

Toddlers Remember Quake Trauma

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There is currently a tremendous amount of interest regarding young children's ability to remember traumatic experiences. This issue has come under public scrutiny as a result of the rapidly increasing number of cases in which children are called to testify as witnesses to violence, or in which adults testify about abuse in childhood (Ceci & Bruck, 1995; Goldstein & Farmer, 1993; Goodman & Helgelson, 1985). Many professionals, clinicians, and academicians have addressed the controversy concerning the reliability of retrieved traumatic childhood memories after the passage of time (e.g., Loftus, 1991, 1993; Terr, 1990, 1994). There have been many attempts to verify the clinical findings on early childhood memories through the use of controlled laboratory experiments with groups of children and adults (Fivush & Hamond, 1990; Kihlstrom & Haraskiewicz, 1982; Myers, Clifton, & Clarkson, 1987; Pillemer & White, 1989; Winograd

& Killinger, 1983). Unfortunately, even very similar studies have produced disparities in results (Sheingold & Tenney, 1982; Usher & Neisser, 1993).

One question that contributes to the difficulty of interpreting experimental laboratory findings, data, and clinical cases is whether memories are retained in unchanged form or undergo developmental modifications that reflect children's maturation, including changes in brain structure, memory reconstruction, and adults' interventions. Furthermore, the traumatic event itself may also influence the manner in which a child perceives and understands that event (Pynoos & Eth, 1984). Many clinicians note that experimental research that is reliant on children and students in psychology labs is unable to simulate real instances of trauma. Being lost in a big shopping mall, listening to reports of JFK's assassination, or watching reportage of the *Challenger* space shuttle explosion cannot

replicate such profound personal traumas as abuse, kidnapping, or experiencing a plane crash or a natural disaster.

In this chapter, we report and discuss data on toddlers' traumatic memories. These data were fortuitously obtained after the devastating 1988 Armenian earthquake. To our knowledge, no research focused on memory for traumatic events has examined memory in young survivors of natural disasters. Traumatic memories observed in young survivors of a large-scale disaster may in fact provide valuable information that may help us to understand the manner in which children remember profound events.

Two of the authors of the present study are very well acquainted with the Armenian quake, having personally lived through the disaster. As a result of the immense need in the affected community, they founded and directed the Children's Psychotherapy Center, located within the disaster zone in Kirovakan, Armenia (Heusser-Markun, 1992; Watts, 1989). This center, the first of its kind in the former Soviet Union, provided professional help for more than 2,500 children and adolescents traumatized by the quake. In the process, it provided an opportunity for the authors to collect data relative to the manner in which young survivors of a large-scale disaster remember the traumatic experience (Azarian, Miller, & Skriptchenko-Gregorian, 1994, 1996).

On December 7, 1988, at 11:41 a.m., a devastating earthquake (6.9 on the Richter scale) struck over 40% of the territory of Armenia, killing more than 100,000 people within 41 seconds (Verluse, 1995). More than 40,000 people were saved from burial under the ruins, and at least 53,000 families were left homeless (Grigorova, Gasparian, & Manukian, 1990; Noji, 1989). Arguably, the children suffered more than the adults, because at the time of the earthquake they were in schools that were inadequately designed and constructed (Pomonis, 1990). In all, 83 schools and 90 kindergartens were destroyed (Grigorova et al., 1990).

Many Armenian children experienced severe physical and psychological trauma as a result of the mass devastation. They suffered from numerous postquake emotional, behavioral, and psychosomatic disturbances (Azarian et al.,

1994; Pynoos, Goenjian, Tashjian, et al., 1993). This provided the authors the opportunity to study children's memory directly in the field of trauma. The subjects, from a rather homogeneous environment and background, were young patients with real, profound, and naturally caused traumas who experienced the same type of traumatic event with (of course) diverse vulnerabilities and consequences.

