



## The impact of September 11 on dreaming<sup>☆</sup>

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### ABSTRACT

This study focuses on a set of dreams related to the September 11, 2001 terrorist attacks and their aftermath, using content analysis and cognitive psychology to explore the interweaving of external public catastrophe and internal psychological processes. The study tests several recent claims in contemporary dream research, including the central image theory of Hartmann [Hartmann, E., & Basile, R. (2003). Dream imagery becomes more intense after 9/11/01. *Dreaming*, 13(2), 61–66; Hartmann, E., & Brezler, T. (2008). A systematic change in dreams after 9/11/01. *Sleep*, 31(2), 213–218], the media exposure factor postulated by Propper [Propper, R. E., Stickgold, R., Keeley, R., & Christman, S. D. (2007). Is television traumatic? Dreams, stress, and media exposure in the aftermath of September 11, 2001. *Psychological Science*, 18(4), 334–340], the continuity hypothesis of Domhoff [Domhoff, W. G. (1996). *Finding meaning in dreams: A quantitative approach*. New York: Plenum], the cognitive and metacognitive approach of Kahan [Kahan, T. L. (2001). Consciousness in dreaming: A metacognitive approach. In K. Bulkeley (Ed.), *Dreams: A reader on the religious, cultural, and psychological dimensions of dreaming* (pp. 333–360). New York: Palgrave], and the threat simulation theory of Revonsuo [Revonsuo, A. (2000). The reinterpretation of dreams: An evolutionary hypothesis of the function of dreaming. *Behavioral and Brain Sciences*, 23(6), 877–901]. Our findings suggest the terrorist attacks had a tangible impact on the content of many people's dreams, but did not fundamentally alter the cognitive processing features of their dreaming. The 9/11 attacks affected what they dreamed about, but not the way they dreamed.

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### 1. Introduction

The attack of September 11, 2001 on the World Trade Center in New York and the Pentagon in Washington, DC, had a profound emotional impact on people all across the United States. The effects were most severe for those who lost loved ones and/or witnessed the destruction firsthand. An early study of post-traumatic stress disorder (PTSD) among 9/11 survivors indicated that up to 20% of residents living close to the World Trade Center had suffered acute symptoms of PTSD, with elevated levels of depression throughout New York City (Galea et al., 2002). Countless other people living outside New York and Washington, DC, also experienced an upsurge of psychological distress and PTSD-like symptoms (Cardenas, Williams, Wilson, Fanouraki, & Singh, 2003; Murphy, Wismar, & Freeman, 2003; Pantin, Schwartz, Prado, Feaster, & Szapocznik, 2003; Speckhard, 2003). Given that one of the primary symptoms of PTSD is recurrent nightmares (Barrett, 1996; Belicki

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& Cuddy, 1996; Hartmann, 1998; Levin & Nielsen, 2007), it seems likely that the 9/11 attack provoked a widespread burst of negative dreaming connected to a specific set of events in the socio-political world.

Some evidence has accumulated regarding the impact of 9/11 on dreaming (Bulkeley, 2008; Hartmann & Basile, 2003; Hartmann & Brezler, 2008; Propper, Stickgold, Keeley, & Christman, 2007). However, no systematic attempt has been made to examine the interaction of content and process features of dreams related to September 11. The present study is aimed at that goal. We have gathered and, after long reflection, analyzed a set of 9/11-related dreams from psychologically healthy college students at a private university in California using the resources of content analysis and cognitive psychology to explore the interweaving of external public catastrophe and internal psychological processes. Our dual analysis of this unique set of dreams puts to the test several recent claims and hypotheses in contemporary dream research:

