

## **A Systematic Change in Dreams after 9/11/01**

Ernest Hartmann MD

Tyler Brezler BA

Tufts University School of Medicine; Newton-Wellesley Hospital,

Boston, MA

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Address for reprints: Ernest Hartmann, MD, 27 Clark St., Newton, MA 02459

## Abstract

*Objective:* Previous studies of dreams after trauma and stress have found increases in the power of the central image of the dream. However it has been difficult to perform properly controlled studies of dreams before and after trauma. The present study is designed to compare dreams before and after 9/11/01 in the same persons. The assumption is that the events of 9/11 produced mild trauma or at the very least emotional arousal in everyone living in the United States. *Methods:* Forty-four persons in the U.S. who had been recording all their dreams for years, each provided 20 consecutive dreams from their records – the last 10 recorded before 9/11 and the first 10 after 9/11. These dreams were assigned random numbers, and scored on a blind basis using a number of rating scales with established reliability. *Results:* Dreams after 9/11 show a highly significant increase in Central Image Intensity, as well as Central Image Proportion ( number of dreams with scorable Central Images), but no change in dream length, dream-likeness, overall vividness, or content involving airplanes or tall buildings. There were no “exact replay” dreams picturing the actual events of 9/11 seen repeatedly on TV. *Conclusions:* These results are consistent with the Contemporary Theory of Dreaming which emphasizes the role of underlying emotion in producing central dream imagery and suggests that the intensity of the central dream imagery is related to the power of the underlying emotion..

## Introduction

We constantly hear that 9/11/01 changed our lives in a myriad of ways. This is clearly true of our social and political lives. In this paper we demonstrate that 9/11/01 altered even our dreams in a measurable manner, and in a manner consistent with what we have called the contemporary theory of dreaming.

Many lines of evidence indicate the importance of emotion in dreaming. Brain imaging studies demonstrate activation in REM sleep of the amygdala and related structures involved in the processing of emotion.<sup>1-2</sup> Neuropsychological studies examining brain lesions which result in reports of complete cessation of dreaming implicate two forebrain areas, one of them in the medial portion of the frontal lobes, including the mesiofrontal dopamine systems considered important in emotional arousal.<sup>3,4</sup> Studies of dream content demonstrate the frequent presence of emotion in reported dreams, the exact level depending on how the questions are asked.<sup>5,6</sup>

Many dream reports include no mention of emotion. The concept has gradually developed that the central imagery of the dream carries the emotional power.<sup>7,8</sup> The Central Image of the dream, defined as “an image that stands out by virtue of being especially powerful, vivid, bizarre, or detailed” (Fig 1) can be reliably identified in most though not all dreams, and its intensity reliably scored.<sup>9,10</sup> Most memorable dreams include one (or occasionally several) powerful central images, and one study showed that Central Image Intensity was significantly higher in memorable dreams compared to recent dreams in the same subjects, while the standard measures “dreamlikeness” and “bizarreness” did not differentiate these two sets of dreams.<sup>11</sup>

Studies of dreams after traumatic events have found prominent central images, and have led to the suggestion that the powerful central image of a dream can be understood as picturing the dominant emotion or emotional concern of the dreamer.<sup>7-12</sup> For instance, the powerful image, “I was swept away by a huge tidal wave,” has been reported frequently in clinical/anecdotal studies of persons who have experienced a variety of traumas (fires, attacks, rapes or attempted rapes).<sup>8,13</sup> The image is not related to the specific trauma experienced, but appears to be picturing the person’s emotional state – “I feel terrified,” or “I feel overwhelmed.” There is evidence based on blind scoring of dream reports that such images are indeed more frequent and intense after acute trauma.<sup>12,14</sup>

Even more remote trauma appears to affect dreams: the “most recent dreams” of students who report having been physically or sexually abused at any time, score higher on intensity of the central dream image than the “most recent dreams” of other students.<sup>12</sup> These studies used an established rating scale measuring the intensity of the “Central Image” or “Contextualizing Image” of the dream, which demonstrates high inter-rater reliability.<sup>12,15</sup>

One study obtained series of dream reports from ten adults who had recently undergone a traumatic event, including rapes, attacks, and escapes from fires. In each case the mean Central Image Intensity, scored on a blind basis, was higher than in populations used for comparison. In the four cases where series of dreams were available before and after trauma in the same individuals, the mean scores were always higher after the trauma.<sup>12</sup> In these studies, the CIs could be reliably identified and scored even when the dream mentioned no emotion.