It should be mentioned that, in routinely gathering data at that time, the Armenian authors did not do so with any particular preconceptions about research on early childhood memory. They were preoccupied with the center's daily problems of organization and administration, and with providing immediate services for children. They were quite unaware of the existing bitter debates about early childhood memory that have, in recent times, been of great concern to Western psychologists. One may regard this circumstance, then, as an additional criterion of and contribution to objectivity of the authors. On the other hand, these circumstances also explain inevitable omissions in the data collected via the child interview protocol used at that time.

Method

Subjects

The subjects were 90 toddlers, survivors of the 1988 Armenian earthquake, who attended the Children's Psychotherapy Center for diagnostic evaluation and subsequent psychological treatment. The age of the subjects at the time of evaluation ranged from 15 to 48 months (average 36.7 months) and from 10 to 44 months at the time of disaster (average 30.7 months). The subject pool included 47 girls (52.2%) and 43 boys (47.8%).

Each child was interviewed using a structured clinical interview addressing diagnostic symptomatology and personal experience associated with traumatization in the quake. Nobody asked the children and their guardians to participate in interviews; they voluntarily came to the center for professional help due to the children's symptoms of postquake stress disturbances.

There was always a steady volume of parents, grandparents, and adult relatives presenting themselves at the clinic, seeking assistance for traumatized children. On average, the children were interviewed 6 months after the earthquake.

Interviewing

Each interview lasted approximately 60 minutes. The portion of the interview devoted to the child's disaster experience usually was of 20 minutes' duration—if there was a story and the child was able and wanted to talk about it.

Reflecting regard for the very young age of the children, the interviews took place in the presence of their guardians. This preferred mode of interviewing fostered feelings of safety and trust in these little, frightened survivors, and it provided an opportunity to facilitate their recollections with the help of close family members. During the interviews, the first responses always came from the children; adults participated in confirming and verifying the children's stories, in defining details, and in providing necessary information related to recent changes in the children's behavioral, emotional, and somatic states following the disaster. There were toys and dolls, crayons, and paper on the table, and the children were encouraged to express their experiences through drawing and play.

All of the interviews were conducted by Anait Azarian. After each interview, she constructed a narrative based on the child's answers and on the adults' remarks. She also noted her own observations of the children's behavioral and emotional reactions.

The children were given the opportunity to report the details of the trauma spontaneously. Interview questions were not designed to elicit specific assessment of completeness or inaccuracies in memory. A few varied and neutral questions were used to initiate the children's spontaneous recall of their personal quake experiences, and to keep them remembering for a while: "Do you remember the earthquake?" "Where were you at that time?" "What happened with you?" "What did you see on the streets?" "What did your mother/father/sibling do at that time?" and so on. Some subjects needed very little cuing to elicit recall. It was

enough if they were asked about certain events or places related to the quake: "How did you injure your hand?" "Why did your family leave your house?" "Where is your brother/father/grandma now?" "Are you afraid of something?"

The children and the accompanying adults also were asked to describe the spontaneous play activity, drawings, dreams, fears, phobias, and any unusual behaviors or reactions of the children following the quake.

Assessment

This is a descriptive study based on the open-ended questions posed to the young survivors during the interviews. The interviewer's focus was first to evaluate these children for PTSD symptoms (which were quite likely to be present, due to the profound impact of the quake stressors) and, accordingly, to examine how these young survivors reexperienced the disaster. It is for this reason that the early evaluations assessed different memory forms (thoughts, behaviors, reactions, and so on) that constituted the children's personal quake experiences.

We did not return to these interviews 6 years later to assess somehow the fullness of the toddlers' memories, for example, by rating their abilities to tell complete quake stories or their abilities to recall only some part of their experiences. The naturalistic, descriptive flow of the interviews did not permit such analyses. Our goal was simply to assess the presence of quake memory for the children at the time of evaluation.

Verbal Memory Forms

We concluded that a subject had a verbal memory of the quake if the child could spontaneously or with only little cuing recall his or her personal quake experience, verified by an adult as true or quite possible. The memory could consist of a very short story, even just a few phrases, but it had to include what the young survivor felt, saw, heard, smelled, or how he or she acted, and of what he or she was scared.

