

The Effect of Trauma on Dream Content—A Field Study of Palestinian Children

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In the present study, we compared the frequency and intensity of threatening events in the dreams of traumatized and nontraumatized Palestinian children. The aim of the study was to test some of the predictions and hypotheses derived from the Threat Simulation Theory proposing an evolutionary function for dreaming. Most, but not all, of our hypotheses were supported by the findings. We discuss the results in the light of the Threat Simulation Theory, and we also consider whether alternative theories of dream function are able to account for them.

KEY WORDS: children's dreams, trauma, dream content analysis, threat simulation theory

TRAUMA AND DREAMS

There is ample evidence that bad dreams and post-traumatic nightmares are a common consequence of exposure to traumatic events both among children (Hart-

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mann, 1984; Nader, 1996; Pynoos et al., 1987; Pynoos & Nader, 1988; Stoddard, Chedekel, & Shakun, 1996; Stuber, Nader, Yasuda, Pynoos, & Cohen, 1991; Terr, 1979; 1983) and adults (Low et al., 2003; Schreuder, Kleijn, & Rooijmans, 2000; Siegel, 1996; Wilmer, 1996). The probability of post-traumatic nightmares increases with the degree of severity of the personally experienced or witnessed threat (Nader, 1996). Furthermore, also “near-miss” encounters with threatening events, i.e., situations in which danger is present but actual consequences are avoided, can lead to bad dreams and post-traumatic nightmares among children (Hanford et al., 1983; Pynoos et al., 1987) and adults (Siegel, 1996). This indicates that threat experience activates dreaming about the event even when the situation does not result in any concrete losses.

THREAT SIMULATION THEORY (TST): AN EVOLUTIONARY HYPOTHESIS OF THE FUNCTION OF DREAMING

The Threat Simulation theory of dreaming (TST) (Revonsuo, 2000) postulates that the function of dreaming is the simulation of threatening events, i.e., the repeated nocturnal rehearsal of the neurocognitive mechanisms involved in threat perception and threat avoidance (for full and detailed account of the theory, see Revonsuo (2000), as only the ideas relevant for the present study are presented here). Second, the Threat Simulation Theory proposes an evolutionary origin for this threat simulation function. The TST places human dreaming in the Environment of Evolutionary Adaptedness (EEA) (Tooby & Cosmides, 1992; 1995), suggesting that the original biological function of dreaming evolved in ancestral populations as an adaptive solution to survival problems repeatedly faced by those populations. The TST states that the human threat simulation system evolved in the Pleistocene environment where dangers were plentiful and ever present, and where a dream production system that selected memory traces containing threat and constructed simulations based on them would have been highly valuable. In the ancestral environment, the threat simulation system may have increased the probability of dealing successfully with subsequent real threats in individuals who possessed a fully activated threat simulation mechanism, and consequently threat simulation may have led to a relative increase in reproductive success. Eventually, as dream production and threat simulation have an innate, genetically transmitted neural basis, the system spread throughout the ancestral population and persisted in successive generations. Consequently, the threat simulation system is still present in modern humans and manifests itself especially in the form of dreams of current concerns, universal negative dream themes, recurrent dream themes, bad dreams, nightmares, and post-traumatic dreams. Whether the system is capable of fulfilling its original biological function in the present environment, highly different from the original evolutionary environment, is open to debate.

To sum up briefly, TST applies the notion of “biological function” as it is commonly understood in evolutionary biology and evolutionary psychology. According to this definition, in order for any system to be biologically functional, it must have solved problems that contributed to the inclusive fitness of the organism’s ancestors in the environment of evolutionary adaptedness (Tooby & Cosmides, 1995). The system originally evolved in that environment exactly because it gave some kind of selective advantage in terms of survival and reproductive success

to the individuals possessing it. The features for which the system was selected thus constitute its “function” in the biological sense of “function.”

From an empirical point of view, an important distinction between postulating a specific function for a cognitive mechanism, and postulating an evolutionary origin for the proposed specific function, needs to be drawn. To state that a mechanism fulfils a function allows for the empirical testing of the specific hypotheses derived from the statement. If dreams are threat simulations, then dreams should frequently include various, specified features manifesting threat simulation. In contrast, to state that a mechanism’s function has an evolutionary origin, i.e., to infer a historical causal relation between the origin of the mechanism (why it exists in the first place) and the present form of the mechanism (what does it do in the current environment), is not a directly testable statement. According to Tooby and Cosmides (1995), evolved psychological mechanisms, i.e., adaptations, represent such good engineering solutions to the specific adaptive problems that it would be extremely unlikely for the solution to have arisen by chance. Therefore, in the end, the decision whether a certain property or a trait is an adaptation or not, is based on a probability assessment (Tooby & Cosmides, 1995). In sum, we can empirically directly test whether dreaming fulfils a threat simulation function, but with current empirical evidence, we can only estimate the probability of whether threat simulation function is an adaptation, originating in our evolutionary past.

TESTING TST

The TST states that real life threats activate the threat simulation system in a qualitatively unique manner, dissimilar from the effects of any other experience on dreaming (Revonsuo, 2000). Dream content is constructed by automatically selecting traces from long term memory, and the memory traces with the highest relative saliency are chosen for simulation. Saliency refers to the degree of negative emotional charge and to the recency of encoding or reactivation of the memory trace. Thus, the most salient memory traces for the dream production mechanism are the ones encoding the most threatening events most recently encountered, often marking situations critical for physical survival and reproductive success. Consequently, the TST offers a novel approach to understanding why traumatic experiences are incorporated into dreams more effectively than other experiences, and why they tend to persist and recur in dreams over and over again.

The TST also predicts that dream production mechanism becomes fully activated in the presence of ecologically valid threat cues, and the earlier the exposure to ecologically valid threat cues, the higher the activation of the threat simulation mechanism. Thus, TST hypothesizes that people who have been exposed to real threatening events early in life should have a more highly activated threat simulation system, and consequently their dreams should contain threatening events more frequently than the dreams of people unexposed to real threat cues. Moreover, the threat simulations should be more intense in the dreams of people exposed to ecologically valid threat cues.

These hypotheses have been previously tested by analyzing the threat content of dreams of ordinary Finnish university students (Revonsuo & Valli, 2000), and of severely and less traumatized Kurdish children and adolescents as well as non-

traumatized Finnish children (Valli, Revonsuo, Pälkäs, Ismail, Ali, & Punamäki, 2005). Threatening events were found to be quite frequent even in the dreams of nontraumatized young Finnish adults. When the threat content of dreams of severely traumatized, less traumatized, and nontraumatized children was compared, the frequency of threatening events was found to be the highest in the dreams of the traumatized children. The dream threats of the traumatized children were also more intense in nature, as threats including aggression, different types of life-threatening events and severe losses as a consequence of threats were more frequently reported. Characteristic to the dream reports of severely traumatized children was that they not only incorporated more life-threatening events, but that a higher percentage of words were used in describing the events. We have interpreted these results as reflecting the ongoing threat simulation response in traumatized children.

THE PRESENT STUDY

The present study was designed to further test the predictions of the Threat Simulation theory. Our aim was to replicate, in a completely different population, a study similar to the one previously carried out on the dreams of severely and less traumatized Kurdish and nontraumatized Finnish children (Valli et al., 2005). The present research setting and sample improve on several aspects of the earlier study. First, the present study provides a larger sample size, and second, offers the possibility to compare traumatized children to culturally matched control group children protected from traumatic events.

By analyzing the threat content of dreams of traumatized and nontraumatized Palestinian children, the predictions (1–2) and hypotheses (a–f) directly tested were the following:

1. Real threats elicit a threat simulation response.
 - a) Real threats should activate the dream production mechanism of traumatized children, thus traumatized children should report more dreams than nontraumatized children.
 - b) Real threats should activate the threat simulation system of traumatized children, thus traumatized children's dreams should contain threatening events more frequently than the dreams of nontraumatized children.
2. Threat simulations are efficient rehearsals of threat perception and avoidance responses.
 - c) In order for threat simulation to be most efficient, threats should be targeted against the dream self and/or people significant for the dream self (close kin, friends), and/or pose a threat for valuable resources. Especially, in traumatized children's dreams, the dream self, significant others, and valuable resources should be more often threatened than in nontraumatized children's dreams.
 - d) The threats in the dreams of traumatized children should be more severe in nature, including a greater proportion of life-threatening events and other severe forms of threat.

