) is compared across time (evening, dream, morning).
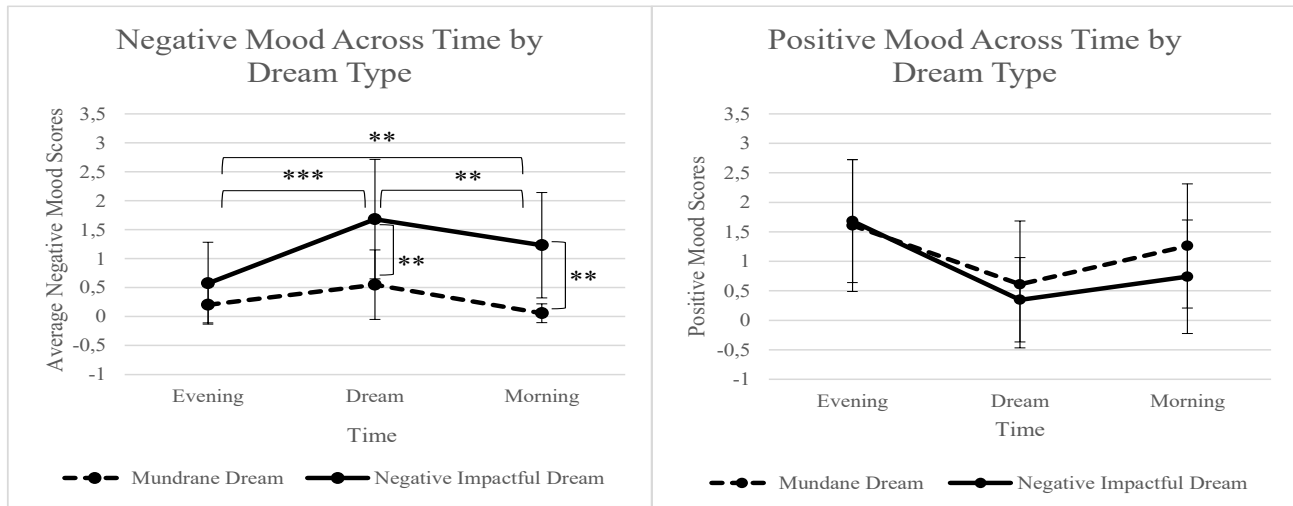
N.B. In order to facilate ease of reading, post-hoc results were not shown across graphs for Figure 1. Please refer to Table 7 for all significant post-hoc results.

on both negative (fear, anger, and sadness average) and positive mood (happiness score). Trend analyses were also performed for all four tests. Correlational analyses were executed to further explore the relationships between evening, dream, and morning mood. Post-hoc t-tests explored differences detected by the ANOVAs; Bonferroni corrections were applied to account for multiple comparison.

3. Results

3.1. Negative Impactful Dreams Compared to Mundane Dreams

The left panel of Figure 1 illustrates the 2 x 3 repeated ANOVA between mundane dreams and negative impactful dreams, specifically regarding average negative mood scores across time. There was a significant main effect for dream type, $F_{(1, 21)} = 34.935$, $p < .0001$, and time, $F_{(2, 42)} = 15.999$, $p < .0001$. The interaction between dream type and time was also significant, $F_{(2, 42)} = 12.078$, $p < .0001$. Specifically, negative mood in impactful dreams can be observed to be much higher compared to mundane dreams, particularly during the dream and at post-sleep. Additionally, negative mood increases at dream time and relatively decreases at post-sleep for both groups, as indicated by a significant quadratic trend, $F_{(1, 21)} = 23.991$, $p < .0001$. Thus, mood changes across time and differs between dream types. In the right panel of Figure 1, a 2 x 3 repeated ANOVA between mundane dreams and negative impactful dreams, specifically regarding positive mood scores across time, is illustrated. Only the main effect of time was found to be significantly different, $F_{(2, 42)} = 12.696$, $p < .0001$. In other words, high positive evening mood decreases during the dream and increases again in the morning, as shown by a significant quadratic trend,

$F_{(1, 21)} = 16.487$, $p = .001$. It can be observed that positive mood in the morning, after a negative impactful dream, is lower than after a mundane dream.

Table 4 demonstrates the significant correlations for negative and positive mood in negative impactful dreams across time. There was a highly significant positive correlation between dream and morning negative mood, $r = .768$, $p < .0001$, and between positive dream mood and positive morning mood in negative impactful dreams, $r = .798$, $p < .0001$. There was also a strong negative correlation between positive dream mood and negative morning mood, $r = -.641$, $p = .001$. Likewise, there was a negative correlation between negative dream mood and positive morning mood, $r = -.651$, $p = .001$. There was, however, no significant correlation between pre-sleep mood and dream mood, as well as pre-sleep and post-sleep mood for positive or negative emotions.