Incoherent or meaningless, trivial statements about the earthquake, lacking any self-experienced contents, were not counted as verbal

memory. We counted the absence of verbal memory in a child if he or she could recall nothing; that is, no matter if the child tried to do so, the result was that he or she could not retrieve and verbalize any memory of what happened nearby during the disaster. For some of the children, it was impossible to assess whether they did or did not have verbal memory. These children constitute a third group. Some of these children bluntly refused to discuss their disaster experiences, whereas others presented stories that were complete reiterations of the stories of others, seemingly appropriated by these children, from their parents, siblings, or relatives.

Nonverbal Memory Forms

Terr (1988) has pointed out that traumatic memory can be recovered from other than verbal sources and that these other memory forms have not been sufficiently examined. Terr assessed children's behavioral memories, including play, fears, and personality changes, after traumatic events. She observed the posttraumatic play or reenactment as the most consistent and prevalent index of behavioral memory. Play can indeed provide very accurate representations of a traumatic event experienced in reality (Saylor, Swenson, & Powell, 1992; Sugar, 1992); the same representations have been found in postdisaster children's repetitive drawings (Skriptchenko-Gregorian, Azarian, & DeMaria, 1996).

In the present study, we restricted our observations of the subjects' behavioral representations by considering postquake personality changes (e.g., avoidance, detachment, withdrawal), fearful and aggressive behaviors, and attitudes and subsequent acts directly related to their quake experiences. For example, we did not count general aggressive or avoidant behavior as behavioral memory of the quake trauma. We counted such behavior only when the child's aggression or avoidance was directed toward an individual who, for example, was with the child and somehow unintentionally hurt or frightened him or her during the quake. We also included repetitive postquake play and repetitive drawing of the disaster scenes as ex-

pressive forms of children's memories. Finally, we included the contents of children's dreams and nightmares as well as any unusual reactions (e.g., sweating and palpitations, head- and stomachaches, nausea and vomiting, confusion and agitation, stupor and freezing) to physical stimuli that could serve as reminders of the psychosensory influence of the quake or their particular disaster circumstances.

Results

Verbal Memory

Of the 90 toddlers, more than half (53.3%) produced verbal memories of what they personally experienced during the quake (see Table 23.1). This is about twice the proportion of toddlers (27.8%) who exhibited no verbal memories about the experienced disaster. About one-fifth (18.9%) of the toddlers refused to talk about the disaster issues or repeated the stories of others.

Many young survivors of the quake were able to give vivid verbal descriptions of their personal disaster experiences and sometimes recounted details of the tragic day that adults had not even noticed. For example, toddlers were more likely to recall unusual behaviors or actions by significant adults, as well as the physical impact of the quake.

One boy, age 30 months at the time of the disaster and 38 months at the time of the evaluation, told the interviewer:

The house broke in pieces. At first, the glass in windows broke. . . . Dz-z-z-z . . . all glass, then stones fell down from the roof. The roof also fell down, the roof fell down directly on our little apple tree. The tree broke and the house sat on the ground. . . . I hate this house. I want my toys and collection of little cars from the house.

A girl (age 33/37 months) related:

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My mother kept me in her hands and did not let me go by myself or stand near her. We were watching what our neighbors were dragging out from the building. Aunt Rosa rescued a big bowl with

Table 23.1 Distribution of the Toddlers With and Without Verbal Memory and With Repetition/Refusal Reactions

	Number	Percentage
With verbal memory	48	53.3
Without verbal memory	25	27.8
With repetition/refusal reactions	17	18.9
Total	90	100

food. Why did she do that? Do you know? We stayed in our yard a very long time, but our father did not come. Mother cried, I didn't, I knew he would come. Also, I remember that people shouted at each other—"Cut the light! Cut the gas!" [To prevent fire.] Why they did say that? Do you know? I can tell you that our cat was in the yard with us, near us. Then she disappeared. I wanted to take her, but my mother did not listen to me. So we now have no cat; I do not know where she could be. Then my father came, he was very dirty. He said: "I am so glad you are safe and sound!"

