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Unwanted Intrusive Thoughts and Cognitive Functioning in Kindergarten and Young Elementary School-Age Children Following Hurricane Katrina

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Seven months after Hurricane Katrina, 183 five- to eight-year-old children were surveyed about their own intrusive thoughts and tested on their level of cognitive functioning (knowledge about the mind and the mind's operations). Basic developmental research suggests that children who lack sufficient knowledge about the mind should have difficulties answering questions about intrusive thoughts. Hurricane-affected children reported relatively more intrusive thoughts with negative content than nonaffected children reported. An association between children's level of understanding of the mind and their ability to report on their own intrusive thoughts supports this hypothesis. Results point to a funneling of intrusive thoughts toward negative content following a traumatic event and highlight the importance of considering children's level of understanding of the mind when investigating intrusive thoughts in young children.

The following study was conducted in the aftermath of Hurricane Katrina, one of the worst natural disasters in U.S. history. On its 2-day path of destruction, the eye of Katrina traveled up the entire state of Mississippi. In the three coastal Mississippi counties, where many of the children in this study reside, the storm surge left an area like a war zone. Common psychological reactions to disasters like this involve *intrusive re-experiencing*, including intrusive thoughts, images, and flashbacks related to the traumatic experiences; *avoidance* of trauma reminders; and *increased arousal* (for excellent reviews on children's psychological response to disaster, see Lonigan, Phillips, & Richey, 2003; Vogel & Vernberg, 1993). The goal of the study presented here is to contribute to the current knowledge on the development of intrusive thoughts in young children exposed to disasters.

Previous studies with elementary school-age children following Hurricane Andrew (La Greca, Silverman, Vernberg, & Prinstein, 1996; Vernberg, La Greca, Silverman, & Prinstein, 1996) and Hurricane Hugo (Lonigan, Shannon, Finch, Daugherty, & Taylor, 1991; Lonigan et al., 1994; Shannon, Pharm, Lonigan, Finch, & Taylor, 1994) found that symptoms of re-experiencing (e.g., intrusive thoughts) were commonly reported up to 10 months postdisaster. However, developmental literature on children's understanding of the mind (Flavell, Green, & Flavell, 1998, 2000) suggests that some children, especially children younger than

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8 years of age, might actually have difficulty monitoring and reporting unwanted intrusions of thought. Our study brings together research and theory from clinical studies on children's psychological responses to disaster with research and theory from developmental studies on children's understanding of the mind and the mind's operations.

Research on children's knowledge about the mind and the mind's operations suggests that children as young as 4 or 5 years of age understand what it means to hold beliefs and desires and the role of these mental states in directing action (see Harris, 2006, for a comprehensive review). Despite these early insights, research has shown that until approximately 8 years of age, children are still learning about several other fundamental aspects of thinking and its relationship to emotion. For instance, studies by Flavell, Green, and Flavell (1993; see also Flavell, Green, & Flavell, 1995) demonstrate that preschool and young elementary school-age children do not fully understand the stream of consciousness (i.e., that thinking is more or less ceaseless process). Preschoolers and young elementary school-age children also have only limited introspective skills (i.e., are poor at identifying when and what they themselves are thinking about; Flavell et al., 1995, 1998; Flavell, Green, Flavell, & Grossman, 1997). Moreover, young children fail to recognize that the mental states and contents in our stream of consciousness are partially uncontrollable and seem to believe that they can exert voluntary control over their own thoughts and ideas (Flavell et al., 1998, 2000). Taken together, these studies suggest that between the ages of approximately 5 and 8 years, children come to realize the existence of thought in themselves and others and that these thoughts might occupy one's mind even when they are not welcome.

To date, an unpublished dissertation study (Duke, 2006; see also Harris & Duke, 2006) is the first and only study to systematically examine children's understanding of intrusive thoughts about prior emotionally charged events. In a series of experiments, Duke (2006) found that children as young as 5 years were sensitive to the idea that intrusive thoughts are emotionally charged (i.e., that they can re-evoke positive or negative feelings associated with a past event). However, only older children (>8 years) were aware of other key properties of intrusive thoughts, namely, that intrusive thoughts are unintended, unwanted, and disruptive. These findings, along with related research on children's knowledge about the mind and the mind's operations, previously reviewed here, suggest that many kindergartners and elementary school children should have difficulty monitoring and reporting intrusions of thought, even though they might actually suffer from them.

In his research on cognitive and affective responses to traumatic stress, Horowitz (1975) showed that intrusive thoughts can occur in nonclinical individuals. He defined intrusive thoughts as "any thought that implies nonvolitional entry into awareness, requires suppressive effort or is hard to dispel, occurs perseveratively or is experienced as something to be avoided" (p. 1458). As Craig, Heisler, and Baum (1996) pointed out, intrusive thoughts are not always disruptive or negative, and they may be about neutral or positive events or feelings. In fact, thought sampling experiments reveal that persons' flow of thoughts is frequently punctuated by unwanted intrusive cognitions. In fact 80 to 90% of a nonclinical sample reported that 22 to 31% of their 4,000 distinct thoughts in a 16-hr day were unwanted intrusive thoughts (Klinger, 1996). Thus, it is in the nature of our minds that we cannot always control the mental states and contents in it; a considerable proportion of our regular mental life consists of unwanted intrusive thoughts (UIT). So if they are "normal," why are intrusive thoughts considered symptomatic of so many mental disorders? The answer may lie not just in the process characteristics (i.e., intrusiveness) but in the content characteristics (i.e., associated negative affect) as well (Clark & Rhyno, 2005).

