

Towards a cognitive-behavioral model of PTSD in children and adolescents

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Abstract

Post-traumatic stress disorder in children and adolescents has been studied only for the past 15 to 20 years and is the subject of a burgeoning corpus of research. Much research has focused on examining whether children and adolescents have the same responses to trauma as those experienced by adults. Many of the research tools used to investigate children's responses are taken from measures designed for use with adults, and these measures have proven to be useful. However, it has not been established that children's responses to traumatic events are related to the same underlying processes as adults' responses. The possible application of two recent cognitive models of PTSD in adults to understanding PTSD in children and adolescents is discussed in this article, within the context of what is already known about children's reaction to trauma and existing theoretical accounts of childhood PTSD. Particular attention is paid towards the nature of children's memories of traumatic events and how these memories relate to the re-experiencing symptoms of PTSD, and cognitive processes that may play a role in the maintenance of PTSD. It is proposed that the adoption of a more specific cognitive-behavioral framework in the study of this disorder may be beneficial and lead to better treatment outcomes.

Key words: Post-traumatic stress disorder, children, cognitive-behavioral model, traumatic memories, maintenance

Introduction

It has been acknowledged only during the past 15 years or so that children and adolescents may suffer from PTSD. In one of the earliest considerations of children's responses to trauma, Garnezy and Rutter (1985) concluded that children's reactions to trauma were not as serious as those developed by adults, and that children's reactions did not warrant inclusion within a diagnostic category of PTSD. This was due particularly to there being no reports that children exposed to disasters displayed PTSD-specific symptoms such as amnesia, psychic numbing or intrusive flashbacks.

Particular barriers to the understanding of children's reactions to traumatic events were quickly highlighted. Yule and Williams (1990) pointed out that studies of children exposed to trauma are difficult to conduct due to the tendency of adults to be highly protective towards such children and deny that children can suffer psychiatric disturbance following trauma. In addition, these authors noted that one of the earliest studies (Galante & Foa, 1986) had not used scales appropriate for detection of traumatic stress reactions in children.

A more detailed understanding of PTSD in children and adolescents was derived from the use of assessment measures designed specifically for PTSD. The Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979) was utilized in a study of children involved in the Herald of Free Enterprise ferry disaster (Yule & Williams, 1990). Children assessed using this self-report measure were found to score in a similar fashion to adults. The PTSD Reaction Index (PTSD-RI), a structured interview based on the DSM-III diagnostic criteria for PTSD, was used by Pynoos et al. (1987) to assess children who had witnessed a fatal sniper attack on their school

playground. Children in the playground at the time of the shooting were very likely to develop PTSD, with 77% developing moderate to severe levels of PTSD.

These key articles that helped to bring about an acceptance of the validity of the PTSD diagnosis in children utilized scales and interviews based on diagnostic criteria initially designed for adults. The study of reactions to traumatic events has been conducted formally for several more years within the adult population, and a number of theories concerning the etiology of PTSD have been suggested. Before theoretical insights can be gleaned from research on adult populations subjected to trauma however, the issue remains of whether it is appropriate to continue to assume that child PTSD is essentially the same disorder as that found in adults.

It is the purpose of this review to examine the theoretical understanding of children's and adolescents' reactions to trauma and how such an understanding may benefit from models of PTSD in adults. First, a brief critical review of theoretical accounts of PTSD in children and adolescents will be provided. Secondly, two recent cognitive models of PTSD in adults that have been shown to account for many of the key features of PTSD and have generated testable hypotheses will be outlined. Third, evidence concerning the pattern of re-experiencing observed in children will be considered. Fourth, the applicability of cognitive processes proposed in adult models of PTSD to PTSD in children and adolescents will be discussed. Fifth and finally, an examination will be provided of how the framework proposed within this article may guide future research into children's and adolescents' reactions to trauma.

Current understanding of PTSD in children and adolescents

In this section, a brief overview will be provided of the most significant conceptualizations of PTSD in children and adolescents that have been offered over the past 15 years. The models were selected so as to provide an idea of the breadth of theoretical perspectives adopted so far in trying to understand children's responses to trauma, and the selection is by no means exhaustive.

Pynoos and colleagues (Pynoos, Steinberg, & Wraith, 1995; Pynoos, 1994; Pynoos, Steinberg, & Goenjian, 1996; Pynoos, Steinberg, & Piacentini, 1999) have considered children and adolescents' reactions to trauma within a developmental life-trajectory model. A child's short-term reaction to a trauma is considered to be moderated by four groups of factors: i) proximal trauma reminders (e.g., external and internal cues, physiological reactivity), ii) proximal secondary stresses (e.g., changes to family and community circumstances), iii) the "ecology" of the child (e.g., parental, school and peer factors), and iv) factors intrinsic to the child (e.g., genetic predisposition, developmental competencies). In particular, it is argued that "the etiology of posttraumatic distress, [is derived from] the nature of the traumatic experience(s) and from the subsequent traumatic reminders and secondary stressors [Pynoos, Steinberg, & Wraith, 1995, p. 72; the italics are the original author's]". A child's long-term reaction and adjustment is likely to be related to ongoing reminders of the trauma and persistent secondary stressors (e.g., physical disability, judicial proceedings, etc.).

This conceptualization is important as it integrates existing psychodynamic, familial, cognitive-behavioral and psychopharmacological approaches to children and adolescents' reactions to trauma, and leaves little doubt as to the dramatic impact of "the legacy of trauma". With regards to future research, Pynoos and colleagues

advocate the investigation of a number of areas, including the development of brain mechanisms and how PTSD intersects with other anxiety disorders over the life span.

In a review of the literature concerning PTSD in children and adolescents, Fletcher (1996) adopted a multifactorial model similar to that of Pynoos and colleagues. Fletcher concluded that children react to trauma in a way very similar to that of adults, and called for further research to examine why it is that some children develop PTSD while others do not. He also stressed that factors other than those relating to exposure to trauma must be investigated.