Nonverbal Memory

The overwhelming majority of the toddlers (90.0%) evidenced nonverbal memory of the experienced disaster (see Table 23.2). Many of these children simultaneously exhibited one or more of the examined forms of nonverbal memory. Most (63.3%) evidenced their memory of the quake through new and unusual reactions to different physical stimuli that reminded them of their psychosensory experience of the quake (loud noises, vibrations, the smell of fire and/or dust, darkness, closeness, and so on). Also, many young survivors (58.9%) began manifesting strong avoidant behavior toward places and people.

One young boy (age 12/20 months) was asleep when the quake began; he was awakened by the terrible underground noise ("growling") of the quake, people's shouts and screams, and the sounds of things falling and breaking in the apartment. After that, he shuddered in response to even "usual" noises or sounds: his parents talking loudly, car sounds on the streets, the sound of the vacuum cleaner, and so on. Simi-

Table 23.2 Distribution of the Toddlers With Different Nonverbal Forms of Disaster Memory (*N* = 90)

	Number	Percentage
With one or more		
nonverbal form of memory	81	90.0
physical-stimulus memory	57	63.3
behavioral memory	53	58.9
expressive memory	31	34.4
dreams of quake trauma	17	18.9
Without any form of the quake memory	9	10.0

NOTE: Columns total more than 90 subjects and more than 100% because children evidenced multiple nonverbal forms of memory.

larly, one girl (age 22/28 months) began to react even to so small a noise as a buzzing fly.

One girl (age 42/46 months) spent more than 4 hours after the quake under the body of her father, who had shielded her against falling concrete debris. After her rescue, she began to exhibit sharp sensitivity to darkness and hot temperatures. She was afraid to enter a darkened room and suddenly felt stifled and suffocated when she was exposed to regular oven heat or covered by a blanket. The girl was also extremely sensitive to her father's scent: She would seek out his old shirts and peak caps, and bring these things to her face and smell them. She persistently wanted to keep these old clothes and became very angry if her grandmother removed them.

One small boy (age 26/30 months) was carried by his mother during the quake as they escaped a shaking, multistoried building. While the strong vibrations continued, his mother fell twice with him on the stairs. After that, the boy was markedly impaired in his attitude toward his mother, refusing to approach her or to play with her. He became very cold toward her.

One father wrapped his daughter (age 18/26 months) in a blanket and ran out of a collapsing building. After that, the girl did not want to be with him. She cried when he took her in his arms, pushing him away with her feet if he did so. The parents also noticed that their daughter was afraid to be covered with a blanket when she was prepared for sleep.

Age

In order to analyze the possible role of age in the children's memories of disaster, we divided the overall sample into three age groups: 10 to 24 months ($n = 21$), 25 to 36 months ($n = 39$), and 37 to 44 months ($n = 30$) at the time of the earthquake. We then considered the results of the toddlers' interviews separately within these age groups (see Table 23.3).

The toddlers' ages had considerable influence on their verbal memory abilities. Only 14.3% of subjects who were 2 years of age and younger could remember, 6 months later, something that had happened to them during the quake. Many more (61.5%) of those who were 2-3 years old at the time of the disaster could remember. This difference in verbal memory ability was statistically significant ($p = 0.0004$). When we compare the youngest and middle age groups, the difference in verbal memory is marked. In the youngest group, the overwhelming majority of the subjects (85.7%) could not remember what they had experienced during the quake. Many fewer subjects in the middle age group (12.8%) remembered nothing about the quake ($p = 0.00005$).

However, age was associated with verbal memory when we compared only the middle age group (25-36 months). On verbal memory ability, there were no significant differences between the middle age group and the eldest examined age group (37-44 months). In these groups, about the same proportions of toddlers—61.5% and 70.0%—had verbal memories of the quake. Similarly, we found no significant difference between the proportions of toddlers in these age groups—12.8% and 6.7%, respectively—who did not have verbal memories of the quake.

The subjects from the youngest age group did not demonstrate repetition or refusal reactions during the interviews. Occurrence of subjects with such reactions in the two older groups was about equal—25.7% and 23.3%.