- Higher central image intensity (Hartmann & Basile, 2003; Hartmann & Brezler, 2008): the impact of 9/11 can be seen not in the altered content of post-9/11 dreams but in the heightened intensity of their “central images.”
- Media exposure (Propper et al., 2007): changes in dream content following 9/11 can be explained by reference to the traumatizing effects of watching television coverage of the disaster.
- Continuity hypothesis (Domhoff, 1996; Domhoff, 2003): frequency patterns in dream content accurately reflect the most important concerns in the individual’s life.
- Cognition and metacognition in waking and dreaming (Kahan, 2001): dream experience includes many of the same types of thoughts, reflections, and mental processes that characterize waking consciousness.
- Threat simulation theory of dreaming (Revonsuo, 2000): the human propensity to experience highly memorable nightmares serves the adaptive function of preparing people for the possibility of facing similar threats in the waking world.

## 2. Methods

### 2.1. Participants

Participants were recruited from an undergraduate psychology class taught by one of us (TK) in the Fall quarter of 2001. As part of the regular class assignments, students were required to keep a sleep and dreams journal for the duration of the quarter. At the end of the quarter the students were invited to participate in a research project involving their journals and a follow-up questionnaire.<sup>1</sup> Twenty-one people volunteered to participate, 17 women and 4 men, with a mean age of 21.3 years. As a group, these participants do not represent the 9/11 experiences of those at “ground zero,” but rather the more diffuse kinds of emotional upheaval experienced by people all across the US. The participants did, however, have a personal connection to the 9/11 attack—a fellow student from the university died on one of the hijacked planes (United flight 93), and memorial events were held on campus for her during the Fall quarter.

### 2.2. Procedure

#### 2.2.1. Dream journal guidelines

The participants kept their journals for 10 weeks, from September 20 to November 30, 2001. They were asked to write at least four entries each week with responses to the following questions: times the participant went to bed and got up; number of times awakened during the night; observations about the quality of sleep; comments about other events that have influenced the participant’s sleep patterns; and a recording of any dreams the participant may have experienced, including any recollection of moods, thoughts, and images. The journals were a required part of the course, but their content was not graded.

#### 2.2.2. Operational definitions of “incorporation dreams” and “matched dreams”

We made a tactical decision at the outset to focus on explicit incorporations of 9/11-related imagery rather than on possible metaphorical incorporations. The question of how to identify and reliably interpret the metaphorical expressions of dreaming remains a challenging issue in contemporary dream research (Lakoff, 2001). For the purposes of this project we decided to bracket out that complex question and concentrate instead on those dreams where the references to 9/11 and its aftermath were direct and literal. We remain open, however, to the additional possibility of metaphorical incorporations of 9/11-related images and themes in people’s dreams. For example, one of us (KB) had a dream three days after the attack in which he was chased by a swarm of bees. The dream’s content (intense fear of danger from an airborne menace) was unmistakably related to and continuous with the dreamer’s waking-life feelings after September 11, and yet according to the criteria used in the present study such a dream would not be considered an explicit incorporation.

<sup>1</sup> Participants were recruited via a letter of invitation distributed during the last week of classes. The letter described the purpose and methods of the study, emphasized that participation was voluntary and in no way connected to the student’s course work, and described how the student’s confidentiality would be maintained. Prior approval was obtained from the university’s Internal Review Board and all participants were treated in accordance with APA Ethical Guidelines (APA, 1992).

To minimize the possibility of imposing our metaphorical expectations about what dream elements were and were not related to September 11, we sorted the dreams according to a short list of keywords with direct, literal connections to the public events of the 9/11 attack and its immediate aftermath (including the US counter-attack in Afghanistan, the anthrax letters, and domestic security warnings of imminent new terrorist attacks).<sup>2</sup> The keywords were as follows: terrorists; Middle-easterners/Arabs/Muslims; Osama bin Laden, Taliban; soldiers; Afghanistan; airplanes being hijacked, crashing, and/or attacking; bombs, explosions; Anthrax. These terms were chosen because of their clear, culture-wide references to the most salient aspects of the September 11 attack and its immediate impact on Americans all over the country. This included the fear that other attacks by terrorists were imminent, prompting a rapid deployment of combat-ready troops to guard airports, bridges, stadiums, and other public gathering spaces, making visible to all the heightened collective mood of fear and insecurity. Although it now appears the anthrax-laced letters found in the US postal system in October of 2001 were not linked to the 9/11 plane hijackings, most Americans at that time feared the two events *were* connected, and so we also included the term on our list.