Symptoms of re-experiencing (e.g., intrusive thoughts) are the most common symptom category following traumatic stress (e.g., see Vernberg et al., 1996) and are characterized not just by their intrusiveness but by the distress that accompanies them. Research of posttraumatic stress provides an opportunity to investigate intrusive thoughts. In their study of posttraumatic stress reactions in older elementary school-age children following Hurricane Andrew, Vernberg, La Greca, and colleagues found that at 7 and 10 months posthurricane, 81% and 78% reported having intrusive thoughts, respectively (La Greca et al., 1996; Vernberg et al., 1996). Similar results were obtained in previous studies of posttraumatic stress following Hurricane Hugo (Lonigan et al., 1991; Shannon et al., 1994; Lonigan et al., 1994). Research with younger children on posttraumatic stress symptoms (including intrusive thoughts) following natural disasters has been rare. One notable exception is a study of PTSD following the Buffalo Creek dam collapse, which included a group of 43 children aged 4 to 9 years at the time of interviews (Green et al., 1991). Of interest, results showed fewer PTSD symptoms in the youngest age group than in the two other age groups. Scheeringa, Zeanah, Myers, and Putnam (2003) also noted that the prevalence of PTSD (and by implication PTSD symptoms) in preschool-age children has been reported to be far lower than in older children and adolescents.

One explanation for these findings, as Scheeringa, Wright, Hunt, and Zeanah (2006) suggested, is that young children's general ability to report on their

own internalizing symptoms may be limited. In fact, the research on children's knowledge about the mind and the mind's operations, previously reviewed, also suggests that young children may lack sufficient knowledge about the mind and the mind's operations to report intrusive thoughts. Complicating the matter further is the perennial problem of trying to investigate intrusive thoughts (and other private phenomena) in the absence of independent measures of what children actually experience. Researchers are limited to asking children about their experiences and making an assumption that their responses are measures of something real, but it is impossible to know how these responses relate to children's actual experiences. However, "because the intrusion of unwanted cognitions into consciousness has an impact on attention, emotion, and cognitive processing" (Clark & Purdon, 1995, p. 975), information-processing procedures have been used to try to investigate the presence of intrusive cognitions indirectly (Freeston et al., 1994; Parkinson & Rachman, 1981). On the assumption that having intrusive thoughts constitutes a certain cognitive load, the presence of additional demands from an information-processing task or distracting stimuli (e.g., loud noise) will create an additional load, which might have an impact on information-processing speed or accuracy.

Our study is the first to make explicit the association between children's understanding of and ability to report on their own intrusive thoughts. The study took place in a postdisaster environment conducive to the natural occurrence of intrusive thoughts (Anthony, Lonigan, Vernberg, & Hecht, 1999). In fact, the level of exposure, particularly the level of loss and disruption, was expected to be a significant predictor of children's reports of re-experiencing symptoms (including unwanted intrusive thoughts). It was also expected that children who lacked sufficient knowledge about the mind (i.e., partial uncontrollability of the mind) would have difficulties answering questions about intrusive thought. By implication, the hypothesis was that children with lower scores on measures of understanding of the mind would have problems reporting on their intrusive thoughts or would deny having intrusive thoughts at all. Moreover, as the more recent literature on unwanted intrusive thoughts previously reviewed highlights, it was also important to consider the content or valence (e.g., negative), as well as frequency and intensity of intrusive cognitions. By implication, different results were expected for negative as opposed to positive or neutral intrusive thoughts. Irrespective of children's self-reports of unwanted intrusive thoughts, it was hypothesized that intrusive thoughts would have an impact on children's attention and information processing.

METHOD

Participants

In total, 184 preschool and elementary school-age children were interviewed, but the data from one child have to be excluded from further analysis, because this child did not complete the interview. From the remaining 183 children, 145 children were from the Hurricane Katrina disaster area, 95 were from coastal Mississippi, and 50 children were from Hattiesburg, Mississippi, a city approximately 75 miles inland. The 38 children composing the control group were from the greater Boston area. The children were recruited from 15 different schools in respective areas and an informed consent letter was sent home to the parents of 5- to 8-year-old children attending these schools. Unfortunately, the exact number of consent letters sent out was not recorded and it is therefore difficult to estimate participation rate. However, the average participation rate is estimated to be 25%, with some variation between schools (10–48%), but with similar participation rates at all three testing sites. In addition to their written consent parents also provided information about the family's resources (i.e., socioeconomic background).

Based on Entwisle and Astone's (1994; see also Hauser, 1994) practical guidelines for measuring socioeconomic status (SES), the family's yearly income was used as an index of children's financial capital, mother's education was considered indicative of children's human capital, and information about the number of available parents/caregivers in children's homes was used as an indicator of children's social capital (see also Coleman, 1988, for the idea that these three kinds of capital might facilitate optimal development). Further, these authors also suggest for any analysis involving SES to include these three variables separately. Unfortunately, questions concerning socioeconomic background (e.g., income) are often subject to nonresponse. This was also the case in our study, and the parents of 26 children (14% of the total) failed to answer one or more of the questions concerning family resources (mostly about the family's annual household income). Thus, data (including missing values) were submitted to NORM™ software developed for the imputation of missing data[1] (Schafer, 1997; Schafer & Graham, 2002) and the results from the complete data set (including simulated values for missing data from 26 children) were used for subsequent analyses.

[1]Multiple imputation is a simulation-based approach to the statistical analysis of incomplete data. In multiple imputation, each missing datum is replaced by $m > 1$ simulated values. The resulting m versions of the complete data can then be analyzed by standard complete-data methods (see Schafer, 1997).