- e) The threat simulation would be most efficient if a perceived threatening situation is followed by an appropriate response to avoid the threat or to cope with it. Thus, in the traumatized children's dreams the dream self should react more often to the threat than in the nontraumatized children's dreams.
- f) Efficient reactions should be rehearsed especially in situations where threat to future reproductive success is greatest. The more severe the threat, the more often the dream self should react to the threatening event.

METHODS

Participants

The participants were originally 413 Palestinian children and adolescents, of whom 269 lived in the Gaza Strip, and 144 in a peaceful area of Galilee, Israel. The children from Gaza will be referred to as the trauma group and the children from Galilee as the control group. In Gaza, the trauma group children lived under extremely violent and dangerous conditions, and they had frequently experienced night raids, confrontations with occupation soldiers, house demolitions, detentions and arbitrary imprisonments, and every-night curfew for 6 years (B'Tselem, 1993; Cohen & Golan, 1991). The children living in Galilee, even though belonging to the Palestinian nation, had not experienced these kinds of dangers, restrictions, violence or losses, but led normal, peaceful lives.

The trauma group consisted of 235 and the control group of 121 children. No demographical differences between the two groups were observed. The participants are described in more detail in Table 1. Thirty-four children from the trauma group and twenty-three from the control group were omitted from the study because of the lack of dream narratives or missing data. The omitted children were older than the children included in the study ($M = 12.1$ years vs. 11.1 years) ($U = 7186.0, p < .05$).

Procedure

The field work was conducted during the last months of the first Intifada in 1993. The children and adolescents were selected using random and systematic sampling procedures (Pedhazur & Schmelkin, 1991). First, for the trauma group, the places of residence were chosen according to the population distribution in the

Table 1. Participants

	Participants		Age		
	<i>N</i>	%	<i>M</i>	<i>SD</i>	Range
Trauma group	235	66	10.8	2.41	5–16
Boys	132	56.2	10.6	2.56	5–15
Girls	103	43.8	11.2	2.19	7–16
Control group	121	34	11.3	2.86	5–16
Boys	61	50.4	11.1	2.79	5–15
Girls	60	49.6	11.5	2.94	6–16

Note. Boldface indicates importance.

Gaza Strip. One town was chosen, and two refugee camps were allotted from eight possible ones. The division guaranteed also representation of social strata of worker- and middle-class families. Second, following a random start, every third house on each street was visited. The control group was from one Galilean village. The village was first divided into four areas in order to secure the representation of worker- and middle-class families. Then, in each area, following a random start, every third house on each street was visited.

Both samples included children from various social-economy statuses, but were not matched. The economic situation was very bad in the Gaza Strip, and therefore the Gaza children objectively suffered more from economic hardships than the Galilean group. Concerning the education, children in both groups were primary and secondary school pupils. However, because of the military violence, the Gaza children's education was frequently interrupted by military confrontations, daytime curfews and strikes.

One of the authors, R-L Punamäki, and a Palestinian psychologist contacted the Gaza children and adolescents in their homes in September and October 1993 (for details, see Punamäki, 1997; 1999). Simultaneously, a local psychologist in Galilee contacted the children belonging to the control group. The parents' (usually mother's) consent to participate in the study was obtained, and there were no refusals to participate among the families in either Gaza or Galilee. This favorable response apparently was because of the cultural code of hospitality, the familiarity of the local field workers, and the curiosity about the study topic.

The fieldwork proceeded in two stages. First, the children and adolescents were asked to participate in the study and the dream diaries and instructions were given to them. The instructions for reporting dreams were written as a tightly-scripted and standardized statement in order to guarantee replication in each house. A semistructured Arabic language dream and sleep diary was developed for the purpose of the study (Punamäki, 1999). The recording period was seven days, and for each night a sheet was prepared. The children were asked to record every morning the dream or dreams that they had had the previous night. They were given a sheet with 20 lines to be filled in: "Last night I dreamed that. . . ." Participants were also instructed to indicate whether they felt that they had been dreaming but could not recall the content. Children naturally reported their dreams in their mother tongue, Arabic.

The fieldworkers explained the dream diary and the questionnaire to the child or group of children page by page and gave standardized examples of how to report dreams and respond to the questions. They checked whether the children had understood the idea by asking them to provide examples on how to fill in the questionnaire. Young illiterate children (two five-year-olds and ten six-year-olds) dictated their dreams to their mothers, who then filled in the diaries. After seven days, the field workers returned and collected the filled in dream diaries. The rate of return of the dream diaries was almost total: One child in Gaza and two in Galilee failed to fill in and return the diary. Finally, the children's dream reports were translated from Arabic into English by a professional translator and by two bi-lingual teachers with extensive translation experience. The subjects and the people involved in collecting the data remained blind to the present research hypotheses.

Scoring Procedure and Content Analysis of Dream Reports

In the present study, dreaming is defined as the subjective, complex, temporally progressing, multimodal experiences we have during sleep (Farthing, 1992). First, actual dream reports were distinguished from other types of non-narrative reports by using the above mentioned definition. In the non-narrative reports, often only the topic of the dream was mentioned, e.g., "I dreamt about my mother" or "I dreamt about a lion." These non-narrative reports were omitted from further analyses. Twenty-five (2.5%) of the reports in the trauma group and seventeen (4.7%) of the reports in the control group were of non-narrative nature.

Second, the dream reports were analyzed according to threat-related content. The scoring and content analysis of the dreams proceeded in two stages: First, identification of descriptions of threatening events in dream reports and second, classification of the identified events with regard to content. Both stages were independently carried out by two judges. The raters first practiced the identification and the classification procedures until they reached a sufficient degree of agreement.

The detailed rating scale is available from the authors; only the basic principles of the scale are described here. Threatening events in dreams were identified by using the following criteria, and the event had to fulfill either the criterion for objective threat or subjective threat (or both). *Objective threat* refers to an event in a dream where the physical or mental well-being of any person would be endangered or where any person's physical resources or territory would be jeopardized (i.e., any event that would be considered threatening if it should really occur in the waking life). Such an event may be directly witnessed by the dreamer reporting the event or only indirectly heard about in the dream. *Subjective threat* refers to an event in a dream that is interpreted or emotionally experienced by the dreamer (i.e., the dream self) to be somehow dangerous. Any event, in which the subject reports the feeling of danger or threat when no objective threat (as defined above) is reported to accompany this feeling, is considered as subjective.

Before starting the content analysis procedure, the dream reports of traumatized and nontraumatized children were first randomized, and the randomized dream reports were then mixed with another randomized dream sample from Kurdish children (Valli et al., 2005). Thus, the raters were blind to the material and could not identify whether a specific dream report came from a traumatized or a non-traumatized child, or even whether it was reported by a Palestinian or a Kurdish child. Second, both raters identified all those sentences in the dream reports which described an event fulfilling at least one of the above threat criteria. The identified descriptions were marked by underlining the respective parts of the dream reports. Those descriptions identified by only one rater were thoroughly discussed, and either selected for the next stage or rejected from further analysis, depending on whether the raters could reach an agreement whether the event in question was a threat or not. Most of the ambiguities in identifying threats resulted from vague and unclear dream event descriptions, and in case of uncertainty, the event was rejected from further analyses. Consequently, ambiguous cases were not included in the study in favor of the hypotheses.

Next, the threatening events in dream reports were classified according to the following content categories: (1) The target of the threat, (2) the nature and the severity of the threatening event for the self, and (3) reaction of the self to the

threatening event. For efficient coverage of the classification method and the results, the more detailed content of these scales is integrated with the results, and indicated in Figures 1–3. The final scores a threatening event received in these scales were designated on the basis that both of the raters had assigned the same score for the event. In the event the raters disagreed, the scoring of the event was thoroughly discussed until the raters agreed, and then, a final classification was assigned to the event. Examples of identification and classification of threatening events in the dream diaries of four illustrative subjects are presented in the Appendix.