Using this list of terms, two research assistants not otherwise involved in the project read through the journals and independently identified the same dreams that contained one or more of the keywords. After reviewing all the journals, the first author identified two additional incorporation dreams that, while not initially flagged by the keywords, directly related in their manifest content to 9/11 and its aftermath.

We are using a more expansive definition of 9/11 incorporation dreams than the one used by Hartmann and his colleagues, who focused their attention only on the single image of a plane crashing into a building, and found no such dreams worth reporting (even while acknowledging (Hartmann & Basile, 2003, p. 66) that some of their participants did report 9/11 incorporation dreams). At the same time, our definition is narrower than that used by Propper and her colleagues, whose list of 9/11-related terms included generic words like fire, smoke, violence, harm, disappearance, and radio, which led to the paradoxical result that 16% of her study's *pre-9/11* dreams were scored as containing one or more content feature related to the attacks (Propper et al., 2007). We crafted our definition to focus as much as possible on those dream reports containing clear, specific indications of relevance to the events of September 11.

Once the incorporation dreams were identified (henceforth IN dreams), an equal number of dreams from the same participants, with similar word counts from approximately the same period of time, were gathered into a second group ("matched" or MA dreams). The set of matched dreams was identified by another independent coder not otherwise involved with the study. For a given incorporation dream, a matched dream with a similar word count (+/- 40 words) was selected from the same journal and from the same week. If more than one matched dream was available, the matched dream was selected by pairing two possible dreams and eliminating one through a coin toss until only one matched dream remained. This procedure resulted in 37 pairs of dreams (incorporation and corresponding matched dream) from 16 participants.

The two groups of dreams were then scored using content analysis categories derived from the Hall and Van de Castle system (Hall & Van de Castle 1966) and updated by Domhoff (1996) and Bulkeley (2006) along with measures of affective, cognitive, and metacognitive processes (Kahan, LaBerge, Levitan, & Zimbardo, 1997). The IN dreams were also evaluated in connection with a questionnaire each subject provided about his or her emotional reaction to September 11 and its aftermath (see Appendix A).

### 2.2.3. Scoring of content categories

For the content analysis, a trained rater unfamiliar with the project coded the IN and MA dreams using a simplified version of the Hall and Van de Castle (HVDC) categories for characters, social interactions, misfortunes and good fortunes, and emotions. These categories represent reliably identifiable and theoretically interesting aspects of dream content, and they have been successfully used in dozens of studies over the past half century (Domhoff, 1996; Hall, 1966; Hall & Van de Castle, 1966; Van de Castle, 1994). The rater read through each IN and MA dream and identified the characters in terms of number, gender, relation to the dreamer, and age (for example, a "mother" character would be coded as a 1FMA, meaning a single female mother adult). For the social interactions, only the presence of a friendly (F), non-physically aggressive (A), physically aggressive (P), or sexual (S) interaction was coded, not its type or directionality as in the original HVDC method. Misfortunes were coded according to the original six-type system (ranging from minor problems like getting lost to major problems like illness and accidental death), and good fortunes according to a revised good fortune scale designed to match the misfortunes scale more completely than in the HVDC version, which only provided one catch-all coding for diverse good fortunes such as flying, finding money, having extraordinary mental powers, and returning from the dead (Bulkeley, 2006). The rater was trained to focus on the manifest content of each dream report, without imputing emotions, thoughts, or motives that were not directly mentioned in the text. The dreams were also coded in this manner by the first author, with an inter-rater agreement of 80%. Differences were resolved by the first author after discussion and reference to the HVDC definitions.

