Emotions in dreams: Evidence against a negative bias of emotional valence.

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Abstract

Investigations of dream emotionality have yielded mixed findings and opinions regarding the emotional nature of dreams remain divided. This debate appears to center on whether or not dream emotionality is characterised by a negatively bias (i.e shows a preponderance of negative emotions). A related issue in this debate surrounds the measurement of emotions and apparent discrepancies in subjective and objective ratings – where objective raters appear to underreport the presence of positive emotions. To investigate this seeming disparity, the present study analysed 159 dream reports obtained from controlled REM and non-REM awakenings in terms of subjective ratings of emotional valence. Researchers then went on to compare a smaller subset (n=92) of these dream reports to objective ratings of those same dream repots using the Hall and Van de Castle content analysis system. According to subjective ratings, positive emotions predominated both REM and non-REM dreaming (Wilcoxon $Z = -4.029$, $p < 0.01$, $r = 0.34$), and the vast majority of dream reports were found to be emotional (84.5%). In contrast, objective raters found a preponderance of negative emotions (Wilcoxon $Z = -4.021$, $p < 0.01$, $r = 0.30$), and found a far smaller proportion of dreams to contain emotion (44.6%). These diverging results support the suggestion that objective raters underreport the presence of positive emotions in dreams. They also propose that contrary to a negative bias of dream emotionality, dreaming appears to be characterized by a preponderance of positive emotions. Implications on various functional theories of dreaming (e.g. Threat-Simulation Theory) and the wider literature are discussed.

Keywords: dream emotionality; emotional valence; non-REM dreaming; emotion detection; content analysis

Background

Despite a number of studies investigating the nature of dream emotionality, there exists much debate over the claim that emotions in dreams characteristically show a negative bias (i.e., that dreams are predominated by negative emotions). Indeed, studies aiming to characterise the emotional valence of dreams have yielded mixed results: some studies have found negative emotions to predominate (Hall & Van de Castle, 1966; Kramer, Winget, & Whitman, 1971; Merritt, Stickgold, Pace-Schott, Williams, & Hobson, 1994; Nielsen, Deslauriers, & Baylor, 1991; Snyder, 1970), while others have found the emotional valence to be relatively balanced (Blagrove, Framer, Williams, 2004; Fosse, Stickgold, & Hobson, 2001), and still others have found a preponderance of positive emotions to be present (St-Onge, Lortie-Lussier, Mercier, Grenier, & DeKoninck, 2005; Sikka, Valli, Virta, & Revonsuo, 2014). Broadly speaking, the current literature can be split into two sides: those that believe that findings suggesting a negative bias in dream emotionality are related to a function of dreaming (Cartwright, 1996; Flanagan, 2000; Hartmann, 1995; Kramer et al., 1971; Revonsuo, 2000), and those that believe that these findings can be explained by a number of methodological differences and biases in dream recall and/or measuring emotion (Schredl & Doll, 1998; Strauch & Meier, 1998; Conduit, Crewther & Coleman, 2000; Mealey, 2000; Montangero, 2000). This study aims to clarify some of the issues surrounding these ongoing issues through comparing subjective and objective ratings of dream emotions obtained from awakenings in REM and non-REM sleep. Such research has value in clarifying issues surrounding the emotional valence of dreaming and informing those functional theories of dreaming that hold that dream emotionality to be negatively biased.

Emotions are Negatively Biased in Dreams: A Function of Dreaming

A number of extensive early investigations (e.g., Hall & Van de Castle, 1966; Snyder, 1970; Kramer et al., 1971) found the emotional contents of dreams to be characteristically negative. Such research led to the presupposition that dreaming is predominated by negative emotions – that dream emotionality shows a negative bias. Various theories have attempted to explain this bias in terms of a function of dreaming (Cartwright, 1996; Flanagan, 2000; Hartmann, 1995; Kramer, 1991; Revonsuo, 2000); perhaps the most well-known of these theories is that of the Threat Simulation Theory (TST) (Revonsuo, 2000; however see Cartwright, 1996; Flanagan, 2000; Hartmann, 1995; Kramer, 1991 for alternate accounts). The

TST posits that dreaming serves a biological function by way of the mental preparation of threatening situations: “Threat simulation during dreaming rehearses the cognitive mechanisms required for efficient threat perception and threat avoidance, leading to increased probability of reproductive success during human evolution.” (Valli et al., 2005, p.188). Under such an account, dreaming is predominated by negative emotions – especially fear and anxiety – as a result of a selected evolutionary mechanism that simulates threatening events while we are asleep. These early studies have subsequently been widely cited in support of such accounts, however contrary evidence does exist.

Many investigations have since been conducted that suggest that the emotional valence of dreaming is rather balanced (e.g. Blagrove, Framer, & Williams, 2005; Fosse, Stickgold, & Hobson, 2002); and two more recent laboratory studies have even suggested that positive emotions appear to predominate (Sikka et al., 2014; St-Onge et al., 2005). Such conflicting results have led many researchers to explain the negative bias of dream emotionality dreams in terms of differences in dream recall (Conduit et al., 2000; Mealey, 2000; Montangero, 2000) or in the methodological measuring of emotions (Schredl & Doll, 1998; Strauch & Meier, 1998). From this perspective, these authors posit that the apparent negative bias in emotional valence is not a true reflection of the nature of dreaming, but rather a reflection of the biases inherent in the methodology employed.

Emotions are Negatively Biased in Dreaming: Evidence for Methodological Biases

Subjective and Objective Ratings of Emotions

Perhaps the most striking difference in findings regarding dream emotionality is between those studies that have measured emotions objectively through external judges, and those that have had them subjectively rated by the dreamers themselves. The most widely used objective method of rating dreams is that of the Hall & Van de Castle content analysis system (Hall & Van de Castle, 1966). In addition to being employed in a number of extensive investigations (Hall & Van de Castle 1966; Snyder, 1970), the Hall and Van de Castle system has been used to establish widely cited norms related to dream content, based on thousands of dream reports (see Domhoff, 2005, for an extensive review). Studies that have employed this system as an objective method of enquiry have generally found dreams to be characteristically devoid of emotion: both in terms of

the overall frequency of emotions (e.g. 0.35 emotions per dream, Hall & Van de Castle, 1996) and in terms of the prevalence of dreams that contain at least one emotion, which has been found to be remarkably low (e.g. 30-35% Snyder, 1970). In addition to the general lack of emotion found, these same investigations have found that when emotions were present that they were more often negative, both in terms of the overall frequency and in terms of dream valence[1] (Hall & Van de Castle, 1966; Snyder, 1970).

In contrast to such findings, other studies that have utilised subjective ratings of emotions have found dreaming to be far more emotional, both in terms of the mean number of emotions per dream (Foulkes, Sullivan Kerr & Brown, 1988) and in terms the prevalence of dreams containing emotion: from around 70% in earlier investigations (Foulkes et al., 1998; Strauch & Meier, 1998), up until 100% in more recent ones (St-Onge et al., 2005, Sikka et al, 2014). These studies have also found the emotional frequency and overall tone to be rather balanced (Blagrove et al., 2004; Fosse et al., 2001; however, see Merrit et al., 1994; Nielsen et al., 1991 for contradictory findings), and two more recent studies have even found positive emotions to prevail (St-Onge et al., 2005; Sikka et al., 2014). Thus, there appears to be differences in findings between subjective and objective methods of enquiry with regards to dream emotionality. Despite such a suggestion, only two studies have investigated this apparent disparity by directly comparing subjective and objective ratings of dreams using the same dream reports (Schredl & Doll, 1998; Sikka et al., 2014).

Schredl & Doll (1998) were the first to do so through rating emotions in dream reports obtained from dream diaries. The study found that dreams rated using the Hall & Van de Castle (1966) system were predominantly devoid of emotion (57.9%) and negatively valenced (26.3% negative; 9% positive), thus confirming results of various former investigations that have used the same system (Hall & Van de Castle; Snyder, 1970; Kramer et al., 1971). Self and external ratings of those same dreams appeared to show quite a different story: participants rated nearly all of the dreams to contain emotion (99.2% self rating) and while there still appeared to be more negative emotions present in all three forms of measurement, this difference was less pronounced

[1] Dream valence refers to the overall frequency of emotions in a dream. If positive emotions predominate, the dream is positively valenced, while if negative emotions predominate, the dream is negatively valenced.

in the self-rating condition (50.4% negative; 36.8% positive) compared to that of the external raters using the Hall & Van de Castle (1966) content analysis system (26.3% negative; 9.0% positive).