Statistical Methods

The data were analyzed using the SPSS 10.0 for Windows. The study groups were compared using nonparametric Mann-Whitney U Two Independent Samples test (U) to evaluate whether the medians on quantitative test variables differed significantly between the two groups. To test for the differences between the groups in the frequency distributions of the qualitative variables (the classification of threatening events), Pearson's Chi-test (χ^2) was conducted. Bonferroni adjustment was used for multiple comparisons to avoid the risk of Type II errors. Kappa Coefficient Analysis, an index that corrects for chance agreements, was used for dream content classifications to estimate the reliability between two independent raters.

RESULTS

Identification and Classification Reliability

In estimating the reliability of the interrater agreement, either the statistical Kappa Coefficient Analysis was performed, or if Kappa could not be computed because of the nature of the data, a simple percentage agreement was used. In case of identification, percentage agreement is reported, as Kappa could not be computed because of the nature of the data. The interrater agreement was calculated using two different strategies:

- (1) If the raters had underlined the same event, the underlining was considered a unanimous identification. The identification agreement percentage was 94.2%.
- (2) If the raters had underlined the same event, but one of the raters had identified the event as two separate threats and the other as one threat, the raters were calculated to agree on one threat and disagree on the other. After discussion the event was either considered to be one threatening event or two separately classifiable events. The identification agreement percentage calculated this way was 85.7%.

Agreement between the raters in deciding what constitutes a threatening event was strong, independently of the way in which it was computed. Altogether 1,241 threatening dream events were identified, 1,169 of them by both raters. After the raters had discussed over the threatening dream events they originally disagreed on ($N = 72$), 1,181 (95.2%) threatening dream events were admitted to the classification stage, and 60 (4.8%) were omitted from further analysis.

Table 2. Number of Dreams, Threatening Events, and Dreams Including Threatening Events

	Number of reported dreams			Threatening events per dream			Number of threatening events	Number of dreams including threats	
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	Range	<i>N</i>	%	<i>N</i>
Trauma group	4.2***	2.1	986	1.0***	0.7	0–4	948	58.7***	579
Control group	3.0	1.8	362	0.7	0.7	0–3	233	47.8	173

*** $p < .001$.

In the classification stage, the interrater reliability was evaluated by using Kappa Coefficient Analysis. A value of the Kappa statistic < 0.4 indicates weak agreement, $0.4–0.75$ moderate agreement, and > 0.75 strong agreement (Fleiss, 1981). We used Kappa value > 0.4 as the minimum criterion of acceptable internal consistency between the raters. The interrater agreement was strong with respect to all three categories, ranging from 0.83 to 0.94.

Dream Recall and the Frequency of Threatening Events

The number of reported dreams per subject, the frequency of threatening events in dream reports per subject, and the percentage of dreams including at least one threatening event per subject are presented in Table 2. The length of the dream report was measured using total recall count (TRC) (Antrobus, 1983), and the relative proportion of words used in describing threatening events versus other events was also calculated (Table 3). The number of threatening events per dream report, the percentage of threat-dreams, and the number of words used in describing threatening events indicate the frequency of threatening situations in dream reports. For each subject, the ratio between the number of threatening events and the number of reported dreams was calculated by dividing the number of threats with the number of dreams. The results per group were calculated by using these ratios.

The results show that the trauma group children reported more dreams than the control group children ($U = 9555.0$), and that the trauma group children had more threatening events per dream report than the control group children ($U = 10432.5$). The trauma group children also had a higher percentage of dreams including threats than the control group children ($U = 8996.0$). In the trauma group 22 children (9.4%), and in control group 35 children (28.9%) had no threatening events in their dream reports.

Table 3. Total Recall Count per Dream Report and Number of Words Used to Describe Threatening Events

Variable	Words per dream report			Number of words used to describe threatening events	
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	%
Trauma group	41.5***	34.6	1–273	20.1**	45.7
Control group	31.6	30.1	3–222	12.8	38.0

** $p < .005$. *** $p < .001$.

Total Recall Count in Dream Reports

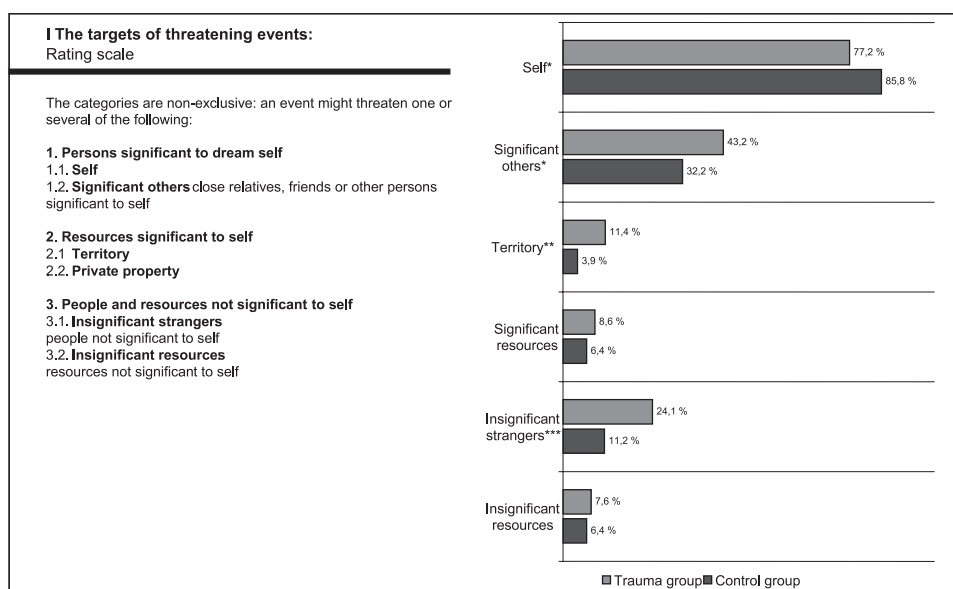
For each subject, a ratio was calculated between the total recall count and the number of words used to describe threatening events by dividing the number of words used to describe threatening events with the TRC. This was done in order to find out the relative proportion of words used for reporting threatening versus other types of dream events. The results per group were calculated by using these ratios, and the means and standard deviations with significance values are presented in Table 3.

The dream reports of the trauma group were significantly longer than those of the control group ($U = 140104.0$), and the children in the trauma group also used a higher percentage of words to describe threatening events than the children in the Control group ($U = 161118.5$).

The Quality of the Threatening Events

The Targets of the Threats

This category describes who or what was being threatened by the threatening event. The dream self was the most often threatened person, followed by significant others and insignificant strangers, as indicated in Figure 1. The self was more often threatened in the control group children's dreams ($\chi^2(1, N = 1181) = 8.36$) than in the trauma group children's dreams. In the dreams of the trauma group, significant others ($\chi^2(1, N = 1181) = 9.45$), insignificant strangers ($\chi^2(1, N = 1181) = 18.41$) and territory ($\chi^2(1, N = 1181) = 11.88$) were more often threatened than in the dreams of the control group.



*** $p < .001$, ** $p < .005$, * $p < .05$

Figure 1. The threatening events were more self- and people-centered than targeted on resources.

The Severity and Nature of the Threatening Events

We investigated how risky for the self would the threatening event be considered if it happened in real life. The threats of the trauma group were, altogether, significantly more severe than the threats of the control group ($\chi^2(3, N = 1181) = 13.91, p < .001$), and especially, the trauma group had more psychologically, socially or financially severe threats than the control group, $\chi^2(1, N = 1181) = 13.18, p < .05$.