Table 1 presents age, gender distribution, ethnicity, and family socioeconomic resources of children in the three geographical sub samples (testing sites). In anticipation of later analyses to test the main hypothesis outlined in the introduction, analyses were conducted to see if there are any differences in the distributions of gender, age, ethnicity, or socioeconomic resources between children of different testing sites or exposure groups. The children recruited from different sites varied in their ages, $F(2, 180) = 3.93$, $p < .05$, and post hoc analyses revealed a significant difference between the Hattiesburg and control group ($p < .05$, Tukey – honestly significant difference [HSD]) only.

Children recruited from the Hurricane Katrina disaster area were further subdivided according to their level of exposure to the hurricane based on information provided by their parents. *Proximity* to the event (during the hurricane) and *loss and disruption* following it were used as two separate indexes of level of exposure. Children who, at the time of the hurricane, were within 20 miles of the Gulf Coast were considered closest in proximity ($n = 42$), those within 20 to 100 miles mid-proximity ($n = 54$), and those more than 100 miles distal or far proximity ($n = 49$). Loss and disruption was measured by two items that assessed extent of damage to the home and neighborhood. Children with major damage to their home and neighborhood were considered suffering major loss and disruption ($n = 50$), those with minor damage to their home but major damage to their neighborhood or vice versa were considered suffering medium loss and disruption ($n = 36$), and those with only minor damage to their home and neighborhood were considered having minor loss and disruption ($n = 59$). Within these groupings, any significant effects of proximity can be attributed to the actual experience of the hurricane, whereas effects of loss–disruption can be attributed to having suffered devastation and having to living in the devastated area (with many physical reminders). Table 2 presents children's age, gender distribution, ethnicity and family socioeconomic resources as a function of their level of hurricane exposure.

TABLE 1
Demographic Characteristics

	Site		
Demographic Variables	*Gulf Coast*[a] *(%)*	*Hattiesburg*[b] *(%)*	*Boston*[c] *(%)*
Age (years.months)			
M	7.1	6.10	7.4
SD	0.11	1.2	0.10
Gender			
Male	45 (47)	23 (46)	26 (68)
Female	50 (53)	27 (54)	12 (32)
Ethnicity			
White	67 (71)	25 (50)	24 (63)
Black	21 (22)	24 (48)	4 (10)
Other	7 (7)	1 (2)	10 (26)
Financial Capital			
< $20,000	13 (14)	15 (30)	8 (21)
$20,000–$50,000	41 (43)	19 (38)	12 (32)
> $50,000	41 (43)	16 (32)	18 (47)
Human Capital			
High School	20 (21)	13 (26)	13 (34)
Associate Degree	41 (43)	18 (36)	5 (13)
Bachelor's Degree	24 (25)	11 (22)	9 (24)
Graduate Degree	10 (11)	8 (16)	11 (29)
Social Capital			
Single Caregiver	10 (10.5)	10 (20)	6 (16)
Two Caregivers	85 (89.5)	40 (80)	32 (84)

[a] $N = 95$.
[b] $N = 50$.
[c] $N = 38$.

There was a significant age difference between exposure groups and the control group: proximity, $F(3, 179) = 3.50$, $p < .05$; loss–disruption, $F(3, 179) = 2.76$, $p < .05$; post hoc analyses revealed significant differences between the control group and the mid-proximity group ($p < .05$, Tukey HSD) and the control group and the minor loss–disruption group ($p < .05$, Tukey HSD). There was a significant difference in the distribution of gender between control and loss–disruption groups, $\chi^2(3, 183) = 8.38$, $p < .05$.

With respect to the distribution of ethnicity, non-parametric statistics did not result in any significant group difference between sites or between control and exposure groups (proximity as well as loss–disruption). No significant group differences were found for either site or level of exposure in the distribution of socio-economic resources. Although there were significant age differences between groups, these were limited to differences between only some but not all groups (main difference between Hattiesburg and control). The significant difference in the distribution of gender was also not evident for all groups (mainly loss–disruption grouping). Nevertheless, these variations in age and gender distribution were considered in analyses by using them as covariates.

Design

Children were interviewed at two different time points: 7 and 10 months posthurricane. For conciseness and because data from the second time point were not yet fully analyzed during the preparation of this article, only the data from the first time point are reported here. At Time 1 four domains were assessed: Occurrence of unwanted intrusive thoughts, attention, understanding of the mind, and executive function. All domains except of executive function are included in our study for

TABLE 2
Demographic Characteristics as a Function of Level of Hurricane Exposure (%)

		Level of Hurricane Exposure					
		Proximity			*Loss–Disruption*		
Demographic Variables	*Control*[a]	*Far*[b]	*Mid.*[c]	*Close*[d]	*Minor*[e]	*Med.*[f]	*Major*[g]
Age (years.months)							
M	7.4	7.0	6.9	7.1	6.9	7.0	7.0
SD	0.10	1.0	1.1	0.11	1.0	1.2	1.0
Gender							
Male	26 (68)	21 (43)	24 (44)	23 (55)	26 (44)	14 (39)	28 (56)
Female	12 (32)	28 (57)	30 (56)	19 (45)	33 (56)	22 (61)	22 (44)
Ethnicity							
White	24 (63)	31 (63)	34 (63)	27 (64)	36 (61)	22 (61)	34 (68)
Black	4 (10)	15 (31)	19 (35)	11 (26)	19 (32)	12 (33)	14 (28)
Other	10 (26)	3 (6)	1 (2)	4 (10)	4 (7)	2 (6)	2 (4)
Financial Capital							
< $20,000	8 (21)	8 (16)	12 (22)	8 (19)	12 (20)	6 (16)	10 (20)
$20,000–$50,000	12 (32)	20 (41)	24 (45)	16 (38)	22 (37)	15 (42)	23 (46)
> $50,000	18 (47)	21 (43)	18 (33)	18 (43)	25 (43)	15 (42)	17 (34)
Human Capital							
High School	13 (34)	9 (18)	12 (22)	12 (29)	18 (31)	4 (11)	11 (22)
Associate Degree	5 (13)	21 (43)	22 (41)	16 (38)	22 (37)	16 (44)	21 (42)
Bachelor Degree	9 (24)	12 (25)	14 (26)	9 (21)	12 (20)	8 (22)	15 (30)
Graduate Degree	11 (29)	7 (14)	6 (11)	5 (12)	7 (12)	8 (22)	3 (6)
Social Capital							
Single Caregiver	6 (16)	2 (4)	12 (22)	6 (14)	7 (12)	5 (14)	8 (16)
Two Caregivers	32 (84)	47 (96)	42 (78)	36 (86)	52 (88)	31 (86)	42 (84)