Table 4. Correlations (r) for negative impactful dreams

Emotion	r	P value	N value
Negative Dream Emotions VS. Negative Morning Emotions	.768	<.0001	23
Positive Dream Emotions VS. Negative Morning Emotions	-.641	.001	23
Negative Dream Emotions VS. Positive Morning Emotions	-.651	.001	23
Positive Dream Emotions VS. Positive Morning Emotions	.798	<.0001	23

Figure 2. In the left panel, mundane and positive impactful dreams have a significant interaction, $F(2, 16) = 6.276$, $p = .010$, when positive mood (happiness) is compared across time (evening, dream, morning). In the right panel, mundane and positive impactful dreams have a significant interaction, $F(2, 16) = 3.959$, $p = .040$, when averages of negative mood (sadness, fear, anger) are compared across time (evening, dream, morning).
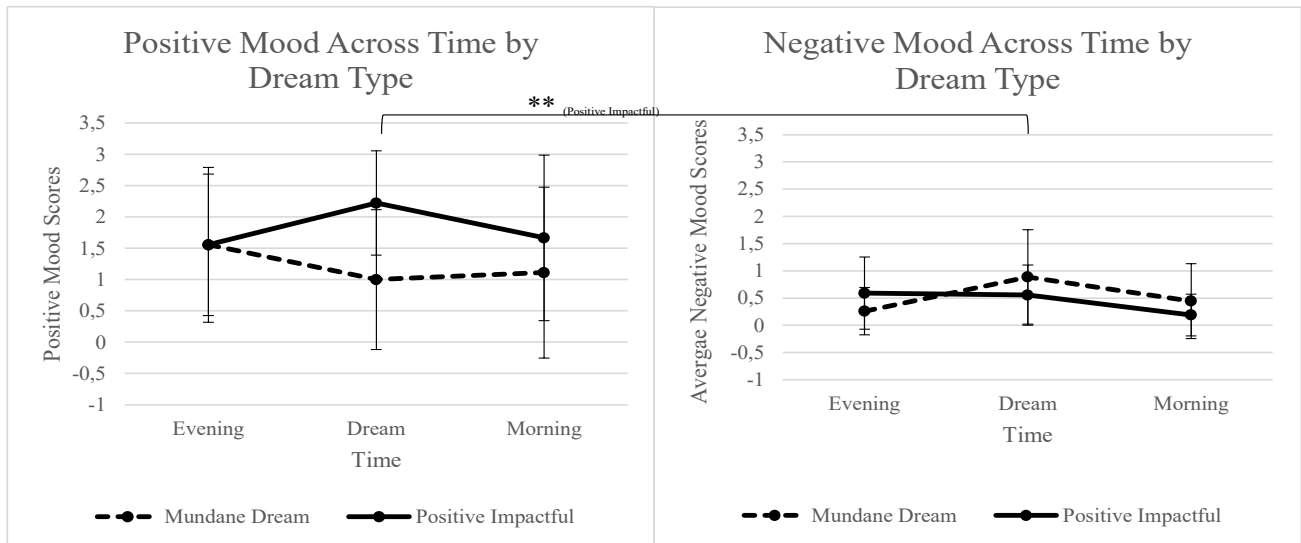
3.2. Positive Impactful Dreams Compared to Mundane Dreams

A 2 x 3 repeated measures ANOVA, comparing mundane dreams and positive impactful dreams across time for positive mood, is demonstrated in the left panel of Figure 2. In this analysis, only the interaction of time and dream type was found to be significant, $F(2, 16) = 6.276$, $p = .010$. Specifically, dream types demonstrated different patterns in mood across time. An increase in positive mood during impactful dreams and a decrease in positive mood during mundane dreams can be observed. The right panel of Figure 2 represents the final 2 x 3 repeated ANOVA, which compares positive impactful dreams and mundane dreams across time for negative mood. The interaction was found to be the only significant effect, $F(2, 16) = 3.959$, $p = .040$. There was a relative stability in negative mood from evening to dream time for the positive impactful dream group; however, there was an increase in the mundane dream group. In mundane dreams, negative emotions increased during the dream and decreased at post-sleep, whereas there was no such increase in negative mood during positive impactful dreams. Interestingly, it can noted that pre-sleep mood was already positive. Based on these results, it can be concluded that both dream types present differential patterns in terms of negative mood across time.