Schwarz and Perry (1994) emphasized the neurobiological impact of a traumatic event, noting that acute stress results in the increased activation of the noradrenergic system which plays an important role in a number of behaviors that are readily identified as being related to PTSD; arousal regulation, vigilance, irritability, locomotion, attention, sleep, and the startle response. The neurobiological changes thought to result from traumatic stress also “create an adaptive record of survival-related information [Schwarz & Perry, 1994, p.312]”. Such records, termed “malignant memories” by Schwarz and colleagues (Schwarz & Kowalski, 1991; Schwarz, Kowalski, & Hanus, 1993), are hypothesized to possess a neural network architecture and incorporate information derived from the traumatic event that that has a potential bearing on the individual’s survival.

The activation of these memories by trauma-related cues results in the individual experiencing high levels of noxious arousal, and potentially, cognitive distortions, memory changes, dissociative states, and altered behavioral and affective activity. It is further noted from animal studies that the developing brain is particularly sensitive to stress, especially when such stress is unpredictable and uncontrollable. The authors proposed therefore that children exposed to trauma may

develop brains with dysregulated neurophysiological systems and neuroanatomical structures that may leave them more vulnerable to suffering from exposure to psychosocial stressors when they reach maturity. The authors described how younger children exposed to trauma may experience a more pervasive and persistent increase in basal autonomic tone and develop a post-traumatic reaction where symptoms are elicited by more general stimuli that are unrelated to the trauma.

An integrative conceptual model that incorporated exposure to trauma, child characteristics (such as gender and age), access to social support and coping styles was tested in a sample of elementary school-aged children exposed to a hurricane (Vernberg, La Greca, Silverman, & Prinstein, 1996). Vernberg et al. found that the four factors identified in the model were together able to predict a considerable amount of the variance in PTSD symptomatology. This study is of importance as it compares the relative importance of exposure variables to non-exposure variables such as social support and coping, and identifies specific targets for treatment (e.g., the use of blame and anger). Follow-up investigations of the same sample of children (La Greca, Silverman, Vernberg, & Prinstein, 1996) found that at seven and 10 months after the disaster the model accounted for less variance in PTSD symptomatology. Although a considerable number of children thought they might die during the hurricane (60%), far fewer were hurt or actually witnessed other people being hurt during the event. The success of the model in predicting children's reactions may result partly from investigating a sample exposed to a comparatively moderate trauma where the protective effects of social support and coping may be more pronounced. Nevertheless, this study presents a significant advance in the methodology and theory used in the investigation of children's responses to trauma.

A number of reviews, while not proposing a specific model of PTSD in children and adolescents, have outlined etiological factors that have been shown to predict the occurrence of the disorder (Amaya-Jackson & March, 1995; Vogel & Vernberg, 1993; Pfefferbaum, 1997; American Association of Child and Adolescent Psychiatry, 1998; Foy, Madvig, Pynoos, & Camilleri, 1996; Gurwitch, Sullivan, & Long, 1998; Yule, Perrin, & Smith, 1999). The most widely accepted predictor of PTSD is exposure severity, while gender, prior exposure to trauma, prior psychiatric disorder, and family functioning also seem to be emerging as having predictive value. A less clear picture exists of the relationship between variables such as age and ethnicity and post-traumatic stress reactions.

A recent review has examined how a cognitive theory of childhood PTSD needs to accommodate developmental factors (Salmon & Bryant, 2002). The authors of this review highlight the need to consider developmental issues that have a bearing on how a child may encode and then resolve a traumatic experience. The development of language is thought to be of particular importance, both when a trauma is experienced and when a child attempts to deal with the traumatic event. The social world of the child is examined, and the role of the family in assisting a child to form complete memories of a trauma is stressed. The authors conclude by providing a relatively clear description of how developmental issues might be considered in both the assessment and treatment of children suffering from PTSD. The role of the family in both assessment and treatment is stressed, in particular the potential negative effect that parents may have in reinforcing a child's avoidant coping. Methods for supporting young children to communicate their experiences and the empirical support for providing such assistance are described.

The reviews described above have demonstrated how the understanding of children and adolescents' reactions to traumatic experiences has advanced to incorporate theory from a variety of domains. Many studies have been directed at examining core assumptions regarding the nature of PTSD in children, such as the pattern of symptomatology observed in children following trauma. The need for further research into a number of aspects of children's reactions is widely acknowledged. Yet, it remains the case that such research is rarely driven by a coherent model that explains the processes that are involved in the formation of specific PTSD symptoms such as intrusive memories, flashbacks, and hyperarousal. The adoption of such a theoretical account may offer clearer guidelines as to how research may be directed beyond examining demographic and psychosocial variables.

Clearly, a theoretical account of PTSD in children and adolescents will need to be able to encompass the full range of aberrations of behaviour, cognition, physiology, and consciousness that are associated with PTSD within a developmental context. Existing models have demonstrated a degree of success in accounting for these aberrations, yet inadequacies are also present. For example, Schwarz and Perry (1994) considered the role of developmental neurobiology with regards to specific PTSD symptoms. Similarly, Salmon and Bryant (2002) placed their discussion of childhood PTSD in the context of "fear networks" (Foa, Steketee, & Rothbaum, 1989). However, the kinds of single-level representations of emotion proposed within these accounts are limited in their explanatory power (Power & Dalgleish, 1997), especially with regards to some of the more disturbing symptoms of PTSD, such as flashbacks and emotional numbing; such accounts cannot explain the discontinuity between the re-experiencing of traumatic events, where adults and children may experience overwhelming sensations as experienced at the time of the trauma, and the

normal, voluntary activation of autobiographical memories. In the next section two cognitive models of PTSD in adults that assume multi-level representations of traumatic events are outlined which may also inform the development of a model of PTSD in younger people.

Cognitive Models of PTSD in Adults

Two models of PTSD in adults have had a tremendous impact on the understanding of the disorder in recent years. This more recent generation of models of PTSD, in addition to overcoming the problems associated with single-level theories of emotion as outlined above, provide more powerful explanations of the time course of reactions to traumatic events and individual differences in the nature of such reactions.

In the first model to be considered here, that of Brewin et al. (1996), it is suggested that the complex pattern of symptomatology observed in individuals with PTSD could be explained by a dual representation model, where the memories of the traumatic event are stored in a different manner to normal memories. These memories remain in a sensory format and are hypothesized to be represented within different neural structures than normal memories.