[a] $n = 38$.
[b] $n = 49$.
[c] $n = 54$.
[d] $n = 42$.
[e] $n = 59$.
[f] $n = 36$.
[g] $n = 50$.

matters of briefness and since executive function measures failed to results in any significant effects. The orders of presenting the tasks from different domains and the four understanding of mind tasks (connection between thoughts and emotions, knowledge of own thoughts, knowledge about mental uncontrollability, and understanding intrusive thoughts) were randomized and counterbalanced through the use of a Latin square. Further, the two stories (positive and negative) in the understanding of intrusive thoughts task were counterbalanced between participants.

Procedures

Children were interviewed individually in a quiet room adjacent to their classrooms. The interviewer was either the author (for 19 children) or one of five female research assistants (two on the Gulf Coast, one in Hattiesburg, and two in Boston). The total interview time per child was approximately 30 min, and all interviews were either video- or audiotaped.

Measures

Self-report of children's unwanted intrusive thoughts. Based on a literature review (e.g., Clark & Purdon, 1995) and expert opinion,[2] four questions were created to assess immediacy, frequency, persistency/recurrence, and content of children's own UIT. Immediacy of UIT was assessed by asking children, "Sometimes we start to think about something we don't really want to think about. When was the last time you started to think about something that you really didn't want to think about? Was it today, was it yesterday, or was it quite a long time ago?" Frequency of UIT was assessed by asking, "And that day when you started to think about something that you really didn't want to think about, was it just once on that day, or was it a few times during the day, or was it lots and lots of times that day?" Content of UIT was

[2] I am most grateful to Paul Harris for his advice on the creation of questions to assess children's own intrusive thoughts.

assessed by asking "When you start thinking about something, you really don't want to think about, what are these thoughts about?" Persistency/recurrence of UIT was assessed by asking, "If you try very hard not to think about (repeat what child has just described) do you sometimes still start thinking about (repeat what child has just described) even though you really don't want to?"

For children who were able to quote particular content, the contents were grouped into two broad categories: negative versus neutral and positive. For instance, negative intrusive thoughts can be about a lost pet or an accident (or Hurricane Katrina), neutral thoughts can be about having lunch outside, and positive thoughts can be about a new toy or a vacation to Disneyworld. Two raters independently coded children's responses according to these two categories. The author was one of the raters, and the second rater was a postgraduate psychology student, who was blind to the study design and group membership of the children. Interrater reliability was very high ($\kappa = .81$, $p < .05$), and in the few cases in which ratings were different between the two raters, differences were discussed and raters agreed on a rating.

For hurricane-affected children, an additional set of questions modeled from those mentioned previously and focused on their thoughts in relation to Hurricane Katrina was created. Occurrence of general thoughts (not UIT) about Hurricane Katrina was assessed by asking children, "Do you sometimes think about Hurricane Katrina?" Occurrence of UIT about Hurricane Katrina was assessed by asking, "Do you sometimes think about Hurricane Katrina even though you really don't want to?" Frequency of UIT was assessed by asking, "How often do you do that? Is it lots of times each day, or is it once or twice most days, or is it once or twice a week?" Content of UIT was assessed by asking, "When you start thinking about Hurricane Katrina, even though you really don't want to, what are these thoughts about?" The contents of UIT were grouped into two broad categories: negative versus neutral and positive. There was perfect interrater agreement between the two raters (i.e., the author and a postgraduate psychology student) who independently coded children's responses according to these two categories.

Attention (cognitive interference of UIT). To assess children's attention skills and possibly cognitive interference from unwanted intrusive thoughts, a subtest of the NEPSY (standardized developmental neuropsychological assessment; Korkman, Kirk, & Kemp, 1998) was utilized. The children's task in the visual attention subtest of the NEPSY was to search a set of items (i.e., pictures) and find the items that matched the particular target item (a full distribution of the general procedure and verbatim instructions can be found in the NESPY manual). The original procedure was modified to contain three consecutive trials (pre, sound, and post). In the sound trial, the experimenter played a loud noise from a digital recorder (i.e., a recording of wind and rain sounds from Hurricane Katrina), whereas children were working on the task. The verbatim instructions were the same for all three trials, and the experimenter recorded the time (the maximum time allotment was 90 sec) for each individual trial and made tally marks for children's off-task behavior (e.g., child looked up and stop working briefly). After each trial, the experimenter counted the number of correct items as well as the number of commission errors to calculate accuracy scores (number correct minus commission errors). Assuming that having intrusive thoughts constitutes a certain cognitive load, the presence of the noise in the sound trial will create an additional load. By implication, there will be more cognitive interference for children with unwanted intrusive thoughts (hurricane related or not), which might possibly result in less accurate responses, increase the time needed to complete the task, or more frequent off-task behavior. Moreover, it is possible that cognitive interference from having intrusive thoughts will continue to affect children's performance even after the noise has vanished (i.e., in the postsound trial). On this assumption, pre- to postsound differences in accuracy, time, or off-task behavior may also be indicative of cognitive interference from UIT.