### 2.2.4. Scoring of process features

In preparation for analysis of the affective, cognitive, and metacognitive processes, the 37 IN and 37 MA dreams were transcribed and coded with a random journal number. The dreams were shuffled a number of times and then numbered.

<sup>2</sup> The main justification for including these post-9/11 events on our list is that *at the time*, these events were widely experienced as an emotional whole; thus it would be artificial and misleading to separate the oneiric impact of the 9/11 attack from the impact of these other major public events that immediately followed the attack itself.

**Table 1**  
Incidence of incorporations, from most to least frequent

Keywords	Abbreviations	Frequencies
Planes being hijacked, crashing, and/or attacking	(P)	13
Bombs, explosions	(B)	8
Soldiers	(S)	6
Terrorists	(T)	4
Middle Easterners/Arabs/Muslims	(M)	3
Osama bin Laden	(O)	3
Afghanistan	(AF)	2
Anthrax	(AX)	2

Identifying information (journal number, type of dream) was removed. Each dream was independently scored by two trained raters who were blind to the research hypotheses, the type of dream, and the identity of the dreamer. Raters read a dream transcript twice and then used the process questionnaires to identify whether particular instances of cognition, metacognition, or affect were present in the narrative (see Kahan, 1994, for a more detailed description of this third-person scoring procedure). For processes that were observed, the rater checked “yes” on the questionnaire, highlighted the example in the narrative, and noted the questionnaire item number next to the highlighted example. Inter-rater reliability was .88, and differences were resolved by the second author.

### 2.2.5. Scoring of post-journal questionnaire

At the conclusion of the Sleep and Dreaming course, students who consented to have their dream journals included in the study were sent a confidential questionnaire which they completed and returned to the first author. In addition to questions about their age, gender, and state of residence, the participants were asked 12 questions about their reactions to the events of September 11 and its impact if any on their sleep and dreams. A thorough analysis of the participants' responses to these questions was deemed beyond the purview of the present study, both because of the narrative complexity of their answers and the considerable time lapse (almost three months) between September 11 and the date of the questionnaire. We used their responses as contextualizing information for understanding the experiential qualities of their IN and MA dreams, but we did not base our primary analysis on these data. In light of Propper et al.'s study, we have included a brief summary of the responses to the television-watching questions (Table 2).

## 3. Results

### 3.1. Descriptive analyses

Out of a total of 567 dreams recorded in the 21 sleep and dream journals, 37 dreams were identified as having one or more of the keywords, 6.5% of the total (Table 1). Sixteen participants (12 women, 4 men) had at least one IN dream; five of the participants (all women) had none. Four participants (all women) had three or more IN dreams. One participant had a personal relationship with the student who died, and although she reported a high degree of emotional distress following her friend's death, she had no explicit IN dreams.

The most frequent type of IN element regarded 9/11-related experiences with airplanes. The second most frequent element was bombs and explosions, often threatening the dreamers in their homes or neighborhoods. Soldiers appeared in six dreams. References to specific names (Osama bin Laden, Afghanistan, Anthrax) were rare, but they did occur. The full text of these dreams is available on the first author's website.<sup>3</sup> Below are four IN dream examples.

7367.1: “I had a dream that everyone in their twenties had to go to war. It was not just limited to males; all people in my age group had to immediately go off to war. . . I remember being very nervous about going, and I was scared to go off with a bunch of people I didn't know.”

1776.1: “I was in the military fighting in Afghanistan. I was a really important Special Forces commando. I was killing bad guys left and right.”

4929.2: “Russia launched nuclear missiles on California. The strangest part of the dream was that George W. Bush ordered Russia to do it, citing that California had been uncooperative in the war against Osama bin Laden and that the US would best be served if the state of California were eliminated.”

8078.4: “Osama bin Laden came to speak at [my university]. The strange thing was, in my dream Osama was a woman. She was invited to speak at [my school] so that we could gain a little insight into what exactly the Taliban was, and why they hated Americans.”