Brewin (2001) has presented evidence from a cognitive neuroscience perspective that suggests “traumatic memories” are laid down in a way that bypasses the hippocampus, the neural structure considered to be responsible for the encoding of memories within a temporal and spatial context. As a result of this difference in information processing, “the sensory (visual, auditory, olfactory, etc.), physiological,

and motor aspects of the traumatic experience are represented in situationally accessible knowledge in the form of analogical codes that enable the original experience to be recreated” [Brewin et al., 1996, p.676-677]. Such representations, termed “situationally accessible memories” (SAMs) by Brewin et al. (1996), are re-experienced as the result of elicitation through associative learning; trauma-related cues will be likely to trigger such re-experiencing. This qualitative difference in representation also means that traumatic memories are not easily accessible by conscious means.

Such an account gives a powerful explanation of the cardinal cluster of symptoms observed in individuals with PTSD: the re-experiencing phenomena. The difference in representation may account for how flashbacks are experienced frequently as dissociative states. The conscious activation of SAMs is thought to allow changes in such representations of a traumatic event, whereby conditioned emotional responses are extinguished through a process of “spontaneous or programmed habituation” [p. 678]. Such habituation, and the associated normalization of attentional and memory biases, is responsible for decreasing the likelihood of intrusively re-experiencing the traumatic event.

However, the full resolution of a traumatic event also may be contingent on an individual’s verbally accessible memory (VAM) of the event. VAMs are theorized to consist of representations of a person’s conscious experience of a traumatic event, such as sensory features, emotional and physiological reactions, and the perceived meaning of the event. Significantly such a representation is likely to be subject to deliberate retrieval from an individual’s store of autobiographical memories. Brewin et al. (1996) stressed that “secondary emotional reactions arising from subsequent conscious appraisal” [p. 682] may interfere with the emotional processing of a

traumatic experience. Attributions of responsibility made after a traumatic event, leading to emotions such as guilt or anger, in addition to being themselves distressing, may prevent the habituation of fear when SAMs are activated. Therefore, the authors therefore suggest that prior to the use of exposure treatment, such secondary emotions be addressed using cognitive techniques.

Brewin et al. (1996) go on to describe three endpoints of emotional processing that arise from the dual representation theory proposed. Completion or integration results when memories of the traumatic event have been fully “worked through”, and are integrated with the individual’s other memories and sense of self in the world. In particular, the individual will have habituated to their SAMs of the event. The presence of unremitting PTSD is termed “chronic emotional processing”, and is thought to be associated with inability to integrate memories of the trauma. This may be the result of aversive secondary emotions, as described above, the lack of social support to assist processing of SAMs or VAMs, and ongoing trauma, among other causes. In addition to the symptoms of PTSD, an individual caught in this stage will continue to have attentional and memory biases towards trauma-related information, and develop more generalized secondary reactions. The final endpoint of processing, “premature inhibition of processing”, results when the individual succeeds in avoiding the activation of unpleasant SAMs and VAMs. While the triggering of negative affect may be automatically avoided by the development of “avoidance schemas”, the individual will continue to have attentional biases, impaired memory for the trauma, avoidance for trauma-related stimuli, and possibly somatization.

The second of this new generation of models of PTSD in adults is that of Ehlers and Clark (2000). Ehlers and Clark (2000) based their model on a dual representation format very similar to that of Brewin et al. (1996), but elaborate on both the

pathological role of “trauma memory” (their term for Brewin et al.’s “SAMs”), and the cognitions, meta-cognitions and thought control strategies considered responsible for the maintenance of PTSD. Ehlers and Clark argued that the combination of trauma memory and the negative appraisal of trauma and its sequelae result in a perception of “current threat” that is accompanied by intrusive phenomena, hyperarousal, anxiety and other emotional responses.

Ehlers and colleagues have demonstrated the maintaining effect of a sense of “current threat” in victims of physical and sexual assault (Dunmore, Clark, & Ehlers, 1999), political prisoners (Ehlers, Maercker, & Boos, 2000), and motor vehicle accident (MVA) survivors (Ehlers, Mayou, & Bryant, 1998; Steil & Ehlers 2000). In addition to the presence of poorly elaborated trauma memories (the recall of which is easily triggered by associated cues), a number of cognitions and meta-cognitions are thought to give rise to this mental state. These include: Dysfunctional meaning attached to symptoms of the trauma (e.g., believing that having flashbacks is a sign that one is “going mad”); Perceived negative responses from others (e.g., “people think I am too weak to cope on my own”); A sense of permanent change (e.g., “my life is ruined”); And change in global beliefs (e.g., “the world is a dangerous place”).

The power of meta-cognition to impede recovery from the acute phase of the disorder was demonstrated by Steil and Ehlers (2000) in their finding that the distress caused by re-experiencing symptoms of MVAs was related to the idiosyncratic meaning assigned to the symptoms (e.g., believing that intrusive thoughts are a sign that one is going “mad”). This relationship existed regardless of intrusion frequency, accident severity, and general anxiety-related catastrophic cognitions. In addition, dysfunctional meaning attached to traumatic symptoms was found to be associated with maladaptive coping strategies such as avoidance, thought suppression (an active

effort to rid one's mind of a cognition), rumination and distraction. These strategies are considered to discourage the full processing of traumatic memories, and in the case of thought suppression, paradoxically encourage the production of distressing intrusive cognitions. A considerable body of work has shown that thought suppression (see Purdon, 1999, for a review) is responsible for an increase in the frequency of intrusive thoughts and memories.

Thus, cognitions and meta-cognitions that are formed after a traumatic event may promote the maintenance of PTSD in two ways. Firstly, dysfunctional cognitions and meta-cognitions produce a sense that the trauma continues to have damaging implications, and consequently generate a feeling of apprehension. Secondly, the thought control strategies that result from these appraisals can discourage emotional processing of memories of the traumatic event. These cognitions and coping strategies may explain how a substantial proportion of traumatized adults emotionally engage in exposure treatments and yet do not proceed to habituation of the memories (Jaycox, Foa, & Morral, 1998). Therefore, Steil and Ehlers (2000) suggest that "therapeutic strategies aimed at identifying, restructuring, and changing the negative idiosyncratic meaning of posttraumatic intrusions should be helpful in alleviating posttraumatic symptomatology" [p. 555].