Belief-based emotions (or nasty surprise) task. This task was modified after Harris, Johnson, Hutton, Andrews, and Cooke (1989; see also Pons, Lawson, Harris, & de Rosnay, 2003) and tested children's understanding of their own emotions that flow from a mistaken belief or perspective. Children are shown a container that usually contains candy (e.g., Smarties tube) and asked about what they believe is in the container. Then children are informed that they will receive the content of the container as a prize at a later time and are asked about their emotions in light of this prospective gift (with the experimenter showing and pointing to an iconic happy face or a sad face). After children discover that the container actually contains paper clips rather than candy, they are questioned about the real content of the box (with the box closed) and their emotions in the face of this nasty surprise. Finally, children are asked to recall their earlier mistaken belief about the content of the box, a *false-belief question* ("When you first saw this [pointing to container], what did you think was inside?") and about the emotions that did flow from this mistaken belief, a *belief-based emotion question* ("How did you feel then,

when you first saw this [pointing to the container]? Were you excited or disappointed about what was inside (showing and pointing to happy and sad face)?''). In addition, as a control question, children were asked to recall the real content of the container, and all children were able to do so. Correct answers to the false-belief (i.e., candy) and belief-based emotions (i.e., happy) questions were coded with a score of 1 and were then combined to an overall score between 0 and 2 for the nasty surprise task.

Knowledge of own thoughts (introspection): No-thinking chair. This task was modeled after Flavell et al. (1995, 2000) and tested children's introspection skills. Children are instructed to refrain from having any thoughts while sitting in a special ''no-thinking'' chair for about 30 sec to 1 min. Afterward, they are instructed to move back to their original chair and are asked whether they did or did not have any thoughts while sitting in the no-thinking chair (thought question). If they report having some thoughts, they are asked about their thought content (thought content question). Finally, all children, regardless of whether they reported having some thoughts or no thoughts, are asked whether it was hard or easy trying not to have any thoughts (hard/easy question) and whether they did anything in particular to try to keep themselves from having thoughts. Details of the verbatim instructions can be found in Flavell et al. (1995, 2000). Children who responded to the thought question that they were having some thoughts while sitting in the no-thinking chair received a score of 1. Because the mere realization that trying to avoid having thoughts is difficult, the response to this question can also be indicative of children's introspection skills. Thus, children's who answered to the hard/easy questions that it was hard to avoid having thoughts also received a score of 1 for this question, even if their responses to the thought questions was that they did not have any thoughts. Finally, the scores from both these questions were added together, resulting in a score between 0 and 2 for the no-thinking chair task.

Knowledge about mental uncontrollability. This task is modeled after Flavell et al. (1998) and assessed children's understanding of the partial uncontrollability of the mind. However, in contrast to Flavell et al.'s third-person narrative version, this modified version assessed children's first-person understanding. For this, children were instructed to sit quietly and relax and to try not to think about anything special. Then, suddenly there was a loud noise played from a tape recorder with the sound of Hurricane Katrina (for approximately 20 sec). Afterward, the children were asked the following four questions:

1. ''While you were hearing that sound, just then did you wonder about what made it or not?'' (did-wonder-question).

If their response to the first question was *yes*, they were asked the following:

2. ''Why did you wonder what made the noise.'' (did-wonder-question).
3. ''What did you think made it? What were you thinking about?'' (did-wonder-question).
4. ''Did you want to think about this?'' (want-to-think question).

By implication, only children who said *yes* to the first (did-wonder) question but *no* to the fourth (want-to-think) question showed the understanding that a sudden loud makes you wonder what made the noise, but this thought process may be involuntary. Correct answers to both these questions were coded with a score of 1 and were later combined to a score between 0 and 2 for this task. To simplify matters, responses to Questions 2 and 3, however, were not included in the analysis for this article.

Understanding intrusive thoughts. Modeled after Harris and Duke (2006), children were told stories about a child protagonist at a bicycle race or a baseball game. One story had a positive ending (e.g., story character wins the race) and the other a negative ending (e.g., story character is involved in an accident and loses the race). Details of the story narratives are provided in the Appendix. After the story was finished, children were shown two colored drawings of Sally on the day after the bicycle race. In the first picture, Sally is concentrating on her math homework, and children were told that while she is working on her homework she is thinking about her homework (pointing to a thought bubble above Sally's head showing her thoughts as she works; i.e., $2+2$). In the second picture, Sally is still sitting in front of her math homework with the thought bubble above her head empty, but then the experimenter puts a little picture of Sally riding her bike in the bubble, and children were told that suddenly and for no reason Sally starts to think about the bicycle race from the day before. After this, children were asked the following questions:

1. ''When Sally starts to think about the bicycle race from the day before, does she look like this (experimenter points to a happy face) or like this

TABLE 3
Self-Reports of Unwanted Intrusive Thoughts

		Proximity			*Loss–Disruption*		
Valence	*Control*	*Distal*	*Mid.*	*Closest*	*Minor*	*Med.*	*Major*
Proportion of children reporting intrusive thoughts							
Negative	13	21	26	17	24	13	27
Positive + Neutral	16	13	15	7	19	10	6*
Frequency of intrusive thoughts							
Negative	2.09	2.00	1.81	2.41	2.04	1.85	2.11
Positive + Neutral	2.13	2.08	2.53	2.57	2.37	2.20	2.67

*$p < .05$.