These studies are somewhat problematic, however. The types of trauma within each study differed; the number of dreams as well as the method of dream collection varied; and there was not always an opportunity to compare dreams before and after the trauma in the same individuals.

The terrorist attacks of 9/11/01 allow us to study these issues more systematically. There is considerable evidence that the events of 9/11 had widespread measurable effects on the psychological health of the U.S. population. Two studies of psychological symptoms reported after 9/11 found a large increase over baseline values in diagnoses of PTSD in people living in lower Manhattan. Those living elsewhere in New York City and elsewhere in the US, had symptoms, but milder ones not qualifying for a clear diagnosis of PTSD.<sup>16, 18</sup> School children throughout the New York City area experienced high rates of anxiety disorders and depressive disorders, even if they were considered to have had only “mild exposure” to the events of 9/11.<sup>16</sup> One national survey found that PTSD was not widespread outside of NYC, but that adults everywhere in the U.S. reported, and were worried about, stress reactions in their children.<sup>17</sup> Even in the Netherlands, a survey showed an increase in attempts at suicide or self-harm in the weeks following 9/11.<sup>18</sup> The reported changes are not all in the direction of anxiety, depression or other pathology. One large study found a significant increase in seven out of twenty self-reported psychological character strengths after 9/11, most prominently “teamwork,” “leadership,” and “spirituality.”<sup>19</sup> Overall, even though most of the population did not experience trauma in the sense required for PTSD it appears likely that almost everyone in the U.S. was influenced in some way. We believe it is fair to say

that almost everyone probably experienced some mild form of trauma or at least emotional arousal, in the period following 9/11/01.

Since a sizable number of people have been recording all their remembered dreams for years, we had an opportunity to compare systematically dreams recorded before and after the events of 9/11. One previous study has investigated dreams before and after 9/11.<sup>20</sup> This was a large-N questionnaire study about nightmares. There were a number of interesting findings including an overall increase in nightmares reported after 9/11 in male, but not female, subjects. However, no actual dream content was examined. A preliminary version of the present investigation, reporting on the first 16 subjects studied, has been published.<sup>21</sup>

## Methods

Forty-four persons living in the United States who had been recording all their dreams for at least two years were identified through notices placed on websites maintained by the Association of Professional Sleep Societies, and the International Association for the Study of Dreams. These 44 persons sent us twenty dreams each – the last ten dreams they had recorded before 9/11/01 and the first ten dreams recorded after 9/11, without any selection or alteration. Participants included eleven men and 33 women, with an age range of 22 to 70. (Age was not available in a few cases, but for those available, mean age was 48 years.) Participants lived throughout the United States. None lived in Manhattan, and none had relatives or close friends who died in the attacks. The study was

explained to participants and they were assured of anonymity; no written consent forms were used; no compensation was given to participants.

The 880 dreams obtained\* were first read by a judge not involved in the later scoring who removed any references to dates of the dream, time of year, or any comments that could have identified the dream as obviously coming before or after 9/11/01. The dreams were then assigned random numbers and scored on a blind basis for the presence or absence of a CI and for Central Image Intensity, the measure discussed above (fig.1). To illustrate the scoring, here is a dream of average length from the study.