A review of the survey data collected after the study yielded no sharply defined patterns (see Table 2). Almost all of the participants expressed a high level of emotional distress following September 11, even those who never dreamed about it afterwards. As already noted, one of the participants who suffered a direct personal loss had no IN dreams at all. Several

<sup>3</sup> <http://www.kellybulkeley.com>.

**Table 2**

Intercorrelations between variables related to television (TV) viewing and number of IN dreams

Question	1	2	3	4
1. TV on 9/11 (h/day)		0.08	.16	-.37
2. TV during week following 9/11 (h/day)			.64**	-.30
3. TV during weeks three through nine following 9/11 (h/week)				-.09
4. Number of IN dreams				

\*\*  $p < .001$ .

of the participants who watched the most television on September 11 (10 or more hours) reported no IN dreams, while those who watched the least television that day (five or fewer hours) all reported at least one IN dream. Most of the participants watched many more hours of television reporting the day of September 11 than they did in the weeks following. A correlational analysis (Pearson's  $r$ ) revealed that none of the television viewing variables predicted the incidence of IN dreams.

### 3.2. Analysis of content categories

The content analysis identified the basic phenomenological patterns of several categories of dream content (characters, social interactions, emotions, and misfortunes/good fortunes), and it provided a sharper set of distinctions between the two sets of dreams (Table 3). Compared to the MA dreams, the IN dreams had more unfamiliar male characters and fewer family members, more physical aggression directed at the dreamer, more misfortune, less good fortune, and fewer sexual interactions. Not surprisingly, these were bleak dreams, unpleasant and filled with threats.

### 3.3. Analysis of process features

Turning to the process features, we used the McNemar procedure for correlated proportions to determine whether the percentage of “yes” responses for the 18 process questions differed for IN and MA dreams (Table 4). The McNemar procedure is based on the binomial distribution and uses a  $\chi^2$  statistic with a correction applied for continuity to determine exact test probability (cited in Hays, 1973, p. 741). As shown in Table 4, two statistically significant results emerged: “fear, upset, or anxiety” was more often observed in incorporation dreams (54%) than in Matched dreams (30%), and “choice” was more often observed in Matched dreams (38%) than in Incorporation dreams (14%).

We also noted the incidence of particular cognitive and metacognitive processes, as observed in the narrative reports by third-party raters. Looking at the data from both IN and MA dreams, two cognitive processes occurred frequently: thinking (Q1) and planning (Q2) were observed in 60% of all the coded the dreams. Cognitive or affective processes noted in 20–50% of the dreams included: remembering a previous event (Q10), focused attention (Q14), thwarted intention (Q15), and the experience of (any) feeling (Q4). Cognitive processes noted in 5–19% of the dreams were: imagining something (Q3), sudden attention (Q13), public self-consciousness (Q16), and all three types of self-reflection (Qs 18, 19, 20). Finally, “remembering” (a previous thought, plan, imagination, or feeling) (Qs 6–9) was noted in fewer than 5% of the dreams. Only “remembering a previous event” (Q 10) was noted with any frequency—in 34% of dreams.

**Table 3**

Content analysis findings

Content category:	Incorporation dreams	Matched dreams	Differences
Male/female	54	43	>11
Familiarity	42	58	<16
Friends	23	21	>2
Family	15	32	<17
Dead/imaginary	1	0	>1
Animals	2	5	<3
Aggression/friendliness	52	51	>1
Befriender	52	30	>22
Aggressor	26	46	<20
Physical aggression	72	48	>24
Negative emotions	82	88	<6
Dreams with at least one			
Aggression	68	44	>24
Friendliness	43	50	<7
Sexuality	3	17	<14
Misfortune	49	28	>21
Good fortune	16	31	<15

Note. All numbers are percentages; statistics were generated by DreamSAT program, available at <http://www.dreambank.net>.