(experimenter points to a sad face)?'' (connection thoughts-emotions question).
2. ''Does Sally mean to start thinking about the bicycle race?'' (mean-to-think question).
3. ''Does Sally want to stop thinking about the bicycle race?'' (want-to-stop question).
4. ''Why does/doesn't she want to stop?''
5. ''If she is thinking about the bicycle race, can she also think about her math homework at the same time?''

In addition, after the first story, children were asked a sixth question: ''Sometimes we do two things at once, like bouncing a ball and walking. But there are other things we can't do at the same time, like blowing up a balloon and drinking milk. Can people only think about one thing at a time, or can they think about two things at once?'' and if so, ''How many things can people think about at once?''

The other story involved a little boy (David) at a baseball game in which a batter hits a ball into the stands and there is again a version of the story with positive ending (boy catches the ball and gets to meet his favorite player) and a negative ending (boy is scared of getting hit by the ball and scrambles to get out of the way and has to go home because he is upset). After the story, children were again shown two pictures of the little boy on the next day. In the first picture, he is studying the letters of the alphabet, and in the second picture he suddenly starts to think about the baseball game from the day before. Children were asked the same set of questions (appropriate for this story line) as asked in the bicycle race story, except for the sixth question, which was not asked again.

Correct answers to the two connection thoughts/emotions questions (i.e., ''happy'' in the positive story and ''sad'' in the negative story) were coded with a score of 1. In addition, children whose answers to the two mean-to-think questions (i.e., ''Sally/David does not mean to start thinking about the bicycle race/baseball game from the day before'') also received a score of 1 for each mean-to-think question (in the positive and negative story). Finally, the scores from all four of these questions were added together, resulting in a score between 0 and 4 for this task. To simplify matters, other questions (i.e., want-to-stop question, why does/doesn't want to stop) were not included in the analysis of this article.

For the subsequent analysis scores from individual understanding of mind tasks (nasty surprise, no-thinking chair, knowledge about mental uncontrollability, and understanding intrusive thoughts) were combined to an overall understanding of mind score between 0 and 10.

RESULTS

Self-Reports of Unwanted Intrusive Thoughts

The majority of children reported having unwanted intrusive thoughts and only 11 children denied having intrusive thoughts. From the 172 children who reported having intrusive thoughts, 128 children were able to specify the content of their intrusive thoughts, and the remaining 44 children said ''I don't know'' or ''I can't remember'' when they were asked to specify the content of their intrusive thoughts. Analysis of children's self-reports of unwanted intrusive thoughts showed that among those children who were able to identify the content of their intrusive thoughts, a greater proportion of control children reported intrusive thoughts with positive or neutral content (see Table 3, upper part). This effect was significant for grouping based on loss and disruption, $\chi^2(3,\ N = 128) = 9.77$, $p < .05$ (Cramer's $\phi = .28$), but not for proximity to the event. Post hoc analysis showed that only for the major loss–disruption group the standardized residuals reached the critical value,[3] indicating that intrusive thoughts with positive or neutral contents were underrepresented in this group ($p < .05$). Table 3 (lower

[3]Critical values that correspond to an alpha of .05 are ± 1.96, or to an alpha of .01 they are ± 2.58.

TABLE 4
Proportion of Children Reporting Recurrent Unwanted Intrusive Thoughts

			Proximity			*Loss–Disruption,*		
Valence	*Recurrence*	*Control*	*Distal*	*Mid.*	*Closest*	*Minor*	*Med.*	*Major*
Negative	Yes	9	14	22	12	14	11	23
	No	4	7	4	5	10	2	4*
Positive +	Yes	11	8	9	6	10	8	5
Neutral	No	5	5	6	1	9	2	1*

*$p < .05$.

part) also depicts the frequency of intrusive thoughts in the control and different exposure groups as a function of valance. Of interest, children tended to have lower scores for intrusive thoughts with negative content and a 4 (group) $\times$ 2 (valence) analysis of variance resulted in a significant main effect of valence, $F(1, 128) = 4.09$, $p < .05$, $\eta^2 = .04$, but no significant effects of groups.

Further, the proportion of children in the various exposure subgroups who said *yes* versus *no* that their intrusive thoughts recur even though they try not to think about them is presented in Table 4, once again as a function of valence. There was a lower proportion of *yes* responses in the control group than in exposure groups (irrespective of valence), and this effect was significant for loss–disruption groups, $\chi^2(3, N = 128) = 9.47$, $p < .05$ (Cramer's $\phi = .27$), but not for proximity. Post hoc analysis again shows that only for the major loss–disruption group the standardized residuals reached the critical value, indicating that *no* responses were underrepresented in this group ($p < .05$).

Analysis of children's response to questions about their thoughts in relation to Hurricane Katrina shows that a majority of the 145 hurricane-exposed children reported having thoughts (not necessarily unwanted intrusive thoughts) about the hurricane. From the 110 children who reported having general thoughts about Hurricane Katrina, 79 children reported having unwanted intrusive thoughts about the hurricane. However, 6 of these children were not able to specify the content of their unwanted intrusive thoughts. The contents of intrusive thoughts about Hurricane Katrina of almost all 73 children, who were able to specify contents, were clearly negative (71); however, the contents of 1 child seemed neutral (i.e., wondering, but not worrying, about what happened to people the child knew), and for 1 child the content had also positive aspects (i.e., thinking about getting a nice kitten after the hurricane). Analyses of the frequency of intrusive thoughts about Hurricane Katrina resulted in a significant difference between the three loss–disruption groups, $F(2, 73) = 4.86$, $p \leq .01$, $\eta^2 = .12$ (means: minor = 2.32, medium = 1.71, major = 2.08). Post hoc tests (Tukey HSD) show significant difference only between the minor and medium loss–disruption groups ($p < .01$). There was no significant difference between the three proximity groups (means: distal = 2.17, mid. = 1.90, close = 2.30).

