Factors in Hartmann's Central Imagery Scale and their relationship to emotion and traumatic experiences

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Summary. The factor structure of Hartmann's scale (1996b) for Central Imagery (CI) was further investigated using exploratory factor analysis. Dreamer-rated emotion and information about any trauma history, was compared to CI and the factors derived from CI. Two dreams from each of 143 participants were collected and rated for both CI and each of the separate descriptor words for CI. Participants also provided information regarding level of emotion in each dream, any trauma history, time since trauma, type, level of distress at the time, and current distress. We found further evidence that the CI scale is best thought of as comprising at least two factors. Dreamer-rated emotion was significantly correlated with all the trauma related variables, but not trait coping style. The number of distressing peritraumatic events was significantly related to CI, and with all but the visual factor. CI may be related to variables at the time of the trauma, rather than current distress.

Keywords: Central image, Emotion, Dreams, Factor analysis, Central Imagery scale, Trauma, Peritraumatic events

1. Introduction

According to the Contemporary Theory of Dreaming (Hartmann, 2007; Hartmann 2010b), the purpose of dreaming is to make broad connections in the mind during sleep. Purportedly dreams free the mind to explore beyond over-learned material, and to make connections in ways that are difficult when one is awake. This process is said to be guided by the dominant emotional concerns of the dreamer. The clearest examples of this are in the dreams of people who have recently experienced trauma. In such cases, the dominant emotional concerns of the dreamer can be surmised from the nature of the traumatic experience. For example, people who have recently experienced some form of trauma where they have felt strong emotions such as feeling overwhelmed, helpless or fearful, commonly report dreams of negative events such as being swept up in a tidal wave or being burned in a house fire. These dreams are considered to be paradigmatic in that they are exemplars of the purpose of dreaming. Hartmann states that they contextualise the powerful emotions experienced by the dreamer which are clearly linked to their recent traumatic experience (Hartmann, 2007). Trauma has had a long association with dreaming. Indeed distressing dreams are included in the Diagnostic and Statistical Manual for Mental Disorders IV-TR as part of the criteria for post traumatic stress disor-

der (PTSD; APA, 2000). Importantly, the aetiology of PTSD is considered to be a traumatic experience and one result is often nightmares. Nightmares may be adaptive; part of the psychological healing process of assimilating traumatic events. There is some tentative evidence from one recent study (Pichioni, et al., 2002) to support this. The researchers considered daily stressors as well as life stressors in 412 psychology students and found that both are related to nightmare frequency. They also found association between nightmares and better coping with stress. They speculated that the high level of self-reported nightmares found in Type A and anxious individuals may be due to an elevated need to deal with stress. They concluded that nightmares may not always be harmful and in fact may be a mechanism that supports our attempts to cope with stressful situations.

However, the nature of distressing dreams might be the factor that is most important for emotional adjustment to trauma. Dreams that merely replicate the circumstances of the trauma are speculated to be failed integration attempts, and as such exacerbate post-traumatic symptoms, compared to other dreams, even highly arousing ones (Mellman et. al, 2001). Indeed, these PTSD nightmares may not be ordinary nightmares at all but rather a memory intrusion into dreams (Hartmann, 1996a). In contrast, dreams that contextualise the emotion associated with the trauma, rather than those that are literal replays of the trauma, may be more adaptive. However, according to Hartmann even the PTSD dreams are new creations that do not in fact simply replay trauma memories, and as such are performing a process of emotional adaption (Hartmann, 2010a).

In support of this premise, Hartmann states that dreams of those who have been through a trauma change over time, reflecting changes in emotional concerns as a result of the integration of the traumatic material into the psyche of the person (Hartmann, 1998; Hartmann, 2000; Hartmann, 2007; Hartmann, 2010b). In a recent study, Hartmann & Brezler