Table 5 lists the significant correlations between mood (positive and negative) in a positive impactful dream. In this case, positive dream emotions were significantly negatively correlated with negative morning emotions, $r = -.811$, $p = .008$, and positively correlated with positive morning emotions, $r = .756$, $p = .018$. Interestingly, positive evening emotions were also positively correlated with positive morning emotions, $r = .808$, $p = .008$, confirming the non-interference of the dream emotions in evening to morning mood.

Table 6 demonstrates the significant correlations between mood (positive or negative) in mundane dreams. It can be observed that positive evening emotions were positively correlated to negative dream emotions, $r = .362$, $p = .042$,

as well as positive morning emotions, $r = .627$, $p = .0001$. Additionally, negative evening mood was positively correlated with negative morning mood, $r = 488$, $p = .005$. Negative dream mood was also correlated with negative morning mood, $r = .452$, $p = .009$.

3.3. Post-Hoc Tests

Paired t-tests correcting for multiple comparison were conducted as post-hoc tests. Table 7 displays t-test results that remained significant after correction. First, pairs were compared across time periods, holding dream type and valence constant (significance threshold adjusted at .008 using Bonferroni corrections). There was a significant difference between negative mood in negative impactful dreams from evening to dream, from dream to morning, and from evening to morning (respectively; $t(21) = -4.84$, $p = < .0001$; $t(22) = 3.21$, $p = .004$; $t(21) = -3.206$, $p = .004$). Additionally, dream valence was compared, holding time and dream type constant (significance threshold adjusted at .008). In this context, there was a significant difference between negative and positive mood scores in the context of a negative impactful dream, in the evening as well as during the dream (respectively; $t(21) = -3.536$, $p = .002$; $t(22) = 3.886$,

Table 5. Correlations for positive impactful dreams

Emotion	r	P value	N value
Positive Dream Emotions VS. Negative Morning Emotions	–.811	.008	9
Positive Evening Emotions VS. Positive Morning Emotions	.808	.008	9
Positive Dream Emotions VS. Positive Morning Emotions	.756	.018	9

Table 6. Significant correlations for mundane dreams

	Negative Evening Mood	Positive Evening Mood	Negative Dream Mood	Positive Dream Mood	Negative Morning Mood	Positive Morning Mood
Negative Evening Mood	-	-.288	.035	.141	.488**	-.182
Positive Evening Mood		-	.362*	.114	-.011	.627***
Negative Dream Mood			-	-.051	.452**	.117
Positive Dream Mood				-	-.084	.342
Negative Morning Mood					-	-.241

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

p = .001). When positive and negative mood in a positive impactful dream were compared, only mood in dream was significantly different (t(8) = 4.423, p =.002). Furthermore, when positive and negative mood in mundane dreams were compared, a significant difference was found between these states at the evening and morning time points (respectively; t(22) = -5.321, p < .0001; t (22) = -5.202, p < .0001). Finally, when dream types were compared for the same dream valence and time (significance threshold adjusted at .004), regarding negative mood in negative impactful dreams and mundane dreams, there was a significant difference between dream mood and morning mood (respectively; t(22) = -5.197, p < .0001; t (22) = -6.191, p < .0001).

4. Discussion

Results from this study indicate that impactful and mundane dreams differ across time and mood. The presence of dichotomously positive and/or negative mood in impactful dreams is consistent with the notion that impactful dreams do have a measurable influence on the pre-sleep to post-sleep change in mood. This change is significantly different in the context of mundane dreams. As expected, the main effect of dream type differed depending on the impactful or non-impactful nature of the dream. This phenomenon was clearly observed when mundane dreams were compared to both negative and positive impactful dreams. The highly significant correlation between dream mood and morning mood for impactful dreams further validates this notion since it is not as consistently seen in mundane dreams. Of interest is that even in mundane dreams, mood tends to be more negative than positive. In addition, positive and negative impactful dreams seem to follow different variations in emotionality across time. Post-hoc t-tests further supported this tendency, most notably by showing highly significant