Cognitive Interference of Unwanted Intrusive Thoughts

Results for the sound trial of the (visual) attention task as well as pre- to postsound trial differences as a function of hurricane exposure are shown in Table 5. There were no significant group differences for accuracy

TABLE 5
Cognitive Interference of Unwanted Intrusive Thoughts/Attention Task

		Proximity			*Loss–Disruption*		
Attention Task	*Control*	*Distal*	*Mid.*	*Closest*	*Minor*	*Med.*	*Major*
Sound Trial							
Accuracy	8.1	7.9	6.5	7.4	7.1	7.35	7.3
Time	58.3	55.7	53.7	54.1	53.2	57.6	53.8
Off-Task	0.03	0.51	0.13	0.62	0.34	0.36	0.50
Pre–Postsound Trial Difference							
△Accuracy	−0.45	−0.77	−0.68	−0.95	−0.58	−0.78	−1.06
△Time	−3.4	−3.2	−2.0	−1.8	−4.8	−2.0	0.34
△Off–task	0.00	−0.05	0.02	−0.21	−0.08	0.03	−0.12

(calculated as the number correct–commission errors) or time need to complete the task (when presound trial performance was entered as a covariate). However, analysis of the frequency of off-task behavior in the sound trial, with presound trial off-task behavior entered as a covariate, resulted in a significant group difference for proximity, $F(3, 183) = 3.72$, $p \leq .01$, $\eta^2 = .06$, but not for loss–disruption. Accordingly, children with closer proximity to the hurricane were more likely to show off-task behavior in the sound trial (whereas off-task behavior was virtually absent in the control group). Moreover, this group difference (proximity) in off-task behavior was also evident in pre- to postsound trial difference scores, $F(3, 183) = 2.95$, $p < .05$, $\eta^2 = .05$.

Self-Report of Intrusive Thoughts and Cognitive Functioning (Understanding of Mind)

Analysis of the overall understanding of the mind score (with a maximum score of 10) showed that children who reported having intrusive thoughts with negative content had higher (i.e., more cognitively advanced) theory of mind scores ($M = 6.45$) than children who did not report having intrusive thoughts ($M = 5.76$) or who reported having intrusive thoughts with positive or neutral content ($M = 5.64$). This analysis resulted in an overall significant effect, $F(2, 183) = 3.73$, $p < .05$, $\eta^2 = .04$, and post hoc analysis yielded a significant difference only between intrusive thoughts with negative versus positive and neutral content ($p < .05$, Tukey HSD), but the difference between intrusive thoughts with negative content versus no reports of intrusive thoughts was statistically not significant. To further test the hypothesis that children's level of understanding of the mind underlies their ability to report intrusive thoughts, a multinomial logistic regression was calculated with children's self-reports of intrusive thoughts (negative, positive, and neutral, or no intrusive thoughts and don't know) as the dependent variable and understanding of the mind scores as the predictor variable. According to this analysis, children's understanding of the mind scores significantly predicted their self reports of (negative) intrusive thoughts ($R^2 = .16$, $p < .05$), and when age, gender, ethnicity, and socioeconomic resources were entered as covariates, this effect remains significant.

DISCUSSION

The initial finding of our study was the marked group difference (for loss–disruption grouping) in the distribution of unwanted intrusive thoughts with negative versus positive and neutral content. The proportion of children reporting intrusive thoughts with positive and neutral content was significantly lower in the major loss–disruption group than in the control group. In the control group about as many children reported positive intrusive thoughts as they did negative intrusive thoughts. Thus, there seems to be an imbalance or funneling of intrusive thoughts toward negative content in hurricane affected children. However, in terms of the frequency of occurrences of intrusive thoughts, those with negative content generally occurred less frequently than those with positive content, irrespective of groups. Of interest, clinical research on the ratio between positive and negative thoughts[4] also emphasizes a balance between positive and negative thoughts, suggesting that deviations from this optimal balance maybe associated with psychopathology (Schwarz & Garamoni, 1989). This association has been confirmed in a study of posttraumatic stress disorder with Vietnam combat veterans (Nasby & Russell, 1997) and most recently also in a study among children with anxiety disorder (Kendall & Treadwell, 2007). Both studies reported that the imbalance between positive and negative thoughts was much more common among participants with PTSD or anxiety disorder, respectively, than in participants without the respective disorder.

Moreover, the intrusive thoughts reported by children in the major loss–disruption group were also more likely to recur even though children attempted to avoid it, perhaps further increasing the burden of these thoughts. By implication, recurrence of intrusive thoughts (i.e., that thoughts recur even though child tried not to) suggests attempts to suppress these thoughts. However, as Wegner and colleagues have demonstrated, thought suppression can be a rather unhealthy strategy to cope with unwanted intrusive thoughts (Wegner, 1989, 1994) and in attempts to suppress intrusive thoughts, these thoughts might actually become hyper accessible and rebound effect (i.e., forming associations with the unwanted thought) can occur. Hence, children's development of thought control strategies should also be considered when further investigating unwanted intrusive thoughts. For instance, modifications of Wegner's (1989) white bear paradigm, appropriate for young children, can be used to assess cognitive control (i.e., thought suppression; e.g., see Kipp & Pope, 1997).

With regard to the cognitive interference measures of intrusive thoughts, the significant group difference in frequency of off-task behavior can be interpreted as supporting the hypothesized impact of unwanted intrusive thoughts on attention and information processing in young children, but the lack of significant group differences in performance accuracy and time limit support

[4]I am grateful to Mark Freeston for suggesting the potential relevance of this line of research.

for this hypothesis. However, using a task in which off-task behavior is most likely to results in performance errors (e.g., playing a video game such as Tetris®) we might have also found differences in accuracy of performance.

