

The dynamics of threat, fear and intentionality in the conduct disorders: longitudinal findings in the children of women with post-natal depression

Jonathan Hill^{1,*}, Lynne Murray², Vicki Leidecker³ and Helen Sharp³

¹*Child Psychiatry Research Group, Room 3.316, University Place, The University of Manchester, Oxford Road, Manchester M13 9PL, UK*

²*Winnicott Research Unit, Department of Psychology, The University of Reading, 3, Earley Gate, Reading RG6 6AL, UK*

³*Division of Clinical Psychology, The University of Liverpool, Whelan Building, Brownlow Hill, Liverpool L69 3GB, UK*

This paper considers how environmental threat may contribute to the child's use of avoidant strategies to regulate negative emotions, and how this may interact with high emotional reactivity to create vulnerability to conduct disorder symptoms. We report a study based on the hypothesis that interpreting others' behaviours in terms of their motives and emotions—using the intentional stance—promotes effective social action, but may lead to fear in threatening situations, and that inhibiting the intentional stance may reduce fear but promote conduct disorder symptoms. We assessed 5-year-olds' use of the intentional stance with an intentionality scale, contrasting high and low threat doll play scenarios. In a sample of 47 children of mothers with post-natal depression (PND) and 35 controls, children rated as securely attached with their mothers at the age of 18 months were better able to preserve the intentional stance than insecure children in high threat scenarios, but not in low threat scenarios. Girls had higher intentionality scores than boys across all scenarios. Only intentionality in the high threat scenario was associated with teacher-rated conduct disorder symptoms, and only in the children of women with PND. Intentionality mediated the associations between attachment security and gender and conduct disorder symptoms in the PND group.

Keywords: conduct disorders; post-natal depression; fear; threat; intentionality; attachment

1. INTRODUCTION

Conduct disorders in young children are common in the general population (prevalence 5–10% depending on threshold). They are disabling, and often lead to antisocial behaviours and multiple mental health and personality problems in later life (Moffitt *et al.* 2002). The causes involve interplay between inherited characteristics, such as emotional expression and regulation, and family and wider social influences (Hill 2002). Commonly, conduct disorder symptoms develop in association with high levels of environmental threat in the form of parental hostility, physical abuse, and marital discord and violence. This is probably accounted for, in part, by correlated parent and child risks, but is likely also to reflect a direct causal relationship (Jaffee *et al.* 2002b, 2005). The implications of high levels of chronic threat for social information processing and emotion regulation were addressed by Dodge and colleagues in their hypotheses linking physical abuse to hostile attributional biases, anger and reactive aggression (de Castro *et al.* 2002). However, studies of other social information processes, and of the role of fear, in the conduct disorders have

been conducted largely independent of the consideration of the role of environmental threat. Deficits in emotion recognition (Denham *et al.* 2002), pragmatic language use (Gilmour *et al.* 2004) and social fear processing (Blair *et al.* 2006) have been conceptualized as risk factors for the conduct disorders without substantial environmental contributions. Two pathways for conduct disorders have thus been hypothesized: one involving anger and reactive aggression with a substantial threat contribution, and the other characterized by limitations in social and emotional processing, arising without substantial environmental influences leading to callous–unemotional traits and proactive aggression. Studies of the neurobiology of aggression and conduct disorders have focused mainly on the second pathway, implicating impaired social emotion processing arising without substantial environmental contributions. In this paper, we consider the possible mechanisms whereby high environmental threat may lead to modifications in the activity of key brain structures, in particular the amygdala, and hence to aggression and conduct disorders. We present the case that under conditions of threat children may learn coping strategies that reduce amygdala activation and fear, and that this in turn increases vulnerability to aggression and conduct disorders. Children with high emotional reactivity reared in threatening or

* Author for correspondence (jonathan.hill@manchester.ac.uk).

One contribution of 11 to a Discussion Meeting Issue 'The neurobiology of violence: implications for prevention and treatment'.

unsupportive environments, who make use of such coping strategies, may be particularly vulnerable to conduct disorders. We then go on to describe the findings from a longitudinal study in which we examined whether insecure attachment in infancy predicted threat-related social cognitions at the age of 5 years of the kind that we hypothesize will be associated with reduced amygdala activation. We also report associations between these threat-related social cognitions and conduct disorder symptoms in the children of women with post-natal depression (PND).

(a) Amygdala function, threat and the conduct disorders

Normally, the amygdala contributes to social learning and social responsiveness through its roles in the establishment of stimulus–punishment associations and in fear processing. Psychopathy in adults and callous–unemotional traits in children are thought to arise from a reduced ability to form the stimulus–punishment associations necessary for successful socialization, coupled with a lack of responsiveness to expressions of fear in others. As a result, individuals with psychopathy do not learn to avoid actions that will harm others (Blair 2006). Amygdala dysfunction has been identified as a causal factor for adult psychopathy, on the basis that deficits seen in psychopathic disorder are similar to those found following amygdala lesions, and adult psychopaths show reduced amygdala activation in functional imaging studies (Blair *et al.* 2006). Psychopathic disorder and callous–unemotional traits in children are thought to stem from amygdala dysfunction without significant contribution from environmental factors (Viding *et al.* 2005; Blair *et al.* 2006). On the other hand, studies of the role of parenting in relation to callous–unemotional traits do not conform to this general view. Cornell & Frick (2007) investigated the interplay between temperament and guilt and empathy in a middle-class sample of 3- to 5-year-olds. Children nominated by their peers as being behaviourally inhibited were rated by their parents as showing more guilt and empathy than uninhibited children. This is consistent with a link between temperamental fearlessness, likely to have a substantial genetic contribution, and dimensions of callous–unemotional traits. However, in the uninhibited subgroup of children, guilt and empathy were lower among those experiencing greater parent-reported inconsistent parenting (Cornell & Frick 2007). Thus, the biological risk for callous–unemotional traits was modified by the quality of the parental environment. Parenting characteristics were also related to outcome in a study of 120 aggressive 11-year-olds followed for 1 year (Pardini *et al.* 2007). Callous–unemotional traits displayed moderate temporal stability and predicted increases in antisocial behaviour. However, children exposed to lower levels of physical punishment showed decreases in callous–unemotional traits, and those experiencing higher levels of parental warmth and involvement had decreases in both callous–unemotional traits and antisocial behaviour. Lower levels of anxiety were associated with increasing callous–unemotional traits only in children who described their primary carer as exhibiting low warmth and involvement. These findings do not necessarily

apply to children with severe callous–unemotional traits; however, they do point to the need of including possible environmental mechanisms in neurobiological hypotheses for callous–unemotional traits.

The amygdala subserves a much broader set of functions than those thought to be relevant to psychopathy, some of which may increase vulnerability in unfavourable environments. In particular, it enables preferential processing of stimuli that are emotional and potentially threatening, and it is implicated in the effect of arousal on memory whereby information associated with strong emotions is better remembered (Phelps & LeDoux 2005). Thus, the child living in an environment of chronic threat may experience repeated negative emotions underpinned by these amygdala-mediated processes. This may result in anger-driven reactive aggression, or in attempts to resolve the fearful state. Given that parents are commonly the source of the threat, they are unlikely also to be able to help the children in reducing their fear by providing comfort. Derryberry & Rothbart (1997) eloquently outlined the potential consequences for the child in attempting to manage threat without support. Where the child, when threatened, is unable to find comfort or protection from the carers he/she ‘may come to rely upon primarily avoidant strategies, disengaging attention from the threatening situation without attending to sources of relief and available coping options’ (Derryberry & Rothbart 1997, p. 647). They outlined two major possible consequences of this strategy with implications for disruptive behaviour problems. First, it is likely to reduce the child’s capacity to attend to the details of the threatening information, and hence reduce the appropriateness and effectiveness of his/her responses. The child who is less able to cope with challenging social situations is more likely to find maladaptive, for example, coercive ways of dealing with them. Second, ‘if this strategy were used too extensively, the child may fail to benefit from the more positive effects of felt anxiety... in impulse control, empathy and conscience’ (Derryberry & Rothbart 1997). Although evidence is not available regarding children’s ability to reduce amygdala activation using avoidant strategies, adults can be taught avoidant strategies in the form of reappraisal of standard negative stimuli, and this has been shown to reduce amygdala activation in response to those stimuli (Ochsner *et al.* 2002). If children were able to reduce amygdala activity via analogous mechanisms, this would provide a means of adapting to high environmental threat, while at the same time increasing vulnerability to the conduct disorders as a result of impaired social learning and emotion processing.