Table 7. Significant multiple paired t-test with multiple comparison corrections

	Mean	Df	t value	p value
Negative Evening Mood vs. Negative Dream Mood (Negative Impactful Dream)	-1.121	21	-4.84	< .0001
Negative Dream Mood vs. Negative Morning Mood (Negative Impactful Dream)	.449	22	3.21	.004
Negative Evening Mood vs. Negative Morning Mood (Negative Impactful Dream)	-.636	21	-3.206	.004
Negative Evening Mood vs. Positive Evening Mood (Negative Impactful Dream)	-1.106	21	-3.536	.002
Negative Dream Mood vs. Positive Dream Mood (Negative Impactful Dream)	1.333	22	3.886	.001
Negative Dream Mood vs. Positive Dream Mood (Positive Impactful Dream)	1.667	8	4.423	.002
Negative Evening Mood vs. Positive Evening Mood (Mundane Dream)	-1.406	22	-5.321	< .0001
Negative Morning Mood vs. Positive Morning Mood (Mundane Dream)	-1.203	22	-5.202	< .0001
Negative Dream Mood (Negative Impactful Dream) vs. Negative Dream Mood (Mundane Dream)	-1.130	22	-5.197	< .0001
Negative Morning Mood (Negative Impactful Dream) vs. Negative Morning Mood (Mundane Dream)	-1.174	22	-6.191	< .0001

distinctions between evening, dream, and morning mood in the context of negative impactful dreams; this was not observed in positive impactful dreams. The current observations consequently validate the usefulness of impactful dreams regarding everyday emotional dimensions. This facet of impactful dreams has not been extensively examined in past literature (such as Kuiken et al., 2006; Kuiken, Loverso, Dunn & Carlisle, D., 2001; Kuiken & Sikora, 1993).

From a theoretical perspective, the observation that impactful dreams appear to be relatively independent from pre-sleep mood does not support the continuity theory for emotions. However, the correlation between dream mood and morning mood indicates a continuity relationship, bringing partial support to the theory. Furthermore, the current results do support the threat simulation theory in the case of negative dreams. Threats in negatively toned dreams do appear spontaneously. As for their effect on morning mood, they seem to be linked with a relative increase of negative mood in the morning, compared to pre-sleep. Although no causal relationship can be established with this methodology, the possibility is supported by post-hoc analysis. It is also consistent with the findings that dreams tend to be more negative, and that threats in dreams can appear even in the absence of significant threats in the pre-sleep experience (Lafrenière, Lortie-Lussier, Robidoux, Dale & De Koninck, under review). Dreams may allow one to simulate threatening events in a dream setting. Specifically, it would allow to cognitively rehearse the mechanisms one needs to perceive and avoid threats (Bradshaw, De Koninck, Lafrenière, Amini, & Lortie-Lussier, 2016; Revonsuo, 2000). The increase in negative emotion from pre-sleep to post-sleep, in the case of negative impactful dreams, does confirm the potential influence of threatening or negative dream mood (see left panel of Figure 1). Interestingly, this suggests that if these dreams comprise threat simulations, their effect is not positive enough to lower post-sleep negative mood.

In addition, it should be specified that, in the absence of immediate pre-sleep threats, the dream generation system may select salient emotional mnesic traces from the distant past. This may have a stronger impact on the dreamer. In this context, a relatively low negative pre-sleep mood may not prevent the dreamer from experiencing negatively impactful dreams, since those dreams would contain threats from the distant past, which are more likely to have a strong emotional component attached to their oneiric presence.

Associating such strong negative emotions with an evolutionarily adaptive dream may further cement its impact and potential use in waking life. Indeed, negative emotions are remembered more vividly than positive ones (Kensinger, 2007); the relative absence of dream elements implying valence in positive impactful dreams (see Tables 1-2) may be due to a lesser degree of vividness. This bias for negative elements may increase the salience of threat-resolution attempts linked to negative emotions. Moreover, both the threat simulation theory (Revonsuo, 2000) and the emotional assimilation theory (Malinovski & Horton, 2015) do not claim that negative dreams reduce contemporary morning stress. Rather, it may be that the benefits of this dreaming activity are realised in the long term.

Moreover, in impactful dreams overall, independently of valence, there is not necessarily a clear and direct link between pre-sleep emotions and dream mood. The pre-sleep experience does not seem to shape the impactful dream experience, or at least not unequivocally so. This finding, cou-pled with the sporadic and rare nature of impactful dreams, suggests that such oneiric episodes might differentially refer to waking life when compared to more frequent mundane dreams. In other words, impactful dreams might integrate incorporations differently, perhaps giving rise to heightened emotional affect as a result.