As to the nature of threatening events, threats including aggression (escapes and pursuits, nonphysical aggression, and direct physical aggression) were the most common types of threats in both groups, while nonaggressive threats (accidents and misfortunes, failures and disease) were less frequent. The dreams of the traumatized children included direct physical aggression (34.3% vs. 25.8%), $\chi^2(1, N = 1162) = 6.09, p < .05$ significantly more frequently than the dreams of the nontraumatized children. Altogether, the trauma group's dreams included aggressive versus nonaggressive (77% vs. 23%) threats significantly more often than the control group's dreams (61% vs. 39%), $\chi^2(1, N = 1164) = 24.77, p < .001$ (see Figure 2).

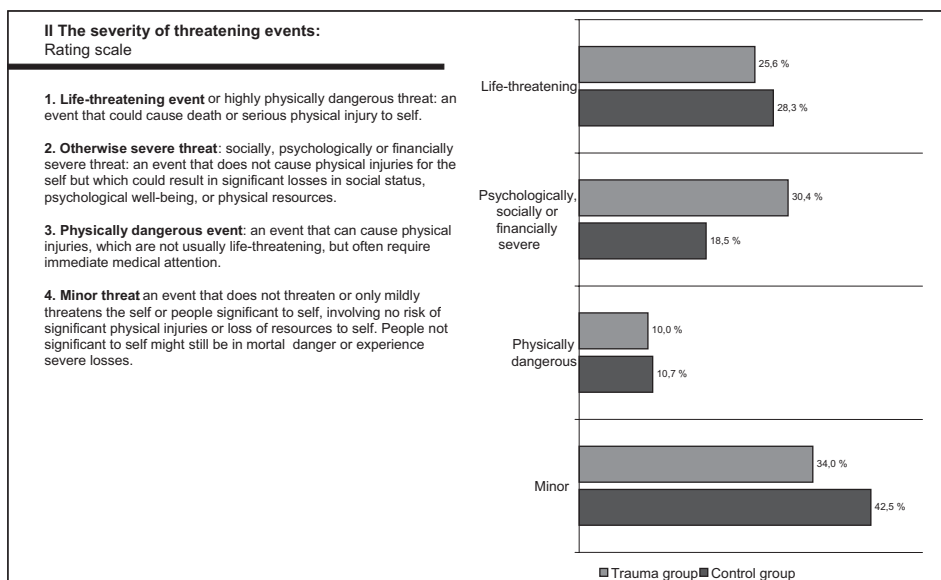


Figure 2. The trauma group children had altogether more severe threats than the control group children. The statistical comparison of the severity of the threat was conducted for the whole category, instead of single subcategories.

The Reaction to the Threatening Events

We expected that in traumatized children's dreams the dream self more often responds to the threat than in the control group dreams. We thus compared the trauma and the control groups according to who reacts to the threatening event (dream self, someone else, nobody, or whether participating in the course of events

is impossible due to awakening or discontinuity within the dream). No significant differences between the two groups were observed (see Figure 3).

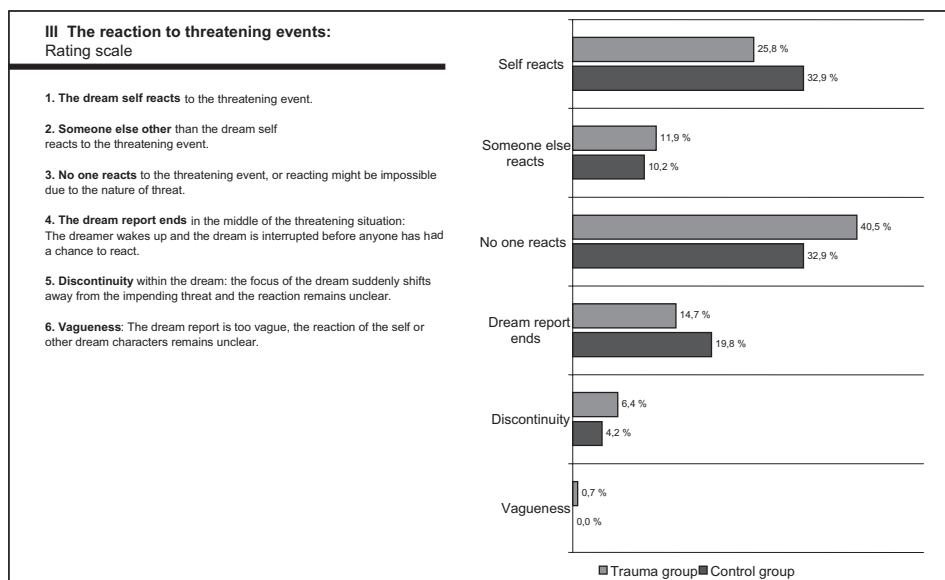


Figure 3. The reactions to the threatening events were similar in both groups, self reacting or no one reacting to the threat being the most common types of responses to the threat.

The Correlation Between the Severity of and the Reaction to the Threat

A crosstabulation was made between the severity of the threat and whether the dream self reacted to the threat or not. In the trauma group the dream self reacted significantly more often to life-threatening events ($\chi^2(1, N = 948) = 42.81$) and less often to psychologically, socially and financially severe threats ($\chi^2(1, N = 948) = 11.65$) and to minor threats ($\chi^2(1, N = 948) = 9.72$), as indicated in Table 4. On the contrary, in the control group there were no significant differences in the frequency of the dream self reacting to the threat depending whether the event was life-threatening or less severe.

DISCUSSION

In the present study, we compared the frequency and intensity of threatening events in the dreams of traumatized and nontraumatized Palestinian children. The aim of the study was to test some of the predictions and hypotheses derived from the Threat Simulation Theory (Revonsuo, 2000). If the function of dreaming is threat simulation, then exposure to real-life threats should fully activate the threat simulation response, and lead to more frequent and more intensive threat simulations in children exposed to ecologically valid threat cues. In contrast, in non-

Table 4. Crosstabulation of Severity of the Threat and Whether the Dream Self Reacts to the Threat

Dream self reacts vs. doesn't react to the threat	Severity of the threat				N/%
	Life-threatening	Psychologically, socially, or financially severe	Physically dangerous	Minor severity	
Trauma group					
N/Expected count (%)	243/25.6	288/30.4	95/10.0	322/34.0	948/100
Dream self reacts, %	41.4***	21.7**	11.1	25.8*	244/100
Dream self doesn't react, %	20.2	33.4	9.7	36.8	704/100
Control group					
N/Expected count (%)	66/28.4	43/18.6	25/10.8	99/42.5	233/100
Dream self reacts, %	29.3	21.3	10.7	38.7	75/100
Dream self doesn't react, %	27.8	17.1	10.8	44.3	158/100

Note. Boldface indicates both importance and statistical significance.

* $p < .05$. ** $p < .005$. *** $p < .001$.

traumatized children, unexposed to ecologically valid threat cues, the threat simulation system should be less activated, leading to less frequent and milder threat simulations.

The results of the present study are largely consistent with the hypotheses. There are differences in the activation of the dream production and the threat simulation systems in traumatized and nontraumatized children, as reflected by the higher number of reported dreams, dreams containing threatening events, threats per dream and words used for threat description in the traumatized sample. The actual content of threat simulations in the dreams of traumatized children appears to be more intense and severe, but the overall differences in the quality of threat simulations in the dreams of traumatized and nontraumatized children are small. Thus, personal exposure to trauma seems to activate the dream production and the threat simulation mechanisms more fully, leading to more frequent threat simulations, whereas the produced threat simulations are not qualitatively that different. The modest differences in the overall dream content between the two groups could be explained if the control group children had experienced the national trauma indirectly through their parents and other parts of the society, even in the absence of overt trauma.

The Reliability of the Content Analysis Method

The interrater identification agreement percent was high, as in our previous studies (Revonsuo & Valli, 2000; Valli et al., 2005). The number of identified threats in dreams as well as the threat description percent of words were similar to the findings of the previous study on traumatized and nontraumatized children's dreams, indicating that trained judges can reliably use the method for identifying threatening events in dreams across different samples and data sets. Similarly, the Kappa Coefficient values for the interrater agreement in content classification were high and similar to the values acquired in the previous study. Furthermore, the

results of content analysis concerning the quality of threats were in unison with the findings of the previous study. Altogether, the test-retest and interrater reliabilities for the Dream Threat Scale are high and results acquired with the method are replicable and consistent, indicating that the classification method is a reliable tool for the content analysis of threatening events in dreams.