Nonverbal forms of disaster memory occurred about equally among the three age groups of toddlers: 85.7%, 94.9%, and 86.7%. The toddlers' ages, therefore, did not play a significant role in their ability to exhibit behav-

ioral and physical-stimulus memory, which, as Table 23.2 shows, were their major forms of nonverbal memory. Age universality of behavioral memories was vividly demonstrated in cases of siblings who experienced the same quake impact.

One girl (age 37/41 months) and her younger brother (age 22/26 months) were playing peacefully together on a carpet when the quake struck. At the time of the evaluation, the sister could describe that the floor started to "move" violently. Books and crockery poured down on the terrorized children. The brother was unable to provide any verbal account of the quake trauma. However, shortly after this traumatic experience, he developed a phobia toward the carpet. He never again played on the carpet, refusing to sit or even stand on it; he preferred to be on a couch or in an adult's arms. His sister, too, began to show personality and behavior changes, such as anger toward her little brother (who was with her during the quake). She frequently kicked, pushed, and pinched him, and she never played with him again.

One set of triplets (age 36/40 months)—two brothers and a sister—recalled the quake day and exhibited identical behavioral changes, postquake play and drawing, and physical stimuli reactions. They began to avoid their mother, who was with them during the quake, and they evidenced great confusion and disorganized panic actions. The children's attitudes and relations with their father—who, during the quake's aftermath, had arrived to help—had not changed. The triplets' younger brother (age 11/15 months) exhibited intense startle reactions to any loud sounds and vibrations.

It is also interesting to examine the earliest age at which the children are able to recall the quake. Usher and Neisser (1993) have classically defined such a threshold as the youngest age at which at least half the subjects recall something about an important event. In our entire sample of toddlers who experienced the quake, we found that 53.3% (i.e., a little more than half) remembered and verbally recalled something about their personal experiences of the earthquake (see Table 23.1). However, the age boundaries of the entire sample are wide—from 10 to 44 months (average 30.7

Table 23.3 Distribution Memory (With and Without Verbal Memory, With Repetition/Refusal Reactions, and With Nonverbal Form of Disaster Memory) for Toddlers by Three Age Groups at Time of Quake

	10-24 Months (<i>n</i> = 12)		25-36 Months (<i>n</i> = 11)		37-44 Months (<i>n</i> = 16)	
	No.	%	No.	%	No.	%
With verbal memory	3	14.3	24	61.5	21	70.0
Without verbal memory	18	85.7	5	12.8	2	6.7
Repetition/refusal reactions	0	0.0	10	25.7	7	23.3
With nonverbal form of memory	18	85.7	37	94.9	26	86.7

months)—and an average range is needed to establish an age threshold for remembering the natural disaster.

To obtain a more precise value of the age threshold, we narrowed the age boundaries of the examined sample. The criterion we used was applied separately to the three age groups that together made up the entire sample (Table 23.3). At this point, the age threshold of recalling the quake became the middle age group (from 25 to 36 months; average age 31.1 months). In this age group 61.5% of the toddlers—much more than 50%—were able to recall the traumatic event. Toddlers in this age group showed significantly greater recall than did toddlers in the younger group ($p = 0.0004$).

To assess the age threshold more carefully, we divided the middle age group into three smaller age subgroups: 25-28 months, 29-32 months, and 33-36 months. The results are shown in Table 23.4. The narrowest or most precise age group that contains the threshold of recalling the quake trauma is 29-32 months (average age 30.4 months). In this age subgroup, 72.7% of the toddlers verbally recalled their quake experience, whereas only 41.7% of the toddlers from the younger age subgroup (25-28 months) were able to do the same.

Discussion

□ This study of trauma memory in 90 toddlers who survived a devastating earthquake produced the following findings:

1. Most toddlers remembered what they personally experienced during the profound natural

disaster, which had happened about 6 months earlier.

2. An overwhelming number of the subjects were able to remember the disaster in nonverbal forms of memory, and this ability was not associated with age at the time of the quake.
3. The toddlers' verbal memories depended greatly on their age: Those who were 2½ years old at the time of the quake were most likely to recall.