Ehlers and Clark (2000), like Brewin et al. (1996), consider exposure to be an integral part of cognitive behavioral interventions for PTSD, but argue that the adoption of cognitive restructuring during reliving may be useful. In this way problematic appraisals associated with key moments of the trauma may be identified and discussed, and the full benefits of exposure can be attained. While Ehlers and Clark expound more the potential role of cognitive techniques in the treatment of PTSD in adults, there exists, however, few significant conceptual differences between

their model and that of Brewin et al. (1996). Each accounts for the extreme nature of the re-experiencing symptoms of PTSD, and the variation in outcome between survivors of trauma. In particular, the onset and maintenance of PTSD symptomatology are distinguished. The early onset of intrusive phenomena is considered a normal reaction to an extreme event (especially after more severe trauma). The maintenance of such symptoms is considered to result from a variety of maladaptive responses.

The nature of children and adolescents' memories of trauma

While children and adolescents have been found to possess the same two-factor structure of re-experiencing and avoidance observed in adults (Dyregrov, Kuterovac, and Barath, 1996), particular consideration must be given to children's memories of traumatic events. Theorists positing a cognitive approach to PTSD in adults (Brewin et al., 1996; Ehlers & Clark, 2000) regard the re-experiencing phenomena of the disorder not only to be its primary distinguishing feature, but also to be indicative of the central underlying abnormality that is responsible for the disorder: the nature of the memories of a traumatic event. These and other authors (e.g., van der Kolk, 1996) argue that traumatic events may be poorly encoded in memory, resulting in primitive representations of events. In addition such representations may also play a considerable role in maintenance of the hyperarousal cluster of symptoms, as the physiological changes encoded during the traumatic event are re-experienced.

It is essential therefore to consider whether the re-experiencing symptoms children experience are like those of adults; that is, such symptoms are the result of triggering involuntary recall of poorly elaborated, sensory based memories of the traumatic event. With regards to this, there is a growing body of research regarding the elicitation, form, and treatment of traumatic memories in children. Three avenues of research have addressed the issue of the existence and role of traumatic memories in children and adolescence: clinical reports of children's memories of traumatic events, symptomatology profiles of samples of children exposed to trauma, and studies that have examined specifically the nature of children's memories of traumatic events.

Clinical reports of children's memories of traumatic events

The landmark case studies conducted into children's reactions to traumatic events examined 5-14 year-old children involved in the Chowchilla bus kidnapping (Terr, 1981). Terr reported the presence of some symptoms that would be considered to fit DSM-IV criteria for re-experiencing: Nightmares or bad dreams with some content pertaining to the kidnapping, "posttraumatic play", and behavioral re-enactment. Flashbacks, however, were not observed in the children. Terr described how older children reported daytime visions of the kidnapping, but suggested that these re-experiencing episodes were voluntary.

In a four-year follow-up study of these children, Terr (1983) reported that their memories of the kidnapping were largely unchanged, and that such memories were still recalled with a "vivid immediacy". A significant number continued to engage in posttraumatic play and behavioral re-enactment, a variant of posttraumatic play which was considered to be less "fun", and very often involved the re-experiencing of psychophysiological responses experienced during the kidnapping. Behavioral re-

enactment is a feature of children's reactions to trauma that may be readily conceptualized within the dual representation theory of Brewin et al. (1996) as the elicitation of motor responses recorded during the trauma.

Perrin, Smith and Yule (2000) share the view that children and adolescents can suffer from intrusive thoughts about a traumatic event, adding that such phenomena can occur either when falling asleep or when triggered by external or internal reminders. Perrin et al. (2000) also briefly overview the debate regarding the reactions of very young children to trauma, noting that while evidence exists to suggest that this group does not suffer from visual flashbacks, they can display signs of re-experiencing through vivid re-enactment of the trauma (Scheeringa & Zeanah, 1995; Scheeringa, Zeanah, Drell, & Larrieu, 1995). In short, many clinical reports note that children 're-see' or 're-feel' the trauma (Terr, 1991) and acknowledge the different sensory modalities that such experiences may take.

Symptomatology profiles of samples of children exposed to trauma

Beyond clinical reports, a number of studies have shown that the full range of re-experiencing symptomatology is found in children and adolescents who have been exposed to traumatic events. A meta-analysis conducted by Fletcher (1994, unpublished manuscript) examined thirty-four studies of children exposed to trauma (with a total sample size of 2, 697) and found similar rates of PTSD in child and adult samples. Fletcher (1996), in discussing these findings, concluded that the DSM-IV diagnosis of PTSD could be applied to all child age groups. While the pattern of symptomatology in Fletcher's meta-analysis for preschool children appears to be different to that of school- and teen-aged children (with pre-school children found to be more frequently distressed by reminders of the trauma, have bad dreams regarding

the trauma, and engaging in post-traumatic play), this meta-analysis does underscore the general acceptance that children re-experience traumatic events.

Quantitative studies of children's memories of traumatic events

The finding that children and adolescents experience unwanted thoughts of traumatic events, have “flashbacks” (albeit not young children), and experience physiological arousal on exposure to trauma-related cues, supports the suggestion that children and adolescents can form SAMs of traumatic events. Further evidence suggesting that some children's memories of traumatic events are comparable to the concept of SAMs comes from the few studies that have sought to assess the nature of these memories in children quantitatively.

Burgess, Hartman, and Baker (1995) adopted a conceptual framework that incorporated neurobiological, information processing and psychodynamic approaches in their study of the memories of 34 physically and sexually abused children. The somatic, behavioral, verbal, and visual qualities of the children's memories were examined. Somatic and behavioral memories of trauma were very common and clearly related to the sexual nature of much of the abuse that was endured by the children in this sample. Most children's memories had a visual quality, though this finding was based on noting whether children were able to draw elements of the trauma they were exposed to. Such an indicator is likely to be highly insensitive due to children's lack of artistic ability or unwillingness to draw their experiences. Verbal memories were of a varying quality, though only three children expressed no memory at all of what happened to them.

Further data concerning the quality of children's memories of trauma have been obtained from one study of pre-school aged children exposed to an extreme natural disaster. Azarian, Lipsitt, Miller, and Skriptchenko-Gregorian (1999) assessed

90 children, aged 10-44 months, after the 1988 Armenian earthquake. More than half of the sample had verbal memories of the earthquake, and nearly all displayed what the authors termed “non-verbal” memories: repetitive earthquake-related play, nightmares, and physiological and somatic reactions that were produced in reaction to specific reminders of the earthquake. An important finding of this study was that memory quality varied across the age range. The youngest age group, that of children aged 10-24 months, contained significantly fewer children with verbal memories than the two older groups, while the rates of non-verbal memory presentation remained approximately equal across the age span.