Trauma and Dream Recall

The present results concur with previous findings revealing that children with severe trauma recall more of their dreams (Punamäki, 1997; Valli et al., 2005). The present results on children living in conditions of war and military violence are also in line with previous findings that have established an association between stressful events and high dream recall (Belicki, 1986; Duke & Davidson, 2002). The exact mechanism of how and why trauma improves dream recall remains unknown, but we put forward the following hypotheses: First, trauma may disrupt sleep and lead to more frequent awakenings. The possibility to wake up while dreaming is consequently increased, thus better dream recall might be a side-effect of more frequent awakenings. Second, improved dream recall after trauma might be a sign of a more active dream production and threat simulation, as predicted by TST. The dream production system is fully activated after exposure to ecologically valid threat cues, leading to increased dreaming and increased dream recall. Third, unpleasant and traumatic events are routinely overrepresented in waking memory compared to mundane events (Chapman & Underwood, 2000). When applied to memory for dreams, traumatized children who have more unpleasant and traumatic dreams may have heightened dream recall because of the emotionally salient nature of their dreams. The present data does not, however, allow us to choose between these alternatives.

Trauma and Frequency of Threatening Events

Exposure to threats in real life increases the incidence of threats in dreams. Less than ten percent of the traumatized children, but almost thirty percent of the nontraumatized children, had no threatening events in their dream reports. Furthermore, a larger proportion of the dreams of the traumatized children included threatening events, and they had more threats per dream report than nontraumatized children. These findings are highly similar to our previous findings concerning threats in dreams of Kurdish children (Valli et al., 2005). In comparison, in Foulkes's study of nontraumatized children's dreams (1982), only one dream out of ten included a feeling of fear, and according to Schredl, Pallmer and Montasser (1996), only 11% of 10- to 16-year-olds report a "bad dream" per week. Thus, exposure to traumatic experiences seems to increase threat-related dream content.

The trauma and the control group further differed in the average dream length and in the percentage of words used for threat description in reports including threatening events. The results are in accordance with our earlier findings. Severely traumatized Kurdish children reported longer dreams and used proportionally more words (61%) in describing threatening events than less traumatized Kurdish

(42%) or nontraumatized Finnish children (20%). In sum, in the light of the previous and the present results, trauma indeed seems to increase the number of dreams reported, dream report length, threat description length, the number of dreams including threats, and the relative amount of threatening events per dream report. Our interpretation is that these results reflect the higher activation of the dream production and the threat simulation systems after exposure to real-life trauma.

Trauma and the Quality of Threatening Events

The Targets of Threatening Events

In both the traumatized and the nontraumatized children, the dream self was the most often threatened dream character, followed by significant others and insignificant strangers. Overall, people were more often the targets of the threats in dreams than resources, such as houses or other inanimate objects or financial resources. Similarly, we found in our earlier study on Kurdish and Finnish children that the dream self was most often the target of the threat, followed by significant others and insignificant strangers, independent of the level of the trauma (Valli et al., 2005). The targets of the threats are also similarly distributed in adults' dreams (Revonsuo & Valli, 2000). Generally, children are more often than adults in the role of the victim in dreams (Domhoff, 1996) and more frequently the target of aggression than the aggressor (Avila-White, Schneider & Domhoff, 1999; Foulkes, 1982; Strauch, 1996; Strauch & Lederbogen, 1999; Van de Castle, 1970).

These findings seem to support the hypotheses of TST. First, threat simulation during dreaming would be most efficient if the dream self and significant others were the most often targeted persons, increasing the level of personal significance of survival in threatening events. Simulation directed to insignificant strangers or resources would not be evolutionary functional, as it would not be an efficient form of rehearsal of one's threat avoidance skills, and thus, would not help preserve the inclusive fitness of the individual.

Although the dream self was by far the most often targeted person, as TST predicts, the dream self was even more often threatened in the dreams of the nontraumatized children (85.8%) than in the dreams of the traumatized children (77.2%), which goes against our prediction. Special family relations in war conditions and developmental aspects may explain these results. Observations and clinical work with families living in conditions of war and military violence show that children are highly concerned about the safety of their parents and take adult responsibilities before maturation (Punamäki, 1987; 2000; Yule, 2002). This tendency may explain why these children are more concerned than the controls about threat towards their significant caretakers and their territories (homes) in their dreams. From both developmental and evolutionary aspects, significant others represent security and survival to children, and this may explain the concern for their safety as reflected in dream content.

The Severity of Threatening Events

We explored how risky for the self would the threatening event be considered if it happened in the real life. Altogether, the threats of the traumatized children were more severe than the threats of the nontraumatized children, even though the nontraumatized children had a slightly higher percentage of life-threatening events than the traumatized children. Similarly, although threats including nonphysical or direct physical aggression were frequent in dreams of both traumatized and nontraumatized children, they were remarkably frequent (77%) in traumatized children's dreams. This might reflect the nature of those real-life threatening events the traumatized children had been exposed to (e.g. curfews, night raids, and house searches and demolitions), but real experiences do not help in explaining the aggressive nature of threats in the dreams of the nontraumatized children. Rather, aggressive threats seem to be overrepresented in both children's (Domhoff, 1996; Hall & Domhoff, 1963; Valli et al., 2005) and adults' dream content (Revonsuo & Valli, 2000) when compared to waking experiences, and traumatic experiences only increase the already high incidence of aggression in dreams.

In our previous study (Valli et al., 2005), the severely traumatized Kurdish children reported more severe threats than the less traumatized Kurdish or the nontraumatized Finnish children. Similarly, previous research on Palestinian, Israeli, and Irish children's dream contents supports to some extent our argument that the level of threat in children's living environment is associated with the level of threat in their dreams. Bilu (1989) reported that 25% of dreams of Palestinian children exposed to military violence incorporated scenes of brutal physical aggression resulting in their own and/or enemy's death. Similarly, the Beduin children who experienced intimidation and harassment by the Israeli army had more dreams concerning threats to physical survival than the Israeli kibbutz children or the Irish children living in peaceful areas. The higher number of severe and aggressive threats in dreams of traumatized children might, therefore, be an indication of a more fully activated threat simulation system after exposure to ecologically valid threat cues.

The Reaction to Threatening Events

We evaluated whether the dream self reacts to the threat, whether someone else or no one reacts to the threat, or whether participating in the course of events was impossible because of awakening or discontinuity within the dream. No statistically significant differences in the frequency distribution of reacting to the threat were observed between the two groups. This result does not support our original prediction that traumatized children should react more often to the threatening events.

Not reacting to the threatening events might, however, reflect the actual life-experiences of the traumatized children. These children had probably often faced situations where reacting to the event would not have led to the elimination of the threat, but might have rather escalated the situation further. Learned helplessness theory (Seligman, 1980) may also help in explaining why the traumatized children failed to react to the threat more frequently than the nontraumatized

children; they had simply learned from previous experience that the situation cannot be changed and that reacting to it is thus futile. Another possibility is that with repeated traumatic experiences habituation and desensitization to the situation occurs, and later occurring traumatic events are experienced as less disturbing. Consequently, with increasing number of traumatic experiences, reacting to new events gradually ceases. In contrast, the nontraumatized children, not subjected to real life-threatening events, might have a more heroic vision of their abilities to resolve the threat by reacting to it.

Although the frequency of reacting to the threat is not higher in the dreams of traumatized children, note that the traumatized children have altogether more opportunities to face threats and practice reacting to the threats, as the overall number of threats is higher in the dreams of traumatized versus nontraumatized children. Nevertheless, the result indicates a failure of TST in explaining the rehearsal responses to threats in dreams of war-traumatized children. Altogether, the distribution of different types of reactions to the threat in this study was quite similar to the findings of our previous study (Valli et al., 2005), where the dream self reacted to one third of the threats, no one reacted to another third, and in the rest reacting was impossible because of awakening or discontinuity. Thus, a more thorough analysis is needed to explore the causes for the failures to react to the threatening situation in order to find out what factors determine whether or not a relevant reaction is elicited.