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(2008) gathered dreams before and after trauma, and reported a systematic change in the intensity of the imagery after the event. Their assumption was that the events of 11 September 2001 in the US would have produced mild trauma or at least emotional arousal in everyone living in the US. Forty-four people who had been recording their dreams for years provided 20 consecutive dreams, with 10 before the event and 10 after it. The results indicated a highly significant increase in the intensity of the imagery in the dreams recorded after the event, scored on a blind basis. This study did not however look at post-trauma recovery, self-reported coping, or what the individuals' level of distress was at the time of the event. Hartmann and collaborators have labelled the intense imagery embedded within many dreams as Central Imagery (or CI). A CI is defined as "a striking, arresting, or compelling image – not simply a story – but an image that stands out by virtue of being especially powerful, vivid, bizarre, or detailed" (Hartmann, Kunzendorf, Rosen & Grace, 2001). CI intensity is rated on a scale of zero to three, with three being high intensity. Intensity scores have been found to be related to the emotion experienced in the dream (Davidson, Lee-Archer, & Sanders, 2005; Hartmann, Zborowski, & Kunzendorf, 2001) and a measure of personality called 'Boundaries in the Mind' (Hartmann, Rosen & Grace, 1998; Hartmann, Zborowski, McNamara, Rosen & Grace 1999). The concept of thick and thin boundaries involves the degree of separateness (thick boundaries) versus connection (thin boundaries) between a broad range of mental functions, processes, and entities (Hartmann, Rosen, & Rand, 1998). For a summary of this concept see Hartmann, Harrison, & Zborowski, (2001). Further, people with a history of abuse report significantly higher CI content in their dreams than people without such a history (Hartmann, 1995b; Hartmann, Rosen & Grace, 1998; Hartmann, Zborowski, Rosen & Grace, 2001). Hartmann speculates that the greater the intensity of the CI, the greater the degree to which emotion is activated in the dream, serving as a mechanism for emotional processing of traumatic events (Hartmann, 1996b). However, in these studies details of the level of trauma experienced, and participants' degree of adjustment to the trauma, were not assessed. Studies assessing CI and trauma need to include information about the person's subsequent adjustment to the trauma, such as their current level of distress or post trauma symptomatology if there is any. Moreover, studies would benefit from considering variables reported in the trauma literature as predictive of poor post-trauma recovery such as distress at the time of the event, trauma during the event (such as threat to life), trauma coping, and trait coping style. Emotional responses at the time of the trauma have been shown to be highly related to the subsequent adjustment (Rizvi, 2008), as has peritraumatic dissociation (Breh, & Seidler, 2007). Indeed, a meta-analysis by Ozer, Best, Lipsey & Wiess (2008) suggested that peritraumatic emotional responses are the most predictive of subsequent PTSD symptomatology. Post trauma symptomatology by definition has as its corollary emotional activation.

The standard method used to rate a CI results in a single score per dream. However, a previous study by Hartmann and colleagues failed to find a relationship between the detail of the imagery (one of the descriptor words used in the definition of a CI) and the measure called 'boundariness' (related to boundaries in the mind), even though vividness and bizarreness were related to it (Hartmann, Elkin, Garg, 1991).

Further, recent research by Davidson and colleagues (2005) suggests that CI may be a multi-dimensional construct. These authors divided participant dreams into scenes, and the emotions associated with these images were rated by both the dreamers and independent judges. A significant correlation between emotion and CI intensity, was found by both the dreamers and the independent judges, as predicted by the Contemporary Theory of Dreaming. However, based on their belief that some of the descriptor words that make up the definition of CI were less related to emotion than others, they looked at a separate measure of the Detail aspect of CI. It was found that it did not correlate significantly with emotion. They concluded that the detail aspect of the imagery may be qualitatively different from the other aspects included in the definition of a CI. A limitation of this study was that the measure of Detail was not validated and the other descriptor words included in the definition were not looked at in a similar way. In a subsequent study (Bilsborrow, Davidson & Scott, 2009), this limitation was addressed by defining each of the seven words that make up the definition of CI (striking, arresting, compelling, powerful, vivid, bizarre, detailed) and scoring each of these on a 5-point Likert scale, with none or little at one end, and extreme at the other. Collected dreams were divided into scenes and each scene was rated for levels on each of the seven descriptor words. Dreamers also rated each dream for the level of emotion they experienced. These descriptor words were then factor analysed and although a single factor solution accounted for a major portion of the variance, a better solution was to extract three factors; impact, attention and visual. Both the impact and attention factors were related to emotion, but the visual one was not. The visual factor was made up of a combination of the detail and vivid descriptor words. As CI is considered to be an activation of the emotional concerns of the dreamer, and previous research has found a relationship between CI and trauma, how the different dimensions of CI relate to a trauma history is of interest. Further, previous research relating to CIs has not considered trauma in much specificity as it only assessed whether 'trauma' or 'abuse' had occurred. Reflecting on how such features as the level of distress at the time of the trauma, how a person copes generally and their current level of distress as a result of any trauma would be of some value. Indeed, as the visual aspect of a CI has been found to be less related to the emotion of the dreamer, there may be a systematic difference between this aspect of dreams and these other trauma related factors.

The aim of the present study was two-fold. The first was to replicate the factor structure of CI reported by Bilsborrow, Davidson, & Scott (2009). The second was to explore in greater detail how peri-traumatic events, trait coping style and current distress as a result of the event relate to CI and emotion in dreaming. We undertook to ask participants about their history of trauma, including the type of trauma, how long since the trauma, peri-traumatic events and level of current functioning. It was hypothesised that the 3-factor structure of CI proposed by Bilsborrow, Davidson and Scott, 2009 would be replicated. Further, it was hypothesised that a person's trauma history, peri-traumatic events, trauma coping, current distress and post trauma symptomatology would be related to both CI and dream emotion, in addition to the non-visual factors.

2. Method

2.1. Participants

A total of 143 participants took part in the study, with 122 being undergraduate psychology students enrolled at the University of Tasmania, Australia, and 21 people who were friends or acquaintances of the first author. Of the students, 98 were first year students, with the remainder being 2nd year psychology students or people recruited through personal contact. Three participants submitted their form twice and their replica reports were discarded. Eighty-eight percent of the sample was females. Participants' ages ranged from age 17 through to 69. The average age of the males was 23.4 years and for the females was 25.8 years.