The two studies discussed above lend weight to the possibility that children exposed to trauma can have non-verbal memories similar to the SAMs described by Brewin et al. (1996). It is noteworthy that Azarian et al. (1999) found that very young children had no verbal memories of the earthquake that they were exposed to, yet possessed non-verbal memories at the same rate as older children. That such young children lack verbal memories is entirely in keeping with their linguistic development (see Salmon & Bryant, 2002, for further discussion of this). However, if the ability to form verbal memories is protective one would have expected this group to demonstrate more non-verbal memories than older children, who with their more developed linguistic and cognitive abilities may have been more able to process the traumatic event. Brewin and colleagues note that adults with PTSD following a trauma may have some verbal account of the event, but that such accounts are likely to be fragmentary and more biased to describing sensory rather than semantic aspects of what occurred.

In conclusion, it is suggested from the existing evidence that Brewin et al.’s (1996) concept of SAMs may be of explanatory relevance to children’s reactions to

trauma. Like adults' re-experiencing of traumatic events, children are likely to possess emotion-laden memories composed of sensory fragments, that are easily elicited by reminders of the event, and can be experienced in the present as intrusive memories and "flashbacks". Further studies of the memories of a greater age range of children are necessary to investigate this proposal. These should include prospective studies that examine the relationship between memory quality and PTSD symptomatology.

The finding of Azarian et al. (1999) that the presence of verbal memories in young children may be protective against the development of non-verbal memories is in particular need of replication. If this is the case, then other barriers to the formation of coherent and non-intrusive memories other than linguistic ability will need to be investigated, such as emotional regulation and willingness to confront fear-eliciting internal or external stimuli. Indeed, one of the advances of the recent adult cognitive models of PTSD is the realization that while verbalizing a traumatic event is a necessary step in the processing of the event, other aspects of the traumatic memory also may need to be modified. Commentators on PTSD in children have drawn attention to young children's limited ability to encode an event in a verbal form (Fivush, 1998; Salmon & Bryant, 2002). Future studies may be beneficially directed towards other aspects of children's memories of trauma. Similarly, dissociation, which is considered to play a significant role in the onset of PTSD in adults by interfering with the process of forming a coherent memory of a traumatic event, has received little attention in studies of children and adolescents exposed to trauma.

Cognitive and meta-cognitive processes involved in the maintenance of PTSD in
children and adolescents

Among the most significant advances brought about in the adult cognitive models of PTSD outlined above is their account of the time course of the disorder. Accounting for the time course of PTSD is considered a necessary component for any model (Dalglish, 1999). Such necessity seems to stem from the finding that, at least for severe trauma such as rape, post-traumatic symptomatology in the immediate aftermath of such an event may be common (Rothbaum, Foa, Riggs, Murdoch, & Walsh, 1992).

Dunmore, Ehlers, and Clark (1999, 2001) argued that factors responsible for the onset and maintenance of PTSD in adults are rarely distinguished in the literature, and that cognitive factors may play as significant a role in these aspects of the time course of PTSD as pre-traumatic and peri-traumatic experiences. Both Brewin et al. (1996) and Ehlers and Clark (2000) acknowledge that the onset of post-traumatic symptomatology may be strongly related to the quality of the memory laid down during the traumatic event, and argue that those individuals who suffer from more chronic PTSD are prevented in some way from processing such memories. This suggestion accounts for the finding that for many individuals the symptoms of PTSD are fleeting, whereas for others the disorder can last for many years.

In the rest of this section an examination, is offered of the kinds of cognitive processes that may be involved in the maintenance of PTSD in children and adolescents. Appraisal, meta-cognitive, and information-processing aspects of cognition will be considered. First however, a caveat must be highlighted regarding the adoption of an onset-maintenance approach to PTSD in children and adolescents. While a growing body of research suggests that, as in adults, stress reactions in the immediate aftermath of a traumatic event may be quite common but diminish rapidly

for most individuals (American Academy of Child and Adolescent Psychiatry, 1998; Mirza, Bhadrinath, Goodyer, & Gilmour, 1998; Yule, Bolton, Udwin, Boyle, O’Ryan, & Nurrish, 2000), such findings should still be considered as tentative, especially in the case of young children who have been the subject of relatively few prospective studies.

Secondary Emotions

In the aftermath of a traumatic event, adults may develop what Brewin et al. (1996) term secondary emotions. According to these theorists, strong secondary emotions such as guilt and anger may interfere with the processing of traumatic memories by preventing a reduction in affect when traumatic memories are activated. Both anger and guilt (Goenjian, 1993; Gurwitch et al., 1998; Pynoos & Nader, 1988; Schwarz & Kowalski, 1991) are common reactions to trauma observed in children. To date both guilt (Pynoos et al., 1987) and anger (Vernberg, La Greca, Silverman, & Prinstein, 1996) have been shown to be associated with PTSD.

Thought control strategies

As discussed in detail above, the cardinal symptoms of PTSD are distressing intrusive thoughts, feelings, and images, through which the individual ‘re-experiences’ the traumatic event. The way in which an individual responds to these reexperiencing phenomena can have significant repercussions; an important feature of Ehlers and Clark’s (2000) model of PTSD is that maladaptive thought control strategies, such as rumination and thought suppression, paradoxically increase the frequency of the intrusions. Unlike other forms of avoidance that would appear to hinder the processing of traumatic memories, such as distraction, thought suppression would appear to actually exacerbate the reexperiencing symptoms.

Only two articles have evaluated the role of thought suppression in children with PTSD. In a study of 40 children exposed to MVAs, aged between eight and seventeen years old (mean age 13.6), Aaron, Zaglul, and Emery (1999) found that nearly one quarter of the exposed children developed PTSD (according to DSM-IV criteria). In a regression analysis of the assessed variables, only fear at the time of the traumatic event and thought suppression were found to be significant predictors of PTSD one month post-trauma, where greater fear and the greater endorsement of thought suppression were associated with worse symptoms.