More recently, Sikka et al. (2014) measured emotions in dream reports obtained from laboratory REM awakenings. Dreams were rated by the dreamers themselves and then by external judges using the same scale. The study found that all of the dreams rated by the subjects were emotional (100%), while external judges rated a significantly lower proportion of those same dreams to be emotional (71.3%). The study also found significant differences in terms of the prevalence of valenced dreams, where self-ratings showed a predominance of positive emotions both in terms of the intensity and frequency. The frequency of positive/negative dreams rated subjectively (82.6% positive; 13.9% negative) contrasted significantly to those externally rated by judges using the same scale where this difference was far more balanced (9.6% positive; 11.3% negative).

While there are many mixed results with regards to these studies, what is clear is that there are significant differences in the emotional ratings of dreams depending on whether the dreams or measured objectively by external judges, or rated subjectively by the dreamers themselves. In terms of a consideration of all the literature presented thus far, there appears to be a general trend for external raters to underestimate the overall presence of emotions in dreams, and especially to underestimate the presence of positive emotions. To account for these differences, various authors have suggested that this underestimation of positive emotions can be explained by a difference in measuring explicitly mentioned emotions and measuring implicit moods/atmospheres (Schredl & Doll, 1998; Strauch & Meier, 1996).

Explicit Emotions vs. General Mood/Feeling

Objective measures of dream emotions, such as the Hall & Van de Castle system, generally aim to assert the presence of emotions in dream reports through identifying explicit words or adjectives that show that a dreamer is experiencing a particular emotional state. Emotions are thus only scored when certain words are used and explicit emotions are mentioned. While judges may feel inclined towards inferring certain emotions from particular situations, they are urged not to do so: “If a dreamer says that he was in a torture chamber or being chased,

the scorer should not assume that apprehension was being experienced unless the dreamer himself says that such an emotion was being experienced." (Hall & Van de Castle, 1966, p. 112).

Since the bizarre nature of dreaming means that the dreamer may have one of a variety of emotional reactions in a dream, such a system prevents objective scorers from the "temptation" of wrongly ascribing emotions to a dreamer (Hall & Van de Castle, 1966, p. 112). While there is obvious benefit in such an approach, an unfortunate consequence is that the system is limited to measuring only those emotions that are explicitly described. An associated problem arises in that explicit descriptions of emotion in dream reports are often lacking, unless dreamers are specifically asked about them (Nielsen et al., 1991; Strauch & Meier, 1996).

From such a perspective, one can imagine that objective raters run the risk of failing to detect emotions in dreams due to the fact that an explicit emotional description is lacking. However, just because an emotion isn't explicitly described in a report, it doesn't mean that there is no emotion. Such a suggestion is supported by Schredl and Doll's (1998) findings, where external raters using the Hall and Van de Castle (1966) system found (57.9%) of dreams to be non-emotional. This is in contrast to other external raters who evaluated the emotions of dreams according to two 4-point scales for respective positive/negative emotions (13.5% non-emotional). Crucially, external raters who used the 4-point scales "were advised not to score only explicitly mentioned emotions but also any implicit moods or feelings possibly revealed by the dream action" (Schredl & Doll, 1998, p. 638). These "implicit moods" are not measurable according to such a system (Schredl & Doll, 1998; Snyder, 1970), but are arguably just as important as explicitly mentioned emotions in terms of a particular affective experience. Indeed, Strauch and Meier (1996) found that dreamers subjectively rate dream moods to be just as intense as explicit emotions in their dream reports.

In addition to explaining the general findings with regards to lack of emotion, authors also suggest that such an inability to measure general moods or atmospheres can explain findings regarding the negative bias in emotional tone (Schredl & Doll, 1998; Strauch & Meier, 1989). This can be explained by the fact that explicit emotions are more often negative, while general moods/atmospheres are more often positive. Evidence for this comes from Strauch and Meier's (1996) study where they measured both explicit emotions and general moods or atmospheres in dreams. They found that 50.6% of dreams contained explicit emotions, but that a further 23.4%

were dreams where only a general mood/atmosphere could be identified. They also found that negative emotions prevailed, but only when explicit emotions were measured. When general moods or atmospheres were taken into account, the overall prevalence of emotional tone was balanced. This was explained by the fact that while explicit emotions were twice as often (2:1) negative than positive, general moods in contrast were two and half times (2.5:1) more frequently evidenced as positive. This makes intuitive sense, as we often describe pleasurable experiences in indirect ways without direct reference to explicit emotions (e.g., "The weather was amazing!", "It was really good to see my old friend again"; Sikka et al., 2014). As a system like the Hall & Van de Castle (1966) cannot detect these implicit emotions, such findings would explain an underestimation of dream emotion (and especially positive emotions) in dream reports.

While such an explanation may explain the underreporting of positive emotions in those studies where only explicit emotions were measured (e.g. Hall & Van de Castle, 1966; Snyder, 1970; Kramer et al., 1971), what can be said about those investigations (e.g. Merrit et al., 1993; Nielsen et al., 1991) that have found a predominance of negative emotions in spite of subjective methods of enquiry? Some authors have explained this in terms of how dream reports were obtained (Schredl & Doll, 1998; Fosse et al., 2001) and in sampling biases of reporting those dreams that are dramatic and highly emotional (Conduit et al., 2000; Mealey, 2000; and Montangero, 2000).

Spontaneous vs. Laboratory Awakenings: Evidence for a Sampling Bias

Some authors have criticized dream reports obtained from spontaneous awakenings at home as being biased in reporting hyperemotional dreams, especially those that are accompanied by negative feelings of anxiety and fear (Conduit et al., 2000; Mealey, 2000; and Montangero, 2000). This argument is based on Cohen's (1974) salience hypothesis of dream recall: dreams that are likely to be recalled upon awakening are highly salient. Evidence in support of this is provided by comparisons of dream reports obtained from REM awakenings, dream diaries, and delayed recall, where dreams are progressively forgotten until only those dreams that are highly salient (those that contain high emotionality and elements of threat) can be recalled (Mealey, 2000). While functional theories of dreaming, such as the TST, would like us to believe that negatively emotionally charged memory traces are more often selected for dream *production*

(Vali et al., 2005), authors that argue for a sampling bias would like us to believe that this negative bias is rather a result of dream *recall*. From this perspective, the negative bias in dream reports is a reflection of a sampling bias and thus is not an accurate representation of dream emotionality.

Evidence of this sampling bias has subsequently criticised results of studies using dreams obtained from spontaneous recall (e.g. results obtained from dream diaries and most recent dreams; Montangero, 2000). The relatively controlled nature of laboratory studies means that this bias can arguably be significantly minimised. When bearing such considerations in mind, authors have suggested that further studies probing for emotion during REM should utilise laboratory awakenings (Foulkes, 1979; Fosse et al., 2001). However, dream reports obtained from the laboratory may provide biases of their own: many dream reports involve dream aspects related to contents of the laboratory (Foulkes, 1979) and involve less aggression and sexuality in comparison to dream reports obtained at home (Domhoff & Kamiya, 1964; Foulkes 1979;). Another potential limitation of laboratory studies is that emotional shifts in dreams more often go from positive to negative than from negative to positive (Merrit et al., 1993; Nielsen et al., 1991). Conceivably then, REM awakenings in laboratory studies may interrupt dreams before these emotional shifts can evidence themselves. Despite these limitations authors have suggested that it is the most reliable method for collecting dream reports (Schredl & Doll, 1998).

Rationale for Present Study

Collectively, the literature outlined above supports the suggestion that the measuring of emotions in dreams is susceptible to a number of methodological biases. There are clear discrepancies between findings regarding dream emotionality, both in terms of the rating of emotions (subjective vs. objective) and in terms of the type of methodology employed (spontaneous awakenings vs. laboratory awakenings). While two studies have been conducted to investigate the direct comparisons of subjective and objective ratings of emotions (Schredl & Doll, 1998; Sikka et al., 2014), no study has compared them using the Hall Van de Castle system under laboratory conditions. Furthermore, while studies (e.g. St-Onge et al., 2005; Sikka et al., 2014) have probed for emotions in REM dreaming, no study has yet aimed to characterise the emotionality of non-REM dreaming. Since there is no widespread agreement in the literature regarding dream emotionality, further research can help enlighten possible biases in measuring

dream emotion and clarify the overall emotional valence of dreaming. Furthermore, since no one theory of dreaming is widely accepted, research conducted in this regard has value in informing those theories of dreaming that are based on the assumption that dream emotionality is predominantly negative.