2.2. Materials

2.2.1 On-line Participation Form- overview

Each participant was required to complete an online questionnaire. The information that was collected from this form was stored in a database on a secure server at the University of Tasmania. The online questionnaire consisted of three webpages, which are described below. The first web page contained information about the study, the second consisted of the questionnaire, and the last page thanked participants and presented further reading if desired. Participants were required to indicate that they had read and understood the information sheet, and agreed to participate, before they could proceed to the first page of the questionnaire.

2.2.2 Questionnaire overview

The questionnaire consisted of six sections. Each of the sections will be discussed in more detail below. In summary, section 1 presented a list of traumatic events and asked if any of these had occurred, how long ago, level of distress at the time, and level of distress currently, for each event endorsed. Section 2 asked participants to identify which of the traumas endorsed (if any) they were referring to and then asked if any of a list of traumatic events occurred at the time of the trauma. It then asked about the ways they had coped with the event, and then about ways they cope generally. Section 3 was the Post Trauma Checklist (Weathers, Litz, Huska, & Keane; 1994). Section 4 presented a list of areas of one's life (home duties etc) and asked how much the traumatic event has interfered with these areas in the last month. In section 5, we asked for two dreams, with a rating of the emotion level from 1 to 10 on each. The last section asked for demographic information such as age and sex.

2.2.3 Traumatic Events List

Fourteen types of traumatic events were listed (such as assault, disaster, life threatening illness). This list was introduced with the statement: "Please consider the events listed below. Have you ever experienced any such event/s that has/have significantly distressed you?" There was no restriction on how many events could be endorsed. Participants could also report a maximum of two 'other' events, and were given the option not to detail the nature of the trauma by selecting the item 'I do not wish to specify the event, but one has occurred'.

2.2.4 Distress at the time and distress now

For each of these events, participants were required to record, a) how long ago this event occurred (seven items from 'less than a month' to 'more than 10 years'), b) the number of times each event occurred, c) distress they experienced at the time of the event, and d) current level of distress. The last two items were presented as a 5 point scale from 'none' to 'extreme', and were used as distress at the time and distress now variables. If more than one trauma was endorsed, participants were asked to identify the trauma they found most challenging or difficult in the next section (section 2).

2.2.5 Trauma during the event

In this section, participants were asked to read a list of seven questions related to trauma and to indicate whether they experienced any of these circumstances at the time of their trauma. They were asked to endorse either 'yes' or 'no' in response to the following questions:
1. Were you physically injured?
2. Was someone else physically injured?
3. Did you think that your life was in danger?
4. Did you think that someone else's life was in danger?
5. Did you feel helpless?
6. Did you feel terrified?
7. Was there blood involved in the incident?
'Yes' responses were added and total scores were later dichotomised for the analysis.

2.2.6 Trauma coping

Participants were next instructed "With respect to this event, please indicate the extent to which you agree or disagree with the following statements about your coping with the event:" Six statements about self assessed coping with the trauma were presented such as: "I have learned to think about this event in a way that helped me to cope" and "I still think that the event sometimes bothers me". Each item was rated on a five point likert scale ranging from "1" Strongly agree to "5" Strongly disagree. Scores were then tallied so that higher scores reflected better coping.

2.2.7 Trait coping style

In this part, another 7 statements were introduced with the following: "Now think about your usual or preferred ways of coping generally. Indicate the extent to which you feel each of the statements below reflect your usual way of coping with life's challenges". Then the list of 7 statements was prefaced with "Normally my way of coping with challenges I face is to ...." These statements were:
1. ...think about it a great deal and try to understand my thoughts and feelings
2. ...talk about and share my thoughts and feelings with others
3. ...just let time heal
4. ...try and find solutions and answers
4. ...hope the problem or challenge will go away
5. ...keep my emotions and thoughts to myself
6. ...try to distract myself and not think about the challenge or difficulty
As with the trauma coping questionnaire, each of these statements was rated on a 5 point likert scale ranging from "1" Strongly agree to "5" Strongly disagree. Scores were then tallied so that higher scores reflected better coping.

Scores were then tallied so that higher scores reflected better coping.

2.2.8 PCL civilian version

The 17 item Posttraumatic Stress Disorder Check List (PCL Civilian version; Weathers, Litz, Huska, & Keane; 1994) was used to assess PTSD symptomatology based on DSM-IV criteria. Scores range from a minimum of 17 to a maximum of 85. The PCL consists of statements relating to PTSD symptomatology having occurred over the last month. Higher scores indicate higher symptomatology and scores over 50 are considered to be suggestive of PTSD (Forbes, Creamer & Biddle, 2001). In our sample, 19% scored over this cutoff, and 24% had the minimum score.

2.2.9 Interference with normal life areas

In this section, participants were asked: "Have these problems interfered with any of the following areas of your life during the past month? Please rate (click on dot) for each life area …" Areas included; work, school, relationships, and sex life. Each item could be rated as either "Not applicable", "Not at all", "A little bit / sometimes", "Definitely / often", "Markedly / very often", or "Very severely / continuously". A total score was derived by adding each score on each of the items. Higher scores represented more severe problems.