The Correlation Between Severity of and Reaction to the Threat

When the threat was classified as life-threatening, the traumatized children reacted to it more often than to psychologically, socially, or financially severe threats or to minor threatening events. In contrast, in the nontraumatized children the severity of the threat had no effect on whether the dream self reacted to the threat or not. The finding supports our hypothesis stating that efficient reactions should be rehearsed especially in those situations where the threat to reproductive success is greatest. Even though the traumatized children did not react to all threatening events more often than the nontraumatized children, they reacted in situations where reaction was most needed.

Alternative Interpretations

Even though our results mostly lent support to the predictions of the Threat Simulation Theory, alternative explanations of the data are conceivable. In the psychological theories on the function of dreaming, dreaming is seen as functional if it somehow enhances the individual's coping capabilities to his current concerns, solves current waking life problems, and promotes psychological well-being, even helps to recover from traumatic experiences (e.g., Cartwright, 1996; Hartmann, 1995; 1996; 1998; Kramer, 1993). Post-traumatic nightmares, in which the emotional content of the traumatic event is repeated over and over again until the traumatic memories are integrated in the memory networks and the trauma is resolved, are seen as exemplary cases of the function of dreaming in progress (Hartmann, 1996;

1998). On the other hand, if the integration process is not successful, post-traumatic dreams may persist for years after the original trauma, and chronic post-traumatic dreams have been interpreted as a failure of dream function (e.g., Kramer, 1993).

Consequently, the argument of the trauma resolution theories seems to be the following: Post-traumatic dreams function like internal psychotherapy if dreamt directly after the original traumatic incidence and continued only for few months, with gradual return to normal dreaming. Then, the incidence can be dealt with and integrated with past experiences to enable adjustment to the current situation and future events. In contrast, if post-traumatic dreams continue for longer period, as in PTSD, the integration process has failed. Now, critical for the trauma resolution theories is how they can distinguish functional dreaming about the trauma from dysfunctional, long-lasting nightmares. Is the dreaming process the same, but functional dreaming differs from dysfunctional only with regards to the length of time the post-traumatic dreams last? If so, how can a process be first functional and later dysfunctional, i.e., how can the same process lead to different outcomes at different times?

To summarize, the trauma resolution theories state that in some persons, post-traumatic dreams do not lead to those positive outcomes they should. The evidence supporting trauma resolution theories is thus only correlational; some people do get better after dreaming about the event, and in these cases dreaming is seen as functional, whereas some do not heal despite of post-traumatic dreaming, and in these cases dreaming is labeled as dysfunctional. Evidently, to avoid this circular reasoning, the trauma resolution theories should specify the mechanism behind the failure of dream function, and to predict, in advance, who will benefit from the healing function of dreams and in whom or under which circumstances the function will fail.

Furthermore, even if we assume a causal relation between dreaming about the trauma and recovery from it, there is little if any direct empirical evidence that post-traumatic dreaming would reduce the negative psychological consequences caused by real-life traumas. In fact, even opposite correlations have been found. Recently, Punamäki, Ali, Ismail, and Nuutinen (2005) reported that in traumatized Kurdish children, dreams including mundane death themes, realistic horror scenes, active participation by the dreamer, and unhappy endings were associated with high levels of psychological distress and poorer mental health adjustment. In contrast, pleasant dream atmosphere, complete narrative, and happy endings appeared to have a possible protective mental health function, as these dream characteristics were associated with less severe psychological impact of the traumatic events. Thus, in these children, dreams repeating emotionally highly negative events did not lead to improved mental health, whereas pleasant, consoling, and avoidant dreams could be seen as protective for mental health (Punamäki et al., 2005). Furthermore, similar correlations between dream content and measures of psychological symptoms were previously found by Punamäki (1998) in the present sample of Palestinian children.

The trauma resolution theories and the TST agree that dream content is determined by emotionally salient memory traces, but offer a different explanation as to why dream content is affected by emotional experiences. The authors suggest that even though traumatic experiences are reflected in dream content, the relation is correlational (i.e., dream content correlates with state of recovery) rather than

causal in the sense meant by trauma resolution theories (i.e., dream content causes recovery). We also feel that the TST offers an alternative view to post-traumatic dreaming by suggesting that persisting post-traumatic dreams involve extreme activation of the biological threat simulation function, rather than a failure in psychologically healing dream function.

Another view for explaining dream content is the Continuity Hypothesis (CH), which states that dreaming reflects waking life experiences, i.e., there is a continuum between waking experiences and experiences within dreams. The CH does not claim anything about the possible function of this continuity, but as it has been clearly demonstrated that waking life experiences are incorporated into dream content (e.g. Domhoff, 1996; Hartmann, 2000; Schredl, 2000; Schredl & Hofmann, 2003; Strauch & Meier, 1996), the CH rather states the obvious. Moreover, the specific predictions and hypotheses of CH have not been described in a clear manner. The most general form of CH seems to predict that the frequency and nature of any real events will be correlated with the frequency and nature of similar dream events in subsequent dream content. The CH is compatible with the vast amount of evidence that real life threatening events are incorporated into subsequent dream content (e.g. Nader, 1996; Nader, Pynoos, Fairbanks, & Frederick, 1990; Pynoos & Nader, 1988; Pynoos et al., 1987; Terr, 1979; 1983), but the CH would not predict that a single exposure to any type of event should lead to persistent, recurring dreams about that event. For example, the high frequency of threatening events in dreams of both nontraumatized adults (Revonsuo & Valli, 2000) and nontraumatized children (Valli et al., 2005) can not be explained by the Continuity Hypothesis alone, as nontraumatized adults and children simply have not experienced real-life threats all that frequently. Consequently, the main differences between the CH and the TST are that, contrary to CH, TST states that even a single exposure to a life-threatening event may lead to persistent threat dreams, and that the human brain comes equipped with general threat scripts, i.e., the tendency for dreams to simulate threatening events most frequent in the ancestral environment, and that threat simulation is the original biological function of dreaming. Schredl and Hofmann (2003) have concluded, and we agree, that the Continuity Hypothesis in its general form is not valid.

Evaluation of the Present Study

First, the data of the present study consisted of home-based dream reports, which are not a representative sample of dreams during different sleep stages or different REM-periods. Analysis of dream reports collected at different intervals during sleep might reveal that threatening events do not occur at the same frequency throughout the night. Even though home-based dream reports and reports collected in laboratory situations have been found to be rather similar (Domhoff, 1996), the question of the frequency of threatening events in different sleep stages should be directly addressed in future studies.

Second, the children participating in this study kept dream diaries only for a period of seven consecutive nights, and thus, the long-term effects of the trauma remain unclear. TST predicts that the effect of a real-life trauma on threat simulation mechanism may last throughout life and, therefore, a longitudinal study

would be needed. Furthermore, because the dream diary period was quite short, some dream diaries included only one or two threatening events. This is not a representative sample of threatening events dreamt by a single subject, and a small number of threats may even bias the data somehow. Therefore, we suggest that in future studies longer dream diary periods should be used.

Third, in an ideal research setting we would have had detailed information about the kinds of threats the traumatized children had been exposed to and about the dangers the children had faced every day in their lives. Unfortunately, as this kind of information was not available, we were not able to compare the frequency or the quality of the real-life threats experienced during wakefulness to the threats dreamt about. As the TST proposes that individual experiences have a major effect on subsequent dream content, studies directly comparing real threats and subsequent dream threats should be carried out to determine the actual influence of waking life threats on the following threat simulations.

CONCLUSIONS

Our results mostly lend support to the predictions of the Threat Simulation Theory and also mostly replicate our previous findings. Our results reveal that trauma affects both the frequency and quality of threatening events in dreams, leading to more frequent and more intense threat simulations. We therefore conclude that the threat simulation system is activated especially in the presence of threat related cues in the environment, and that a threat simulation response is elicited after experiencing a real-life trauma. Further studies would be required especially concerning threat avoidance behaviors of the dream self during threat simulation dreams, and comparison between experienced real threats and subsequent dream content.