Aims and Hypotheses

In accordance with the outlined rationale, this study will compare subjective and objective ratings of emotions in dream reports obtained from laboratory awakenings during the three major sleep states: REM, light non-REM, and deep non-REM. The study will have two main aims. Firstly, this study will aim to characterise the nature of dream emotionality both in terms of the general emotionality, and in terms of emotional valence. Secondly, this study will aim to clarify some of the issues surrounding the objective measurement of dream emotions and clarify whether objective raters significantly underreport the presence of positive emotions. Owing to the mixed findings regarding dream emotionality, and the fact that the emotional nature of non-REM dreams have not yet been explored, the first aim will not be associated with any direct hypotheses. The second aim, however, will directly test two hypotheses related to the objective raters underreporting positive emotions in dreams:

H_1: Objective raters using the Hall and Van de Castle system will significantly underreport emotions in dreams in comparison to subjective raters.

H_2: There will be significant differences in the overall emotional valence of the objective and subjective raters, evidenced by a negative bias of dream emotionality according to objective raters.

Methods

Design

This study employed a repeated measures quasi-experimental design. Participants spent three inconsecutive nights in a sleep laboratory, during which a series of controlled awakenings were conducted to obtain dream reports from REM and non-REM sleep. The data was collected alongside data for a larger study that aimed to explore non-REM dreaming in relation to sleep microstructure (see Wainstein, 2013).

Participants

Researchers employed a method of convenience sampling and recruited participants in the form of paid volunteers. This recruitment consisted of two screening phases: an initial online questionnaire that was completed for course credits, followed by an interview session. To control for any major inter-participant differences or any issues that may affect the reliability of the obtained dream reports, participants were screened in the two phases according to the following inclusion/exclusion criteria:

Inclusion Criteria

***Subjective Sleep Quality*.** To control for irregular sleeping patterns and poor sleep quality, all subjects were required to report satisfactory sleeping habits and receive a *Pittsburg Sleep Quality Index* (PSQI) score of less than 5.

Habitual Dream Recall. To control for any major differences in inter-participant dream recall, participants were included who reported to be moderate to frequent dreamers (i.e., at least be able to recall dreams every two weeks), as measured by a 7-point scale (Schredl, 2002).

***Verbal Fluency*.** To control for any major differences in the verbal reports of dream recall owing to language proficiency, participants were included who demonstrated fluency in the English language and obtained a verbal IQ score of at least 100 on the *Wechsler Abbreviated Scale of Intelligence* (WASI).

Exclusion Criteria

Drug Use – Due to influences of psychoactive drugs on various aspects of sleep and dreaming (see Schierenbeck, Riemann, Berger, & Hornyak, 2008, for a review), participants were excluded who reported past/present use of illicit substances. In addition to this, participants who were smokers were further excluded due to the observed changes of nicotine intake on sleep architecture and reported dreaming (Page, Coleman, & Conduit, 2006).

Psychiatric Disorders – To control for any chronic medical or psychiatric conditions that may affect participants' sleep habits or dreaming, participants who showed any chronic medical or psychiatric conditions as assessed by the *Mini International Psychiatric Inventory* (M.I.N.I) were excluded.

Following the two phases of the screening process, a final sample of 22 participants met the appropriate criteria for further participation. Due to research suggesting that there are no significant sex differences in the emotional valence of dreams (e.g. Schredl & Doll, 1998), equal representation of the respective genders was not considered a specific requirement for the purposes of the present study.

Materials and Measures

Screening Measures

Pittsburg Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989; See Appendix A) – The PSQI is a widely used measure of subjectively reported sleep quality. Research has shown that the PSQI has high reliability and validity for the purposes of clinical assessment and research (Doi et al., 2000). A score of < 5 on the PSQI has been able to accurately distinguish good sleepers from bad ones and is a reliable indicator of good sleeping habits (Buysse et al., 1989).

Mini International Neuropsychiatric Interview (M.I.N.I) – The M.I.N.I. is a short structured interview schedule that aims to diagnose the major psychiatric disorders that are outlined in the DSM-IV. Studies have shown it to be both a valid and reliable measure in the assessment of psychiatric symptoms (Sheehan et al., 1998) and its ease of administration in terms of time make it a very useful tool for research purposes.

Wechsler Abbreviated Scale of Intelligence (WASI, The Psychological Corporation, 1999) – The WASI is a brief, easy-to-administer test of intelligence. Its brief administration and high levels of reliability and validity make it an effective measure for screening purposes in research (Strauss, Sherman, & Spreen, 2006).

Dream Recall Frequency Scale (Schredl, 2002) – the Dream Recall Frequency Scale is a 7-point self-report measure that aims to assess subjective ratings of how often someone recalls his/her dreams. The scale has shown high-retest reliability and is effective in discerning inter-individual differences in dream recall (Schredl, 2004).

Subjective Measures

Multidimensional Dream Questionnaire (MDQ; Wainstein, 2013; see Appendix B). The MDQ was constructed for the purposes of the broader study. However, not all questions on this questionnaire were relevant to the aims of the present study; only those measures that were relevant were analysed further (see Appendix B).

Q5 of MDQ. Panksepp's (1998) seven basic emotions (see Appendix C, for basic instructions). Subjects were asked to rate dream emotionality according to Panksepp's seven basic emotions (Panksepp, 1998; see Appendix C for description for each emotion). Participants were asked to measure the reported presence of one or more of these seven emotions, as well as relative intensity of the emotion experienced (1 – little; 2 – moderate, 3 – great, no rating – emotion not present). Emotions could thus be analysed both in terms of frequency and experienced intensity. These seven emotions are dervied from neuroscientific findings that have identified seven neuroanatomical systems that have been shown to be involved in processes of affect regulation (see Pankseep 1998, for a review of these findings). These basic emotions are: RAGE, FEAR, GRIEF, SEEKING, CARE, LUST, and PLAY[2]. These emotions can be further dichotomised according to their emotional valence: positive or "approach" affective states: SEEKING, CARE, LUST, PLAY; and negative or "avoidance" affective states: RAGE, FEAR, GRIEF (Burgdorf & Panksepp, 2006, p. 175). Importantly, while at first glance this dichotomy may seem like a naive oversimplification, the dichotomising of each of these emotions is based

[2] Capitals are used to distinguish these affective neuroanatomical systems from our colloquial understanding and use of them as emotions.

upon biological evidence showing a role for each of these systems in the regulation of pleasure and displeasure, and approach or avoidance behaviours (Burgdorf & Panksepp, 2006).

Q6 of MDQ. Pleasantness-Unpleasantness Scale. Eight of the subscales used in the MDQ are based on Hauri, Sawyer and Rechtschaffen's (1967) eight dimensions derived from a factor analysis of the content of dreams. Previous investigations have shown high inter-rater reliabilities to be drawn for these scales (Weisz & Foulkes, 1970). One sub-scale of interest for the purposes of the present study is that of self-reported pleasantness. This was measured on a 7-point scale (from 1 – very pleasant, to 7 – very unpleasant, with an intermediate option of 4 – neutral) and is a useful estimate of the overall pleasantness of the dream. This may be compared to the respective measures of dream emotion to assess how well the respective dichotomy of emotions reflect the pleasantness/unpleasantness of the dream.

Objective Measures

Hall and Van de Castle system (1966). The Hall and Van de Castle Coding System is the most widely used objective measure of dream contents. In terms of emotion, it measures the relative presence/absence of five main emotional categories: happiness, anger, apprehension, sadness, and confusion (see Appendix D for an outline of these 5 emotions). Hall and Van de Castle (1966) further dichotomised these five emotions into positive (happiness) and negative (anger, apprehension, confusion, sadness) emotions. Each of the emotion categories is quantified through the scoring of explicit words relating to that category. While judges may feel inclined to infer emotions based on the contents of the dream reports, the authors maintain that "this temptation should be resisted" and judges should only code emotions according to explicit mention of a particular affective state (Hall & Van de Castle, 1966, p. 112)[3]. The Hall and van der Castle rating system was chosen for the present study for two reasons: Firstly, it is the most popular used objective measure of dream content: the widely cited norms of dream contents that have been established are based on studies that have used 1000's of dream reports according to this system (Domhoff, 2005). Secondly, this system has been employed in a number of extensive

[3] According to Hall & Van de Castle (1966), one exception may be made to this rule. This occurs when there is a combination of a described event and an explicitly mentioned physiological response (e.g. crying, sweating, trembling) that gives clear insight as to the particular emotion being experienced. This scenario is, however, infrequent and should be approached with caution.

investigations that consequently found dreams to be predominated by negative emotions (e.g. Hall & Van de Castle, 1966; Snyder, 1970). Thus, in accordance with the aims of the present study, this system remains an important scale concerning dream emotionality and any major discrepancies found would have the greatest implications on the present literature.