2.2.10 Written dreams

In the dream section, participants are asked to 'type in two of your most recent dreams'. The instructions also remind participants that the questionnaire is anonymous and hence there was no need to screen their dream content due to embarrassment or fear of negative evaluation. The space available for them to record their dream journal was expandable to allow for long dreams. A drop-down box was provided for participants to rate the emotion of the dream, with numbers from "0" to "10", and the instructions saying "as a guide, 0 means no emotion and 10 means the most intense emotion you have ever felt in a dream". Dreamers are also asked to note whether it is a recurring dream, and a 'yes' or 'no' tick box was provided.

2.2.11 Demographic information

Here we collected gender, age, and highest level of schooling.

2.2.12 Final page

The final page could be printed by first year Psychology students to receive course credit. It also contained information on a number of services that deal with trauma, as well as web addresses of organisations that provide trauma counselling.

2.3. Procedure

The questionnaire was distributed in libraries all over the Potential participants were provided with a brochure or contacted via email. Psychology students were contacted by a mass email. The email contained a link directly to the web page. There were no exclusion criteria for participation. Participants completed the whole questionnaire on line. Results were collected on a secure University server as a database. Each questionnaire submission was also converted into an email and these results were compared with the database entries. Each webpage submission had its own unique identification number, which was used for matching purposes. Dreams were aggregated into a single document and blindly scored on each of the seven descriptor words using the Bilsborrow et al. method, where interrater reliability was high for each of the descriptor words at .85 or over (Bilsborrow, Davidson & Scott, 2009). Each dream was separately rated for total CI, using the Hartmann et al. method (Hartmann, Kunzendorf, Rosen & Grace, 1998).

3. Results

3.1. Dream Variables

As shown in Table 1, the adults in the sample read more The dream variables for emotion and CI descriptors were assessed for each of the two dreams per participant. Means, SDs, correlations and paired t tests for each variable between the two dreams are presented in Table 1.

Table 1. Means and standard deviations for dream1 and dream 2 on each of the dependent variables. Correlations and p-values, as well as the t statistic and its p value on each of the DVs between dream 1 and 2

	Dream 1		Dream 2					
	M	*SD*	*M*	*SD*	*r*	*p*	*t*	*p*
Emotion	7.13	2.25	6.44	2.71	.18	.040	2.58	.01
CI	2.03	.62	1.91	0.68	.32	.000	2.05	.04
Vivid	3.51	1.01	3.71	1.01	.39	.000	2.17	.03
Detailed	3.34	1.06	3.52	1.19	.40	.000	1.70	.09
Compelling	3.63	.93	3.66	0.97	.30	.000	0.30	.76
Powerful	3.34	.98	3.28	1.08	.20	.020	0.58	.57
Bizarre	2.78	.97	2.87	1.04	.19	.020	0.85	.40
Striking	3.48	1.03	3.39	1.07	.28	.001	0.86	.39
Arresting	3.45	1.0	3.15	1.16	.38	.000	2.95	.01

Table 2. Matrix of inter-correlations between each of the 7 descriptors used in the study (n=143)

	Vivid	Detail	Bizarre	Strike	Arresting	Compel	Powerful
Vivid	1.00						
Detailed	.90**	1.00					
Bizarre	.59**	.60**	1.00				
Strike	.72**	.63**	.76**	1.00			
Arresting	.79**	.73**	.71**	.88**	1.00		
Compel	.70**	.60**	.56**	.74**	.81**	1.00	
Powerful	.65**	.57**	.68**	.74**	.79**	.80**	1.00

Note. ** (p<.01), using a one-tailed test

Taken together, all the variables show low to medium significant correlations, ranging from (r=.18) for emotion and (r=.40) for detailed. Dream 1 has significantly higher emotion, CI, and Arresting content, and significantly lower Vividness content. Because the average provides a more comprehensive representation of dream content and there is no systematic basis for explaining differences between the two dreams, it was decided to use the dream average scores in the subsequent analyses.

3.2. Factor analyses

Three factor analyses were performed on the seven CI descriptor items. Table 2 shows the correlations between the descriptor words, indicating moderate to high correlations. A Generalised Least Squares factor analysis was performed and the factors were then rotated using the Oblimin method. One, two and three factor solutions were computed and these results are discussed below.

3.2.1 One factor solution

One factor accounted for 72.8% of the variance which is quite high. However, the residual correlations were also quite high, with the chi square test of adequacy for the model being significant, $\chi 2$ (14, N=143) = 101.87, p<.001. We applied McDonald's (1985) criterion which suggests that if there are residuals over 0.1, further factors may be needed.

In the one factor model 30% of the residuals were over this cut-off, suggesting a poor fit for the data.