*I am in a street festival where people are planning to camp on the sidewalk. I unload belongings to put into my spot. The belongings include a bicycle, and then a filing cabinet, some rugs and a sleeping bag. Later I am outdoors with several men. We are disassembling a large printing press or something. We are cranking a huge socket wrench several feet long. Charlie is directing us. We turn it slowly, bit by bit. It requires all our strength. Charlie says be careful, it is under pressure. As the casing comes off, I attempt to hide behind a big piece of machinery. I come out OK. Then, I'm in an outdoor party – perhaps a pot-luck dinner. We are sitting around on camping chairs. Someone is pouring champagne. I notice that our neighbor Bob has his own bottle.*

Three different scorers all agreed that the dream did include a CI, in fact that there were several images. Scorers all agreed that cranking the huge socket wrench was the

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\* Actually, 884 dreams were scored rather than 880. In a few cases, the participant apparently submitted ten dreams but the judges determined – on a blind basis – that a text submitted as a single dream was clearly two separate dreams. Since all dreams had already been labeled and numbered, the additional dreams were included and scored.

most powerful image. This was scored as the CI. All gave it an intensity score of either 1.5 or 2.0 -- a definite CI, of moderate intensity.

The dreams were also scored on what emotion might be pictured by the CI ( fig 1), and on two standard dream content scales: dream-likeness, and overall vividness.<sup>22</sup> Length of the dream report was scored roughly as number of lines of text. Additionally the dreams were scored on three ad-hoc scales for dream content: any content involving 1) attacks of any kind, 2) tall buildings or towers and 3) airplanes. Each of these three scales was scored from 0 (no such content), to 3) (very definite content of this kind). Fifty of the dreams were scored by two experienced scorers, who showed good inter-rater reliability – correlations of  $r = .70$  to  $r = .90$  on all measures., with the exception of “which emotion might be pictured.” Since interrater reliability was not satisfactory on the individual emotions pictured, these will not be discussed further in this paper.

One of the scorers went on to rate all the dreams and that scorer’s ratings were used in the analyses below. The code was then broken and dreams were regrouped by participant on each measure. For each participant a mean value pre-9/11 and a mean value post-9/11 were obtained and analyzed by two-way ANOVAs for Pre vs. post 9/11 ( within-subject factor), and Gender ( across-subjects factor) on each measure. Since eight measures were analyzed, error corrections for multiple tests were applied, using both the Bonferroni and the Sequential Bonferroni (Dunn Sidak) methods.

## Results

The most clear-cut change found was an increase in Central Image Intensity after 9/11 compared to before (fig. 2). The same result was seen in Presence or Absence of a CI, expressed as CI Proportion (the proportion of dreams scored “yes” for a CI). Table 1 presents the results and statistical analyses on all measures studied. CI intensity, and CI Proportion were significantly higher after 9/11 ( $p < .004$  and  $p < .001$ ), but the dreams after 9/11 were not scored as longer, more dream-like or more vivid overall. There was no significant effect of gender, and there were no significant interactions between pre- vs.-post and gender.

The dream content after 9/11 did not involve significantly more tall buildings or towers, or more airplanes. There was only a trend toward an increase in dream content involving attacks ( $p < .03$  by ANOVA, but no longer significant after correction for multiple tests). The attacks were of many different kinds -- often personal encounters with frightening people or animals -- with no obvious relationship to the actual events of 9/11. There was not a single dream, before or after 9/11, involving planes hitting the WTC towers or similar buildings, or anything close to these images seen so often on TV.

The length of time over which the ten dreams before and ten dreams after 9/11 occurred varied considerably between subjects. The mean time span covered by the ten dreams was eight weeks, with a range of one week to 22 weeks. An attempt was made to relate CI Intensity and other measures to the length of time before or after 9/11, but no significant relationship emerged. An attempt was also made to determine whether the distance of the participant’s residence from Manhattan made any difference in the results. Again, nothing significant was found.

## Discussion

This study demonstrates a systematic measurable change in dreams in the period after 9/11/01 compared to the period before 9/11. Thus the attacks of 9/11 appear to have affected even dreams, which are sometimes thought of as especially private and difficult to study. The main, and highly significant, change was an increase after 9/11 in the intensity or power of the central imagery of the dream.

The study did not find a change in specific dream content: the dreams did not replay the vivid images seen many times on TV by almost all of us, nor was there an increase in content involving the prominent elements of the attacks – airplanes and tall buildings or towers. There was a trend to increased content involving “attacks,” but with no specific type of attack predominating. An informal review of the “attack” images suggests no clear increase in any definable content, but rather an increase in the emotional state of being attacked, or being afraid of an attack. The dreamer was almost always the victim or potential victim of the attack.

