Are dream emotions shifted towards more negativity compared to waking-life emotions? An empirical study

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Summary. Emotions are an integral part of the dream experience and research has focused on the interplay between waking-life emotions and dreams emotions. Previous studies indicate a so-called negativity bias, that is, the emotional tone of dreams is on average lower than the average waking life mood. Overall, 83 participants completed a questionnaire and were then divided into two subgroups keeping different versions of dream diaries. The findings support the notion of a positivity bias regarding the retrospective measurement of overall emotional quality in waking life and a negativity bias regarding dream emotions. In addition, there is a medium sized correlation between the two domains, supporting the notion of an emotional continuity between waking and dreaming. Future research can use experience sampling methods in conjunction with dream diaries to study the interaction between waking-life emotions and dream emotions more closely.

Keywords: Dream emotions, negativity bias, questionnaire, diary

1. Introduction

Dreaming is defined as subjective experiences during sleep (Schredl, 2018), emotions are an integral part of these experiences (Sikka & Gross, 2023). The question that interested researchers from early on was how these emotions experienced during dreams relate to emotions in waking life; the so-called emotional continuity between waking and dreaming (Hartmann, 2011). The methodological issues of how dream emotions are measured are intricately linked in answering this question and, thus, will be reviewed in the following.

The first large-scaled dream content analytic study (Hall & Van de Castle, 1966) was based on 1.000 dreams reported by students; the explicitly mentioned negative emotions outweighed explicitly mentioned positive emotions by 4 to 1. However, using rating scales allowing the external judge to rate emotions even if they are not explicitly mentioned (e.g. for a dream like “I saw a huge bear and ran away.”) yielded a different picture but a still a slight preponderance of negative emotions (Röver & Schredl, 2017; Schredl & Doll, 1998; Sikka et al., 2017). This is likely explained by underestimating positive dream emotions using external judges, as rating scales presented to the dreamer after s/he recorded the dream yielded a balanced ratio of positive and negative dream emotions (Röver & Schredl, 2017; Schredl & Doll, 1998; Sikka et al., 2017). In some samples even more positive than negative emotions were reported (Sikka et al., 2017; Sikka et al., 2014). Interestingly, the methods through which dreams were elicited can also affect the ratio of positive and negative emotions: dreams obtained by awakenings in the sleep lab are more often positive than home dreams (Sikka et al., 2018) and most recent dreams (report of the last dream the participants remembered) are more negatively toned than diary dreams (Schredl, 2020). Summarizing this research, it can be concluded that self-rating scales in conjunction with diary dreams might be the best approach for measuring dream emotions (Sikka & Gross, 2023).

Given that research seem to converge on finding balanced dream emotions (Schredl, 2018), there is still the unanswered question why this is the case as persons tend to rate their waking life being more positive than negative, sometimes called positivity bias (Diener et al., 2018). Sikka et al. (2021) were able to show in two samples that mind-wandering reports and waking reports are indeed rated more positively whereas self-rated emotions of dream reports were balanced. One possible explanation was that during REM sleep the fronto-parietal control network is downregulated and, thus, does not attenuate limbic activation. This activation pattern might also play a role in nightmare etiology (Levin & Nielsen, 2007) with nightmares being the most extreme negatively toned dreams. As it easier to remember REM dreams upon awakening compared to NREM dreams (Nielsen, 2000), focusing on REM sleep physiology seems plausible. Other theoretical concepts, e.g., the hypothesis of the rebound in dreams of thoughts and emotions suppressed during wakefulness (Wegner et al., 2004) and the idea of a “day/night affective homeostasis” (Sterpenich et al., 2020) might help to explain the findings that dream emotions are on average more negative than waking-life emotions.

The finding that within the same sample waking-life reports were rated to be more positive than negative whereas dream reports yielded balanced or more negative emotions was replicated by several studies (Conte et al., 2020;

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Gross et al., 2021; Nielsen et al., 1991; Perogamvros et al., 2017). In a re-analyses of the data reported by Schredl and Reinhard (2009-2010), it could also be demonstrated that the averaged general daytime mood rated on a five-point scale ranging from very negative (-2) to very positive (+2) in the evening was significantly above zero, whereas dream emotions were balanced. Thus, there is solid evidence that dreams are on average more negatively toned than waking-life experiences.