3.2.2 Two factor solution

In the two factor solution, a much better fit for the data was established. The two factors accounted for 84.6% of the variance and only one residual was over the 0.1 cut-off. The chi squared test of model adequacy produced $\chi 2$ (8, N=143) = 47.59, p<.001 which is still statistically significant.

3.2.3 Three factor solution

When three factors were used, total variance explained was 91.5%. There were no residuals over the 0.1 cut-off. The chi squared test of model adequacy showed $\chi 2$ (3, N=143) = 16.98, p=.001, which is still significant.

The pattern and structure correlations for both the two and three factor solutions are shown in tables 3 and 4.

In a previous factor analysis (Bilsborrow, Davidson & Scott, 2009) three oblique factors were produced. The **Visual** factor was based on the *Vivid* and *Detailed* descriptor words. The **Attention** factor was based on bizarre and striking, and the third factor (**Impact**) was based on the compelling and powerful descriptor words, with arresting loading on both the **Attention** and **Impact** factors. As regression scores with equal weights are potentially more robust across studies, factor scores based on equal weights were

Table 3. Factor pattern matrix scores for both the two and three factor solutions for the 7 descriptors used in the study (n=143)

	Two Factor Solution		Three Factor Solution		
Descriptor Word	Factor 1 (Impact/Attention)	Factor 2 (Visual)	Factor 1 (Attention)	Factor 2 (Visual)	Factor 3 (Impact)
Vivid	.250	.727	.121	.754	.110
Detailed	.060	1.04	.045	1.06	.049
Power	.909	.070	.020	.040	.968
Bizarre	.714	.091	.570	.142	.120
Compelling	.833	.024	.037	.059	.820
Striking	.974	.058	1.06	.044	.041
Arresting	.835	.141	.450	-.200	.364

Table 4. Factor structure matrix scores for both the two and three factor solutions for the 7 descriptors used in the study (n=143)

Descriptor Word	Two Factor Solution		Three Factor Solution		
	Factor 1 (Impact/Attention)	Factor 2 (Visual)	Factor 1 (Attention)	Factor 2 (Visual)	Factor 3 (Impact)
Vivid	.785	.910	.740	.914	.729
Detailed	.708	.999	.660	.998	.647
Power	.857	.599	.752	.614	.924
Bizarre	.781	.616	.769	.625	.689
Compelling	.851	.637	.756	.650	.889
Striking	.932	.659	.999	.674	.807
Arresting	.940	.757	.892	767	.875

calculated and correlated with the factor scores produced as regression estimates in the factor analyses. For the three factor solution, the correlations were ***Visual*** factor r=.98, ***Attention*** factor r=.95, and ***Impact*** factor r=.99. For the two factor solution the correlations were ***Visual*** factor r=.98, ***Impact/Attention*** factor r=.99. It was decided to use factor scores based on equal weights in the analyses, and factor scores based on the average of the two dreams were derived in this way. On balance it was decided that the greater economy of the two-factor solution outweighed the small gain in variance explained in extracting the third factor. Accordingly the remainder of the results will be based on the two-factor solution.

Descriptive statistics for the CI variables are presented in table 5. The figures shown relate to the average of dream 1 and dream 2 scores. The mean CI score, for the average of both dreams is 1.97, with a standard deviation of .53.

3.3. Trauma Variables

Descriptive statistics for each of the 7 trauma related variables are presented in Table 6. Note that higher scores on

Trait coping style and Trauma coping are indicative of better coping, whilst all other scores indicate that a higher score means more of that measure.

Distress at time and *Distress now* are the most highly correlated of all the explanatory variables at r=.79. The total score of the PCL is significantly correlated with all but the measure of trait coping style, and the average of all correlations with this variable is the highest. The variable with the least number of significant correlations is *Trait Coping Style*, as it only correlates with *Trauma Coping*. There is a positive correlation between *Trauma Coping* and *Trait Coping Style*, which is expected as both these variables are scored the same way, with higher scores meaning better coping. This has resulted in negative correlations between these and other variables as higher scores on other measures are related to greater distress. However, even though a negative correlation was expected between *Trauma Coping* and *PCL Total*, instead it was positive.

Of the two dreams provided by each participant, in 65 cases neither was a recurring dream, 57 had at least one recurring dream, and 21 indicated that both were recurring. Whether a dream was recurring was not correlated significantly with the CI variables, but it was with dream emotion. This correlation of r=.27 was significant at the .01 level on a two tailed test.