The results show that most of the toddlers in the sample (90.0%) remembered the quake, either verbally or nonverbally. Even in the youngest age group (10-24 months at the time of the quake), 85.7% of the children appeared to remember (mostly as measured through behavioral representations and physical reactions) 6 months after the event. Three children in this age group provided some verbal recollections. These data demonstrate that toddlers indeed have the ability to remember profoundly traumatic events that happen to them. However, the individual observations show that there are limits to children's registering and storing these memories. The children in this study remembered very selectively, mostly recalling only events that had some personal meaning for them. During the quake, they noticed mostly what was most important to them and directly affected their interests. This suggests that their stories were true and not recollections of what others had told them about the event. As a matter of fact, young quake survivors remembered not the natural disaster, but rather what had personally happened to them, their favorite belongings, and the people important to their welfare. A child could notice and then recall the loss of

Table 23.4 Distribution of the Toddlers by Age at Time of the Disaster With Verbal Memory of the Quake (Three Age Subgroups)

	25-28 Months (<i>n</i> = 24) 12		29-32 Months (<i>n</i> = 39) 11		33-36 Months (<i>n</i> = 36) 16	
	No.	%	No.	%	No.	%
With verbal memory	5	41.7	8	72.7	11	68.8

his stuffed toy bear, and yet could pay no attention to a multistoried building that had collapsed on his street. Also, the children often expressed irritation or anger with their memories of dead parents, because, due to the parents' absence, they had begun to experience certain inconveniences. These small egoists would remember, for example, how their totally confused and panicked mothers or grandmothers behaved and sometimes unintentionally frightened them at the very moment of the terrible disaster. The children often exhibited behavioral memories revealed by their anger, hatred, and avoidance reactions as a sort of behavioral memory toward adults who had accidentally hurt them while rescuing them from dangerous places.

Such egocentricity of young children should be considered among other important mechanisms of trauma memory impairment. It has already been shown that young children's traumatic memory impairment may be a result of their own perceptual errors and distortions (Terr, 1988, 1990), the distorting influence of the profound traumatic event (Pyne & Eth, 1984), or later implantation of memories made by adults (Loftus, 1993). Also, Williams (1994b) suggests that negative psychosocial consequences of devastating trauma may have significant negative effects on a victim's traumatic memory across the life span. Williams (1994a) has reported evidence that women can forget childhood trauma, even such intense trauma as sexual abuse. The evidence presented here suggests that toddlers' memory limitations may be caused by their selective memorizing of aspects of the event that are most relevant to them at the time of trauma. This should be taken into consideration by researchers addressing issues of young children's memory, accuracy, and

reliability in research, forensic, and psychotherapy fields.

The second finding of this study corresponds well with the observations made by Gaensbauer, Chatoor, Drell, Siegel, and Zeanah (1995), Scheeringa, Zeanah, Drell, and Larrieu (1995), Terr (1988, 1990), and others. These researchers have noted that representations of trauma in the memory of young children are usually encoded in nonverbal forms—behavioral, sensory, affective, and physiological. Thus, in Terr's well-known study, 18 of 20 young subjects demonstrated the presence of behavioral (nonverbal) memories of trauma. In our study, 81 of 90 examined toddlers, regardless of their ages, showed nonverbal memories of the quake.

Discussing the universality of behavioral memory in children, Terr (1988) concludes that behavioral memory appears to operate by different rules than verbal recollections: Behavioral memory does not rely on conscious awareness. The marked prevalence of nonverbal forms of quake memory—especially behavioral and physical-stimulus memory (Table 23.2)—that do not require verbal skills and conscious awareness and do not depend on the examined toddlers' ages may be accounted for by the mechanism of stress conditioning (Azarian, Lipsitt, & Skriptchenko-Gregorian, 1996). There now is no doubt that even very young children are quite efficient learning organisms (Lipsitt, 1967). For learning to occur, children must be sensitive to environmental events. Under certain conditions, environmental events can function as reinforcing stimuli that shape or selectively strengthen responses in the behavioral repertoire of the young child. At this time, the final effect of the stimulus depends on the external background or milieu against which

the stimulus is applied, as well as on the current internal state of the organism (Wyrwicka, 1972). Thus, a new and "surprising" stimulus of very high intensity (e.g., during the quake, the mother grabs the child from his bed), applied against the external background of profound stress (the mother presses the child to her chest, runs from the collapsing building, and falls on the stairs while holding the child) and the child's specific internal state (the child was sleeping in his bed), may at once evoke very persistent and aversive reactions in the child when the mother attempts, later, to take him in her arms.