Apparently the increased emotional arousal after 9/11 produced an increased number of scorable Central Images, and an increase in their power or intensity, as well as a trend towards an increase in the emotional state of potentially being attacked. The results support the previous studies, reviewed above, on increased Central Image intensity in dreams during the obviously emotional state following trauma.

We realize that the concept of a central image that stands out in a dream, and its measurable intensity, are not intuitively obvious concepts, and may not appear to have been perfectly defined. Unfortunately we have no better definition for a central image than the one provided to the scorers ( fig 1) in this study and others. We hope that the dream example provided in *Methods* makes the scoring process clearer. As mentioned, scorers in this study and the others have achieved a high inter-rater agreement.

We also consider the CI to be important for several reasons not yet mentioned. We have data, not yet published, showing that dreams called “important” by the dreamer had significantly higher CI intensity than dreams called “unimportant”, and another data set showing extremely high CI intensity in dreams called by the dreamer “highly significant.” Also, we have anecdotal evidence suggesting that when a dream is remembered for many years, what is remembered is almost always one powerful image ( or occasionally several images). Thus Freud reports only one dream remembered from childhood. What he remembers is an image of men with birds’ beaks carrying his mother’s body. Jung likewise reports one dream he remembered from childhood; it involved going down stairs into a basement and seeing a huge frightening pillar called “the man-eater.” We have collected many such long-remembered dreams from colleagues, and almost always what was remembered was one powerful image.

Concerning the most definite finding – the significant increase in Central Image Intensity and Central Image Proportion after 9/11 -- we need to consider whether factors other than the 9/11 attacks might be responsible. For instance does the time of year in

itself make a difference? Do dreams in October or November generally show higher CI scores than dreams in July and August? There are no studies specifically examining time of year effect. However, we have reviewed a number of small studies of dreams, in our laboratory and others, and found no change relating to time of year. Or, could a factor such as the start of the school year in September have had an effect on our results?

Almost certainly not. We have seen no obvious effects relating to the start of the school year in previous studies, even in students, and furthermore the participants in this study were mostly 30-60 years old, and to the best of our knowledge included no full-time students.

Next, accepting that the events of 9/11 had an effect on dreams, we might question whether this is a direct effect of emotional arousal on dreams, as we have suggested, or whether altered sleep patterns – for instance increased awakenings -- might have produced the changes we found. Increased awakenings have indeed been reported in the period soon after 9/11, in those living in New York City.<sup>23</sup> Error! Bookmark not defined. We have no direct information as to whether the participants in the present study, living all over the United States, experienced increased awakenings after 9/11. However, the one study that did investigate the effect of awakenings on Central Imagery -- involving subjects wearing a recording device, who were awakened at different times during REM-sleep and Non-REM sleep -- showed no effect of spontaneous or artificial awakenings on the Central Image intensity scores or the Central Image proportion in the dreams obtained.<sup>23</sup> Thus it appears unlikely that awakenings accounted for the effects in the present study.

. It is of interest, and was somewhat surprising, that there was no increase in dream content involving airplanes, or content involving tall towers resembling the WTC. Airplanes and tall buildings did sometimes appear in the dreams, but no more frequently after 9/11 than before. Dreams scored as involving attacks of any kind tended to increase, but with a much lower significance level than C I Intensity or CI Proportion. The content involving attacks continued to picture various scenarios involving dangerous animals or monsters, being chased by a violent criminal, battlefield scenes, and other frightening images common in dreams. Insofar as there is an effect, it appears to be the emotional theme or idea of an attack that enters the dreams after 9/11, rather than the specific scenes of the actual terrorist attacks.