Certain flaws are apparent in this study, most notably the use of a scale that includes intrusion items in addition to thought suppression items (the White Bear Suppression Inventory; Wegner & Zanakos, 1994), a small sample size, and that the children were assessed only at one month post-trauma. Nevertheless the study used both the key post-traumatic stress self-report measures available for use with children (the IES and the PTSD-RI), and included a suitable control group (non-MVA attendees at an accident and emergency department). Ehlers, Mayou, and Bryant (in press) also offer support for the role of thought suppression in their study of children involved in MVAs, where a single item assessing this strategy was found to be a significant predictor of PTSD at both three and six months post-trauma.

Dissuading a child from the use of thought suppression is a simple target for treatment. However further research is necessary to discover if thought suppression leads to an increase in the frequency of intrusive cognitions, as has been demonstrated in adults. Gaskell, Wells, and Calam (2001) demonstrated that the standard experimental thought suppression paradigm is workable with children aged seven to 11 years, while also finding that this thought control strategy was not responsible for an increase in intrusive thoughts.

Other thought control strategies, such as distraction, which may not exacerbate the occurrence of intrusive thoughts and memories but may still delay the processing of traumatic memories, are worthy of investigation. Stallard, Velleman, Langsford, and Baldwin (2001) found that in their sample of 97 children aged seven to 18 years who had been involved in MVAs, the use of distraction was associated with a diagnosis of PTSD at six weeks after the accident, though was not predictive of PTSD at eight months post-trauma. Very little is known about the developmental course of thought control strategies with regards to PTSD or any other anxiety or depressive disorder. Unfortunately, the avoidance cluster of symptoms within the DSM-IV classification of PTSD includes one symptom for the avoidance of thoughts, feelings and conversations associated with a traumatic event; this crude grouping may mask important differences between adults and children in the use of what are quite distinguishable avoidant strategies. The findings of Aaron et al. (1999) and Ehlers et al. (in press) suggest that more detailed research regarding the varieties of cognitive avoidance is warranted.

The negative interpretation of intrusive symptoms

One factor only recently identified within the domain of adult PTSD is the interpretation of post-traumatic symptoms, in particular the intrusive symptoms (see Steil & Ehlers, 2000). For example, the occurrence of flashbacks may be seen by the individual as a sign that he or she is suffering from brain damage or “going mad”. Emotional numbness may be interpreted as indicating future unhappiness, as a result of being unable to form a close relationship with anyone (for further examples, see Ehlers & Clark, 2000).

In addition to further enhancing a sense of current threat, such cognitions also promote use of maladaptive thought control strategies, such as thought suppression

(see earlier). At present few studies in children have formally acknowledged the potential role of such interpretations. Terr (1983) noted that one of the Chowchilla bus kidnapping children had developed a fear of being afraid, a process that is related to the interpretation of symptoms. The only specific test of the role of these kinds of appraisals is that of Ehlers et al. (in press) where the appraisal of the self as going mad was associated with PTSD symptomatology at both three and six months post-trauma.

A concept that has been more readily applied to child psychopathology is that of anxiety sensitivity. Anxiety sensitivity is the construct of tending to catastrophise or over-interpret signals of anxiety. Within adults, this construct has been identified as being closely associated with certain anxiety disorders (Taylor, Koch, & McNally, 1992). Within children, the Childhood Anxiety Sensitivity Index (CASI; Silverman, Fleisig, Rabian, & Peterson 1991) has been used to account for a significant proportion of variance on measures of children's fears and trait anxiety, which could not be explained by anxiety frequency. Increasingly evidence has suggested that this construct is a unique predictor of trait anxiety, and has potential implications for the assessment and treatment of anxiety (Silverman & Weems, 1999).

With regards to the psychopathology of PTSD in children, no study has examined specifically the role of anxiety sensitivity, though two studies have examined the role of anxiety sensitivity in a group of children with a number of anxiety disorders (Chorpita, Albano, & Barlow, 1996; Weems, Hammond-Laurence, Silverman, & Ginsburg, 1998). While there is some disagreement over the age at which anxiety sensitivity might influence general anxiety and fearfulness (where Silverman & Weems, 1999, argue persuasively in support of their finding that younger children are affected by their anxiety sensitivity), the emerging consensus is that by 11 to 12 years children possess the cognitive capacity to be concerned with

abstract objects of fear, such as going crazy, losing control, or death. In each of these studies however, the number of children with PTSD was very small. This preliminary evidence that the construct of anxiety sensitivity is important in the development of anxiety disorders in children suggests that there is a pressing need to investigate meta-cognitive processes in pediatric PTSD.

Rumination

Ehlers and Clark (2000) describe how individuals involved in a traumatic event may ruminate over issues such as how the event could have been prevented, and how justice or revenge might be achieved. They also propose four ways in which rumination may maintain PTSD: through strengthening maladaptive appraisals of the trauma, interfering with the processing of traumatic memories, increasing feelings of anxiety and hopelessness, and providing more internal cues to intrusive traumatic memories.

Within child and adolescent populations, very few studies have examined children and adolescents' use of rumination. Broderick (1998) assessed children aged between nine and 12 years for their responses to academic, family and peer problem situations, and found that girls used rumination as a means of coping with stressors more than boys. Studies examining the role of rumination in child psychopathology are even more scarce, in particular with regard to child's reactions to trauma. Some studies have demonstrated that the attributions children and adolescents form concerning the causes of a traumatic event can influence the development of post-traumatic symptomatology (Joseph, Brewin, Yule, & Williams, 1993), though very little research has examined the repetitive kind of preoccupation identified by Ehlers and Clark (2000). One study has examined rumination and PTSD in children, that of Ehlers et al. (in press), who found that two items pertaining to ruminative styles

(thinking about the trauma over and over, and wondering why the trauma happened to them) predicted the maintenance of PTSD symptoms.

Broderick's (1998) study makes apparent individual differences in the use of rumination among prepubescent children, and given the importance attached to rumination by recent studies of PTSD in adults (Clohessy & Ehlers, 1999; Dunmore et al., 1999; Ehlers et al., 1998), further research in children exposed to traumatic events is warranted. In particular such research may need to examine whether specific cognitions such as those identified by Ehlers et al. (in press) result from an individual's more global "behavioral-attentional style" (Nolen-Hoeksema, 1991).