The present study aimed at comparing retrospective estimates of waking-life mood (last two weeks) with retrospective estimates of dream emotions, that is, using the same measurement approach for the two domains. It was expected that waking-life emotions were rated more positively compared to dream emotions (positivity bias for waking-life emotions). As previous research indicated that emotions rated by the dreamer after recording the dream are more valid (cf. Schredl & Doll, 1998), two different emotion measures based on diary dreams (one five-point emotional tone scale vs. a composite of two scales measuring positive and negative emotions separately) were also included to back up the findings obtained by the retrospective dream emotion measure. Based on the continuity hypothesis of dreaming, especially the continuity of emotions (Schredl, 2018), we expected a positive correlation between waking-life mood and the emotional tone of dreams.

2. Method

2.1. Participants

The total sample consisted of 83 participants (59 women, 24 men) with a mean age of 30.80 ± 16.14 years. The diary group with the emotional tone measure version 1 (single five-point scale) encompassed 40 participants (27 women, 13 men) with a mean age of 30.60 ± 16.33 years, whereas the diary group with version 2 (difference between two four-point scales for positive and negative emotions) included 39 participants (29 women, 10 men) with the mean age of 30.90 ±16.06 years.

2.2. Questionnaire

For eliciting dream frequency, a 7-point scale (coded as 0 = never, 1 = less than once a month, 2 = about once a month, 3 = about 2 to 3 times a month, 4 = about once a week, 5 = several times a week, 6 = almost every morning) was presented (Schredl et al., 2014). The retest reliability of the scale for a mean retest interval of 54.8 ± 41.8 days was high: r = .85 (Schredl, 2004). The overall emotional tone of dreams was measured on a five-point scale (-2 = Very negative, -1 = Somewhat negative, 0 = Neutral, +1 = Somewhat positive, and +2 = Very positive) (Schredl et al., 2014). .The retest reliability for one to three-week intervals was on average r = .764 (Dyck et al., 2017).

For measuring the overall mood during waking life, a 112 mm visual analogue scale was developed. The participants were asked to think about all areas of life during the last two weeks and give an averaged estimate. A similar visual analogue scale was presented for measuring the percentage of positive emotions during the past two weeks using as reference all positive and negative emotions that occurred in that time span.

2.3. Dream diaries

Both diaries consisted of three similar sheets for eliciting the dream report and the dream emotions on three occasions. First, the participants were asked to record the date of the morning with successful dream recall. Then, they should provide a written dream report (as complete as possible). After recording the dream, the emotional quality of the dream should be rated: In version 1 on a five-point scale similar to the scale provided in the questionnaire (-2 = Very negative, -1 = Somewhat negative, 0 = Neutral, +1 = Somewhat positive, and +2 = Very positive) and in version 2 two separate scales for rating the intensity of positive and negative emotions in their dreams on two four-point rating scales (0 = none, 1 = mild, 2 = moderate, 3 = strong) were present (Röver & Schredl, 2017). In version 2, the emotional tone was computed as the difference between positive and negative emotions (ranging between -3 and +3). If the participant reported more than one dream in the morning ratings should be provided for every dream.

2.4. Procedure

The project was carried out by eleven students supervised by the author. After developing the measurement instruments, the participants were recruited from the social environment of the student researchers. Overall, 120 envelopes with the materials (50% diary version 1, 50% diary version 2) and stamped return envelopes (to ensure maximal anonymity) were send out. As the envelopes of the different versions were mixed prior to put on the addresses of the recipients, the participants were not specifically assigned into groups but more or less randomized. The response rate was 69.17% as 83 participants sent back their materials. First, all participants completed the questionnaire with the retrospective estimates of waking-life mood, dream recall frequency, and the retrospective estimated of overall emotional tone of dreams and then the subgroups completed their respective dream diaries on a maximum of three occasions with successful dream recall during the next two weeks. Lastly, the materials were returned using the stamped re-

Table 1. Waking-life measures.