In this context it is intriguing, and perhaps theoretically important, that not a single dream in the entire study portrayed the events that all of us (including presumably the participants in the study) saw many times on television, on 9/11/01 and for days and weeks thereafter. There were no dreams whatever of planes hitting the WTC, or any content even close to that in the present study.. The authors do have two reports of such “replay dreams,” neither of them occurring within this study. These two dreams were reported three months, and nine months, respectively, after 9/11, both by middle-aged men who were undergoing severe personal stress at the time of the dream -- in one case the breakup of an important long-term relationship, and in the other case a myocardial infarction followed by immediate quadruple bypass coronary surgery. Both men were interested in their dreams, and had expressed surprise that they had had no dreams of the terrorist attacks -- until these intensely stressful personal events occurred. Even in these two dreams, the “replay” was not exactly what had been repeatedly seen on TV. In the

more clearly remembered dream, the dreamer himself was inside a tall building similar to the WTC buildings when there was an explosion higher up, and glass started falling all around.

If we can generalize from our sample, it appears that the terrorist attack scenario is not dreamt about simply as a result of having been seen repeatedly. Rather the 9/11 images of planes hitting towers have become tidal waves! These images, or rather the ability to reconstruct similar imagery, seem to be stored in a manner similar to the tidal wave, which we can summon in our dreams at times of personal emotional stress. The results also support the view that dream images are new creations, guided by emotion, not replays of waking experiences.

The present results are very consistent with what has been called the Contemporary Theory of Dreaming.<sup>8</sup> The first tenets of the theory are: 1) There is a continuum of mental functioning – and presumably cerebral cortical functioning – running from focused, waking activity through looser waking to daydreaming and dreaming.. Focused waking thought can be considered one end of a continuum and dreaming the other end. 2) Dreaming is hyper-connective. Mental contents that are kept separate in waking are more easily brought together in dreaming. 3) The connections are not random. They are guided by the emotion of the dreamer. In the clearest cases, the central imagery of the dream pictures the emotion of the dreamer. The intensity of the central imagery is a measure of the power of the emotion.<sup>8, 12, 24</sup>

Indeed the studies reviewed in the introduction demonstrate higher CI intensity after trauma, and higher CI intensity in students who report having been abused at any time. These are situations presumably involving stress and emotional arousal. The results of the present study, examining dreams after a specific traumatic or stressful event— the attacks of 9/11/01 – are consistent with the previous studies, and lend support to point 3 of the theory. The increased overall emotional arousal, assumed to have been experienced after 9/11 by all subjects, apparently produced a measurable increase in the intensity of the central dream imagery.

The generalizability of these results needs to be examined. Can persons who record all their dreams be considered representative of the US population? There are no studies dealing specifically with characteristics of people who record their dreams. However interviews with many such persons by the senior author suggest that they are basically normal people with no clear psychopathology. They are distinguished chiefly by their interest in aspects of their inner lives, including not only their dreams, but also their daydreams, fantasies and, in some, their artistic productions. Most of them are frequent dream recallers.

There are a number of personality studies of people who recall dreams frequently, a group that overlaps with the study group. As mentioned, the present study group did not have high dream recall in all cases: the time span over which ten dreams were recorded was as long as 22 weeks. However, most of the participants were frequent dreamers, recording at least one or two dreams per week. Overall, only very minor and inconsistent differences have been found in the personalities of frequent dream

recallers compared to infrequent recallers. The only clear exception is the personality measure Thin versus Thick Boundaries. Using the well-established Boundary Questionnaire, frequent dream recallers are found to have thinner boundaries in many senses.<sup>8, 25, 26</sup> And CI intensity has shown to be higher in dreams of students with thin boundaries.<sup>27</sup> Thus the only suggestion of possible differences between our participants and the general population would be that our participants might have thinner boundaries. Thin boundaries usually include sensitivity in various senses, so it is possible that our participants might have had a quantitatively stronger reaction to the attacks of 9/11 than the average person, but this is far from certain. In theory it would be interesting to repeat our study using people who are perhaps more average -- recalling fewer dreams and not recording their dreams -- but obviously these conditions would have made the study impossible to perform.