REFERENCES

- Antrobus, J. S. (1983). REM and NREM reports: Comparison of word frequencies by cognitive classes. *Psychophysiology*, 20, 562–568.
- Avila-White, D., Schneider, A., & Domhoff, G. W. (1999). The most recent dreams of 12–13 year-old boys and girls: A methodological contribution to the study of dream content in teenagers. *Dreaming*, 9, 163–171.
- B'Tselem. (1993). *Human rights violations in the occupied territories 1992/1993*. Jerusalem: Author.
- Belicki, K. E. (1986). Recalling dreams: An examination of daily variation and individual differences. In J. Gackenbach (Ed.), *Sleep and dreams: A sourcebook*. London: Garland Publishing Inc.
- Bilu, Y. (1989). The other as a nightmare: The Israeli-Arab encounter as reflected in children's dreams in Israel and the West Bank. *Political Psychology*, 10, 365–389.
- Cartwright, R. D. (1996). Dreams and adaptation to divorce. In D. Barret (Ed.), *Trauma and dreams* (pp. 179–185). Cambridge: Harvard University Press.
- Chapman, P., & Underwood, G. (2000). Mental states during dreaming and daydreaming: Some methodological loopholes. *Behavioral and Brain Sciences*, 23, 917–918.
- Cohen, S., & Golan, D. (1991). *The interrogation of Palestinians during the intifada: Ill-treatment, "modern physical pressure" or torture*. Jerusalem: B'Tselem.
- Domhoff, G. W. (1996). *Finding meaning in dreams. A quantitative approach*. New York: Plenum Press.
- Duke, T., & Davidson, J. (2002). Ordinary and recurrent dream recall of active, past and non-recurrent dreamers during and after academic stress. *Dreaming*, 12, 185–197.
- Farthing, G. W. (1992). *The psychology of consciousness*. New Jersey: Englewood Cliffs, Prentice Hall.
- Fleiss, J. L. (1981). *Statistical methods for rates and proportions*. 2nd ed. New York: Wiley.

- Foulkes, D. (1982). *Children's dreams. Longitudinal studies*. New York: Wiley-Interscience.
- Green, S. B., Salkind, N. J., & Akey, T. M. (1997). *Using SPSS for Windows: Analyzing and understanding data*. New Jersey: Prentice Hall.
- Hall, C. S., & Domhoff, W. G. (1963). Aggression in dreams. *International Journal of Social Psychiatry*, 9, 259–267.
- Hanford, H. A., Mayes, S. D., Mattison, R. E., Humphery, I. I., F. J., Bagnato, S., Bixler, E. O., et al. (1983). Child and parent reaction to the Three Mile Island nuclear accident. *Journal of the American Academy of Child and Adolescent Psychiatry*, 25, 346–356.
- Hartmann, E. (1984). *The nightmare. The psychology and biology of terrifying dreams*. New York: Basic Books.
- Hartmann, E. (1995). Making connections in a safe place: Is dreaming psychotherapy? *Dreaming*, 5, 213–228.
- Hartmann, E. (1996). Outline for a theory on the nature and functions of dreaming. *Dreaming*, 6, 147–170.
- Hartmann, E. (1998). *Dreams and nightmares: The new theory on the origin and meaning of dreams*. New York: Plenum Press.
- Hartmann, E. (2000). We do not dream of the 3 R's: Implications for the nature of dreaming mentation. *Dreaming*, 10, 103–110.
- Kramer, M. (1993). The selective mood regulatory function of dreaming: An update and revision. In A. Moffit, M. Kramer & R. Hoffman (Eds.), *The functions of dreaming* (pp. 139–195). New York: State University Press.
- Low, J. F., Dyster-Aas, J., Willebrand, M., Kildal, M., Gerdin, B., & Ekselius, L. (2003). Chronic nightmares after severe burns: Risk factors and implications for treatment. *Journal of Burn Care Rehabilitation*, 24, 260–267.
- Nader, K. (1996). Children's traumatic dreams. In D. Barrett (Ed.), *Trauma and dreams* (pp. 11–24). Cambridge: Harvard University Press.
- Nader, K., Pynoos, P., Fairbanks, L., & Frederick, C. (1990). Children's PTSD reactions one year after a sniper attack at their school. *American Journal of Psychiatry*, 147, 1526–1530.
- Pedhazur, E. J., & Schmelkin, L. (1991). *Measurement, design, and analysis. An integrated approach*. Hillsdale, NJ: Lawrence Erlbaum.
- Punamäki, R-L. (1987). Psychological stress of Palestinian mothers and their children in conditions of political violence. *The Quarterly Newsletter of the Laboratory of Comparative Human Cognition*, 9, 116–119.
- Punamäki, R-L. (1997). Determinants and mental health effects of dream recall among children living in traumatic conditions. *Dreaming*, 7, 235–263.
- Punamäki, R-L. (1998). The role of dreams in protecting psychological well-being in traumatic conditions. *Journal of Behavioral Development*, 22, 559–588.
- Punamäki, R-L. (1999). The relationship of dream content and changes in daytime mood in traumatized vs. non-traumatized children. *Dreaming*, 9, 213–233.
- Punamäki, R-L. (2000). Personal and family resources promoting resiliency among children suffering from military violence. In L. van Willigen (Ed.), *Health hazards of organized violence in children, vol II*. Utrecht: Pharos of Alpha Omega Alpha Honor Medical Society.
- Punamäki, R-L., Ali, K. J., Ismahil, K. H., & Nuutinen, J. (2005). Trauma, dreaming, and psychological distress among Kurdish children. *Dreaming*, 15, 178–194.
- Pynoos, P., Frederick, C., Nader, K., Arroyo, W., Steinberg, A., Eth, S., et al. (1987). Life threat and posttraumatic stress in school-aged children. *Archives of General Psychiatry*, 44, 1057–1063.
- Pynoos, P., & Nader, N. (1988). Psychological first aid and treatment approach to children exposed to community violence: Research implications. *Journal of Traumatic stress*, 1, 4–9.
- Revonsuo, A. (2000). The reinterpretation of dreams: An evolutionary hypothesis of function of dreaming. *Behavioral and Brain Sciences*, 23, 877–901.
- Revonsuo, A., & Valli, K. (2000). Dreaming and consciousness: Testing the threat simulation theory of the function of dreaming. *Psyche*, 6. Retrieved February 1, 2006, from <http://psyche.cs.monash.edu.au/v6/psyche-6-08-revonsuo.html>.
- Schredl, M. (2000). Continuity between waking life and dreaming: Are all waking activities reflected equally often in dreams. *Perceptual and Motor Skills*, 90, 844–846.
- Schredl, M., & Hofmann, F. (2003). Continuity between waking activities and dream activities. *Consciousness and Cognition*, 12, 298–308.
- Schredl, M., Pallmer, R., & Montasser, A. (1996). Anxiety dreams in school-aged children. *Dreaming*, 6, 265–270.
- Schreuder, B. J., Kleijn, W. C., & Rooijmans, H. G. (2000). Nocturnal re-experiencing more than forty years after war trauma. *Journal of Traumatic Stress*, 13, 453–463.
- Seligman, M. E. P. (1980). *Human helplessness: Theory and applications*. New York: Academic Press.