(b) Threat, emotion regulation and social information processing in the conduct disorders

Several kinds of avoidant strategy can be envisaged, such as withdrawing attention from the source of threat or denial that there is a threat. Within interpersonal exchanges, perceived threat can also be varied depending on the interpretation that is put on others’ behaviours. What others’ behaviours are ‘about’, otherwise referred to as their intentionality (Searle 1983), can be construed in terms of their motives,

attitudes, emotions or plans. This is what Dennett referred to as 'Adopting the Intentional Stance' (Dennett 1987), although 'responding in' might be more appropriate for children because it is not implied that they make a choice. The alternative is to respond in the 'Physical Stance', whereby social behaviours do not have intentionality with respect to mental states, and instead are viewed as no more than sounds or movements (Dennett 1987; Bolton & Hill 2004). Thus, the raised voice of a carer, which according to the intentional stance is angry and threatening, becomes simply a louder sound when interpreted using the physical stance, and similarly the threatening gesture of a peer is only an arm raised.

Intentionality is similar to mentalization but is more restricted in its scope, as mentalization refers not only to responding using the intentional stance but also to the range of competences required in implementing it effectively (Fonagy & Target 2006). Intentionality also differs from 'theory of mind' as currently conceived (Carpendale & Lewis 2004). Theory of mind refers to the ability to take the perspective of another accurately, whereas intentionality refers to a mode of interpreting and responding irrespective of whether the interpretations are correct or the responding appropriate. Theory of mind is generally tested under emotionally neutral conditions and is thought of as a general capability, whereas intentionality may be examined in relation to varying emotional demands and the same individual may show marked variations depending on those demands.

In this study, the extent to which the child responded in the intentional or physical stance was assessed using a doll play challenge (Murray *et al.* 1999b). Children were asked to show what happens in their families at bedtime (low threat), in a bad and nasty time (high threat) and in a happy and best time (low threat), and their accounts were rated on an intentionality scale. Responding using the intentional stance in a doll play task has two elements: making use of the plastic objects to represent people and their surroundings, and showing the interpersonal reasons for the doll play characters' behaviours. Higher intentionality scores were assigned where both elements were clearly present and lower intentionality scores where one or both were to some degree lacking. Details of the scoring are provided in §2.

(c) *The role of attachment processes*

Links between emotion regulation and intentionality are likely to be influenced by attachment processes. Fonagy & Target (1997) argued that secure attachment provides the psychosocial basis for acquiring an understanding of others' minds. The child is likely to maintain the intentional stance if expressions of fear or distress in the face of threat elicit comfort from a carer, but may otherwise drop to the physical stance, simultaneously alleviating the negative emotions and reducing opportunities to further understand the carer's mind. Thus, we expect insecure attachment to be associated with responding using the physical stance under conditions of threat.

Whether a child responds using the intentional stance is likely to be influenced also by factors other

than attachment security. For example, theory of mind capabilities are likely to enhance the use of the intentional stance when responding to social challenges (Fonagy 2006). However, we predict that this general capability does not equip the child to maintain the intentional stance in the face of threat and so will only be associated with intentionality in response to low threat social challenges. The quality of family conversations about mental states and feelings have also been found to be related to mentalizing abilities (Dunn & Brown 2001), and may be expected to be associated with making use of the intentional stance. We predict that the context of the family conversations is crucial to the context in which it promotes intentionality. The quality of family interactions while responding to and regulating anger or distress is likely to be related to the child's capacity to maintain the intentional stance in the face of threat. By contrast, family interactional patterns where negative emotions are not aroused will be associated with the child's ability to maintain the intentional stance in low threat contexts. In this study, theory of mind and the quality of mother-child conversations in a non-threatening context were assessed at the age of 5 years, so these predictions could be tested.

(d) *Implications of lower intentionality for conduct problems*

If a child responds habitually to threat with reduced intentionality he/she may come to this avoidant strategy more generally in regulating fear or anxiety, along the lines outlined by Derryberry & Rothbart (1997). However, the child who drops to the physical stance to deal with fear or anxiety may become vulnerable to antisocial behaviours in at least four ways: first, he/she reduces his/her capacity to process the details of the social situation and hence his/her ability to respond appropriately; second, he/she is deprived of the regulatory function of anxiety or fear to inhibit impulsive actions; third, the emotional responsiveness associated with empathy and conscience is reduced; and fourth, by turning away from the mental state of the other he/she becomes indifferent to the damaging consequences of his/her actions. In a previous study, we tested our hypothesis that conduct disordered children are prone to using an avoidant strategy to deal with fear through lowering intentionality by comparing boys referred with conduct disorder symptoms and community controls using story stem challenges (Hill *et al.* 2007). The key contrast was between challenges that involved fear and distress (a child is frightened by a dog, a child is distressed after being scalded) and those with conflict (a fight between two children, an argument between parents). There was a significant interaction term between conduct disordered versus control groups, and fear/distress versus conflict stories, because conduct disordered boys had lower intentionality scores than controls but only in response to story stem challenges involving fear and distress.

(e) *Attachment and conduct problems*

Associations between attachment and conduct problems have been demonstrated in prospective studies

and cross section (Lyons-Ruth *et al.* 1997; Speltz *et al.* 1999; Belsky & Fearon 2002; Burgess *et al.* 2003; Keller *et al.* 2005; Guttman-Steinmetz & Crowell 2006; Moss *et al.* 2006). However, there have been variations in the types of insecure attachment associated with conduct disorder symptoms and in whether or not attachment security is associated with symptoms only in interaction with other factors such as fearlessness or social risk (Belsky & Fearon 2002). Current concepts and models of the way that attachment security may be relevant to the conduct disorders also vary substantially. One line of argument suggests that attachment security contributes to conduct disorders only inasmuch as it affects the child's capacity to solicit emotional support in dealing with the vulnerabilities that directly lead to aggressive and disruptive behaviours (Greenberg *et al.* 2001; Keller *et al.* 2005). This is in contrast to proposals that envisage direct links between attachment status and conduct disorders (Moss *et al.* 2006). For example, aggressive behaviours may be seen as a manifestation of attempts to cope with the consequences of disorganized attachment. Attachment insecurity or disorganization is not, however, the only influence on emotion regulation, and it may be that the mechanisms in the conduct disorders involve an interplay between attachment and other emotion regulatory processes. For example, Burgess *et al.* (2003) hypothesized that risk for externalizing behaviour problems might arise from both low temperamental fearfulness and the downregulation of fear associated with avoidant attachment. They found that the combination of fearlessness assessed at 24 months and avoidant attachment assessed at 14 months predicted externalizing behaviour problems at 4 years. Overall, the available evidence is consistent with there being effects of attachment on conduct disorders only in the presence of other risks, as evidenced in statistical interactions, and with conduct disorder symptoms as direct manifestations of attachment processes.

(f) Gender, social information processing and the conduct disorders

Males have higher rates of conduct disorders in childhood than females (Moffitt *et al.* 2001). This is mainly because males are exposed to more risk factors than females rather than because males are more vulnerable. Gender differences in peer relationships were identified as a key factor in the elevated rates of conduct disorders in the Dunedin Health and Development Study. Some of these differences may be relevant to the development of intentionality in social interactions. Boys tend to engage in physical competitive activities and develop relationships that emphasize dominance and status, while girls' groups commonly are oriented towards verbal and emotional intimacy (Maccoby 2002). Girls are therefore more likely to be experienced in tracking interpersonal processes using the intentional stance than boys.

(g) The role of parental depression

Associations between maternal depression and behaviour problems in children are well documented

(Hay *et al.* 2003). These do not establish that maternal depression is the key risk because it is associated with other psychiatric disorders and psychosocial risks. For example, many women with depression have a history of conduct problems and marked interpersonal difficulties in adult life (Jaffee *et al.* 2002a; Hill *et al.* 2004). Rates of conduct disorders in the children of mothers with depression and antisocial personality disorder are higher than among those with depression only (Kim-Cohen *et al.* 2006a). In turn, the adverse parenting environment may arise from psychosocial risks associated with maternal personality disorder such as elevated rates of physical maltreatment and exposure to domestic violence (Kim-Cohen *et al.* 2006a).

Where it can be shown that maternal depression is the key risk, a critical issue in the investigation of possible mechanisms concerns the timing of maternal disorder. Post-natal depression (PND) has been of interest both owing to possible effects on early mother–infant interactions (Murray *et al.* 1996) and evidence from animal studies that early perturbations of maternal care may affect gene expression and neurodevelopment (Szyf *et al.* 2007). Establishing the specific contribution of PND to psychopathology requires measurement of depression outside of the post-partum period because there are strong associations between ante-natal depression and PND, and between PND and subsequent persistence or recurrence of depression (Hay *et al.* 2003). Hay *et al.* addressed this issue by assessing not only PND but also antenatal depression, and maternal depression when children were at the ages of 1, 4 and 11 years, in an urban community sample. PND predicted violence reported by parents and teachers at the age of 11 years, after accounting for depression assessed at other time points. The biological father's history of arrests made an independent contribution to violence at the age of 11 years, together with PND. Previous findings of the study described in this paper have also indicated that there may be a persistent effect on child psychological adjustment of PND not accounted for by subsequent episodes of depression, nor by associated psychosocial factors (Murray *et al.* 1999a).