Table 5. Descriptive statistics for the CI variables, which are the average of dream 1 and dream 2, used in the study (n=143)

Variables	Mean	SD
CI	1.97	0.53
Impact Factor	0	0.98
Visual Factor	0	0.99
Detail	3.43	0.94
Vivid	3.61	0.84
Powerful	3.31	0.79
Arresting	3.30	0.90
Compelling	3.64	0.77
Bizarre	2.82	0.78
Striking	3.44	0.84

Table 6. Descriptive statistics for each of the trauma related variables

Variables	Mean	SD	Min	Max
Distress at time	4.4	.9	1	5
Trauma during event	2.7	2.1	0	7
Trauma coping	17.8	4.5	0	28
Trait coping style	22.0	4.8	0	32
Life interference	12.3	7.9	0	40
Distress now	2.4	1.1	1	5
PCL total	34.7	15.1	17	76

Table 7. Correlations between each of the trauma-related variables used

	Distress at time	Trauma during event	Trauma Coping	Trait Coping Style	Life Inter-ference	Distress now	PCL total
Distress at time	1.00						
Trauma during event	.68**	1.00					
Trauma coping	-.16	-.13	1.00				
Trait coping style	.05	-.11	.37**	1.00			
Life interference	.66**	.56**	-.31**	-.06	1.00		
Distress now	.79**	.51**	-.37**	-.02	.67**	1.00	
PCL total	.62**	.56**	.49**	-.16	.76**	.67**	1.00

Note. ** Denotes significance at the .01 level (2 tailed)

3.4. Relationships between variables

Table 8 shows correlations between the dependent variables (dream measures) and the explanatory variables (trauma measures). In considering all the variables, it was decided to show CI and dreamer emotion in both explanatory and dependent variable modes. CI is shown in the end column as an indicator of the degree to which it correlates with the descriptor method of measuring the imagery intensity of the dreams. The correlations shown range between .64 and .90, which indicates substantial overlap between the two methods. CI and the Impact factor (but not the Visual factor) are correlated with trauma at the time of the event (Trauma during event). None of the other correlations are statistically significant. Dreamer emotion is one of the dream measures, even though it was not rated independently. It is also considered to be a trauma measure as it relates to the research questions posed by this study in relation to our dream variables.

To further elucidate the relationship between the various indicators of trauma and coping and dream emotion, a step-wise regression analysis was performed with dream emotion as the dependent variable and all the explanatory variables, (the trauma variables), included as potential predictors. The strongest predictor of level of emotion was PCL total with the only other significant contribution coming from Trauma during event. PCL total accounted for 11% of the variance (R= .33, p<.01) and Trauma during event improved the variance accounted for from 11% to 17% (R=.42, p<.01). This suggests a moderate to strong relationship.

4. Discussion

This study was concerned with the number of factors that contribute to the Central Imagery construct. In addition, it sought to identify how any history of trauma influenced CI, any factors that were derived from CI, as well as dreamer emotion. Our previous study identified three factors making up the construct, which were labelled Impact, Attention and Visual (Bilsborrow, Davidson & Scott, 2009). In the present study, our aim was to replicate this methodology in an attempt to more fully examine the factor structure of CI. We

Table 8. Correlations between each of the dependent variables and each of the explanatory variables. All dream measures are averages of dream 1 and dream 2

	D'tress at time	D'tress now	Trauma during event	Trauma Coping	Trait Coping style	PCL total	Interfere with life	Dream Emot.	CI
Dream Emotion	.20*	.27**	.31**	-.24*	-.08	.33**	.20*	1.00	.25**
CI	.09	.05	.25**	-.11	-.13	.12	.12	.25**	1.00
***Visual* factor**	.14	.08	.14	-.02	.01	.07	.14	.08	.66**
***Impact* factor**	.11	.07	.25**	-.08	-.05	.11	.11	.20*	.90**
Vivid	.12	.05	.13	-.08	-.04	.09	.10	.14	.72**
Detailed	.15	.10	.13	.04	.05	.05	.11	.07	.64**
Compelling	.07	.07	.23**	-.04	-.04	.12	.16	.22**	.77**
Powerful	.07	.06	.27**	-.06	-.01	.09	.15	.30**	.84**
Bizarre	.11	.06	.22**	-.04	.02	.07	.11	.07	.71**
Striking	.14	.09	.20*	-.13	-.06	.12	.14	.13	.82**
Arresting	.09	.03	.22**	-.10	-.12	.09	.10	.20**	.86**

Note. * Denotes significance at the .05 level (2 tailed) ** Denotes significance at the .01 level (2 tailed)

calculated one, two and three factor solutions to look at each in terms of a fit for the data. The one factor solution accounted for an acceptable amount of the variance (nearly 73%) which gives reasonable justification for Hartmann's (1996b) approach of treating CI as a single construct, but qualitatively there were too many large residuals. McDonald (1985) has proposed that looking at the residual variance is informative as residuals over 0.1 may suggest a further factor to be extracted, and in the one factor solution we found that 30% were over this level. We found that either two or three factor solutions were qualitatively a better fit. Moreover, when more than one factor was extracted, a second factor based on the detailed and vivid descriptor words was not significantly correlated with any of the dependent variables, even though the other factor or factors were. This suggests that there is value in at least a two-factor solution, which separates out the visual factor. The visual factor in this study was less related to the emotion of each dream as rated by the dreamer, which is consistent with the finding of the earlier study. Although a three factor solution was statistically better based on the residual variance, on balance it was decided that the greater economy of the two-factor solution outweighed the small gain in variance explained in extracting the third factor.