Total Recall Count (Antrobus, 1983). Total recall is arguably the most widely used measure of information processing during sleep. It measures the approximate word count of verbal accounts in describing mentation through excluding repeated words, "uhm" and "ahs", and irrelevant dream commentary (Antrobus, 1983). Studies have found inter-rater reliability to be high (Antrobus, Fein, Jordan, Ellman, & Arkin, 1991). Total Recall Count was used to ensure the approximate length of verbal reports were suitable for objective ratings. A lower limit of 30 and an upper limit of 300 were chosen. This criterion is based on the lower and upper limits that have been outlined by previous authors (Schredl & Doll, 1998; Hall & Van de Castle, 1966), and ensures that dream reports are sufficiently long for objective emotion detection but not too long that subjective ratings are biased towards exclusively reporting emotions that are present at the end of the dream.

Procedure

Sleep Night Protocol

The study was carried out in a hospital sleep laboratory, in accordance with an agreement between the hospital and the University of Cape Town. A trained researcher monitored the sleep stages using standard polysomnography, and participants were awoken multiple times each night for dream reports to be obtained. All participants underwent an adaptation night to familiarise themselves with the laboratory setting and the MDQ. Participants were woken up 5 - 6 times during the experimental nights, where they provided verbal dream accounts of any recall of experienced mentation. These reports were digitally recorded and later transcribed.

Controlled Awakenings

Because the original study aimed to explore the relationship between sleep mentation and sleep microstructure, no fixed time being set for the respective awakenings; participants were awoken according to the desired phasic readings for the respective sleep stages. Efforts were

made to counterbalance awakenings across the three sleep states: Stage 2 (light non-REM), Stage 3 and 4 (deep non-REM), and REM, and across the course the night to control for any nighttime effects[4]. The awakening protocol was based on the dream recall procedure of Foulkes, Spear and Symonds (1966), and Antrobus, Kondo, Reinsel and Fein (1995). The general dialogue between researcher and participant following a controlled awakening was as follows:

"Tell me everything that was going through your mind just before you were awoken."

Followed by:

"Is that everything you could remember?"

After the participant had recounted all that he/she may be able to remember with regards to the dream, they were subsequently asked to fill in the MDQ. Participants were urged not to recall remembered dreams from a previous time of the night, and only to recall what mentation – if any – they were experiencing shortly before they were awoken. In an effort to minimise any attempts to please the researcher, participants were told that any type of recall, including no recall whatsoever, were of interest to the study and thus were urged to be as honest as possible.

Objective Scoring

Researchers asked two trained external judges to rate the verbal transcriptions of the dreams according to the Hall and Van de Castle content analysis system.

Ethics

The Psychology department's ethics committee granted ethics approval for the study. All methods involved – including participants' compensation – were carried out in accordance with the guidelines set out in the university's research code of ethics. Consent was obtained prior to any involvement in the preliminary testing or nights spent in the sleep laboratory and at all stages in the research process. Participants were also reminded that their involvement in the study was entirely voluntary and were free to withdraw at any time without consequence.

Data Analysis

[4] As there are characteristic decreases in deep non-REM sleep over the course of the night, awakenings during stages 3 and 4 were more prevalent during the first half of the night.

Data Management – Data was managed and stored using a licensed version of SPSS statistical package (version 21).

Statistical Analyses – Statistical analysis was carried out in two phases.

Subjective Ratings – The first phase of data analysis utilised those awakenings that resulted in verbal dream reports[5] and where participants completed questions on the MDQ. These subjective ratings (n=159) were analysed in terms of the emotion frequency, emotion intensity, and dream valence. Emotional dreams were classified as dreams where participants reported experiencing at least one of the seven basic emotions, while non-emotional dreams were classified as dreams where the participant indicated that no emotion was present. These emotional dreams were further classified according to the prevalence of positive and negative emotions: positively valenced dreams were predominated by positive emotions, negatively valenced dreams were predominated by negative emotions, and balanced dreams were dreams where the number of positive and negative emotions was the same.

Direct Comparisons - The second phase of the analysis involved directly comparing subjective and objective measures of emotion in dreams. These dreams consisted of a subsample (n=93) that met the set total recall count (TRC) criteria (30-300) for objective ratings. Scores for the respective raters were compared for each dream report and an overall Kappa agreement rate was calculated for emotional valence. Ideally discrepancies between the raters are solved by discussion, however time limits associated with the present study meant that this was not possible. As a result, it was felt that the most appropriate way of dealing with this was to average any discrepancies in valence across the dreams. This should be taken into account when evaluating the results of the objective ratings. Data analysis of dream emotionality followed the same rules as the subjective ratings in terms of overall emotion (emotional, non-emotional), as well as the dream valence (positive, negative, balanced).

Inferential Statistics

[5] Dream reports in this instance may include verbal recall of remembered mentation (e.g. images, sounds, ideas) that may not necessarily contain all of the contents, or characteristic completeness, of a normal dream.

To establish whether observed differences reached levels of statistical significance, inferential statistics were used for hypothesis testing. Due to the use of nominal variables and concerns over normality, a non-parametric test was preferred. Since the samples were related to one another, a Wilcoxon's Sign Rank Test was used. An important caveat should be inserted here: Inferential statistics were based on the total number of dream reports and participants provided a variable number of dream reports towards the final sample. Thus, individual differences cannot be fully accounted for in the present study. This should also be taken into account when interpreting the results.

Results

Descriptive Statistics of Sample and Awakenings

Following the screening process, a final sample of 22 participants met the suitable criteria and spent a total of 70 inconsecutive nights in the sleep lab. Due to concerns of over data reliability, researchers decided to exclude data from two participants in the final analysis: one showed highly disrupted sleep architecture, while the other exhibited severe sleep inertia following the controlled awakenings. In terms of demographics of the final sample, these participants were all undergraduate students between the ages of 18 and 25 (M =19.65, SD=1.60); 16 were female and 4 were male.

Using the data from these participants, a total of 267 controlled awakenings were performed over the three major stages of sleep (REM, light non-REM, deep non-REM); these awakenings either resulted in verbal dream reports of experienced mentation, no recall of experienced mentation, or the reported experience of a white dream[6] (see Table 1, for an overview of these awakenings). In line with the general literature regarding REM and non-REM dreaming(e.g. see Aserinsky & Kleitman, 1953), reports of dreaming were far more prevalent subsequent to awakenings in REM compared to other respective stages of non-REM. Due to the study's aims revolving around dream emotion, only positive dream reports were included in further analyses. Nine dream reports were removed listwise due to missing information on the MDQ: this left a final sample of 159 dream reports from 20 participants to be used for the subjective ratings of dream emotions.

[6] A white dream refers to the experience of having felt like one was dreaming but being unable to recall any of the dreams' contents.

Table 1

Descriptive statistics: awakenings across the major sleep stages

	Light non-REM	Deep non-REM	REM sleep	Total
Dream Report	86 (65.6%)	33 (40.2%)	49 (90.7%)	168 (62.9%)
White Dream	21 (16.0%)	27 (32.9%)	1 (1.9%)	49 (18.4%)
No Recall	24 (18.3%)	22 (26.8%)	4 (7.4%)	50 (18.7%)
Total	131 (100%)	82 (100%)	54 (100%)	267 (100%)

Note: Numbers are represented by frequencies; their respective prevalence is quoted in parentheses (%).

Subjective Ratings of Dream Emotionality

Emotion Frequency

The number of reported emotions were calculated and compared over the major stages of sleep (see Table 2). The only difference of not appears to be that of REM sleep, which appears more emotional than other respective stages of non-REM. The emotional valence of these emotions was then compared. Positive emotions seem to predominate as more than two-thirds of the reported emotions were positively valenced. This difference was stable across the sleep stages. The difference between the average number of positive and negative emotions were then calculated (positive, $M = 1.03$, $SD = 0.90$; negative, $M = 0.50$, $SD = 0.71$): This resulting difference was found to be significant, Wilcoxon $Z = -5.09$, $p < 0.01$, $r = 0.31$. showing that participants reported significantly more positive emotions than negative ones.

Valenced Dreams

Emotionality was then explored in terms of the valence of dreams (see figure 2 and table 4, for an overview of these findings). Subjects reported that they experienced at least one emotion in 85.5% of the dreams. Just as was the case in the frequencies of emotions, positively valenced dreams appear to predominate negatively valenced dreams by a ratio of approximately 2:1. These differences were then compared across the sleep stages. The only discrepancy appeared to be in deep non-REM, which contained relatively fewer negatively valenced dreams.