There is therefore some evidence for a persistent effect of PND, with two major caveats. First, statistical power to examine the contrast between depression confined to the post-partum period and later depression is generally limited by the strong association between the two. For example, in the study of Hay *et al.*, out of the 26 with PND, only seven did not have a recorded recurrence of major depression. Second, there is some evidence for familial aggregation of PND (Murphy-Eberenz *et al.* 2006; Forty *et al.* 2006), so that the association may be accounted for by common genetic effects on PND and child psychopathology.

There is increasing evidence that risks interact in the development of the conduct disorders. For example, the association between child maltreatment and antisocial behaviour problems is higher among individuals with a functional polymorphism conferring low levels of expression of the gene encoding the neurotransmitter-metabolizing enzyme monoamine oxidase A (MAOA) (Caspi *et al.* 2002;

Table 1. Descriptive statistics for the control and PND groups. (*p*-values are from two-sided independent group *t*-tests and χ^2 -tests.)

	control (<i>n</i> =35)	PND (<i>n</i> =47)	<i>p</i>
mean age in months (s.d.)	60.5 (1.0)	60.3 (0.9)	0.34
proportion of males	49%	47%	0.87
proportion of social classes I, II or III non-manual	69%	64%	.65
proportion of insecure attachment at 18 months	26%	64%	0.001
proportion of maternal depression at 18 months–5 years	17%	51%	0.002
proportion of child involvement in marital discord	14%	40%	0.01
proportion who did not pass the false belief task	12%	20%	0.36
mean (s.d.) McCarthy General Cognitive Index	111.1 (10.3)	111.2 (12.8)	0.96
mean (s.d.) McCarthy Verbal Subscale	57.1 (10.3)	58.3 (10.6)	0.61
mean (s.d.) maternal child focused speech	1.21 (1.1)	1.14 (0.9)	0.75
mean (s.d.) intentionality: bedtime	7.40 (2.28)	7.28 (2.95)	0.86
mean (s.d.) intentionality: bad and nasty time	6.06 (3.65)	6.02 (3.41)	0.96
mean (s.d.) intentionality: happy and best time	4.91 (3.38)	5.06 (3.27)	0.84

Kim-Cohen *et al.* 2006b). The way in which reduced MAOA may contribute to the risk of conduct problems in the presence of maltreatment is not known; however, animal studies point to the possibility of a link between altered monoamine levels and hyper-reactivity to stress (Ward *et al.* 1998). In rats, MAO (A and B) inhibition during brain development results in increased aggression in response to social threat (Mejia *et al.* 2002). Animal studies also found that maternal behaviour during the first days has long-term effects on reactivity to threat (Menard & Hakvoort 2007). Thus, genetic and early environmental vulnerabilities to conduct disorders may arise from emotional reactivity, in interaction with subsequent environmental threats (Frick & Morris 2004). We have previously reported that boys referred with conduct problems show both dysregulated aggression and reduced intentionality in response to distress portrayed in doll play scenarios (Hill *et al.* 2007). If PND is associated with elevated emotional reactivity, we expect that there will be an interaction between PND and reduced intentionality to threat in relation to conduct problems in children.

We set out to test the following hypotheses:

- (i) Insecure attachment in infancy will be associated with lower intentionality, specifically in response to a high threat doll play challenge, at 5 years.
- (ii) Theory of mind and quality of observed mother–child conversations will be associated with intentionality scores in tasks where no threat is posed, but will not be associated with lower intentionality in response to threat.
- (iii) Lower intentionality, specifically in response to threat, at 5 years will be associated with conduct disorder symptoms in interaction with maternal PND.
- (iv) Insecure attachment in infancy will be associated with elevated conduct disorder problems at 5 years in the children of mothers with PND, mediated by intentionality in response to threat.
- (v) Male gender will be associated with lower intentionality, which will mediate the association between gender and conduct disorder symptoms in the children of women with PND.

2. METHOD

All participants provided written informed consent prior to taking part in this Cambridgeshire Local Ethics Committee approved study.

(a) Participants

The sample comprised 82 children participating in a prospective longitudinal study of the impact of PND on child development (Murray 1992). There were 47 children of mothers with PND (mean age: 60.5 months, s.d.=1.0) and 35 control children (mean age: 60.3 months, s.d.=0.9). The gender and social class distributions in each of the PND and control groups were very similar (table 1). The distribution of attachment categories assessed using the Strange Situation Test at the age of 18 months was secure, 43; avoidant, 34; ambivalent, 2; disorganized, 3; and so only secure (*n*=43) and insecure (*n*=39) groups were contrasted in data analyses. Children of mothers with PND had elevated levels of insecure attachment compared with children of control mothers (table 1).

The original sample comprised 100 mother–infant dyads, recruited at approximately eight weeks post-partum. Initial recruitment was through screening a community sample of 702 primiparous mothers of healthy full-term infants for PND, by administering the Edinburgh Post-natal Depression Scale (EPDS) (Cox *et al.* 1987) at six weeks post-partum. Women scoring over 12 on the EPDS were interviewed; 61 women who met research diagnostic criteria (Spitzer *et al.* 1978) for depressive disorder were identified, 58 of whom were recruited for the study. Forty-two non-depressed mothers randomly selected from the same post-natal population were also recruited. All the mothers were white, their mean age was 28 years (s.d.=4), 64% were in the upper to middle-class households (UK Standard Occupation Classification; classification I, II or III non-manual) and 49% had been in full-time education for at least 12 years. Of the original sample of 100 assessed in infancy, 94 (50 PND: 44 controls) were assessed at the age of 5 years and videotaped assessments of the children in a doll play procedure were available for 82 children.¹

(b) Measures**(i) Infant attachment at 18 months**

The quality of infant attachment to the mother at 18 months was assessed using the Strange Situation procedure (Ainsworth & Wittig 1969). Attachment was classified from videotapes following the procedures described by Ainsworth *et al.* (1978) and Main & Solomon (1990). Cohen's kappa coefficient for the secure, avoidant, resistant and disorganized attachment classifications of the two researchers who independently scored 63 randomly selected videotapes of the Strange Situation was 0.94 (see Murray *et al.* 1996).

(ii) Assessments at the age of 5 years*Recent maternal depression*

Mothers were interviewed using the Schedule for Affective Disorders and Schizophrenia, Lifetime Version (Endicott & Spitzer 1978). Episodes of DSM Major Depressive Disorder occurring between the time the child was 18 months old and the present were recorded, along with the timing of onset and remission.

Chronic difficulties and child involvement in parental discord

The Life Events and Difficulties Schedule (LEDS; Brown & Harris 1978) was used to assess current chronic difficulties. In addition to the usual LEDS probes, a number was introduced to elicit information about the degree to which the child had been actively exposed to, or was the focus of, any marital conflict, over the past 12 months.

(iii) Cognitive development

The McCarthy Scales of Children's Development were administered (McCarthy 1972). These scales have been widely used in research and are a valid and reliable measure of children's cognitive development. Two scales were used: the General Cognitive Index (GCI) and the Verbal Subscale.

(iv) Theory of Mind

The procedure of Wimmer & Perner (1983) was used. The child was presented with a narrative involving two characters and three containers. The protagonist puts some chocolate into one of the containers and then leaves the scene; in his absence the mother moves the chocolate to one of the other containers. On returning, the protagonist wants the chocolate, and the child is asked where the character will look, having first established that the child knows the correct location. Success was scored when the child both remembered the correct location and represented the protagonist's false belief. Of the 82 children, four were unable to locate the chocolate correctly, so the sample size for analyses of theory of mind is $N=78$. Of these children, 13 (16%) failed the false belief item.

(v) Maternal communication with the child during a snack: maternal sensitivity

The mother and the child were shown into a comfortably furnished room and provided with some light refreshments, including fruit juice, oranges and a cake. These items were, in part, selected to elicit the mother's involvement in helping the child, and possible control

over what and how much the child ate. The quality of the mother's communication with the child was coded from a transcript of the ten minute snack interaction. Ratings were designed to provide a parallel to the analysis of mothers' speech to their infants when they were two months old. They reflected positive comments, genuine questions, and expansions and extensions relevant to the child or to a common focus of interest. Inter-rater reliability and associations with family adversity were reported previously (Murray *et al.* 1996).