**Table 4**

Percentage of “Yes” ratings concerning the incidence of cognitive, affective, and metacognitive processes in incorporation (IN) dreams and matched (MA) dreams

“During the dream, did the dreamer”	Incorporation dreams	Matched dreams	Differences	Significance of exact test <sup>a</sup>
Make a choice	14	38	<24	0.02
Make a plan	65	54	>11	0.45
Have a thought	65	57	>8	0.61
Imagine something	19	16	>3	1
Experience any feeling	57	46	>11	0.396
Experiences fear, upset or anxiety	54	30	>24	0.02
Remember a previous plan	3	0	>3	1
Remember a prior thought	3	6	<3	1
Remember a previous imagination	0	0	0	<sup>b</sup>
Remember a previous feeling	0	3	<3	0.25
Remember a previous event	38	30	>8	0.55
Attention suddenly captured	16	22	<6	0.59
Sustained attention	30	16	>14	0.17
Difficulty accomplishing a task	27	16	>11	0.21
Concern for impression made	9	9	0	1
Reflect on: own thoughts, feelings	11	3	>8	0.18
Reflect on: own behavior	14	11	>3	0.66
Reflect on: external environment	22	14	>8	0.37

<sup>a</sup> Significance of exact test using the McNemar procedure for correlated proportions (McNemar, 1955; cited in Hays, 1973).

<sup>b</sup> Analysis could not be performed because there were no instances of “yes” ratings.

#### 4. Discussion

The primary finding of this study—that more than three-quarters of the subjects had at least one incorporation dream in the 3 months following 9/11—indicates that, for a significant number of people, dreaming relates directly to their experiences in the public world of society and politics. The corresponding fact that a quarter of the subjects had no incorporation dreams indicates that not all people have dreams of this sort, at least in the form of direct, literal references. The scattered occurrence of IN dreams throughout the 3-month journal period suggests a “time-lag” effect by which the deep emotional impact of a catastrophic event may not appear immediately in people’s dreams but may emerge over the course of time (Nielsen, Kuiken, Alain, Stenstrom, & Powell, 2004). The appearance of soldiers in six IN reports might be explained as an ordinary type of occurrence that could be found in dreams before 9/11. However, most of the soldier dreams in our set were identified by the dreamers themselves in their journals as related to their feelings about 9/11 and its aftermath.

Several content differences emerged between the IN and MA dreams, but we found few major differences in the cognitive or metacognitive processes of these same narratives. This suggests the terrorist attacks of September 11 may have had a tangible impact on dream content, but it did not fundamentally alter the dreaming process. According to our data, the attacks may have affected what people dreamed about, but they did not alter the way they dreamed (also see Kozmová & Wolman, 2006).

Our findings cannot be directly compared to the findings of Hartmann and his colleagues that dream image intensity increased after 9/11, because our sample does not include any pre-attack data. Contrary to Hartmann et al.’s claim that 9/11 did not affect the “specific content of the dream,” we found that for some people their dream content was indeed affected by the 9/11 attack, in explicit and clearly identifiable ways. Unlike the Hartmann studies, ours found several references to planes crashing into buildings, being hijacked, burning, etc. The difference may be due to dissimilarities in participant ages (mean age of 53 in Hartmann & Basile; 21.3 in our study) and number of post-9/11 dream reports (440 in Hartmann & Brezler; 567 in ours). The small number of subjects in both studies (44, 21) means we cannot make any broader claims about the frequency or distribution of 9/11-related incorporation dreams. However, the evidence from our study makes it difficult to maintain a claim that 9/11 had no explicit impact on subsequent dream content.