Young children's learning mechanisms and related behavioral memories are psychobiologically adapted for warning, avoiding, freezing, or fight/flight reactions, but not for comparatively long, time-consuming, conscious processes. Very young humans lacking verbal and analysis skills need such mechanisms and memories to survive in a hostile environment in spite of their developmental disadvantages. Verbal coping mechanisms for dealing with past experiences, and the presence of mediating corresponding verbal memories, are characteristic of older children and adults.

The earliest age at which a salient event can be verbally remembered is one of the most intriguing topics in the study of childhood memory. Sheingold and Tenney (1982) examined 42 college students and pointed to the period between 3 and 4 years of age as critical to their subjects' ability to recall a sibling birth. Usher and Neisser (1993) also examined college students ($N = 222$) and found that their earliest age of recall was 2 years for such past events as hospitalization and sibling birth. In their study, 2 years was defined as 24 to 35.99 months. Terr (1988) points to the approximate age of 28-36 months as the "cutoff point" in ability to recall traumatic events. She argues that at this age, children begin constructing grammatically ordered phrases and are able to express some inner feelings verbally. Sugar (1992) observed a 26-month-old girl spontaneously verbalize a clear description of her trauma in a plane crash, which she had experienced at the age of 16 months. He also observed a 27-month-old boy who was able to recall in detail

the trauma of a car accident experienced 3 months before. Sugar indicates that the age at which traumatic memories can be verbalized depends on the age of onset of speech phrases and the young victim's cognitive ability. Some studies in nonpatient adult populations with nontraumatic memories have shown availability of earliest verbal memories between the ages of 3 and 4 years (Kihlstrom & Haraskiewicz, 1982; Pillemer & White, 1989).

Efforts to establish an exact earliest age of verbal memory (age threshold) that might be generally acceptable have thus far not proved successful. The age threshold of recalling the quake in our examined toddlers was found to be about 2½ years (29-32 months). The findings in our study are consistent with the findings of researchers who have dealt with traumatized patients. However, the results obtained in different populations must be compared cautiously; the variances may be due not only to differences in degree of subjects' traumatization, their current age, and delays in asking to recall, but also to the nature of the traumatic event. Terr (1988, 1990, 1994) emphasizes the idea that different traumatic events can result in different memories in terms of completeness and stability. In her 1988 study, repeated events (child sexual abuse) were remembered more poorly than single events (e.g., a plane crash). The same was found for long events versus short events, with memory for short events being more complete. We have been unable to find in the literature any studies of comparable traumas to compare with our toddlers' memories of the quake. Studies of children's traumatic memories have focused mainly on sexual abuse, which represents a long-lasting, repeated, "secret" trauma. Disaster trauma, on the other hand, has a sudden impact of multiple psychophysiological, emotional, and information stressors occurring simultaneously. Postdisaster stress occurs along all sensory channels, and it may contribute to the development of distinctive forms of memory, such as strong physical-stimulus memory and behavioral memory.

Limitations of the current study's comparability with other data can be overcome only through further investigation of a variety of

stressful and traumatic life events. Memories of young survivors who have experienced natural and human-made disasters, transportation accidents, and some forms of domestic violence have not been sufficiently studied. The implications of this study for further research are that it is necessary to explore (a) whether gender differences influence subjects' traumatic memories, (b) how delay in asking young children to recall the traumatic event may affect their verbal memory ability, (c) whether it is possible that different degrees of traumatization—even during the same mass traumatic event—can produce different qualities of remembering, and (d) what constitute the major personal/environmental dimensions of the space within which the child selectively memorizes.

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