(vi) Conduct disorder symptoms

Teachers completed the Pre-School Behaviour Checklist that consists of 22 items covering externalizing and internalizing behaviours (McGuire & Richman 1988). The six conduct disorders items, fights, destructive, difficult to manage, interferes with other children, has tantrums, and teases other children, were summed to create the scale used in this paper.

(vii) Dolls' house assessment

The dolls' house procedure was the same as has been described in previous publications (Murray *et al.* 1999b). The child was shown a dolls' house that was furnished but had no doll characters in it. The back of the house was removed so that the child's play could be video recorded through the observation window. The researcher explained to the child that they were going to pretend that this was the child's own house, and asked him/her to choose figures to represent the people in the child's family. The researcher then asked the child to show what happened in the family during four scenes: a meal time (warm up); bedtime; bad and nasty time; and happy and best time. The researcher was not directive in the use of the play materials; however, standard probes were introduced in order to ensure that the child did respond to the demands of the scene. In the bedtime story, the questions 'do you go straight to sleep, or does it sometimes take some time' and 'do you wake up in the night sometimes' were always asked. In the bad and nasty time, if the child could not think of one, or said that they never occur, the administrator said, 'let's pretend it is a bad and nasty time', and similarly in the happy and best time. Where the child told a story that was not apparently related to the demands of the scene, the administrator would respond along the lines of, 'is that what happens when it is a (e.g. bad and nasty) time?'

The child's stories were rated using a coding scheme that was developed for use with the MacArthur Story Stem Battery (MSSB; Hill *et al.* 2000, 2007; Emde *et al.* 2003; Minnis *et al.* 2006). Some minor modifications were made of the rating rules to take account of the differences between the dolls' house play procedure and the MacArthur Story Stem Battery. A copy of the manual used to rate narratives in this study is available from the first author.

The intentionality scale assesses the extent to which the reasons for the doll participants' behaviours, in terms of mental states, such as needs, desires, feelings and beliefs, are made explicit or can be readily inferred from the behaviours. This is a 12-point scale in which ratings 10–12 require that explicit reference is made to the feelings or motives of the participants, whereas

ratings in the range 7–9 are made where mental states can be readily inferred but are not referred to explicitly. For example, in the ‘bad and nasty time’ scenario, a sequence in which the child says, ‘there is a big storm in the night and Michael is frightened and goes into his parent’s room for a cuddle’ would contribute to a rating in the range 10–12. By contrast, ‘there is a big storm in the night and Michael goes into his parent’s room for a cuddle’ would contribute to a rating in the range 7–9. Contributions to ratings 4–6 come from portrayed actions whose intentionality refers to physical circumstances of the doll characters, rather than their states of mind or motives. This would be rated, for example, if the child said, ‘there is a big storm in the night. Michael is mending his bike.’ Ratings in the lowest range 1–3 reflect sequences where the dolls are manipulated outside of the rules of their symbolic function. For example, ‘there is a big storm in the night, and Michael flies up on to the roof, and then slides down the chimney.’

The doll play assessments were rated by V.L. blind to all of the assessments at 18 months and 5 years. V.L. was trained by J.H. who contributed to the development of the original rating system. Inter-rater reliability (intraclass correlation coefficient) between V.L. and J.H. on assessments from 20 children ranged between 0.72 and 0.85 for the scales used in this study.

(c) Variables and analyses

The distributions of intentionality scores were examined using histograms and found to be appropriate for parametric analyses; however, the teacher-rated externalizing symptoms were skewed, and so analyses were conducted using the log-transformed scores. Associations with earlier and concurrent measures were examined using correlation coefficients, two-sided between-group *t*-tests and analysis of covariance. Contrasts in associations with attachment security and gender across different dolls’ house scenarios were examined using repeated-measures ANCOVA with appropriate covariates and testing for interactions with scenario type. Predictions of teacher-rated conduct disorder symptoms were examined in multiple linear regression, including interaction terms to test whether effects were modified by risks such as PND. In view of the moderate correlations among them, the tolerance value of each intentionality variable in the regression analyses was used as a check for multicollinearity. Tolerance values of 0.1 and higher are generally regarded as acceptable. Mediation was examined in linear regression using the method outlined by Baron & Kenny (1986) whereby variable B may be considered as a mediator between variables A and C, if there are associations between A–B, A–C and B–C, and the contribution of A–C becomes non-significant when considered jointly with variable B (Baron & Kenny 1986).

3. RESULTS

The PND and control groups did not differ significantly in mean General Cognitive Index (GCI) and Verbal Subscale scores, proportions passing the false belief task and maternal sensitivity during a snack

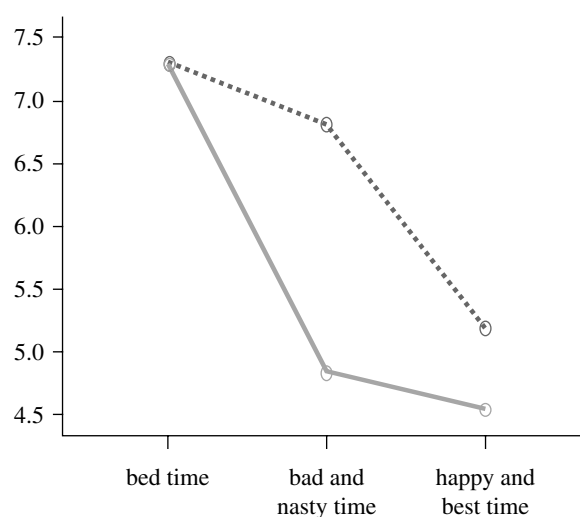


Figure 1. Estimated marginal mean intentionality scores comparing children who were secure (dashed line) and insecure (solid line) at 18 months in low and high threat scenarios at the age of 5 years.

(table 1). Children of mothers with PND were more likely to have been exposed to maternal depression between 18 months and 5 years, and to be involved in marital discord as 5-year olds. Only four mothers met the criteria for DSM major depression at the 5-year assessments, and of these three were in the PND group. The groups did not differ in mean intentionality scores assessed in the doll play procedure at 5 years.

Intentionality scores in each of the scenarios were moderately correlated: bedtime with bad and nasty time ($r=0.57, p<0.001$); bedtime with happy and best time ($r=0.53, p<0.001$); and bad and nasty time with happy and best time ($r=0.48, p<0.001$). There were weak associations between GCI scores (but not the Verbal Subscale) and intentionality in the bedtime story ($r=0.23, p=0.03$), but no associations with scores in the other scenarios. There were no associations between intentionality in any of the dolls’ house scales and social class, the child’s age, maternal depression between 18 months and 5 years or the child’s involvement in current marital conflict. Unless otherwise stated, all analyses were conducted controlling for GCI.

(a) Infant attachment security and intentionality at the age of 5 years

Hypothesis 1 was examined in repeated-measures ANCOVA. Overall, mean intentionality scores were lower in the bad and nasty time story compared with the bedtime story ($p<0.001$) and in the happy and best time compared with the bad and nasty time ($p=0.029$). The interaction term between insecure attachment at 18 months and doll play scenario in the prediction of intentionality at 5 years was statistically significant ($F(2,78)=5.48, p=0.006$; figure 1). Follow-up analyses revealed that infant attachment security was associated with intentionality in the high threat, bad and nasty time, scenario, but not the low threat, bedtime and happy and best time, scenarios (table 2). Infant insecure attachment explained 13% of the variance in intentionality scores in the bad and nasty time scenario at 5 years ($\beta=-0.36, p=0.001$).

Table 2. Mean intentionality scores at the age of 5 years contrasting children rated secure and insecure at the age of 18 months. (The table shows unadjusted means and mean differences and their 95% CI. p values are from two-sided independent group t -tests, and ' p cov' values from analysis of covariance, controlling for McCarthy general cognitive ability scores.)

	secure ($n=43$)	insecure ($n=39$)	mean (95% CI)	p	p cov
intentionality: bedtime	7.53 (3.13)	7.10 (3.05)	0.63 (−0.93–1.79)	0.53	0.59
intentionality: nasty time	7.26 (3.59)	4.69 (2.90)	2.56 (1.12–4.00)	0.001	0.001
intentionality: happy time	5.58 (3.35)	4.36 (3.15)	1.22 (−0.21–2.66)	0.094	0.098

Hypothesis 2 was tested in repeated-measures ANCOVA testing for interactions between passing the false belief task and doll play scenario, and maternal sensitivity and doll play scenario in the prediction of intentionality. Attachment security was retained in the models owing to its association with intentionality in the bad and nasty time scenario. The interaction term between passing the false belief task and doll play scenario was statistically significant ($F(2,73)=3.21$, $p=0.046$; figure 2), and the interaction between maternal sensitivity and doll play scenario approached statistical significance ($F(2,77)=2.79$, $p=0.068$). Follow-up analyses were conducted in three separate hierarchical linear regressions: entering attachment; theory of mind; and maternal sensitivity jointly in the second step (table 3). Theory of mind and maternal sensitivity were each associated with intentionality in the low threat bedtime scenario, but neither was associated with intentionality in the high threat bad and nasty time scenario, which was only predicted by attachment status. Only theory of mind was associated with intentionality in the happy and best scenario.