Sample	Overall emotional tone	Proportion of positive emotions
Total sample (N = 83)	65.05 ± 20.21	67.37 ± 19.07
Diary sample 1 (N = 40)	66.05 ± 20.32	67.70 ± 17.78
Diary sample 2 (N = 39)	62.15 ± 20.21	66.00 ± 20.51

Note. Visual analogue scales range from 0 to 112

Table 2. Overall emotional tone of dreams (questionnaire measure, N = 83).

Category	N	Percent
Very positive (+2)	0	0.00%
Somewhat positive (+1)	22	26.51%
Neutral (0)	28	33.73%
Somewhat negative (-1)	31	37.35%
Very negative (-2)	2	2.41%

Table 3. Emotional tone of N = 110 diary dreams reported by 40 participants (Diary group 1).

Category	N	Percent
Very positive (+2)	8	7.27%
Somewhat positive (+1)	20	18.18%
Neutral (0)	24	21.82%
Somewhat negative (-1)	47	42.73%
Very negative (-2)	11	10.00%

turn envelopes. Four participants did not remember any dreams during the study period (25.03.2024 to 07.04.2024) und, thus, could not be included in the diary data analyses. The statistical analysis were carried out with SPSS for Windows 27 (IBM, Chicago, IL, USA). For the diary data that included several data points per participant, mixed-model analyses were computed. Otherwise, one-sample t-tests and Pearson correlations were computed.

3. Results

The mean values of the waking-life measures for the total group and the two diary groups are presented in Table 1. For the total group, the two measures were highly correlated ($r = .712$, $p < .0001$) and their means did not differ ($t = -1.4$, $p = .1621$). The diary groups did not differ regarding their overall emotional tone in waking life ($t = 0.9$, $p = .3956$) and their proportion of positive emotions in waking life ($t = 0.4$, $p = .6947$). The distributions for the dream emotion measures (questionnaire and diaries) are depicted in T ables 2 to 4.

In Table 5, the means and standard deviations for the three different dream emotions measurement techniques are depicted. For the diary measures, means per participant were computed first. The mean number of dreams per participant was 2.75 ± 1.06 for Diary group 1 and 3.00 ± 1.19 for Diary group 2. Both diary measures were highly correlated with the retrospective questionnaire measure (see Table 5). If emotional tone of the diary dreams was more positive than negative, the participants' retrospective estimated also indicated a more positive overall general tone of dreams. Whereas the overall emotional tone (questionnaire measure) and the averaged difference of emotional tone (diary group 2) correlated with the waking-life emotion variables, the averaged emotional tone of diary group 1 did not (see Table 5).

To address the issue of a possible positivity and/or negativity bias, it was tested how large the differences from the scales' midpoint (56 in the case of the waking-life measures and zero for the dream emotion measures) were. For comparability, the differences were computed as effect sizes (see Figure 1). For the overall emotional tone in waking life, the effect size was $d = 0.448$ ($t = 4.1$, $p < .0001$). The effect size for the proportion of positive emotions in waking life was slightly higher: $d = 0.594$ ($t = 5.4$, $p < .0001$); however, the difference between the two measures was not significant ($t = -1.4$, $p = .1621$).

Table 4. Emotional tone of N = 110 diary dreams reported by 40 participants (Diary group 1).

Difference (Positive – negative emotions)	N	Percent
+3	9	7.96%
+2	11	9.73%
+1	15	13.27%
0	19	16.81%
-1	15	13.27%
-2	22	19.47%
-3	22	19.47%