In apparent contrast to Propper et al. (2007), the present study did not find a connection between television exposure and IN dreams. However, we gathered our data on this question three months after 9/11, whereas Propper and her colleagues collected information about television exposure the day after the event, suggesting their data are more reliable than ours in this regard. Although Propper et al. do not dwell on this point, we view as equally significant their findings that 32% of the dreams following 9/11 included at least one content feature related to the attacks. Even taking into account their arguably over-broad definition of IN dreams, Propper et al. found numerous instances of literal incorporations of 9/11 events in their participants’ dream reports. This result is consistent with our study.

The working assumption of Domhoff’s approach to content analysis is the continuity hypothesis—frequencies in dream content correlate with important, emotionally salient concerns in the individual’s waking life. Our study offers mixed results in support of the continuity hypothesis. The fact that 16 of the 21 participants reported at least one 9/11-related IN dream

accurately reflects the widespread emotional impact of the terrorist attacks, and the people who had the most IN dreams were also highly anxious and upset in their waking lives following 9/11. However, five participants who were also upset after 9/11 had no IN dreams, including the person with the closest relationship with the student who died on United flight 93. Perhaps other research methods would find more evidence of waking-dreaming continuity, especially if metaphorical and symbolic themes were taken into account. The limits of our study prevent us from saying anything about the possibility of metaphorical 9/11 incorporations, beyond our belief that they do occur.<sup>4</sup> In sum, our data bolster the idea that dream content can be used as a broadly accurate gauge of people's waking-life feelings, concerns, activities, and experiences, although more work needs to be done to refine content analysis, including greater attention to metaphors, individual variations, and cultural dynamics.

Regarding the process variables analyzed in this study, our findings are consistent with other research showing that dreaming and waking cognition are more similar than different (Kahan & LaBerge, 1996; Kahan et al., 1997; Wolman & Kozmová, 2007). Our mostly null findings (i.e., 16 of the 18 process variables did not significantly differ between the two sets of dreams) indicate a steadiness and consistency of cognitive functioning across varying conditions and states of consciousness. The intrusion of 9/11 material did not alter the basic processes of dreaming cognition. This is further evidence that dreaming is not a random, ad hoc occurrence but rather reflects the regular activation during sleep of many of the same cognitive systems that characterize waking awareness. Regarding the two differences that were found: (1) The significantly lower incidence of "Choice" in the IN dreams fits well with the content analysis findings of high levels of misfortune and aggression suffered by the dreamers. According to both measures of analysis, the participants experienced less agency in their IN dreams and more vulnerability to external threats. (2) The process variable analysis showed a significantly elevated degree of fear and anxiety in the IN dreams, which we would expect given the emotional impact of 9/11. Strangely, however, the content analysis showed high frequencies of negative emotion in both IN and MA, with the latter actually higher than the former. The discrepancy is likely due to the HVDC content analysis convention that feelings of surprise and confusion are treated as negative emotions; the process variable approach handles the coding of such cognitive processes very differently, so the compatibility of the two systems breaks down at this point. This suggests the need for more sophisticated methods of scientifically assessing the relationship between emotion and cognition in dreaming.

The threat simulation theory (TST) of Antti Revonsuo has been criticized as a general theory of dream function (for discussion, see Pace-Schott, Solms, Blagrove, and Harnad (2003)), but as a more focused hypothesis regarding one prototypical aspect of dreaming it retains a good deal of explanatory power (Valli, Revonsuo, Palkas, & Punamaki 2006; Valli et al. 2005). The IN dreams gathered in our study can be taken as evidence that at least some dreams simulate vivid, highly arousing threats from actual dangers in the individual's waking world. The clearest example was this: "I was a passenger on an airplane and I was prepared in the event that there were hijackers on the plane. I made sure I had an aisle seat so that if there were terrorists on the plane I would be able to attack them." (8078.3) Whether or not these threatening, 9/11-simulating dreams functioned to promote better waking-life adaptation is impossible to say based on our data. It does seem clear, though, that the IN dreams were related to the individual's psychological efforts to process the frightening events of 9/11, manage their emotional reactions, and scan their immediate environment for related threats.