(b) *Intentionality, attachment, theory of mind, maternal sensitivity and conduct disorder symptoms at the age of 5 years*

There were no associations between the log-transformed teacher-rated conduct disorder symptoms and family social class ($t=0.82$, $p=0.41$), age of child ($r=-0.08$, $p=0.49$), maternal depression between 18 months and 5 years ($t=0.68$, $p=0.50$) or involvement in current marital conflict ($t=1.24$, $p=0.22$).

In order to test hypothesis 3, the log-transformed teacher symptom scores were first regressed on intentionality scores in the low and high threat scenarios, controlling for CGI scores. In tests for possible effects of collinearity among the intentionality scores, the tolerance of each variable was 0.6 or higher. None made a significant contribution to the model (table 4). When group \times intentionality interaction terms were added in the third step, there was a significant interaction between maternal PND and intentionality in the bad and nasty time scenario. In follow-up analyses, intentionality in the high threat, bad and nasty time, scenario accounted for 31% of the variance in the teacher-rated conduct symptom scores ($\beta=-0.57$, $p<0.001$) in the maternal PND group, but only 3% in the control group. There were no statistically significant interactions between social class ($\beta=-0.06$, $p=0.63$), maternal depression between the age of 18 months and 5 years ($\beta=0.10$, $p=0.49$), or involvement in marital conflict ($\beta=-0.14$, $p=0.32$), and intentionality in predicting teacher-rated conduct problems.

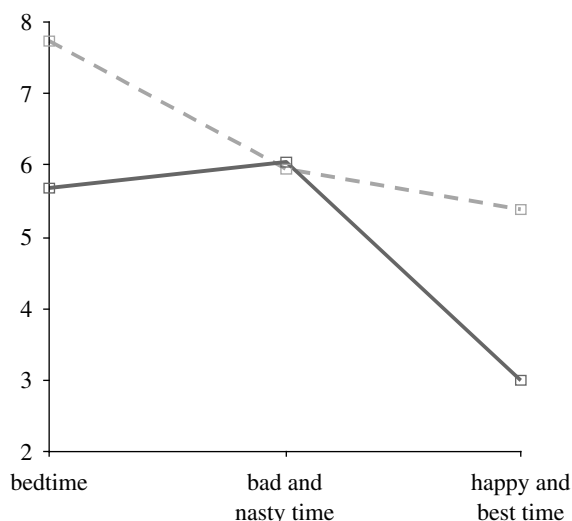


Figure 2. Estimated marginal mean intentionality scores comparing children who passed (dashed line) and failed (solid line) the false belief task in low and high threat scenarios at the age of 5 years, controlling for attachment.

In view of the interaction between intentionality in the bad and nasty time scenario and PND, we tested hypothesis 4 that intentionality would mediate the association between attachment and conduct disorder symptoms, only in the PND group (figure 3). In the first step, intentionality in the high threat scenario was regressed on attachment security in the PND group. Insecure attachment explained 21% of the variance in intentionality scores ($\beta=-0.46$, $p=0.001$). Then teacher-rated conduct symptoms were regressed on to attachment security, which explained 16% of the variance ($\beta=0.40$, $p=0.006$). Finally, we examined whether the contribution of insecure attachment security to teacher-rated conduct disorder symptoms in the PND group was altered by the introduction of intentionality. When insecure attachment was entered into the hierarchical regression after intentionality, the variance explained fell from 16% to 3% ($\beta=0.18$, $p=0.21$), and the contribution of intentionality remained significant ($\beta=-0.48$, $p=0.001$), consistent with mediation.

Theory of mind was not associated with conduct disorder symptoms in the overall sample ($t=1.38$, $p=0.12$) or in the PND group ($t=1.22$, $p=0.23$), neither was maternal sensitivity assessed in the snack task (overall sample: $r=-0.18$, $p=0.10$; PND group: $r=-0.16$, $p=0.28$).

(c) *Gender, intentionality and conduct disorder symptoms*

Boys had lower intentionality scores than girls in all three scenarios, and the interaction term between

Table 3. Summary of multiple linear regression analyses predicting intentionality in low and high threat scenarios.

intentionality	ΔR^2	ΔF	d.f.	p	variables	β	p
bedtime	0.13	3.56	3.73	0.018	attachment	-0.04	0.70
					ThOM	0.21	0.068
					maternal sensitivity	0.26	0.021
bad and nasty time	0.13	3.73	3.73	0.015	attachment	-0.36	0.001
					ThOM	-0.01	0.92
					maternal sensitivity	0.02	0.84
happy and best time	0.10	2.86	3.73	0.045	attachment	-0.17	0.14
					ThOM	0.26	0.035
					maternal sensitivity	0.06	0.61

ThOM, theory of mind.

Table 4. Summary of hierarchical regression analysis for the prediction of teacher-rated conduct disorder symptoms from intentionality ratings in low and high threat scenarios.

step	ΔR^2	ΔF	d.f.	p	variables	β	p
1	0.02	1.37	1.80	0.25	McCarthy GCI	0.13	0.25
2	0.10	2.77	3.77	0.047	McCarthy GCI	0.18	0.10
					bed time intentionality (BTI)	-0.06	0.70
					bad and nasty time intentionality (BNI)	-0.24	0.07
					happy and best time intentionality (HBI)	-0.06	0.67
3	0.18	4.52	4.73	0.003	McCarthy IQ	0.19	0.065
					BTI	-0.14	0.40
					BNI	0.18	0.30
					HBI	0.05	0.77
					group (PND versus control)	0.14	0.17
					BTI by group	-0.17	0.39
					BNI by group	-0.65	0.001
HBI by group	-0.04	0.82					

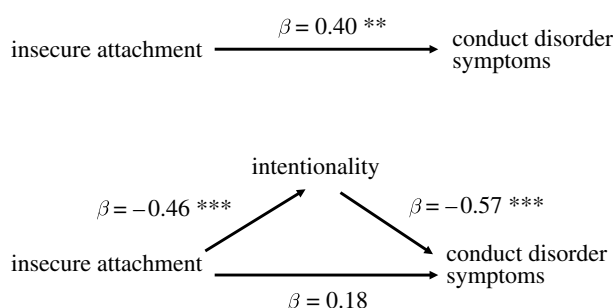


Figure 3. Mediation by intentionality in the high threat scenario (bad and nasty time) of the association between insecure attachment at 18 months and teacher-rated conduct disorder symptoms at the age of 5 years in the PND group. ** $p < 0.01$; *** $p < 0.001$.

gender and scenario was non-significant (table 5). Of specific relevance to mediation (hypothesis 5) in the PND group, gender explained 25% of the variance in intentionality scores in the high threat bad and nasty time scenario ($\beta = -0.50$, $p < 0.001$) (figure 4). Boys in the PND group had higher conduct symptoms than girls, with gender explaining 22% of the variance ($\beta = -0.47$, $p = 0.001$). When gender was entered into the hierarchical regression after intentionality, the variance explained fell from 22% to 5% ($\beta = 0.25$, $p = 0.088$). This was consistent with mediation by intentionality in the context of high threat of the association between gender and conduct disorder symptoms in the PND group.

(d) Gender, attachment, intentionality and conduct disorder symptoms

When gender and attachment were examined jointly in linear regression, each made contributions to intentionality in the high threat bad and nasty time scenario, in both the overall sample ($\Delta R^2 = 0.25$, gender $\beta = -0.36$, $p < 0.001$, attachment $\beta = -0.28$, $p = 0.005$) and the PND group ($\Delta R^2 = 0.34$, gender $\beta = -0.39$, $p = 0.005$, attachment $\beta = -0.33$, $p = 0.015$). Teacher-rated conduct symptoms were then regressed on to gender and infant attachment security jointly in the overall sample, and each made independent contributions ($\Delta R^2 = 0.16$, gender $\beta = 0.25$, $p = 0.022$, attachment $\beta = 0.27$, $p = 0.014$). In the PND group, gender and attachment jointly explained 28% of the variance in conduct symptoms (gender $\beta = 0.37$, $p = 0.01$, attachment $\beta = 0.27$, $p = 0.055$). In hierarchical linear regression with intentionality entered followed by gender and attachment, their joint contribution to the variance in conduct symptom scores fell to 6% (gender $\beta = 0.23$, $p = 0.12$, attachment $\beta = 0.15$, $p = 0.30$) consistent with mediation by intentionality of the links between both attachment security and gender and conduct disorder symptoms in the PND group.