The mean of retrospective estimates of the overall emotional tone (see Table 2) was below zero (-0.16 ± 0.85), corresponding to an effect size of $d = -0.185$ that approached significance ($t = -1.7$, $p = .0963$). That is, participants tended to estimate the emotional tone of their dreams slightly more negative than positive. The diary data based on the single five-point scale (see Table 3) also yielded a negative mean for all dreams: -0.30 ± 1.12 (mixed model analyses: $F = 5.3$, $p = .0264$). Similar, the diary data based on the difference between positive and negative dream emotions (see Table 4) also yielded a negative average: -0.54 ± 1.91 (mixed model analysis: $F = 6.4$, $p = .0162$). In sum, all waking-life measures showed means over zero, whereas all dream measure were below zero. Based on the averaged dream emotions scores (see Table 5), the difference between the emotional tone of the diary dreams did not differ from the retrospective estimate for Diary group 1 ($t = 0.8$, $p = .4211$), whereas the mean of the differences of the two rating scales for measuring emotions in diary dreams (Diary group 2) was significantly lower compared to the retrospective estimate of overall dream emotional tone ($t = 2.3$, $p = .0259$).

4. Discussion

The findings support the notion of a positivity bias regarding the retrospective measurement of overall emotional quality

Table 5. Correlations between dream emotion variables and waking-life emotion variables.

Variable	Mean ± SD	Overall emotional tone (dreaming) r = (p-value)	Overall emotional tone (waking life) r = (p-value)	Proportion of positive emotions (waking life) r = (p-value)
Overall emotional tone of dreams (Questionnaire, N = 83)	-0.16 ± 0.85	---	.250 (.0115)	.338 (.0009)
Averaged emotional tone of dreams per participant (Diary group 1, N = 40)	-0.27 ± 0.80	.591 (<.0001)	.075 (.3225)	.175 (.1405)
Averaged difference of emotional tone of dreams per participant (Diary group 2, N = 39)	-0.63 ± 1.48	.516 (<.0001)	.433 (.0030)	.337 (.0181)

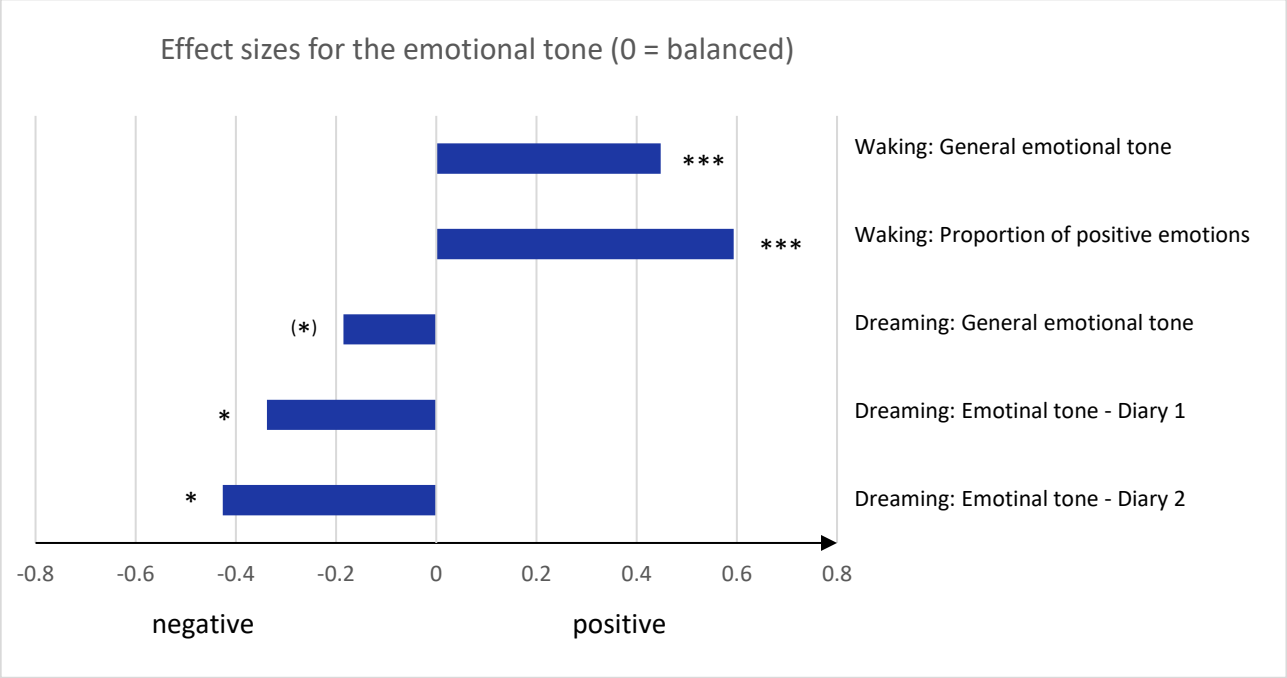

Figure 1. Positivity and negativity for dream-related and waking-life emotional tone variables (difference from zero: (*) p < .10, * p < .05, *** p < .001)