- Siegel, A. (1996). Dreams of firestorm survivors. In D. Barrett (Ed.), *Trauma and dreams* (pp. 159–178). Cambridge: Harvard University Press.
- Stoddard, F. J., Chedekel, D. S., & Shakun, L. (1996). Dreams and nightmares of burned children. In D. Barrett (Ed.), *Trauma and dreams* (pp. 25–45). Cambridge: Harvard University Press.
- Strauch, I. (1996). Animal characters in dreams and fantasies of children. *ASD Newsletter*, 13, 11–13.
- Strauch, I., & Lederbogen, S. (1999). The home dreams and waking fantasies of boys and girls between ages 9 and 15: A longitudinal study. *Dreaming*, 9, 153–161.
- Strauch, I., & Meier, B. (1996). *In search of dreams. Results of experimental dream research*. Albany: State University of New York Press.
- Stuber, M., Nader, K., Yasuda, P., Pynoos, R., & Cohen, S. (1991). Stress responses after pediatric bone marrow transplantation: Preliminary results of a prospective, longitudinal study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 30, 952–957.
- Terr, L. (1979). Children of Chowchilla: A study of psychic trauma. *Psychoanalytic Study of the Child*, 34, 547–623.
- Terr, L. (1983). Chowchilla revisited: The effects of psychic trauma four years after the school-bus kidnapping. *American Journal of Psychiatry*, 140, 1543–1550.
- Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J. H. Barkow, L. Cosmides & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 19–136). New York: Oxford University Press.
- Tooby, J., & Cosmides, L. (1995). Mapping the evolved functional organization of mind and brain. In M. S. Gazzaniga (Ed.), *The cognitive neurosciences* (pp. 1185–1197). Cambridge, MA: MIT Press.
- Valli, K., Revonsuo, A., Pälkäs, O., Ismahil, K. H., Ali, K. J., & Punamäki, R-L. (2005). The Threat Simulation Theory of the evolutionary function of dreaming: Evidence from dreams of traumatized children. *Consciousness and Cognition*, 14, 188–218.
- Van de Castle, R. L. (1970). *The psychology of dreaming*. New York: General Learning Press.
- Wilmer, H. A. (1996). The healing nightmare: War dreams of Vietnam veterans. In D. Barrett (Ed.), *Trauma and dreams* (pp. 85–99). Cambridge: Harvard University Press.
- Yule, W. (2002). Alleviating the effects of war and displacement on children. *Traumatology*, 8, 160–180.

APPENDIX

Examples of identification and classification of threatening events in the dream diaries of four illustrative subjects are presented. Obvious misspellings of the following reports have been corrected by the authors of the present article, but no major changes have been made to the original translation. The identified threatening events in the dream reports are marked with *italics*, and numbered consecutively. The classification of these threatening events in further detail is presented in Table A1.

THE TRAUMA GROUP

Female, 12 years

1. (1) *I dreamt that the camp was full of soldiers. They were following the people and shooting bullets on them. I was running away. I did not know where to go.* (2) *The soldiers were following me, chasing me, and trying to catch me. I screamed loudly, and thereafter I woke up screamingly.*
2. I dreamt that I was going to school, and the streets were full of people. (3) *I saw some young men, running among the people. I got scared; I run away. (Subjective threat)* (4) *I fell in a deep hole, nobody saw me, and I started to cry. "Save me," I shouted. Nobody heard me; I woke up.*
3. I dream that I was walked in the street. I found and plastic ball and I took it and walked to my home. (5) *I found that the way to my home was lost. I screamed called my father and my mother.*
4. I was walking in the market place. (6) *The car entered the street and after me it stopped, the people passengers came down and followed me, I screamed, but my voice did not come out, I was not head. I woke up.*
5. (7) *I was by the sea. The army soldiers followed us, me and other boys. The boys run away, but I was stuck in my place.* (8) *The sea was high and the waves, waves were covering me with water, I was screaming.*
6. I was going to the shop and (9) *on my way I found so many dogs. I screamed and tried to climb on the wall but the dogs attacked me.* I woke up.
7. I dreamt that tomorrow is the fiesta, and my mother bought for us glimmerings and new clothes. In the morning my brother gave me lots of money and I went swinging. (10) *Big boy came and took the money from me, and I wept and screamed a lot.* I wake up in the voice of rain.

Male, 12 years

1. I was sitting with my family at home, and (11) *we had curfew.* Suddenly I and my brother went to watch the TV. And time passed. While we sitting in front of it, something happened, we were not expecting. (12) *We heard hard knocking on the door of our house, and the door was about to be broken. My mother went to open the door. She saw a lot of occupying soldiers. The soldier pushed her with her hand and entered. I and my brother shivered from fear, and my younger sister started to cry. They asked my mother and father their identity cards. We gave them to them, then they started to search the house.* After that I got up from my sleep and realized that I was in my dream. I went to bathroom.
2. That I was playing with my friends football. (13) *While we were playing, the soldiers entered the camp. And the people started to throw stones on them, and (14) the soldiers started to chase us and to fire on us. They took me and some of the friends were hit.* After that I left.

3. I dreamt last night that sister came with her husband and children and then the other children came with her husband and children, and we were talking and laughing until the night. Then they all went home back happily about the laughter that we had had.
4. I dreamt last night that my neighbors came to me, and we went together football and many other games. When we got tired, we got rest a little bit. Then we went hunting, I hunt one bird and my friends did not hunt one bird. Then we went to our homes.
6. I dreamt last night *(15) the soldiers were all over the streets walking and knocking the doors. When they reached our door, I started to read verses of Koran; the soldiers left for other house, (16) our neighbor's house, they were knocking the door, and a little girl answered when they asked for the youths. They did not believe her, but went to the house, but they did not find any youth in the house. They left with a great fury because they did not have anybody to imprison.*
7. That *(17) the chased/wanted came to our camp and after their arrival in the few minutes, the soldiers came quickly. The chased man got to their car quickly, the cars of the chased men were moving quicker than that of the soldiers, the soldiers did not find them, and after a few minutes, the soldiers left the camp defeated because they did not find the wanted man.*

THE CONTROL GROUP

Female, 15 years

1. No dream.
2. I dreamt that the teacher told us we were going jogging next day. I bought all I needed for the trip and went to the school. After reaching our destiny, we ate, and the teacher started talking to us, and then we had a running race. *(18) My leg ached and fell down.* I woke up.
3. I dreamt that *(19) I failed the exam. (20) I started to study hard for the next examination to be taken place next week. I was very nervous the day of the exam, and I forgot everything I studied. And I failed again.*
4. No dream.
5. No dream.
6. I dreamt that *(21) I entered the classroom late. The teacher reproached me and kicked me out.*
7. No dream.

Male, 13 years

1. I can't remember.
2. I dreamt that I was on a school trip. *(22) One of the boys drowned in the sea, and no one was a good swimmer except me. And I saved him.*
3. I dreamt that I was acting in a theatre. I was very funny.
4. I dreamt that I went to a wonderland. I saw a lot of interesting things in my dream.
5. I can't remember.
6. I dreamt that *(23) soldiers attacked. They caught me and tortured me. When I ran away, I blew them up.*
7. I can't remember.

Table A1 Classification of Threatening Events in Dreams of Trauma and the Control Group

The number of the threatening event	I. The target of the threatening event	II. The severity of the threatening event	III. The reaction to the threatening event
1	Self, insignificant strangers	Life-threatening	Self reacts
2	Self	Life-threatening	Self reacts
3	Self	Minor	Self reacts
4	Self	Danger to physical well-being	Self reacts
5	Self	Minor	Self reacts
6	Self	Life-threatening	Self reacts
7	Self, significant others	Life-threatening	Self reacts
8	Self	Life-threatening	Self reacts
9	Self	Life-threatening	Self reacts
10	Significant resources	Minor	Self reacts
11	Self	Minor	No one reacts
12	Self, significant others, territory	Psychologically severe	Someone else reacts
13	Self, significant others, insignificant strangers	Psychologically severe	Someone else reacts
14	Self, significant others, insignificant strangers	Life-threatening	No one reacts
15	Self, significant others, territory, insignificant strangers and resources	Psychologically severe	No one reacts
16	Insignificant strangers and resources	Psychologically severe	No one reacts
17	Insignificant strangers	Minor	Someone else reacts
18	Self	Danger to physical well-being	No one reacts
19	Self	Minor	No one reacts
20	Self	Minor	Self reacts
21	Self	Minor	No one reacts
22	Self, Significant others	Life-threatening	Self reacts
23	Self	Life-threatening	Self reacts