4. DISCUSSION

The central ideas informing this study were that responding using the intentional stance promotes effective social action but may expose the child to fear in threatening situations, and that inhibiting the

Table 5. Mean intentionality scores at the age of 5 years contrasting boys and girls. (The table shows unadjusted means and mean differences and their 95% CI. p values are from two-sided independent group t -tests, and p cov values from analysis of covariance, controlling for McCarthy general cognitive ability scores.)

	female ($n=43$)	male ($n=39$)	mean difference (95% CI)	p	p cov
intentionality: bedtime	8.51 (2.51)	6.03 (3.15)	2.49 (1.24–3.73)	<0.001	<0.001
intentionality: nasty time	7.47 (3.18)	4.46 (3.19)	3.00 (1.60–4.40)	<0.001	<0.001
intentionality: happy time	6.47 (3.43)	3.38 (2.24)	3.08 (1.79–4.37)	<0.001	<0.001

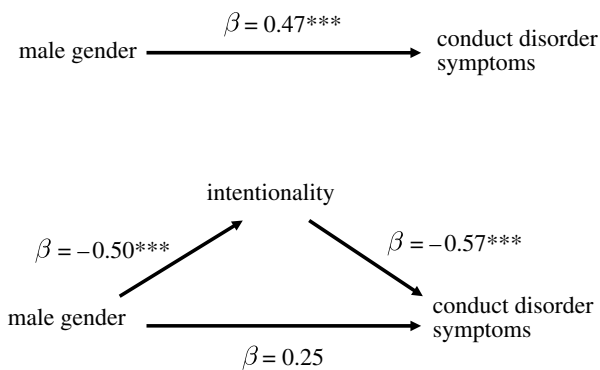


Figure 4. Mediation by intentionality in the high threat scenario (bad and nasty time) of the association between male gender and teacher-rated conduct disorder symptoms at the age of 5 years in the PND group. *** $p < 0.001$.

intentional stance may reduce fear but promote conduct disorder symptoms. We considered four possible influences on the use of the intentional stance: attachment security; gender; theory of mind; and maternal sensitivity assessed in a non-threatening task. Attachment security indexes how effectively the infant seeks comfort from a carer in the face of a threat, and therefore we expect that the secure infant is more able than the insecure to reduce fear or anxiety while maintaining the intentional stance specifically in threatening situations. The child's fear is also reduced by understanding the situation better, and understanding enhances their strategies for resolving the problem. Girls generally engage in social interactions that require higher levels of interpersonal understanding than boys, so may be expected to be more adept in using the intentional stance when asked to respond to social challenges. Theory of mind competences are associated with the capacity to perspective-take which we predicted would promote responding using the intentional stance in low threat scenarios. Maternal sensitivity in a non-threatening context is also likely to promote intentional stance use, but only in low threat situations. We assessed the extent to which the 5-year-old child uses the intentional stance in dolls' house tasks with an intentionality scale, contrasting high and low threat scenarios. Children rated as securely attached with their mothers at the age of 18 months showed evidence, in their doll play responses, of being better able to preserve the intentional stance than insecure children in a high threat bad and nasty time scenario, but not in low threat 'bedtime' and 'happy and best time' scenarios. Girls had higher intentionality scores than boys across all three scenarios. Theory of mind competence and maternal sensitivity were also each associated with intentionality, but the interaction

terms indicated that this was confined to the low threat scenarios. Thus, the findings were consistent with domain-specific processes whereby attachment, theory of mind competences and maternal sensitivity contribute to the maintenance of the intentional stance via mechanisms that are threat dependent.

We also hypothesized that lower intentionality impairs the regulation of social aggression through its impact on social understanding and through fear reduction, particularly when responding to actual or perceived threats. In this study, only intentionality in the high threat scenario was associated with teacher-rated conduct disorder symptoms, and only in the children of women with PND. Furthermore, intentionality mediated the associations between attachment security and gender and conduct disorder symptoms in the PND group.

(a) *Interaction between intentionality and PND*

While intentionality emerged as central to the relationships between threat, attachment, gender, social cognition and conduct disorder symptoms, its association with conduct symptoms was not uniform across the sample. Intentionality in the high threat scenario explained 31% of the variance in symptoms among children exposed to PND but only 3% in the control group. Although PND was associated with subsequent maternal depression and the likelihood of the child being involved in marital discord at the age of 5 years, only PND moderated the effect of intentionality. We could not however rule out the possibility of moderation by antenatal depression or conditions comorbid with PND such as maternal anxiety disorders.

We predicted the interaction on the basis that animal studies find associations between early perturbations of mothering and emotional reactivity, and the combination of high reactivity and lower intentionality may create the conditions for conduct disorder symptoms. However, we did not have measures at the age of 5 years of emotional reactivity and so could not test this hypothesis directly. Some indirect support is provided by the follow-up of this sample till the age of 16 years, in which the children of the mothers with PND had greater depressive symptomatology, compared with those not exposed to PND, mediated via elevated morning cortisol at the age of 13 years (Halligan *et al.* 2004, 2007). This pathway did not appear to be explained by depression or other psychosocial factors after the post-natal period. Alterations in hypothalamic–pituitary–adrenal (HPA) axis functioning and early exposure to maternal depression have also been associated with emotional reactivity in infants (Huot *et al.* 2004; Davis *et al.* 2007). Thus, the PND by

intentionality interaction in predicting conduct disorder symptoms may reflect an interaction with emotional reactivity related to early parenting in the PND group.

(b) Attachment security and intentionality

The finding of an association between infant attachment and intentionality in response to threat at 5 years is in contrast to several studies finding low stability of attachment security, and stressing the openness of attachment processes to later experience (Waters *et al.* 2000; Thompson & Raikes 2003). In spite of clear evidence in this sample that early psychosocial adversity (PND) was associated with later adversities (maternal depression in the pre-school years and current involvement of the child in marital discord), none of these risks was associated with intentionality ratings. In a previous report from the same study (Murray *et al.* 1999b), recent and current family adversities were associated with several features of the children's dolls' house representations. Most of these referred to the content of the narratives, such as how much neglect was portrayed. This suggests that some aspects of children's representations of family relationships, especially their content, may be influenced by recent experiences, while others such as the strategy for interpersonal information processing may have its origins, or be evidenced, in early attachment security.

(c) Strengths and limitations of the study

The study design had several strengths. The sample was representative of the local community in that it had been recruited from post-natal wards, and there was a high participation rate and retention of subjects at follow-up. There was however a higher representation of more advantaged families than in the UK generally. Relevant standardized assessments were conducted at 18 months and 5 years, and the ratings of the dolls' house assessments were made according to the written rating rules and blind to all other information about the subjects, except gender. The sequence of scenarios in the doll's house procedure developed by Murray and colleagues was well suited to testing hypotheses regarding continuities from infant attachment status. Although bedtime may, in some families, be difficult or emotional, the majority of the children told everyday stories of bedtime routines, and seemed to regard it as relatively undemanding emotionally. In the bad and nasty time, most children provided accounts of conflict or threat, and some of them quite severe. Where children did not portray events relevant to the theme, the administrator reminded them, so that in most cases it was clear that the child was responding to the emotional implications of the scenario.

(d) Implications for the neurobiology of aggression

The amygdala has rightly taken the centre stage in neurobiological models of aggression. In particular, reduced amygdala activation may contribute to both social and emotion regulation processes in callous-unemotional behaviours. Accounts of the causes of amygdala under-activation have generally given priority to deficits, possibly with substantial genetic

contributions. We have argued in this chapter that forms of adaptation to threat in childhood may also lead to under-activation of the amygdala. We have focused on the role of avoidant mechanisms in the face of threat, and their role in generating vulnerability to the conduct disorders. The findings reported in this paper are consistent with there being a threat-related avoidant strategy, in the form of lowered intentionality, associated with a history of insecure attachment and also with male gender, which contributes to vulnerability to conduct disorder symptoms. Whether or not children develop avoidant strategies in the face of threat, and hence reduced amygdala activation, will require a prospective study of the temporal relationship between environmental insults, such as physical abuse, and subsequent behavioural and neurobiological processes.

This work was supported by the Tedworth Charitable Trust. L.M. was supported by a senior research fellowship from the Medical Research Council.

The dolls' house assessments were administered by Alison Hipwell. Vicki Leideker coded intentionality in the dolls' house assessments while carrying out a research project for the University of Liverpool DClinPsychol degree. She was supervised by Jonathan Hill and Helen Sharp.

ENDNOTE

¹Technical problems, e.g. poor sound quality, meant that tapes could not be rated for 12 children.