This difference however, was not significant: Chi-Sqaure = 0.73, p = 0.69, Cramer's V = 0.08, suggesting that valence is stable across the sleep stages.

Felt Intensity of Positive/Negative Emotions

The results for the reported intensity for positive and negative emotions across a three-point scale (little, moderate, great) are provided in table 3. The results showed that positive emotions were rated to be significantly more intense than negative ones, Chi-Square = 9.98, $p < 0.01$, Cramer's V = 0.20. Thus, positive emotions appear to predomainte dreams both in terms of frequency and intensity.

Table 2

Prevalence of Positive and Negative Emotions Across the Sleep Stages

	Light non-REM	Deep non-REM	REM sleep	Total
Positive Emotions	72 (67.29%)	30 (68.18%)	62 (66.67%)	164 (67.21%)
Negative Emotions	35 (32.71%)	14 (31.82%)	31 (33.33%)	80 (32.79%)
Total	107 (100%)	44 (100%)	93 (100%)	244 (100%)

Table 3

Prevalence of Emotional Valence Across the Sleep Stage

	Light non-REM	Deep non-REM	REM sleep	Total
Negatively Valenced	40 (50.0%)	16 (51.6%)	26 (54.2%)	82 (51.6%)
Positively Valenced	20 (25.0%)	5 (16.1%)	13 (27.1%)	38 (23.9%)
Balanced emotions	5 (6.3%)	4 (12.4%)	7 (14.6%)	16 (10.1%)
No emotion	15 (18.8%)	6 (19.4%)	2 (4.2%)	23 (14.5%)
Total	80 (100%)	31 (100%)	48 (100%)	159 (100%)

Table 4

Felt Intensity of Positive/Negative Emotions

	Positive Emotions	Negative Emotions	Total
Little	45 (27.4%)	38 (47.5%)	93 (38.1%)
Moderate	96 (58.6%)	32 (40.0%)	128 (52.4%)
Great	23 (14.0%)	10 (12.5%)	33 (13.5%)
Total	164 (100%)	80 (100%)	244 (100%)

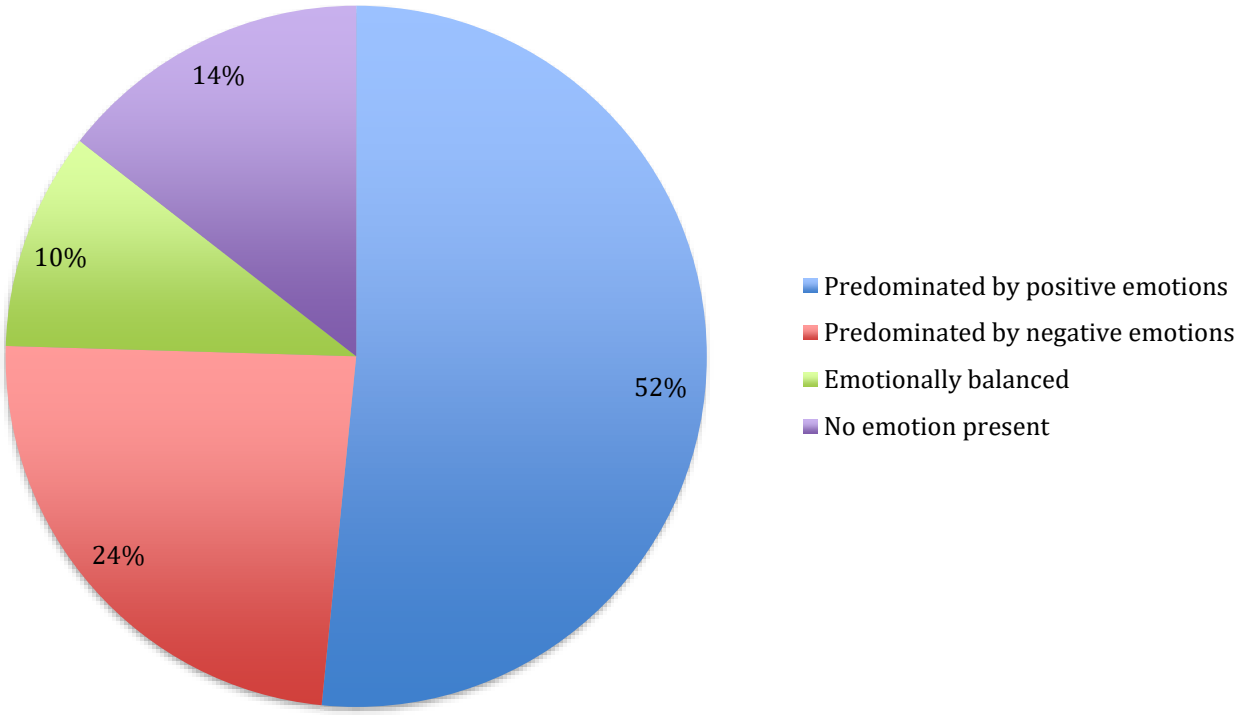

Figure 1. Showing the relative distribution of subjective ratings of valenced dreams (n=159

Direct Comparisons: Discrepancies in Subjective and Objective Ratings

Of the 159 dream reports used in the initial analysis, 92 of the dreams met the outlined TRC criteria for objective ratings and were used for the direct comparisons. An agreement between the two raters was calculated and fount to be significant, Kappa value = 0.404, $p < 0.001$, yielding a value of moderate agreement (Viera & Garret, 2005). Objective raters agreed on the overall valence of 73.9% of the dreams, further suggesting that moderate agreement was reached. Of these valence discrepancies, 18 were between negative valence and no-emotion, while the other 6 were between positive valence and no emotion. These were subsequently averaged in the respective dreams, as well as the overall valence leaving 12 non-emotional dreams, 9 negatively valenced dreams, and 3 positively valenced dreams.

Hypothesis 1: Objective Raters Significantly Underreport Emotions

The first hypothesis that was tested was that objective raters would significantly underreport emotions in dreams compared to subjective raters. This was tested through comparing the prevalence of emotional and non-emotional dreams (see figure 2 and table 3). In terms of overall dream emotion, judges rated more than half of the dreams to be non-emotional (55.4%). In contrast, subjects rated emotional dreams to predominate, both in the larger sample used in the initial analysis (85.5%; n=23) and in the smaller subset (90.3%; n=9). This suggests a clear discrepancy between subjective and objective raters in terms of emotion detection and supports the notion that external raters underreport the presence of emotions compared to the dreamers themselves. Thus, our first hypothesis is supported

Hypothesis 2: Objective Raters Show a Negative Bias of Dream Emotionality

Emotion Frequency

The second hypothesis that was tested was whether objective raters would significantly underestimate the prevalence of positive emotions compared to subjective ratings, and that this would result in an overestimation of negative emotions and negatively dreams. According to the subjective ratings of the subsample, a total of 156 of the seven basic emotions were rated across the 92 dreams. Of these emotions, 105 were positive, while the other 51 were negative. There averages were calculated for the average number of positive ($M = 1.13$, $SD = 0.88$) and negative

emotions (M = 0.55, SD = 0.73) per dream report were calculated and compared. As in the initial sample, this difference was found to be significant, Wilcoxon Z = - 4.029, $p < 0.01$, r = 0.34, showing that participants subjectively rated significantly more positive emotions than negative emotions.

The ratings given by external judges were then considered. Judges rated a total of 55 emotions to be present in dreams: 12 were rated as being positive and the other 43 were rated as being negative. As was done with the subjective raters, the respective means were calculated for the respective positive (M = 0.13, SD = 0.40) and negative (M= 0.46, SD = 0.62) emotions. These mean differences were compared and found to be significant, Wilcoxon Z = - 4.021, $p < 0.01$, r = 0.30. Thus while subjective raters identified significantly more positive emotions than negative emotions, objective raters identified significantly more negative emotions.

Dream Valence

The same contrasting findings are apparent in overall dream valence (see Table 3 and figure 2). According to subjects, over half of the dreams were positively valenced, however objective raters who rated these same dreams found a far smaller percentage of dreams to be positively valenced. In contrast, objective raters found negatively valenced dreams to be more prevalent compared to subjective raters – this difference however, is somewhat more balanced. Collectively, these results further support the suggestion that judges underreport the presence of positive emotions in dreams, which leads to a type of negative bias in dream emotionality. Due to both the significant findings in emotional frequency and the clear discrepancies that are evident in terms of dream valence, our second hypothesis is also supported.