"Current threat", worry and attentional biases

Following a traumatic event children suffering from PTSD are likely to have elevated levels of anxiety (Ellis, Stores, & Mayou, 1998; Lonigan, Shannon, Taylor, Finch, & Sallee, 1994; Vogel & Vernberg, 1993). Such anxiety is likely to be the result of a number of factors, but whatever the causes, ongoing anxiety is considered by most theorists to impair the successful processing of traumatic memories; accessing emotion-laden memories of a traumatic event is unlikely to produce clinical improvement if no extinction of fear can occur (Foa, Steketee, & Kozak, 1989).

Ehlers and Clark (2000) describe how adults with PTSD often possess a particular form of anxiety that they term "current threat" (see above). These authors consider this state to be strongly related to various beliefs that an individual holds regarding their present condition and their more global worldview. A discussion of the possible role of children and adolescents' views of their own symptomatology has been given above. With regards to their more global assumptions, a recent study by Bishop (2001) found that a traumatic event has little bearing on a child's "assumptive world" (Janoff-Bulman, 1989); indeed the absence of a relationship between the

child's beliefs about the world and their levels of anxiety and depression is taken to suggest the fascinating possibility that "children may deal with traumatic events by subsequently rejecting assumptions about the world that threaten their sense of security" [p. 404].

An early study into children's fears following a traumatic event (a lightning strike at a boy's football match) demonstrated that, not unsurprisingly, the children exposed to the tragedy were more likely than control groups to have fears and worries regarding a number of phenomena. These phenomena included lightning and thunderstorms, disasters, death and dying, as well as other events and situations that were not so related to the event they were exposed to, such as animals and the supernatural (Dollinger, O'Donnell, & Staley, 1984). While such fears may result from amendments to a child's self-schema and external threat schemata (Kendall & Ingram, 1987; Kendall & Ronan, 1990), the intensity of such fears also may be aggravated by worrying.

Vasey (1993), following the work of Borkovec, Shadick, and Hopkins (1991), defined worry as "an anticipatory cognitive process involving repetitive thoughts and images that contain fear-producing content related to possible traumatic events and their potentially catastrophic implications [p.7]". Such a process is likely to play a significant role in enhancing specific fears following a traumatic event, in addition to maintaining a generally anxious mood. Vasey's consideration of childhood worry centers largely around the role of children's cognitive development, acknowledging that worry requires the ability both to anticipate future events as well as the related ability "to go beyond what is observable and consider what is merely possible [Vasey, 1993, p.9]". Before a child is seven to eight years of age, he or she is unlikely to be able to consider the future (Piaget & Inhelder, 1966), though at the slightly earlier age

of five to six years children have been found to produce anticipatory thoughts of threat (Vasey, 1991).

For the child who already has experienced an extremely frightening event, it may be considerably easier to conceive of future threats, as demonstrated in the study of Dollinger et al. (1984). For children exposed to trauma, worry may be directed towards the prevention of the reoccurrence of an experienced event. In adult populations, it has been proposed that beliefs regarding the importance of worry, especially as a way of coping with future anticipated threats, play a key role in the maintenance of high levels of anxiety (GAD; Wells, 1995). The role of the meta-cognitive beliefs outlined by Wells (1995) have not yet received attention with regards to childhood anxiety disorders, yet Vasey (1993) has acknowledged that the role of children's beliefs concerning their own problem solving skills and cognitive states are related to uncontrollable worry. Future research directed at examining children's beliefs regarding worry could highlight how children think about the future following trauma and whether an endorsement of worry may maintain elevated levels of anxiety and contribute to the maintenance of PTSD.

For some time it has been known that following a traumatic event adults suffering from PTSD demonstrate an attentional bias (as measured using the modified Stroop task) towards trauma-related cues than adults not suffering from PTSD (Cassiday, McNally, & Zeitlin, 1992; Foa, Feske, Murdock, Kozak, & McCarthy, 1991; Kaspi & McNally, 1991; McNally, Kaspi, Riemann and Zeitlin, 1990; Thrasher, Dalgleish & Yule, 1994). A variety of explanations have been proposed for why such a bias occurs (see Thrasher & Dalgleish, 1999, for a review), but no clear account exists as to why different methodologies for examining attentional biases (e.g. the dichotic listening task; Trandel & McNally, 1987) do not demonstrate the

same bias as conclusively. Brewin et al. (1996) view the presence of attentional bias as indicator that SAMs of a traumatic event have not been processed and are accompanied by high levels of emotion.

Three studies involving samples of children exposed to traumatic events have investigated the role of attentional biases in this age group. Moradi, Taghavi, Neshat-Doost, Yule, and Dalgleish (1999), in a study using the modified Stroop task, found that children aged nine to 17 years who had been exposed to traumatic events such as MVAs or assaults, demonstrated an attentional bias towards trauma-related words, relative to neutral words and to children who had not been exposed to trauma. Unfortunately a sample of children who had been exposed to trauma but did not develop PTSD was not included in this study, and as the authors conclude, the children included in the study were old enough to have met all the significant cognitive developmental milestones. The same samples of children also performed the dot probe task (Dalgleish, Moradi, Taghavi, Neshat-Doost, & Yule, 2001). Children with PTSD selectively allocated attention towards socially threatening stimuli, and away from depression-related stimuli (no trauma-related stimuli were used).

Ribchester (2001) has overcome some of the failings of these studies into children's selective attention following trauma. Ribchester found that children suffering from PTSD who had been exposed to a MVA demonstrated greater response latencies towards trauma-related words on a modified Stroop task, relative to other word categories and a sample of children also exposed to MVAs but not suffering from PTSD. In addition to using an appropriate control group, this study also found that the threat-specific attentional bias was eliminated following treatment with eye movement desensitization and reprocessing (EMDR).

Although the findings from these studies are broadly consistent with others that have examined attentional biases in anxious children (Vasey et al., 1995, 1996), it has not been demonstrated that such biases play a role in the maintenance of PTSD in either children or adults. It remains to be established whether attentional bias is a discrete cognitive process involved in the etiology and maintenance of PTSD, an experimental index of PTSD symptoms (e.g., hypervigilance), or, as Brewin et al. (1996) have suggested, an indicator of the presence of unprocessed SAMs.