The explanatory variables investigated were related to trauma, distress, and coping strategies. Our expectation was, based on previous research on trauma and CI, that a person's current level of distress would be related to CI due to the 'activation' of emotion by the trauma. In previous research, a simple history of trauma or abuse was enough to increase the level of a CI in that person's dreams compared to those without (Hartmann, Zborowski, McMamara, Rosen, Grace, 1999; Hartmann, Zborowski, Rosen, & Grace, 2001). The present study attempted to tease out some of the possible variations relating to the degree to which any trauma in the person's history has current relevance. Having had a trauma is not sufficient to indicate current emotional activation. For example, if the trauma was a long time ago and/or the impact of the trauma had been resolved, then having a trauma per se presumably would not be enough to increase a CI. Therefore, a reasonable expectation would be that if a more pure sample of those still afflicted with residual distress were to be distilled from all who have had a history of trauma or abuse, then its effect on CI would be more noticeable. In addition, the level of current distress would also be expected to impact on the level of emotion contained within their recent dreams. In previous research, the level of trauma, the length of time and consequently the degree to which the trauma had been resolved, had not been ascertained. Therefore, we looked at both the level of distress at the time, as well as the current level of distress. The results of the present study did not support the idea that a trauma would automatically translate into higher CI scores. Indeed current distress, including PTSD symptomatology, did not correlate significantly with CI. Of the trauma, distress or coping variables assessed, only the one dealing with the number of peri-traumatic events was related to CI, or the other measures related to CI. This measure called Trauma during event, predicted all the dependent measures other than the visual factor. The visual factor was made up of the two descriptor words of vivid and detailed, and neither of these was significantly related to Trauma during event either. It appears that there is a relationship between the number of potentially distressing events at the time of the trauma, such

as whether someone's life was in danger, and the intensity of the imagery of that person's dreams. Moreover, Trauma during event correlated at a similar level with all the descriptor words (other than the visual factor words), with the non visual factors, as well as with the separate measure of CI. This was seen as further validation that our method of rating all the descriptor words separately captures a significant portion of the CI construct. Indeed, our Impact factor correlated at r=.90 with the separate measure of CI.

The second main dependent variable was the level of emotion in dreams as indicated by the dreamer. This measure of emotion was significantly correlated with all variables except the trait coping measure. Its highest correlations were with Distress now, Trauma during event and PCL total. Apart from Trauma during event, these are all indicators of current distress. It may be that there is some bias because the trauma variables and dream emotion are all self-rated, and this could artificially increase the correlations. In addition, the regression analysis showed that PCL total was the greatest predictor of emotion, with Trauma during event contributing to a lesser degree as well. It therefore looks likely that current distress has the strongest impact on the emotion of dreams, although the number of peritraumatic events also does contribute to this.

Given that the trauma during event measure was the only one that correlated significantly with CI, it is interesting to note its rather significant correlation with many of the other trauma related measures, which themselves were not significantly related to CI. Of all the measures, the strongest relationship was with distress at the time of the event (r=.68). Obviously this makes sense as these are both measures related to the time of the event. However, distress at time was a different type of measure to trauma during event, with the later being a measure of how many of a number of events that could occur at the time of the traumatic incident, did actually occur for them.

We found a moderate relationship between Trauma during event and post trauma symptomatology (r=.56). The current study also found that PTSD symptomatology was moderately related to other measures dealing with the time of the trauma, such as trauma coping (r=.49), and distress at the time (r= .62). The question remains, that with such strong correlations between these measures, why the distress at the time or trauma coping measures did not show a similar relationship to CI as the other did. One potential possibility is that peritraumatic factors tap something deeper or different than the measure of distress. The present study's results show that current distress, as a result of a trauma and as measured by the PCL and a simple question relating to the level of current distress, did not affect the intensity of the imagery of these people's dreams in the same way that the number of events at the time of the trauma did. Not everyone who experiences a trauma develops PTSD. The PCL total score was a measure of PTSD symptomatology. The other measures that correlated with it may simply be indicators of the distress that people who have these symptoms exhibit. On the other hand, peritaumatic events may be more independent of PTSD, but have substantial overlap. As Hartmann notes, often PTSD results in traumatic dreams that are failed integration attempts and as such are not processing the trauma adequately. He refers to PTSD nightmares as a not truly nightmares but rather memory intrusions into dreams (Hartmann, 1996a). In addition, Hartmann's research found that CIs were significantly higher in

those with a history of physical or sexual abuse. Another study by Amstadter & Vernon (2008) found that those who had suffered a sexual trauma had the highest level of emotion post trauma, compared to other types of trauma. One explanation for the current findings could be that abuse is a special case of trauma that typically involves more of the type of peritraumatic events that the present study found a relationship with. Furthermore, perhaps the level of CI in a person's dreams is indicative of traumatic memories that are being processed 'offline' and are not as related to PTSD symptomatology.