Table 3

Comparisons of Valenced Dreams

	Subjective (n=159)	Subjective (n=92)	Objective (n=92)
Positively Valenced	82 (51.6%)	55 (59.8%)	7 (7.6%)
Negatively Valenced	38 (23.9%)	23 (25%)	32 (34.8%)
Balanced Emotions	16 (10.1%)	5 (5.4%)	2 (2.2%)
No Emotion	23 (14.5%)	9 (9.6%)	51 (55.4%)
Total	159 (100%)	92 (100%)	92 (100%)

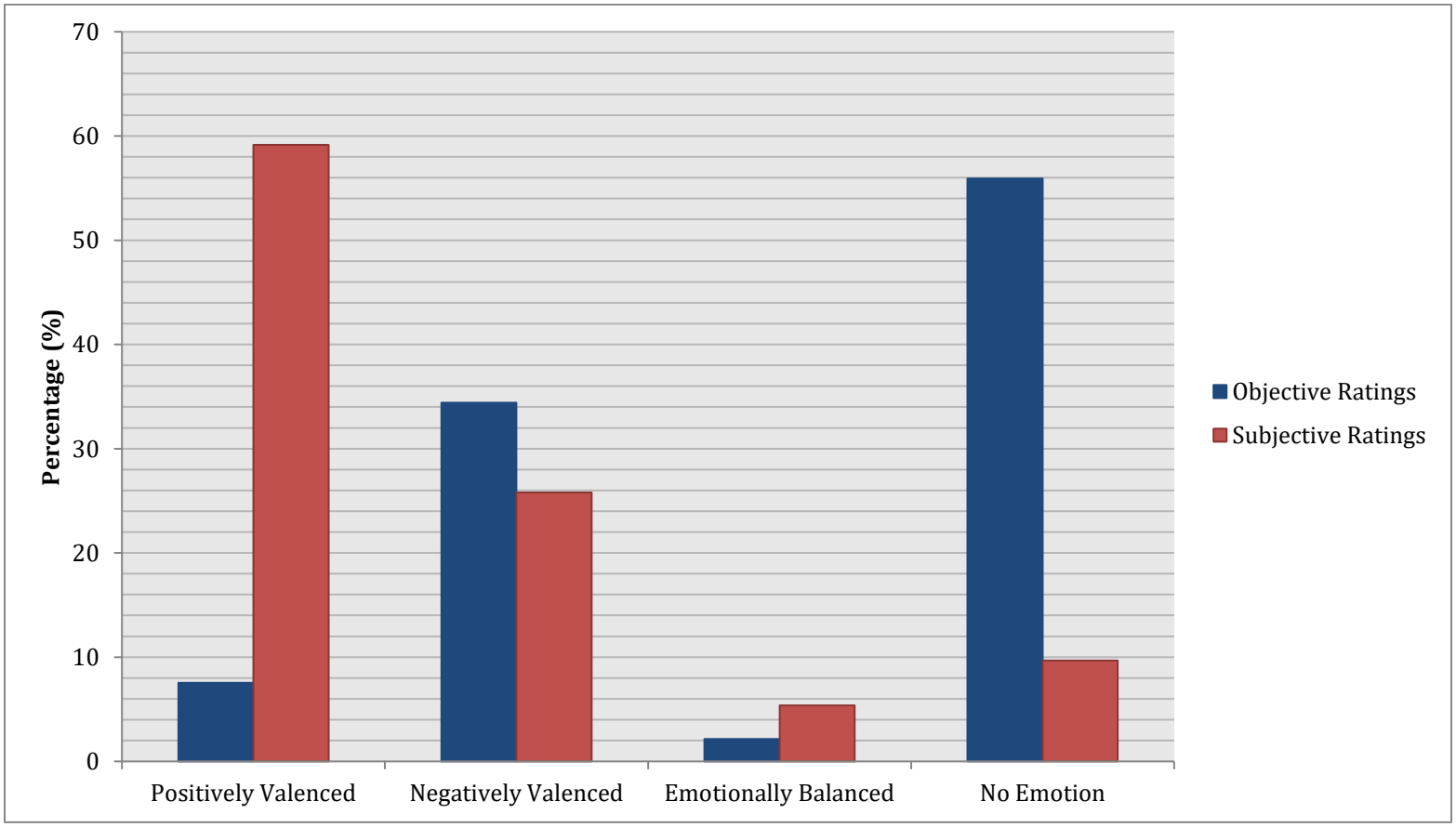

Figure 2. Showing differencs in emotionality and valence as rated by objective raters and subjective raters (n=93).

Comparisons of Self-Reported Pleasantness

Participants rated the majority (56.52%) of dreams to pleasant, while the remaining dreams were evenly distributed as being unpleasant or neutral (both 27.2%). These findings were then matched to the corresponding valence of dreams of the subjective and objective ratings (see figure 3). The prevalence of pleasant/unpleasant dreams strikingly resembles the distribution of the valenced dreams of the subjective ratings and seems to deviate remarkably from those of the objective raters. While negatively valenced dreams and unpleasant dreams seem somewhat matched according to both objective and subjective raters, there are major discrepancies between positively valenced dreams and pleasant dreams, as well as neutral dreams and dreams that were found to be emotionally balanced[7]. These results support the validity of the MDQ, both in the relative emotional detection of dreams and the corresponding dichotomisation of those emotions into positive and negative. On the other hand, the clear mismatch of findings regarding the pleasantness and valence according to objective ratings suggests that the Hall and Van de Castle system doesn't adequately capture the emotional experience of dreams.

[7] For the purposes of the comparisons, non-emotional dreams and emotionally balanced dreams were combined into a "balanced" group. This was done for meaningful comparisons to be made with dreams that were rated as "neutral" in terms of pleasantness.