in waking life (cf. Diener et al., 2018) and difference between waking-life and dream emotions towards more negative dream emotions (cf. Sikka & Gross, 2023). Interestingly, the diary measures of dream emotions are more negatively toned compared to the retrospective estimates of dream emotions, this is similar to a positivity bias, but shifted, from more negatively toned (diary dreams) to more neutral dream emotions if measured retrospectively. On the other hand, there is a medium sized correlation between the two domains, supporting the notion of an emotional continuity between waking and dreaming (Hartmann, 2011). Even though the different measures of dream emotions showed satisfactory inter-correlations, measuring emotions of diary dreams with a unipolar five-point scale might be problematic – not showing the expected correlation between waking-life emotions and dream emotions.

From a methodological viewpoint, it is worth to point out that both aspects (waking-life emotions and dream emotions) were measured in the same sample. Comparing different samples with just measuring one domain (waking or dreaming) can be problematic as dream emotions are correlating with waking-life emotions as have been shown in this study and previous studies (e.g., Schredl & Reinhard, 2009-2010) and averaged waking-life mood can differ from sample to sample. Even though the sample was heterogeneous (large age range), this should not affect the results too much as the main hypotheses were tested in a within-subject design. Similar, the sample size seems appropriate as large effects, e.g., positivity bias, were found. It should be noted that the retrospective measures regarding waking-life emotions included a time frame of two weeks whereas for the retrospective measure of the general emotional tone of dreams no time frame was provided. In the view that the results seems plausible, this methodological aspect might have not affected the results in a marked way.

In the present study, about three dreams per participant were available for computing the mean emotional tone of the diary dreams. As dream content, including dream emotions, varies considerably from night to night (Schredl, 1998), the question remains how many measurement points are needed to measure inter-individual differences in dream emotions reliably. For dream recall, a diary of at least two weeks is recommended (Schredl & Fulda, 2005), thus relying on 14 measurement points. In the present study, this measurement issue does not affect the results, as the focus was not on measuring inter-individual differences in the emotional tone of dreams.

Despite relying only on three dreams per participants, the correlations between the diary measures for emotional tone and the retrospective measure of the general emotional tone of dreams were satisfactory high. But, if inter-individual differences in dream emotions should be related to trait measures, e.g., personality dimensions, a higher number of measurement points, that is, dream reports might be necessary. Despite the high correlation of the averaged diary emotional tone based on the unipolar five-point scale with the retrospective assessment of dream emotions, the correlation of this measure with waking-life emotionality was low. Gaillard and Phelippeau (1977) pointed out that two scales measuring the intensity of positive and negative emotions might be more valid than a unipolar scale as participants might have problems to rate the mean emotional tone of dreams that include strong positive and strong negative emotions. As some researchers (Merritt et al., 1994; Sikka et al., 2014) use self-ratings of a large number of different emotions, future research can compare these different methods of measuring dream emotions via self-ratings. One problem with the probing approach is that asking for emotions after every dream report can increase the awareness and might even affect subsequent dreams (cf. Stern et al., 1978). Interestingly, these methodological aspects seem not to affect the findings regarding the negativity bias regarding dream emotions in relations to waking life emotions as dif-

ferent approaches (Nielsen et al., 1991; Schredl & Reinhard, 2009-2010; Sikka et al., 2021) yielded comparable results.