REFERENCES

- Ainsworth, M. D. & Wittig, B. A. 1969 Attachment and exploratory behaviour in 1-year olds in a Strange Situation. In *Determinants of infant behaviour* (ed. B. M. Foss), London: Methuen.
- Ainsworth, M. D., Blehar, M. C., Waters, E. & Wall, S. 1978 *Patterns of attachment: a psychological study of the Strange Situation*. Hillsdale, NJ: Earlbaum.
- Baron, R. M. & Kenny, D. A. 1986 The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* **51**, 1173–1182. (doi:10.1037/0022-3514.51.6.1173)
- Belsky, J. & Fearon, R. M. 2002 Infant-mother attachment security, contextual risk, and early development: a moderational analysis. *Dev. Psychopathol.* **14**, 293–310. (doi:10.1017/S0954579402002067)
- Blair, R. J. 2006 The emergence of psychopathy: implications for the neuropsychological approach to developmental disorders. *Cognition* **101**, 414–442. (doi:10.1016/j.cognition.2006.04.005)
- Blair, R. J., Peschardt, K. S., Budhani, S., Mitchell, D. G. & Pine, D. S. 2006 The development of psychopathy. *J. Child Psychol. Psychiatry* **47**, 262–276. (doi:10.1111/j.1469-7610.2006.01596.x)
- Bolton, D. & Hill, J. 2004 *Mind, meaning and mental disorder*, 2nd edn. Oxford, UK: Oxford University Press.
- Brown, G. W. & Harris, T. 1978 *Social origins of depression: study of psychiatric disorders in women*. London: Tavistock.
- Burgess, K. B., Marshall, P. J., Rubin, K. H. & Fox, N. A. 2003 Infant attachment and temperament as predictors of subsequent externalizing problems and cardiac physiology. *J. Child Psychol. Psychiatry* **44**, 819–831. (doi:10.1111/1469-7610.00167)

- Carpendale, J. I. & Lewis, C. 2004 Constructing an understanding of mind: the development of children's social understanding within social interaction. *Behav. Brain Sci.* **27**, 79–96.
- Caspi, A., McClay, J., Moffitt, T. E., Mill, J., Martin, J., Craig, I. W. *et al.* 2002 Role of genotype in the cycle of violence in maltreated children. *Science* **297**, 851–854. (doi:10.1126/science.1072290)
- Cornell, A. H. & Frick, P. J. 2007 The moderating effects of parenting styles in the association between behavioral inhibition and parent-reported guilt and empathy in preschool children. *J. Clin. Child Adolesc. Psychol.* **36**, 305–318.
- Cox, J. L., Holden, J. M. & Sagovsky, R. 1987 Detection of postnatal depression. Development of the 10-item Edinburgh postnatal depression scale. *Br. J. Psychiatry* **150**, 782–786.
- Davis, E. P., Glynn, L. M., Schetter, C. D., Hobel, C., Chicz-DeMet, A. & Sandman, C. A. 2007 Prenatal exposure to maternal depression and cortisol influences infant temperament. *J. Am. Acad. Child Adolesc. Psychiatry* **46**, 737–746. (doi:10.1097/chi.0b013e318047b775)
- de Castro, B. O., Veerman, J. W., Koops, W., Bosch, J. D. & Monshouwer, H. J. 2002 Hostile attribution of intent and aggressive behavior: a meta-analysis. *Child Dev.* **73**, 916–934. (doi:10.1111/1467-8624.00447)
- Denham, S. A., Caverly, S., Schmidt, M., Blair, K., DeMulder, E., Caal, S., Hamada, H. & Mason, T. 2002 Preschool understanding of emotions: contributions to classroom anger and aggression. *J. Child Psychol. Psychiatry* **43**, 901–916. (doi:10.1111/1469-7610.00139)
- Dennett, D. 1987 *The intentional stance*. Cambridge, MA: MIT Press.
- Derryberry, D. & Rothbart, M. K. 1997 Reactive and effortful processes in the organization of temperament. *Dev. Psychopathol.* **9**, 633–652. (doi:10.1017/S0954579497001375)
- Dunn, J. & Brown, J. 2001 Emotion, pragmatics and developments in emotion understanding in the preschool years. In *Jerome Bruner: language, culture, self* (eds D. Bakhurst & S. Shanker). Thousand Oaks, CA: Sage.
- Emde, R. N., Wolf, D. P. & Oppenheim, D. 2003 *Revealing the inner worlds of young children. The MacArthur story stem battery and parent-child narratives*. New York, NY: Oxford University Press.
- Endicott, J. & Spitzer, R. L. 1978 A diagnostic interview: the schedule for affective disorders and schizophrenia. *Arch. Gen. Psychiatry* **35**, 837–844.
- Fonagy, P. 2006 The mentalization-focused approach to social development. In *Handbook of mentalization-based treatment* (eds J. G. Allen & P. Fonagy), pp. 53–100. Chichester: Wiley.
- Fonagy, P. & Target, M. 1997 Attachment and reflective function: their role in self-organization. *Dev. Psychopathol.* **9**, 679–700. (doi:10.1017/S0954579497001399)
- Fonagy, P. & Target, M. 2006 The mentalization-focused approach to self-pathology. *J. Personal Disord.* **20**, 544–576. (doi:10.1521/pedi.2006.20.6.544)
- Forty, L. *et al.* 2006 Familiality of postpartum depression in unipolar disorder: results of a family study. *Am. J. Psychiatry* **163**, 1549–1553. (doi:10.1176/appi.ajp.163.9.1549)
- Frick, P. J. & Morris, A. S. 2004 Temperament and developmental pathways to conduct problems. *J. Clin. Child Adolesc. Psychol.* **33**, 54–68. (doi:10.1207/S15374424JCCP3301_6)
- Gilmour, J., Hill, B., Place, M. & Skuse, D. H. 2004 Social communication deficits in conduct disorder: a clinical and community survey. *J. Child Psychol. Psychiatry* **45**, 967–978. (doi:10.1111/j.1469-7610.2004.t01-1-00289.x)
- Greenberg, M. T., Speltz, M. L., DeKlyen, M. & Jones, K. 2001 Correlates of clinic referral for early conduct problems: variable- and person-oriented approaches. *Dev. Psychopathol.* **13**, 255–276. (doi:10.1017/S0954579401002048)
- Guttman-Steinmetz, S. & Crowell, J. A. 2006 Attachment and externalizing disorders: a developmental psychopathology perspective. *J. Am. Acad. Child Adolesc. Psychiatry* **45**, 440–451. (doi:10.1097/01.chi.0000196422.42599.63)
- Halligan, S. L., Herbert, J., Goodyer, I. M. & Murray, L. 2004 Exposure to postnatal depression predicts elevated cortisol in adolescent offspring. *Biol. Psychiatry* **55**, 376–381. (doi:10.1016/j.biopsych.2003.09.013)
- Halligan, S. L., Herbert, J., Goodyer, I. & Murray, L. 2007 Disturbances in morning cortisol secretion in association with maternal postnatal depression predict subsequent depressive symptomatology in adolescents. *Biol. Psychiatry* **62**, 40–46. (doi:10.1016/j.biopsych.2006.09.011)
- Hay, D. F., Pawlby, S., Angold, A., Harold, G. T. & Sharp, D. 2003 Pathways to violence in the children of mothers who were depressed postpartum. *Dev. Psychol.* **39**, 1083–1094. (doi:10.1037/0012-1649.39.6.1083)
- Hill, J. 2002 Biological, psychological and social processes in the conduct disorders. *J. Child Psychol. Psychiatry* **43**, 133–164. (doi:10.1111/1469-7610.00007)
- Hill, J., Hoover, D. & Taliaferro, G. 2000 *Revised manual for the MacArthur narrative completion task*. Topeka, Kansas: Menninger Clinic.
- Hill, J., Pickles, A., Rollinson, L., Davies, R. & Byatt, M. 2004 Juvenile- versus adult-onset depression: multiple differences imply different pathways. *Psychol. Med.* **34**, 1483–1493. (doi:10.1017/S0033291704002843)
- Hill, J., Fonagy, P., Lancaster, G. & Broyden, N. 2007 Aggression and intentionality in narrative responses to conflict and distress story stems: an investigation of boys with disruptive behaviour problems. *Attach. Hum. Dev.* **9**, 223–237. (doi:10.1080/14616730701453861)
- Huot, R. L., Brennan, P. A., Stowe, Z. N., Plotsky, P. M. & Walker, E. F. 2004 Negative affect in offspring of depressed mothers is predicted by infant cortisol levels at 6 months and maternal depression during pregnancy, but not postpartum. *Ann. NY Acad. Sci.* **1032**, 234–236. (doi:10.1196/annals.1314.028)
- Jaffee, S. R., Moffitt, T. E., Caspi, A., Fombonne, E., Poulton, R. & Martin, J. 2002a Differences in early childhood risk factors for juvenile-onset and adult-onset depression. *Arch. Gen. Psychiatry* **59**, 215–222. (doi:10.1001/archpsyc.59.3.215)
- Jaffee, S. R., Moffitt, T. E., Caspi, A., Taylor, A. & Arseneault, L. 2002b Influence of adult domestic violence on children's internalizing and externalizing problems: an environmentally informative twin study. *J. Am. Acad. Child Adolesc. Psychiatry* **41**, 1095–1103. (doi:10.1097/00004583-200209000-00010)
- Jaffee, S. R., Caspi, A., Moffitt, T. E., Dodge, K. A., Rutter, M., Taylor, A. & Tully, L. A. 2005 Nature X nurture: genetic vulnerabilities interact with physical maltreatment to promote conduct problems. *Dev. Psychopathol.* **17**, 67–84. (doi:10.1017/S0954579405050042)
- Keller, T. E., Spieker, S. J. & Gilchrist, L. 2005 Patterns of risk and trajectories of preschool problem behaviors: a person-oriented analysis of attachment in context. *Dev. Psychopathol.* **17**, 349–384. (doi:10.1017/S0954579405050170)
- Kim-Cohen, J., Caspi, A., Rutter, M., Tomas, M. P. & Moffitt, T. E. 2006a The caregiving environments provided to children by depressed mothers with or without an antisocial history. *Am. J. Psychiatry* **163**, 1009–1018. (doi:10.1176/appi.ajp.163.6.1009)