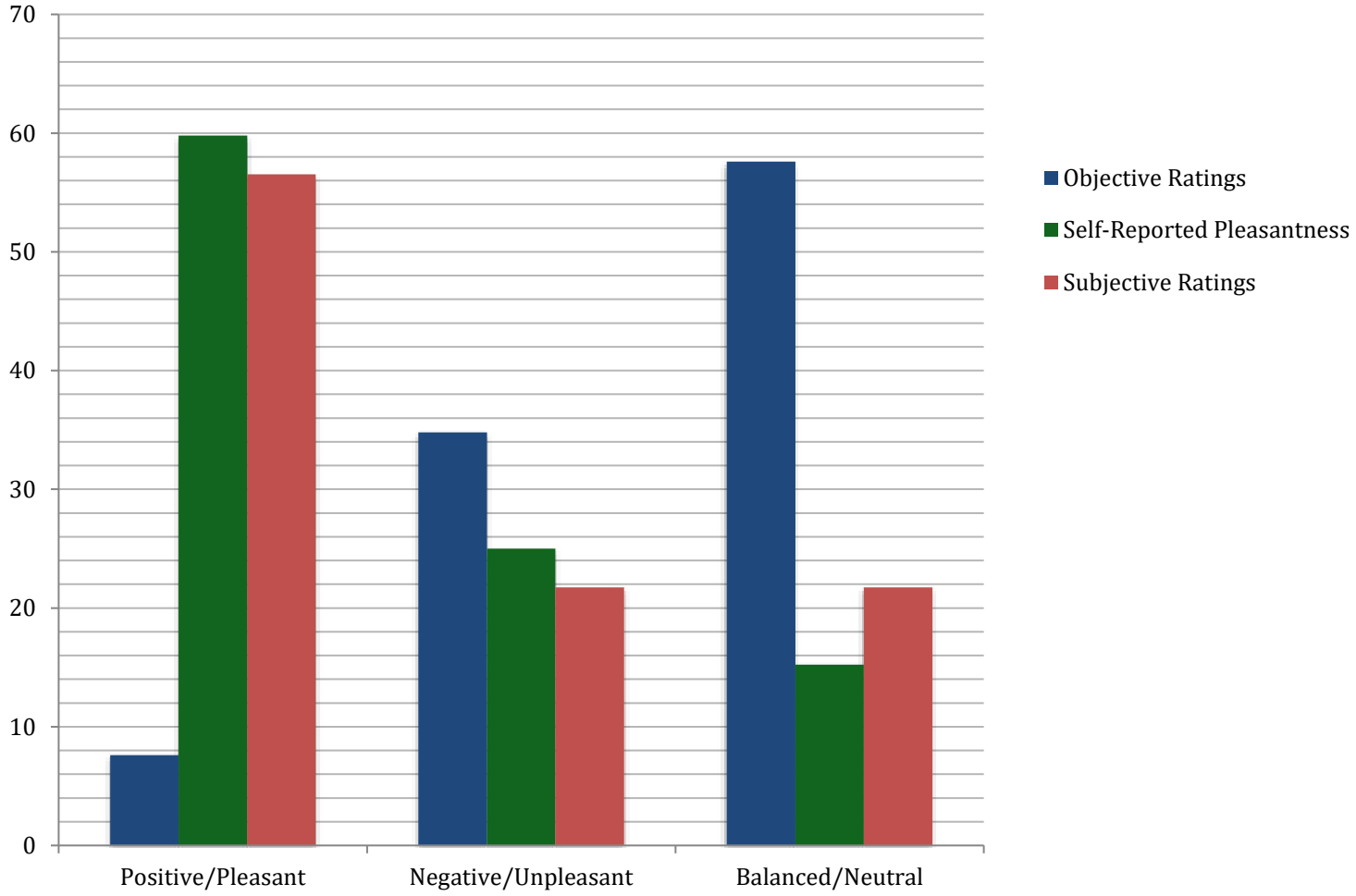

Figure 3. Showing comparisons of subjective and objective dream valence to self-reported pleasantness (n=93).

Discussion

In accordance with the aims outlined, the results of the present study consisted of two main findings. These findings and their respective implications of such findings on current literature and functional theories of dreaming are discussed below.

Dreaming is Emotional and Positively Valenced

The first aim of this study was to characterise the emotionality of dreaming from laboratory awakenings in the three main states of sleep (light non-REM, deep non-REM, and REM sleep). This was evaluated in terms of general emotionality (prevalence of dreams containing at least one emotion) and in terms of emotional valence (prevalence and intensity of positive and negative emotions in dreams). The results found that dreamers subjectively rated the vast majority of dreams to be emotional (i.e. to containing at least one emotion) compared to non-emotional dreams. These mirror previous studies that have employed subjective ratings and found the vast majority of dreams to contain emotion (Foulkes et al., 1988; Meritt et al., 1994; Sikka et al., 2014; St-Onge et al., 2005) and go against a number of the early investigations that have found the prevalence of emotion in dreams to be "curiously lacking" (Hall & Van de Castle, 1996, p. 116; Snyder, 1970). In terms of the valence of these emotions, positive emotions seem to predominate, both in terms of frequency and in terms of positively valenced dreams. Furthermore, owing to the fact that participants rated positive emotions to be more intense than negative emotions, this rules out the possibility of a type of "positivity offset" (Cacioppo, Gardner, & Bernston, 1999, p.12), or the situation where "mild positive emotions prevail but negative emotions dominate when intensity is taken into account." (Sikka et al., 2014, p. 62). As the present results suggest, this is clearly not the case.

In terms of the distribution of emotion across the three sleep states, emotions were most evident in REM dreaming. This high degree of emotionality is in line with previous laboratory studies, where almost all REM reports contain elements of emotionality (St-Onge et al., 2005; Sikka et al., 2014). Bearing this in mind, dreams obtained from other stages of non-REM showed comparably high rates of emotionality. These dreams also showed similar emotional valences to REM dreams and suggest that differences in positive and negative emotions are stable across the respective sleep states. Considering that no study has yet explored the emotional nature of non-

REM dreams, these results provide novel evidence supporting the suggestion that like REM dreams, non-REM dreams are also characterised by a high degree of emotionality and show a preponderance of positive emotions. While this represents initial support for such a suggestion, further research is needed with regards to non-REM dreams and how they contribute to the nature of our dream emotionality.

Explicit Emotions Don't Tell the Whole Story: Shortcomings of Content Analysis

The second aim of this study was to investigate any evident disparities when comparing subjective ratings of dreams with objective ratings of those same dream reports. The first hypothesis that was tested was whether objective raters underreport the presence of emotion compared to subject ratings. In accordance with the first hypothesis, objective raters using the Hall and Van de Castle (1966) system significantly underreported emotions in dreams compared to subjective ratings. This was reflected in the greatly reduced number of dreams that were found to be non-emotional. This low prevalence of emotional dreams is in accordance with previous studies that have employed the Hall and Van de Castle system (e.g. Hall & Van de Castle, 1966; Snyder 1970; Schredl & Doll, 1998).

The second hypothesis that was tested was whether external raters would rate dreams to be more negatively valenced compared to subjective raters, both in terms of the ratio of emotion frequency and the number of valenced dreams. The results were in accordance with such a hypothesis, as the two methods of emotion measurement clearly show diverging findings: On the one hand, subjects found positive emotions to predominate, while on the other hand external raters found negative emotions to predominate. When compared to measures of self-reported pleasantness, the present findings clearly support the suggestion that this difference can be explained in an underreporting of positive emotions on the part of objective raters.

The most plausible explanation from current literature for such an underreporting of emotions – and especially positive emotions – is that objective raters cannot accurately detect implicit moods and atmospheres that may be present in dream reports. This is because systems that code dreams according to content analysis are only allowed to code those emotions that are explicitly described. Given that the vast majority of implicit moods and atmospheres are positively valenced (Strauch & Meier, 1996), objective raters may erroneously underreport the

presence of positive emotions in dreams and mistakenly conclude that negative emotions predominate. Such an inference however, is clearly unwarranted. As the results of the present study and other former investigations (e.g. Schredl & Doll, 1998; Sikka et al., 2014) have shown, there are clear disparities in the general findings of dream emotionality between objective ratings and the dreamers themselves. As a result, the very norms established by Hall and Van de Castle and the findings in widely cited investigations (e.g. Hall & Van de Castle, 1966; Snyder, 1970) that have employed such a system should be interpreted with an appropriate level caution. As argued above, the present findings support current literature that suggests that findings based on such a system cannot be an accurate reflection of human dreaming and accordingly do not present convincing evidence for a negative bias of dream emotionality.

Implications For TST and Other Functional Theories of Dreaming

In terms of the implications of these findings on functional theories of dreaming, these results go directly against the underlying premises of the Threat Simulation Theory (Revonsuo, 2000) and other such functional accounts that are based on a negative bias of dream emotionality (e.g. Cartwright, 1996; Flanagan, 2000; Hartmann, 1995; Kramer, 1991). Firstly, the present results show quite a different story to the proposed negative bias as they suggest that dreaming is in fact predominated by positive emotions and supplements a growing body of recent literature of laboratory studies showing similar results (e.g. Sikka et al., 2014; St-Onge et al., 2005).

Secondly, these results clearly call into question the validity of some of the widely cited findings (e.g. Hall & Van de Castle, 1966; Snyder, 1970) that provide valuable evidence in support of the TST and other such functional accounts. Objective Measures that code emotions according to content analysis (e.g. Hall and Van de Castle coding system) have been praised by these researchers for their ability to test underlying assumptions: “Because the TST makes claims about the contents of dreams, dream content analysis can be used in the direct testing of the TST” (Valli & Revonsuo, 2009, p. 19). Clearly, these results call into question the validity of such measures of content analysis and their corresponding findings. These measures fail to adequately detect implicit emotions and moods, which arguably comprise an important part of our dreaming life. In our pursuit of characterising dream emotionality, use of such a system appears to bring more problems than it proposes to solve. As such, future research should employ measures that match correspond to the emotional experiences of dreamers – both explicit

and implicit. While the Hall and Van de Castle system can reliably code the contents of other aspects of our dream life, the measuring of emotions, described by Hall and Van de Castle (1966) as one of their "most difficult tasks" (p. 110), appears to be a task too far for such a system.

Limitations and Future Research

While these results clearly have related implications on the wider literature, the extent to how they may inform the dreaming literature is constrained by a number of limitations.

Methodological Limitations

Perhaps the greatest limitations that constrain the generalisability of the outlined results are related to four methodological issues. Firstly, while the initial sample of 159 dream reports is sufficiently large sample for comparing the subjective ratings of dreams, the smaller sample of 98 dream reports used for content analysis could be argued to be somewhat underpowered as they don't meet the minimum sample of 100-125 dream reports outlined by Domhoff (2005) for content analysis. Secondly, different awakenings produced varying numbers of dream reports in participants. Thus, participants each contributed a different number of dream reports towards the final sample. From this perspective, individual differences cannot be fully accounted for according to the data. Thirdly, the decision to average out the respective discrepancies in objective scoring is less than ideal. While an average will give an approximation of each respective rater's opinion, it is impossible to know whether their scoring would have been considerably different had they solved the evident discrepancies by inter-rater discussion.