Conclusions

It has not been the aim of this article to outline the effects that trauma has on a child's development and distal psychopathology (see Pynoos et al., 1999, for such an account). This is not to say that trauma and PTSD do not have long-term developmental consequences for children, in terms of both psychopathology, and more general functioning such as school performance. The work of Bolton, O'Ryan, Udwin, Boyle, and Yule (2000) in the follow-up of children involved in the Jupiter disaster demonstrated that children are at a greater risk in the aftermath of a traumatic event of developing a range of anxiety and affective disorders, especially if they have PTSD. Rather, it has been the purpose of this article to stress the need for a more detailed understanding of the precise mechanisms that govern the incidence and course of post-traumatic stress reactions, as well as how other psychopathology can result following a traumatic event.

The present article has not been aimed at conclusively advocating any specific cognitive-behavioral model for the understanding of children and adolescents'

reactions to trauma, but has argued that adopting a “dual representation” framework in attempting to understand PTSD in children and adolescents may be useful. It has been demonstrated that children with post-traumatic stress disorder possess both representations of traumatic events that fit within the notion of SAMs, and verbally accessible memories and that incorporate maladaptive appraisals and “secondary emotions” that are associated with a worse outcome, the key aspects of the architecture described by both Brewin et al. (1996) and Ehlers and Clark (2000).

Adopting such a framework to the understanding of PTSD in children and adolescents offers specific directions for future research. First, predictions can be made regarding how the time course of PTSD varies according to a child’s developmental stage. Very young children, who are largely dependent on their caregivers to appraise danger and for the formation of a coherent narrative of a distressing event (Salmon & Bryant, 2002), would be likely to form PTSD symptomatology in the short-term following a traumatic event (largely as a function of their caregiver’s levels of distress and communication with their child); lacking the verbal ability and emotional regulatory capacities to process their SAM representations of the trauma, PTSD symptoms, if present, may remain at a stable level for a long period of time. Elementary school-aged children would be able to lay down more coherent memories of a trauma than very young children. Those that do lay down the kinds of memories that give rise to re-experiencing and hyperarousal may be less likely to engage in strategies of coping that impair the processing of such memories, e.g. cognitive avoidance, rumination, or worry, as they lack the more abstract cognitive abilities that motivate and enable the use of such coping. Older children and adolescents, like elementary school-aged children, would be able to appraise an event as traumatic on their own and be more able to form a coherent

memory of it represented in a verbal format. However, they are also more able to engage in maladaptive ways of coping, and so a significant minority of this age group, much in the same way as adults, would be likely to form chronic reactions to trauma.

Second, the role of the family, already demonstrated to be important in the development of PTSD in children and adolescents (Smith, Perrin, Yule, & Rabe-Hesketh, 2001), may be further investigated. In the context of a dual representation account of PTSD, a child's family may play a role in moderating PTSD at a number of points: by enabling a child to verbalize a traumatic event as it occurs, enabling the verbalization and emotional processing of a traumatic event in its aftermath, and influencing a child's appraisals and coping styles after a traumatic event.

Third, the role of pre-traumatic psychological disorders in increasing the risk of PTSD (Asarnow et al., 1999; La Greca, Silverman, & Wasserstein, 1998) may be better understood. Pre-existing elevated arousal may lead to a child laying down more emotion-laden memories and be related to the onset of PTSD, while the presence of maladaptive cognitive and meta-cognitive styles may play a role in the maintenance of posttraumatic symptomatology.

Fourth, the increased prevalence of emotional disorders in children and adolescents exposed to trauma may be further investigated. As has already been demonstrated in adults exposed to trauma (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999), a child's appraisals following a trauma may be associated with depression and anxiety, as well as post-traumatic symptomatology.

Fifth, our understanding of the role of verbal accounts of a trauma may be further informed. An examination of the literature on child and adult reactions to trauma highlights the need to understand the degree to which the remission of PTSD

is related to the formation of verbally-based memories of a traumatic event. Both the adult cognitive models outlined above and a number of theorists in the domain of child and adolescent PTSD (Fivush, 1998; Salmon & Bryant, 2002) have highlighted the need for individuals exposed to trauma to form a coherent memory of a traumatic event that is represented in a verbal format. In one study of adults treated for PTSD using exposure it was found that the transformation of sensory and action-oriented descriptions of the traumatic event to meaningful and reflective accounts was associated with clinical improvement (Amir, Stafford, Freshman, & Foa, 1998). It is unclear whether it is the change in narrative structure that is associated with an improvement in post-traumatic stress symptomatology, or other factors that are influenced by exposure techniques, such as the extinction of conditioned fear responses.

Sixth, the importance attached to forms of cognitive avoidance by both Ehlers and Clark (2000) and Brewin et al. (1996) suggests that future research may be usefully directed towards understanding how children's use of thought control strategies varies across development. Research into children's use of other cognitive activities (such as worry and rumination) across development will further inform how maladaptive coping maintains PTSD.

The case for applying elements of adult approaches to psychopathology to the understanding of childhood emotional disorder has already been made, e.g., the information processing perspective on anxiety (Daleiden & Vasey, 1997). However, there exists in this application of adult theory the danger that "the more the research is about psychopathology, the less it is about development [Steinberg, 2002, p.127]". Adopting a dual representation framework does preclude developmental considerations when understanding children's reactions to traumatic events. Rather,

such a framework allows investigation into developmental influences on the specific processes that contribute to the onset and maintenance of PTSD.

While considered the “first-line” approach to treatment, the “active ingredients” of cognitive-behavior therapy for PTSD in children and adolescents have yet to be established (Cohen, Berliner, & March, 2000). Exposure treatments have been shown to be effective in child as well as adult populations (Saigh, Yule, & Inamdar, 1996), but the success of this treatment could be attributable to different therapeutic processes. As mentioned above, exposure treatment may allow a reduction in the negative affect and arousal incorporated in traumatic memories, modify the structure and form of the traumatic memory such that the memories are less likely to be triggered by external sensory stimuli, or both of these processes. The role of cognitive elements of CBT similarly needs clarification, and it is suggested that cognitive interventions will benefit from incorporating an understanding of children’s cognitive avoidant and meta-cognitive processes in the aftermath of trauma. The framework presented here for understanding elements of children’s and adolescents’ reactions to trauma may inform how cognitive behavioral treatments might be improved and tailored to a child’s development.

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