These events, such as whether they thought theirs or someone else's life was in danger, are considered to be potential predictors for the development of PTSD. That is, dissociation can be activated at the time of a trauma due to peritraumatic events, and this is predictive of the development of PTSD. (Jehel, Paterniti, Louville, & Guelfi, 2006; Nishi, et al., 2010). Indeed stressors at the time of a traumatic event, such as perceived dangers to the individual, in some cases may be stored in memory differently to other memories of an event. For instance, employing Rosenzweig's (1943) paradigm for inducing 'repression' in participants by creating a stressful or 'ego defensive' condition after which recall was measured, Kunzendorf and Moran (1993-1994) showed that dissociation can lead to changes in encoding for the event. They showed that during a stressful event, some people dissociate from the reality of the event and encode it as 'not real' or 'just a dream'. Afterwards, those people then exhibited source amnesia for the stressful event but not total amnesia. Thus, having experienced this stress and dissociation, they might later regard unbidden imagery of the event (flashbacks) as 'not real', and therefore dismiss it or actively suppress it from conscious imagination. In the dreaming state, such active monitoring is mostly shut down and so these images of the stressful event would no longer be suppressed resulting in strong emotion relating back to the original event. This is a possible explanation for why CI might be related to dissociative trauma events (trauma during event) rather than current distress related to the event (We acknowledge the contribution of one of the reviewers in suggesting this interpretation). Whatever the case, this relationship warrants further exploration. Future studies could look at various peritraumatic variables to see how each contributes to CI, bearing in mind that we found a cumulative effect.

The scales we used to measure trait coping style and coping with the event, were not well-known measures. In fact, scrutiny of the results shows a lack of consistency between these scales and other measures, indicating that results from them may be somewhat spurious. The PCL on the other hand, is widely used and very well validated (for example see Walker, et al., 2002). Those with higher scores may be experiencing current distress around the clinical indicators of PTSD which include hyper-arousal, hyper-vigilance and avoidance. Previous research has found that any history of either sexual or physical abuse resulted in higher CI scores (Hartmann, Zborowski, McMamara, Rosen, Grace, 1999; Hartmann, Zborowski, Rosen, & Grace, 2001). There may be a qualitative difference between current distress related to previous trauma and the trauma itself whereby peri-traumatic events are what influence dream imagery.

Scores on the Trait Coping Style measure, only correlated significantly with the other coping variable, Trauma Coping. This seems to indicate that the trait coping measure does not relate to current distress, or distress at the time of the trauma. The measure called Distress at time, was most related to Distress now. This may have been due to the nature of the questionnaire. These measures consisted of one question only, which simply asks the level of distress on a 5 point scale. The questions followed each other. It is quite possible that this fact has artificially inflated the correlation due to proximity and having only the single answer. On the other hand, the PCL measure consists of 17 questions, and is much more likely to provide a more accurate measure of current distress. The fact that there was a positive correlation between PCL Total and Trauma Coping is a little harder to explain, given that it measures distress and the other measures better coping with the event. In addition, other variables that presumably measure current distress such as Life interference and Distress now showed a negative relationship. This certainly adds weight to the idea that Trauma Coping measure is inconsistent.

A limitation of this study was the fact that the measures of trait coping and trauma coping, were not validated measures and results of zero-order correlations with some of the other scales may reflect this. The questions related to state and trait coping were few and may not have tapped those two constructs very well. Indeed further research could look at validated measures of coping styles that have been shown to be related to poor outcomes, such as a repressive coping style (Myers 2010). Another area that could be improved in subsequent studies is adopting a longitudinal approach rather than a retrospective, cross-sectional design. The length of time between the trauma and when the information was gathered was not controlled and so memory for these events may be distorted and have affected self-ratings. In addition, Hartmann (2007) speculates that as the emotionally arousing information is processed, over time the imagery in that person's dreams becomes less intense. To date, this has not been empirically investigated and a systematic look at dreams in a longitudinal study of this kind could prove fruitful. Furthermore, given that most people go on to assimilate the traumatic material without lingering post trauma symptomatology, it may be advantageous to look at whether factors such as resiliency and emotional maturity impact on CI over time.

5. Summary and Conclusions

We found that the Central Imagery construct is best thought of as having two dimensions. Although it is not unreasonable to talk of Central Imagery as a single construct (since the first factor accounts for so much of the variance) there is now consistent statistical evidence that the vividness and detailed aspect of CI constitute a separate factor, and that this visual factor does not relate to the predisposing conditions (trauma) as the other factor or factors do. Moreover, in the current study at least, the visual factor did not add very much further to the CI construct. We also found that trauma is significantly related to the level of emotion in a person's dream, such that the more post trauma distress that is felt currently, the higher will be the dream emotion as stated by the dreamer. In addition, the only explanatory variable that consistently affected the CI of dreams, as well as the Impact /Attention factor, was the number of peri-traumatic events endorsed by the dreamer. This suggests that CI is related to the events that take place at the time of the trauma more specifically rather than such things as coping strategies or current level of distress resulting from the trauma. We also

found that the Visual factor, as well as the two visual descriptor words, were not related to this variable. This adds further weight to the notion of there being at least a second factor in the CI construct. It is suggested that future research could look at which type of peri-traumatic events have the greatest impact on CI, whilst considering the intensity of those events and cumulative effects of multiple events.

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