Lastly, the fact that the present study used two different scales to measure the different emotions means that it's difficult to know to what extent the observed differences are reflections of discrepancies in the different scales. For example, Panksepp's (1998) basic emotions comprise seven emotional categories: four positive, and three negative, while the Hall and Van de Castle system comprises five categories: one positive, and four negative. As Mealey (2000) points out: "It is hard to avoid the conclusion that dream content is full of threatening images and emotions when a majority of available scoring categories have negative valence." (p. 972). Arguably then, a reflection of a preponderance of negative emotions from the objective raters in the present study could reflect the unbalanced number of categories for negative emotions, while the

preponderance of positive emotions from subjective raters could reflect a larger number of categories in positive emotions. Future studies should incorporate two conditions (subjective and objective) using the same scale as has been done in previous studies to control for this (Schredl & Doll, 1998; Sikka et al., 2014).

Emotional Shifts Are Interrupted

Another possible limitation to consider is that of the presence of emotional shifts in dreams. Two studies (Meritt et al., 1994; Nielsen et al., 1991) have reported a considerably large proportion (e.g. 46%, Merritt et al., 1994) of dreams to present emotional shifts during the course of the dream – dreams starting with one emotion and ending with another. These studies both found that emotional shifts from positive to negative were far more prevalent than the opposite shifts from negative to positive. Thus, the majority of dreams that had emotional shifts started out as positive and ended up as negative. Under such a perspective, it's conceivable that controlled laboratory awakenings may interrupt dreams before these positive-negative emotional shifts can take place or "naturally unfold" (Sikka et al., p. 62). The present findings thus may represent an underestimation of negative emotions as they commonly evidence themselves at the end of dreams. However, the methodology employed in these two studies is arguably questionable: Since these participants were not asked to transcribe *all* remembered dreams upon awakening and were given a relative freedom as to what dreams they could report, it is likely that the dreams chosen by participants for transcription were a highly emotional, dramatic subset of dreams. Thus, the high prevalences may not be representative of our normal dreaming life and provide a perfect example of a methodology prone to a "biased method of dream reporting" (Mealey, 2000, p. 972). Further research using laboratory awakenings in different times of the REM cycle can clarify the nature of these emotional shifts and their plausibility as a limitation of laboratory research.

Differences in Setting: Home vs. Laboratory

Another limitation related to dreams obtained from laboratory studies concerns the laboratory setting itself. Dream reports obtained from laboratory settings appear to be more positively valenced and less emotionally intense. Evidence for such a suggestion comes from St-Onge et al.'s (2005) study that directly compared home and laboratory dreams using the same

participants. The study found that significantly less negative dreams were reported in the laboratory setting compared to at home. Other studies have also found that laboratory dreams contain significantly lower amount of aggression and sexuality (Foulkes, 1979) and that nightmares are typically rare (Hartmann, 1984). Collectively these results call into the question the validity of dream reports obtained from laboratory dreams and accordingly, the present findings may not be an accurate representation of how we normally dream at home.

However, contrary findings to such a suggestion to exist: Weisz and Foulkes (1970) found no significant differences in the emotional valence of dreams across the laboratory and home settings. Furthermore, dream reports obtained from spontaneous awakenings at home are more likely to represent biased emotional subsample of reported dreams from the night before (Conduit et al., 200; Mealey, 2000; Montangero, 2000). In contrast, laboratory studies using controlled awakenings arguable significantly minimise such an effect, as participants are asked to report what they were dreaming just before they had been woken up. Thus, while there is evidence for differences in emotional valence of the dream reports obtained from the laboratory and dream reports obtained from home (e.g. St-Onge et al., 2005), it is unclear to what extent these differences are a reflection of methodological biases. Further research investigating these possible differences is warranted.

Conclusion

The present study sought out to clarify some of the issues surrounding the emotional nature of dreams. In accordance with the aims, the study yielded two main findings that have implications on current literature. Firstly, contrary to a number of previous investigations showing a negative bias of dream emotionality, the present results suggest that dreaming is characteristically emotional and positively valenced. Since previous investigations have all probed for emotion during REM sleep, these results also provide novel evidence by suggesting that non-REM mentation has comparable levels of high emotionality and positive dream valence. Secondly, the present findings support the notion that objective raters significantly underreport the presence of positive emotions and support the suggestion that objective measures, such as the Hall and Van de Castle system, fail to adequately capture the emotional nature of our dreaming life. Since a number of functional theories of dreaming are based on an assumption of a negative bias in dream emotionality (e.g. TST), this research goes directly against the assumptions of such

accounts. Furthermore, the clear disparities in subjective and objective ratings call into question the reliability of some of the main investigations – based on objective ratings – that appear to support them. While the nature of research investigating the emotions of dreams inevitably faces a number of limitations, this study represents a step forward in the literature towards clarifying some of the debate surrounding the inherent biases in dream emotionality.

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Appendix A: Pittsburg Sleep Quality Index (PSQ

Appendix B: Multidimensional Dream Questionnaire (MDQ)

*****Extracted from Wainstein, D. (2013). Non-REM dreaming in relation to the cyclic alternating pattern: An exploratory study. (Unpublished master's thesis). University of Cape Town, Cape Town, with permission.

Appendix C: Instructions for Basic Emotions

*****Extracted from Wainstein, D. (2013). Non-REM dreaming in relation to the cyclic alternating pattern: An exploratory study. (Unpublished master's thesis). University of Cape Town, Cape Town, with permission.

Appendix D: Hall and Van de Castle 5 Basic Emotions (Domhoff, 2005, p. 522-534)

"Classes of Emotions

Anger

(Coding symbol: **AN**.) This class of emotions is generally easy to identify. Representative of some of the terms coded under anger are: annoyed, irritated, mad, provoked, furious, enraged, belligerent, incensed, and indignant. As with the following emotional classes, all degrees of intensity are included within each class, and no coding distinction is made between weak expressions of anger such as being peeved or strong expressions such as being infuriated.

Apprehension

(Coding symbol: **AP**.) The emotions included in this class can be considered related to fear, anxiety, guilt, and embarrassment. Although differences are recognizable among them, all these conditions lead to conscious concern on the part of the person experiencing them. The person feels apprehensive about the possibility of physical injury or punishment, or the possibility of social ridicule or rejection. Thus the common denominator underlying these emotions is that the person is uncomfortable because the threat of some potential danger exists . The following terms, which are not meant to be all inclusive, refer to various degrees of apprehension: terrified, horrified, frightened, scared, worried, nervous, concerned, panicky, alarmed, uneasy, upset, remorseful, sorry, apologetic, regretful, and ashamed.

Sadness

(Coding symbol: **SD**.) All the words that describe an unhappy emotional state are coded in the sadness class. References to physical pain or physical distress are not included in any of the emotional classes. Some examples of terms that would be coded as sadness are: disappointed, distressed, hurt, depressed, lonely, lost, miserable, hopeless, crushed, and heartbroken.

Confusion

(Coding symbol: **CO**.) Although it may be debatable as to whether confusion is a condition possessing the same degree of autonomic involvement as the preceding

emotions, we have chosen to place it in the classification of emotions. It is true that confusion resides more in the head as a state of cognitive ambiguity than it does in the viscera as a gut-type reaction. However, the feeling state accompanying uncertainty may begin to shade toward a type of free-floating anxiety, toward frustration, or toward depression. Since confusion is therefore "emotionlike," and also because it is reported fairly frequently in dreams, mention of it seems to belong most appropriately in the classification of emotions. Confusion is generally produced either through confrontation with some unexpected event or else through inability to choose between available alternatives. Some words that may indicate confusion are: surprised, astonished, amazed, awestruck, mystified, puzzled, perplexed, strange, bewildered, doubtful, conflicted, undecided, and uncertain.

Happiness

(Coding symbol: **HA**.) All the words that describe a general state of pleasant feeling tone are included in this class. Some of the terms that would be coded as happiness are: contented, pleased, relieved, amused, cheerful, glad, relaxed, gratified, gay, wonderful, elated, joyful, and exhilarated."

*Extracted from Domhoff, G. W. (2005). The content of dreams: Methodologic and theoretical implications. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and practies of sleep medicine* (4th Ed., pp. 522-534). Philadelphia: W. B. Saunders.

Appendix E: Consent Form

*****Extracted from Wainstein, D. (2013). Non-REM dreaming in relation to the cyclic alternating pattern: An exploratory study. (Unpublished master's thesis). University of Cape Town, Cape Town, with permission.