## 5. Limitations

The limits of this study derive from the unique and fast-moving historical circumstances in which the project was conceived and carried out. Our primary concern was the ethical imperative to do nothing that might further upset the already disturbed college students who participated in the research. They were already keeping the sleep and dream journal as part of their regular coursework prior to our study, and the only additional request we made of them was to fill out a brief questionnaire at the end of the school term. If we had been able to interview the students in more detail about their feelings about 9/11 and their dream lives in general, we would undoubtedly have improved and deepened our understanding of what did and did not change in their post-9/11 dreams. But to pursue that kind of research responsibly would have required more thorough preparations than our short and tumultuous timeframe allowed. Thus we followed the path of caution, and drew as much insight as we could out of the limited data we were able to gather from our participants.

## 6. Conclusion

The results of this study support dream theories that focus on the significant continuities between waking and dreaming cognition and emotion. To some extent, each of the theories discussed above fit that description, although none of them can fully account for our data. We found more IN dreams than suggested by Hartmann, and less influence by television watching than predicted by Propper. A strong version of Domhoff's continuity hypothesis might not anticipate that 93.5% of the post-9/11 dreams would not contain any explicit reference to the terrorist attacks, and a strong version of Revonsuo's threat simulation theory would likely expect an even higher percentage of nightmares anticipating 9/11-type dangers to the dreamer.

<sup>4</sup> Perhaps as a metaphoric response to the heightened sense of patriotism following 9/11, the IN dreams also had more acts of befriending than the MA dreams. A rise in prosocial impulses in waking and dreaming may be another aspect of post-traumatic experience, beyond the suffering caused by repetitive nightmares (Folkman, 2008).

Each of these theories has proven merit, but a truly comprehensive framework for the study of dreaming in its full phenomenological multiplicity remains an unfinished work (Hunt, 1989). We believe significant progress toward that end can be made by further investigation of the recurrent patterns in dreaming process and content, using more precise analytic methods, larger and more diverse groups of participants, and deeper familiarization with the personal and cultural dynamics shaping the participants' waking, sleeping, and dreaming lives.

The findings presented here support continuing efforts to study the impact of major public events on personal dream experiences. We have shown that the systematic analysis of sleep and dream journals from students in college classes can be a valuable resource in this area of research, and we have demonstrated the fruitfulness of combining empirical findings on dream content and dreaming process. Whether by human or natural causes, the future will inevitably bring new collective disasters, and we can be confident, unfortunately, that those catastrophes will prompt an upsurge of unpleasant, nightmarish dreaming for many people. We recommend that future research investigate the public health implications of these group-crisis dreams, as well as their significance for a fully developed phenomenology of dreaming experience.

## Appendix A. Dream Research Questionnaire

1. Did you have any personal connection to the terrorist attack of 9/11? (If so, what?)
2. How did you first see/hear about the attack?
3. What were your reactions when you first saw/heard about the attack?
4. On September 11, (roughly) how many hours did you spend watching TV news or special reports concerning the terrorist events?
5. In the one week immediately following September 11, (roughly) how many hours per day did you spend watching TV news or special reports concerning the terrorist events?
6. In the weeks between September 18 and today, (roughly) how many hours per week did you spend watching TV news or special reports concerning the terrorist events?
7. Please describe any connection you see between the events of 9/11 and your sleep and dreams.
8. Have you been emotionally affected by the terrorist attacks (or related events) since 9/11?
9. Have your feelings about traveling by plane changed since 9/11 (If so, how?)
10. Have you taken any plane trips since 9/11?
11. If you have flown since 9/11, how would you rate your anxiety about flying now, as compared with before 9/11? (circle one): not at all anxious somewhat anxious very anxious extremely anxious.
12. If you have flown since the plane crash in Queen's New York (November 12), how would you rate your anxiety about flying now, as compared with before November 12? (circle one): not at all anxious somewhat anxious very anxious extremely anxious.

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