Another important finding of this study was that children with higher levels of understanding of the mind were much more likely to report intrusive thoughts with negative content than children with lower scores. This provides some support for the hypothesis that children's level of understanding of the mind might underlie their ability to report on their intrusive thoughts (particularly those with negative content). This hypothesis is also supported by the finding that children's scores on understanding of mind tasks proved to be a significant predictor of their reports of intrusive thoughts with negative content. Failure to report intrusive thoughts (or other internalizing symptoms) and possibly limited awareness of them might complicate therapeutic intervention. By implication, children's level of knowledge about the mind should be taken into account by mental health care professionals, when questioning young children about internalizing symptoms following traumatic events or in other situations. An association between cognitive variables and posttraumatic stress has also been found in a study with Vietnam Combat Veterans (McNally & Shin, 1995). Results from this study indicate that higher cognitive ability can buffer against the effects of traumatic stress. Very similar results were obtained in a study with children (Breslau, Lucia, & Alvarado, 2006), which also reports that children with above-average IQ were not only at a lower risk for exposure to trauma but also at a far lower risk for PTSD.

Moreover, research with children and adolescents affected by the Bosnian war has further implications for the relationship between trauma and sociocognitive functioning. Jones (2005; see also Jones & Kafetsios, 2002, 2005) reported that children with high moral values were more troubled, reporting more trauma symptoms than children with a nonquestioning attitudes about the war. By implication, moral reasoning is at the most advanced level of sociocognitive functioning, and thus this finding suggests that although high levels of sociocognitive functioning seems to result in more frequent reports of PTSD symptoms, higher cognitive ability (i.e., moral reasoning) is not always protective against the negative effects of trauma. However, the ability to reflect on one's mental life (or mentalizing) has been proposed as a first critical step for effective psychotherapeutic intervention (Fonagy et al., 2002). Thus, it may be beneficial for effective psychotherapy to foster children's cognitive functioning (i.e., their understanding of the mind) before formal therapeutic interventions such as cognitive-behavioral therapy is conducted. Several experimental intervention or trainings have proven to be effective in enhancing children's level of understanding of the mind (e.g., Peskin & Astington, 2004).

One limitation of our study is that the subjective appraisal of children's experience of the hurricane was not assessed (directly). Assessment of hurricane exposure was based on parent's information about the family's experience of the hurricane, but it is possible that children might appraise their experiences differently than their parents. Thus, children should also be questioned directly about their subjective experiences in future research. Similarly, children's appraisal of the emotional valance of their intrusive thoughts was also not assessed (directly) in our study. Assessment of the emotional valance of intrusive thoughts was based on researcher's ratings of the contents of children's intrusive thoughts (i.e., negative vs. positive/neutral), but children's subjective appraisal of the emotional valance of their intrusive thoughts might be different from the researcher's rating. Hence, both the researcher's rating as well as children's subjective appraisal should be assessed in future studies on intrusive thoughts in young children. Another possible limitation of our study is the exclusive focus on intrusive thoughts. However, re-experiencing symptoms also include recurrent distressing dreams (American Psychiatric Association, 2000), and it could be informative to assess intrusive thoughts as well as dreams. If we find that young children who do not report having intrusive thoughts do have recurrent distressing dreams, this would indicate that these children also suffer from their traumatic experiences, even though they do not report having intrusive thoughts, perhaps because they lack sufficient knowledge about the mind and the mind's operations.

Implications for Research, Policy, and Practice

Our study has two important implications for research, policy, and practice on intrusive thoughts in young children. First, the results of this study emphasize the importance of considering the content of unwanted intrusive thoughts. Although it appears natural and normal for children that a considerable proportion of their cognitive activity consists of unwanted intrusive thoughts, it seems that in a healthy state of mind there is a balance between positive and negative content of these unwanted intrusive cognitions. Following potentially traumatic experiences, however, this equilibrium between positive and negative unwanted cognitions seems to shift toward almost exclusively negative content in youth. Second, it is also important to consider children's level of understanding of the mind and the mind's operations when questioning kindergarten

and elementary school-age children about cognitive symptoms, particularly when investigating unwanted intrusive thoughts. It remains, however, an open question whether an advanced level of understanding of the mind and thus greater likelihood to report intrusive thoughts (and by implication awareness of them) protects against the negative effects of trauma or whether it actually fuels them.

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APPENDIX

Bicycle Race Story

Sally loves to ride her bicycle and she always dreamed of winning the town bicycle race. For a year, she practiced and practiced. Finally, the day of the race came. Sally pedaled as fast as she could . . .

(*Positive*) . . . and even stayed on her bike around the trickiest turn on the course. When she came to the finish line, the crowd cheered—she had won the race! She stood in front of everyone and got her first-place medal. She was so excited.

(*Negative*) . . . but when she got to trickiest turn on the course, another biker ran right into her, and they both fell onto the ground. Sally was not injured, but the other man broke his leg and had to be taken away in an ambulance. Sally was very scared.

Baseball Game Story

David loves to play baseball. For his birthday, his dad took him to a real baseball game at a big stadium. As he was watching the game, a batter hit a ball into the stands. The ball came at David very fast . . .

(*Positive*) . . . and he held his glove high in the air and caught the ball! After the game, he got to meet his favorite player, and he signed the ball he had caught. It was so exciting.

(*Negative*) . . . and he was very scared that it was going to hit him. He scrambled to get out of the way, and the ball just missed him. Even though he was not hurt, he was too upset to watch the rest of the game and had to go home. It was so scary.