- Kim-Cohen, J., Caspi, A., Taylor, A., Williams, B., Newcombe, R., Craig, I. W. & Moffitt, T. E. 2006b MAOA, maltreatment, and gene-environment interaction predicting children's mental health: new evidence and a meta-analysis. *Mol. Psychiatry* **11**, 903–913. (doi:10.1038/sj.mp.4001851)
- Lyons-Ruth, K., Easterbrooks, M. A. & Cibelli, C. D. 1997 Infant attachment strategies, infant mental lag, and maternal depressive symptoms: predictors of internalizing and externalizing problems at age 7. *Dev. Psychol.* **33**, 681–692. (doi:10.1037/0012-1649.33.4.681)
- Maccoby, E. E. 2002 Gender and social exchange: a developmental perspective. *New Dir. Child Adolesc. Dev.* **95**, 87–105. (doi:10.1002/cd.39)
- Main, M. & Solomon, J. 1990 Procedures for identifying infants as disorganised/disoriented during the Ainsworth Strange Situation. In *Attachment in the preschool years* (eds M. Greenberg, D. Cicchetti & E. M. Cummings), pp. 121–160. Chicago, IL: University of Chicago.
- McCarthy, D. 1972 *McCarthy Scales of children's abilities*. New York, NY: Psychological Corporation.
- McGuire, J. & Richman, N. 1988 *Pre-School Behaviour Checklist (PBCL) handbook*. Windsor: NFER-Nelson.
- Mejia, J. M., Ervin, F. R., Baker, G. B. & Palmour, R. M. 2002 Monoamine oxidase inhibition during brain development induces pathological aggressive behavior in mice. *Biol. Psychiatry* **52**, 811–821. (doi:10.1016/S0006-3223(02)01418-X)
- Menard, J. L. & Hakvoort, R. M. 2007 Variations of maternal care alter offspring levels of behavioural defensiveness in adulthood: evidence for a threshold model. *Behav. Brain Res.* **176**, 302–313. (doi:10.1016/j.bbr.2006.10.014)
- Minnis, H., Millward, R., Sinclair, C., Kennedy, E., Greig, A., Towlson, K. et al. 2006 The Computerized MacArthur Story Stem Battery—a pilot study of a novel medium for assessing children's representations of relationships. *Int. J. Methods Psychiatr. Res.* **15**, 207–214. (doi:10.1002/mpr.198)
- Moffitt, T. E., Caspi, A., Rutter, M. & Silva, P. 2001 *Sex differences in antisocial behaviour*. Cambridge, MA: Cambridge University Press.
- Moffitt, T. E., Caspi, A., Harrington, H. & Milne, B. J. 2002 Males on the life-course-persistent and adolescence-limited antisocial pathways: follow-up at age 26 years. *Dev. Psychopathol.* **14**, 179–207. (doi:10.1017/S0954579402001104)
- Moss, E., Smolla, N., Cyr, C., Dubois-Comtois, K., Mazzarello, T. & Berthiaume, C. 2006 Attachment and behavior problems in middle childhood as reported by adult and child informants. *Dev. Psychopathol.* **18**, 425–444. (doi:10.1017/S0954579406060238)
- Murphy-Eberenz, K. et al. 2006 Is perinatal depression familial? *J. Affect. Disord.* **90**, 49–55. (doi:10.1016/j.jad.2005.10.006)
- Murray, L. 1992 The impact of postnatal depression on infant development. *J. Child Psychol. Psychiatry* **33**, 543–561. (doi:10.1111/j.1469-7610.1992.tb00890.x)
- Murray, L., Fiori-Cowley, A., Hooper, R. & Cooper, P. 1996 The impact of postnatal depression and associated adversity on early mother-infant interactions and later infant outcome. *Child Dev.* **67**, 2512–2526. (doi:10.2307/1131637)
- Murray, L., Sinclair, D., Cooper, P., Ducournau, P., Turner, P. & Stein, A. 1999a The socioemotional development of 5-year-old children of postnatally depressed mothers. *J. Child Psychol. Psychiatry* **40**, 1259–1271. (doi:10.1017/S002196309900476X)
- Murray, L., Woolgar, M., Briers, S. & Hipwell, A. 1999b Children's social representations in dolls' house play and theory of mind tasks, and their relation to family adversity and child disturbance. *Soc. Dev.* **8**, 179–200. (doi:10.1111/1467-9507.00090)
- Ochsner, K. N., Bunge, S. A., Gross, J. J. & Gabrieli, J. D. 2002 Rethinking feelings: an fMRI study of the cognitive regulation of emotion. *J. Cogn. Neurosci.* **14**, 1215–1229. (doi:10.1162/089892902760807212)
- Pardini, D. A., Lochman, J. E. & Powell, N. 2007 The development of callous-unemotional traits and antisocial behavior in children: are there shared and/or unique predictors? *J. Clin. Child Adolesc. Psychol.* **36**, 319–333.
- Phelps, E. A. & LeDoux, J. E. 2005 Contributions of the amygdala to emotion processing: from animal models to human behavior. *Neuron* **48**, 175–187. (doi:10.1016/j.neuron.2005.09.025)
- Searle, J. 1983 *Intentionality*. Cambridge, MA: Cambridge University Press.
- Speltz, M. L., DeKlyen, M. & Greenberg, M. T. 1999 Attachment in boys with early onset conduct problems. *Dev. Psychopathol.* **11**, 269–285. (doi:10.1017/S0954579499002059)
- Spitzer, R. L., Endicott, J. & Robins, E. 1978 Research diagnostic criteria: rationale and reliability. *Arch. Gen. Psychiatry* **35**, 773–782.
- Szyf, M., McGowan, P. & Meaney, M. J. 2007 The social environment and the epigenome. *Environ. Mol. Mutagen.* **49**, 46–60. (doi:10.1002/em.20357)
- Thompson, R. A. & Raikes, H. A. 2003 Toward the next quarter-century: conceptual and methodological challenges for attachment theory. *Dev. Psychopathol.* **15**, 691–718. (doi:10.1017/S0954579403000348)
- Viding, E., Blair, R. J., Moffitt, T. E. & Plomin, R. 2005 Evidence for substantial genetic risk for psychopathy in 7-year-olds. *J. Child Psychol. Psychiatry* **46**, 592–597. (doi:10.1111/j.1469-7610.2004.00393.x)
- Ward, H. E., Johnson, E. A., Goodman, I. J., Birkle, D. L., Cottrell, D. J. & Azzaro, A. J. 1998 Corticotropin-releasing factor and defensive withdrawal: inhibition of monoamine oxidase prevents habituation to chronic stress. *Pharmacol. Biochem. Behav.* **60**, 209–215. (doi:10.1016/S0091-3057(97)00580-7)
- Waters, E., Weinfield, N. S. & Hamilton, C. E. 2000 The stability of attachment security from infancy to adolescence and early adulthood: general discussion. *Child Dev.* **71**, 703–706. (doi:10.1111/1467-8624.00179)
- Wimmer, H. & Perner, J. 1983 Beliefs about beliefs: representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition* **13**, 103–128. (doi:10.1016/0010-0277(83)90004-5)