Analyses also indicate that positive impactful dreams and mundane dreams differ significantly in mood, particularly during dreams but also in the morning. Positive impactful dreams are indeed followed by a more positive morning mood than mundane dreams (see left panel of Figure 2), although post-hoc analysis does not show this trend as significant. It still, however, suggests that morning mood is more positive in the case of positive impactful dreams, whereas pre-sleep mood in mundane dreams does not improve significantly overnight, and in fact may even become more negative. The reduction in positive mood associated with mundane dreams carries over to waking mood. This interestingly suggests that even remembering mundane dreams does seem to reduce positive morning mood. It would be important, in future studies, to compare morning mood after a remembered mundane dream to morning mood when there is no dream recall.

In brief, specific to this study, results indicate that dream mood and morning mood are especially related. Since emotions have been proposed to be at the core of dreams (Seligman & Yellin, 1987), this relation may be especially true for impactful dreams (Kuiken & Sikora, 1993).

Limitations and Directions for Future Studies

Various strengths can be identified in this study. Since the sample was drawn from a large normative study, this confirmed that impactful dreams are a minority. In this case, out of 566 participants, only 32 having experienced one strongly emotional impactful dream were found. This study also suggests that impactful dreams can be differentiated from mundane dreams through measures of emotional valence, both self-reported and scored by external judges. This can also be confirmed using the HVDC scale.

It can be proposed that emotions in impactful dreams are especially central, since this study found significant emotional differentiations between positive and negative impactful dreams despite the possible limitations of the HVDC method. Alternately, this may be related to increased emotional intensity and centrality in impactful dreams, which possibly results in emotions being frequently mentioned in dream reports. Further studies could address these hypotheses with the help of alternate emotion scoring methods, such as using dreamers' self-reports of within-dream emotions. In that regard, involving the dreamer in the process of dream coding, among other methods, has been suggested as increasing the validity of emotional scoring (Sabourin, Robidoux, Pérusse & De Koninck, under review). This alternate technique would have the added benefit of addressing emotion intensity, which is not directly covered by the HVDC scoring system. Since impactful dreams are defined by their emotional impact, scoring emotional intensity might allow for a deeper understanding of the nature and implications of these dreams. Additionally, different age groups could be included in the analysis, since in-dream emotions have been reported to diminish in frequency as age increases, as well as interact with both gender and age (Dale, Lortie-Lussier & De Koninck, 2015; Dale, Lafrenière & De Koninck, 2017).

In addition to these considerations, it must be mentioned that temporal references in dreams were not considered in this study, although the dream diaries contained a lengthy section in which participants would rate the temporal references of incorporations. It has been suggested that waking-life incorporations with a strong emotional component tend to refer to the distant past more often than mundane incorporations, at least relating to negative valence (Lafrenière, A., Lortie-Lussier, M., Robidoux, R., Dale, A., & De Koninck, J., under review). This is also supported by the observation that impactful dream mood is not always linked to evening mood. Future studies could investigate this possible avenue, and explore the link between temporal references and emotional strength of oneiric elements in impactful dreams. Different waking-life experiences at different points in time may have a range of distinct oneiric impacts; still, very little is known about this connection, outside of the growing field of nightmare research. Positive emotions especially have seen limited research in the context of emotional impact.

Future studies might also address the matter of identifying emotionally impactful dreams and clarifying whether they differ from intellectually impactful dreams. The question of obtaining 'pure' emotionally or intellectually impactful dreams would be an interesting avenue to explore. It would allow researchers to determine whether such dreams affect the dreamer in different ways, barring the obvious immediate variance in affect impact. Such an assumption might be tested within a normative sample using Kuiken's Post-Dream Questionnaire (Kuiken et al., 2001), which separates morning mood changes from thought-provoking effects. Furthermore, using the Questionnaire to explore whether the dreamer has experienced subjective intellectual change, such as a new way of solving a problem, might provide additional support for the hypothesis that impactful dreams serve an adaptive purpose.

Finally, exploring impactfulness along a continuun would be a relevant future direction while investigating impactful dreams. Dream selection itself could be based on a sliding scale of emotional impact, so as to explore the fine line between impactful and mundane. In addition, classifying emotional valence along continua linked to HVDC scores (such as failures and successes, aggressions and friendliness, etc.) would allow the complexity of such ratings to be preserved. Those scores may be analyzed using modelling techniques, so as to move away from a positive-negative dichotomy in favor of a wider emotional range.

Emotions are complex, and intricately intertwined within dream fabric. As such, present results indicate some lasting emotionality through dreams and waking life. Ultimately, emotionally impactful dreams seem to leave a trace on our minds that warrants continued exploration, with potential theoretical implications for dream function theories.

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