There is a broad view of dreams known as the Continuity Hypothesis -- suggested by a number of researchers, and often attributed to Domhoff<sup>28</sup> -- who formulates it as “the concerns people express in their dreams are the concerns they have in waking life.” He provides data from a number of sources supporting this “continuity.” The hypothesis is widely accepted in its very general form. However the idea of “concerns” is vague enough so that it is difficult to say whether the results of the present study are consistent with the hypothesis. The participants were not questioned specifically about their concerns, but it can be assumed that after 9/11 there was an increased concern about further terrorist attacks. If one assumes that the waking concerns were specific, and centered around the idea of planes hitting tall buildings or similar attacks, then the present results lend no support to the hypothesis. However, if one assumes that the

concerns were more general emotional concerns -- a lack of safety and a feeling of vulnerability to attack, then the trend towards more content involving attacks in the dreams after 9/11 may be considered to be supportive of the hypothesis. But the results lend far clearer support to the tenet of the Contemporary Theory suggesting that the power of the central imagery of the dream is related to the power of the underlying emotion or emotional state. And the study supports the idea that the dream image is an emotionally guided construction or creation, not a replay of waking experience.

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Table 1: Results on all measures tested

| Measure                | Mean ( $\pm$ SD)<br>before 9/11 | Mean ( $\pm$ SD)<br>after 9/11 | ANOVA: stats for after vs before 9/11* |      |          |                  |
|------------------------|---------------------------------|--------------------------------|--|------|----------|------------------|
|                        |                                 |                                | Deviation from<br>grand mean           | F    | p        | eta <sup>2</sup> |
| CI Intensity           | 1.10 ( $\pm$ .43)               | 1.29 ( $\pm$ .41)              | $\pm$ .07                              | 9.4  | < .004** | .18              |
| CI Proportion          | 0.71 ( $\pm$ .20)               | 0.79 ( $\pm$ .15)              | $\pm$ .04                              | 11.6 | < .001** | .22              |
| Length<br>(text-lines) | 12.93 ( $\pm$ 9.79)             | 11.88 ( $\pm$ 7.23)            | $\pm$ .05                              | 0.7  | NS       |                  |
| Dream-likeness         | 4.54 ( $\pm$ .92)               | 4.52 ( $\pm$ .93)              | $\pm$ .01                              | 0.1  | NS       |                  |
| Vividness              | 3.85 ( $\pm$ .91)               | 3.94 ( $\pm$ .93)              | $\pm$ .04                              | 0.7  | NS       |                  |
| Content: attacks       | 0.03 ( $\pm$ .09)               | 0.10 ( $\pm$ .14)              | $\pm$ .04                              | 5.1  | < .03**  | .11              |
| Content: towers        | 0.06 ( $\pm$ .09)               | 0.10 ( $\pm$ .16)              | $\pm$ .02                              | 2.4  | NS       |                  |
| Content:<br>airplanes  | 0.05 ( $\pm$ .10)               | 0.06 ( $\pm$ .11)              | $\pm$ .01                              | 1.3  | NS       |                  |

\* Values are included only for the “within subjects” factor ( after vs before). The “between subjects” factor ( gender) showed no significant effects. There were no significant interactions.

\*\* Applying Bonferroni corrections as well as the less strict Sequential Bonferroni ( Dunn-Sidak) corrections for multiple tests leads to the same conclusion: results on “CI Intensity” and “CI Proportion” are still significant. Results on “Content: attacks” are no longer significant at  $p < .05$ .