Whereas the retrospectively rated emotional tone of waking life was on the positive side, the retrospective rated dream emotions were balanced, even slightly more negative than positive – a finding that is in line with previous research (Gross et al., 2021; Nielsen et al., 1991; Schredl & Reinhard, 2009-2010; Sikka et al., 2021). Although the suggestion that REM sleep physiology, highly active limbic system, reduced activation of the prefrontal areas (Maquet et al., 1996), might explain this difference – proposed by Sikka et al. (2021) –, solid empirical evidence is still lacking because a direct link between these activation patterns using imagining techniques and reported emotional tone of dreams have not been demonstrated yet. One problem is the low temporal resolution of the PET technique (Maquet et al., 1996) and the other problem is that methods with high temporal resolution, e. g., high-density EEG (Siclari et al., 2017), can not reliably measure the activity of "deeper" brain structures like the limbic system. Thus, the question why dreams in general tend to be l more negatively toned than waking life experiences is still unanswered. Within this context, the finding that sleep quality might moderate that continuity between waking emotionality and dream emotions (Conte et al., 2021) is of interest: Persons with poor sleep quality (possibly reflecting waking-life stress) showed a larger shift between waking-life emotional tone to dreams compared to good sleepers. One might speculate that the day/night affective homeostasis (Sterpenich et al., 2020) might be affected by factors like waking-life distress. This would fit in with the models of nightmare etiology (e.g., Levin & Nielsen, 2007) indicating that waking-life stress can accentuate the difference between waking-life emotional tone and the emotional tone of dreams. Another interesting question in this context is why activating antidepressants like serotonin reuptake inhibitors can increase nightmare frequency but not the intensity of positively toned dreams (cf. Tribl et al., 2013). The finding obtained in Diary group 2, that self-rated dream emotions of diary dreams are on average more negative than the retrospective estimate of overall emotional tone might point to a positivity bias, that is, seeing the world retrospectively more positive than it has been (cf. Diener et al., 2018), even though the shift is from negatively toned (diary) to neutral. This would fit in the findings that persons retrospectively underestimate their nightmare frequency (Robert & Zadra, 2008), even though subsequent research has shown that the difference is rather small (effect size = 0.101; Zunker et al., 2015). As mentioned above, one can hypothesize that asking every morning for estimates of dream emotions might have an effect on dreams and their emotions. It can be assumed that the "true" measurement value is somewhere between the two measures, indicating that it makes sense – like in the present study – to use both approaches measuring dream emotions.

The original positivity bias (Diener et al., 2018) was proposed for retrospective measures of overall well-being in waking life. Several dream studies (Gross et al., 2021; Nielsen et al., 1991; Sikka et al., 2018) applying experience sampling methods for eliciting reports in waking life and still found a positivity bias (waking) and a shift towards more negative emotionss (dreaming), thus, the difference in dream emotions and waking-life emotions could not solely attributed to a "general world view of a happy life" affecting the retrospective measures.

The findings indicate that the emotional tone of dream emotions were correlated with waking-life emotional tone – supporting the so-called emotional continuity (Hartmann, 2011). However, only two of the three measures of dream emotions were significantly related to waking-life emotions; this might reflect the fact that some studies found a significant association between waking and dream emotionality (e.g., Gilchrist et al., 2007; Schredl & Reinhard, 2009-2010) whereas other studies (e.g., Conte et al., 2020) did not. This indicates that methodological issues, for example, how dream emotions are measured (non-significant finding of the unipolar scale in the present study), how waking-life emotions are measured (overall emotional tone, day-to-day variations, specific emotions vs. emotional tone (positive – negative), emotions of a report vs. general estimates of the experienced emotions), the type of dreams (most recent dreams vs. diary dreams), can affect the empirical results and, thus, further research is needed to establish a solid empirical approach to address the question of emotional continuity between waking and dreaming.

To summarize, the findings indicate that there is a significant difference regarding self-rated overall emotional tone of waking-life emotions compared to dream emotions with dreams being on average more negatively toned than waking-life experiences. Future research can use experience sampling methods in conjunction with dream diaries to study the interaction between waking-life emotions and dream emotions more closely – being aware of the fact that these methods can increase emotional awareness (Eisele et al., 2023) and, thus, might bias the findings in some way. This research might help to answer the question whether dreaming plays a role in emotion regulation (cf. Kramer, 2007).

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