### Figure 1: Scoring Dreams for the Central Image (CI)

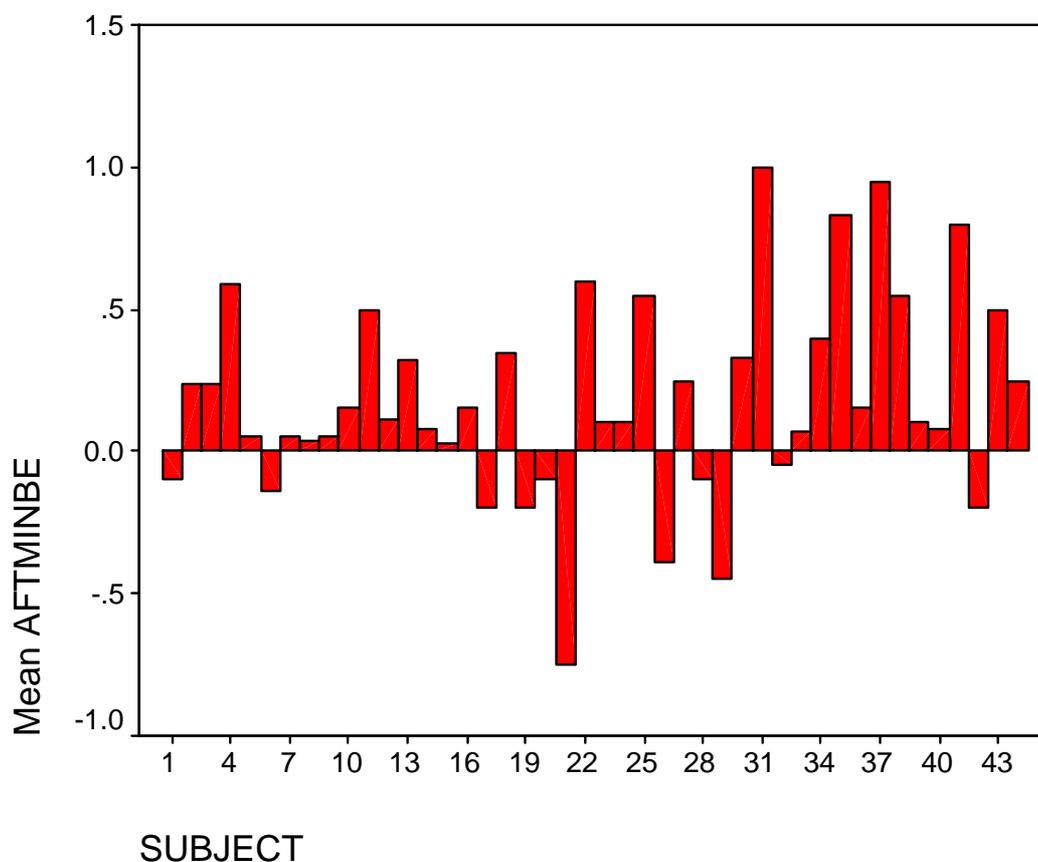
Definition: A contextualizing image or Central Image is a striking, arresting, or compelling image — not simply a story — but an image which stands out by virtue of being especially powerful, vivid, bizarre, or detailed.

#### EMOTION LIST

- |  |                                |
|--|--------------------------------|
| 1. fear, terror  | 11. power, mastery supremacy   |
| 2. helplessness, vulnerability, being trapped, being immobilized | 12. awe, wonder, mystery       |
| 3. anxiety, vigilance  | 13. happiness, joy, excitement |
| 4. guilt   | 14. hope                       |
| 5. grief, loss, sadness, abandonment, disappointment             | 15. peace, restfulness         |
| 6. despair, hopelessness (giving up)                             | 16. longing                    |
| 7. anger, frustration  | 17. relief, safety             |
| 8. disturbing — cognitive dissonance, disorientation, weirdness  | 18. love (relationship)        |
| 9. shame, inadequacy   |                                |
| 10. disgust, repulsion   |                                |

| Dream ID# | 1. CI? (Y/N) | 2. What is it? | 3. Intensity (rate 0-3) | 4. What emotion? | 5. Second emotion? |
|-----------|--------------|----------------|-------------------------|------------------|--------------------|
|           |              |                |                         |                  |                    |
|           |              |                |                         |                  |                    |
|           |              |                |                         |                  |                    |

**Fig. 1.** Score sheet for Central Image (CI). A rater reads a dream report, identifies it by ID number and then decides whether there is a scorable central image and if so, to rate its intensity using a seven point scale: 0 (no image), 0.5, 1.0, 1.5, 2.0, 2.5, 3.0. The rater then tries to judge what emotion, from the list, might be pictured by the central image.



**Fig. 2.** Central Image intensity before and after 9/11/01.

Each bar represents, for a given subject (subjects #1-44), a mean score<sup>xxix</sup> for Central Image Intensity on all dreams after 9/11/01 minus the mean score for Central Image Intensity on all dreams before 9/11/01. ( t-test for correlated samples: mean difference = 0.19;  $t = 3.3$ ,  $p < .002$ )