

# Articles

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## Security of Attachment as a Predictor of Symbolic and Mentalising Abilities: A Longitudinal Study

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### Abstract

*The development of symbolic and mentalising abilities was examined in 33 children whose security of attachment had been assessed in infancy. It was found that securely attached children: (i) were better able to incorporate an experimenter's play suggestions into their sequences of symbolic play at 31 months; and (ii) performed better on a version of Wimmer and Perner's (1983) unexpected transfer task at age 4. There was also evidence of superior mentalising abilities among the secure group at age 5, despite no group differences being found in general cognitive ability. We suggest that these security-related differences might be related to mothers' propensity to treat their securely attached children as individuals with minds. In support of this hypothesis, mothers in the secure group adopted more sensitive tutoring strategies, and were more likely to describe their children in terms of their mental characteristics. Possible developmental pathways linking security of attachment in infancy with subsequent development were investigated using path analyses.*

*Key words:* Attachment; symbolic play; maternal sensitivity; mentalising abilities

Since the publication of Wimmer and Perner's (1983) classic findings, there has been general agreement that, by the end of the preschool years, children understand that people's behaviour is governed by their beliefs about the world. Thus, when presented with Wimmer and Perner's 'unexpected transfer' task, 4-year-olds typically realise that a naïve protagonist will search for an object in the place where it was originally hidden, rather than in its current location. Similar developments have been described in children's understanding of 'informational access', or the

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awareness of how people's beliefs are determined by the information which is available to them (Perner, 1991). In attempting to explain these findings, some theorists have posited innately specified 'metarepresentational' capacities which ultimately allow the representation of others' representations of reality (e.g. Leslie, 1991). Alternatively, children's developing understanding of other minds has been seen as a process of gradual revision of the child's 'theories' about how mind determines behaviour. Thirdly, supporters of the various species of simulation theory (e.g. Harris, 1991) argue that mentalising abilities are largely dependent upon children's past experiences of other minds, such that children who have encountered a wide enough range of situational possibilities are able to use these experiences as a basis for predicting behaviour. A fourth view, mainly influenced by the work of Vygotsky (e.g. 1978), holds that individuals' engagement with other minds is the result of the internalisation of the perspectives of others in interpersonal contexts, and the foundation of 'dialogic' modes of thinking (Ferryhough, 1996).

Recently, the focus of research in this area has shifted away from pinpointing the precise age at which children can pass false belief tasks toward the question of whether *individual differences* in children's social experience impact upon the child's nascent mentalising abilities. For example, Dunn and colleagues (Dunn, Brown, Slomkowski, Tesla & Youngblade, 1991; Youngblade & Dunn, 1995) found that children who grew up in families where feelings were commonly discussed went on to perform better on mentalising tasks. The size of the child's available 'social resources' also appears to be important in this respect. Perner, Ruffman and Leekam (1994) reported that children with many siblings were relatively more successful on mentalising tasks than their peers from smaller families, an effect which Ruffman, Perner, Naito, Parkin and Clements (1996) showed to be specific to older siblings. A study of Greek and Cypriot children (Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki & Berridge, 1996) found that daily interaction with a large number of adult family members and with older children was related to superior performance on a battery of false belief tasks. One might expect the observed relations between familial interactions and mentalising abilities to stem in part from these children's greater experience of interpersonal conflict, which is likely to be resolved with reference to the mental states of the participants. For example, Dunn et al. (1991) found that children whose mothers frequently attempted to control the behaviour of older siblings were better able to explain a puppet's behaviour in terms of its false belief. To date, however, no studies have considered how the development of mentalising abilities might be influenced by individual differences in the quality of interpersonal relationships *in infancy*. One of the most important aspects of such early relationships is the nature of the relationship between the child and the primary caregiver, specifically, the *security* of this attachment (Ainsworth, Blehar, Waters & Wall, 1978).

Why might security of attachment be related to the development of mentalising abilities? First, security-based differences have already been found in the realm of symbolic play, which, in its requirement of an understanding of non-veridical mental orientations to reality, is generally agreed to be a precursor of mentalising abilities (e.g. Harris, 1992; Hobson, 1993; Leslie, 1987). During infancy, children rated as securely attached to their mothers have been reported to engage in more frequent and sophisticated bouts of solo pretence than their insecurely attached peers (Belsky, Garduque & Hrncir, 1984; Bretherton, Bates, Benigni, Camaioni & Volterra, 1979; Matas, Arend & Sroufe, 1978). Belsky et al. (1984) found that securely attached 12-

to 18-month-olds benefited comparatively little from an experimenter's instructions within a play context, since they were already performing close to their maximum level in the pre-instruction condition. By the third year of life, this early superiority in *solo* play develops into differences in the ability to interact with others in *collaborative* bouts of pretence. For example, Slade (1987) found that maternal involvement in toddlers' play served a facilitating function for securely attached children, but not for their insecurely attached peers. If securely attached children are better able to recognise and act upon the perspectives of others in a play scenario, it may be that these children will be better able to represent such perspectival differences at the level of belief. This suggestion is supported by Lillard (1993), who argued that symbolic play may offer a *zone of proximal development* (Vygotsky, 1978) for the abilities which underpin an understanding of other minds.

Security-based differences have also been observed in at least two further areas which may be relevant to the development of mentalising abilities: (a) in infancy, mothers of securely attached children are more sensitive to their children's needs (Ainsworth, Bell & Stayton, 1971) and consistent in their patterns of mothering (Isabella, 1993); and (b) mothers of securely attached children are more likely to invoke mental states in describing the behaviour of others (Fonagy, Steele, Steele, Higgitt & Target, 1994). Although Fonagy et al.'s (1994) findings were derived from mothers' responses to the Adult Attachment Interview (George, Kaplan & Main, 1985), it may be reasonable to assume that such differences in the use of mental state terms will carry over to mothers' interactions with their infants.

We suggest that all of these differences exist because mothers of securely attached children are more likely to treat their children as mental agents, or individuals with minds, from an early age. A similar point is made by Ainsworth et al. (1971), who suggest that the mother of a securely attached child is 'capable of perceiving things from [the child's] point of view' and respects the child 'as a separate person; she also respects his activity-in-progress and thus avoids interrupting him' (p. 43). Through her greater ability to 'tune in' to her child's current mental activity, the mother of the securely attached child is able to present alternative perspectives on reality (for example, by offering suggestions for a new act of pretence, or by talking about the mental states of family members) in such a way that they can be readily assimilated (Fernyhough, 1996). This in turn gives reason to suspect that securely attached children, through their increased opportunities for active engagement with their own and others' mental states, will develop a superior understanding of other people's mental orientations to the world, and the beliefs and desires which direct and motivate behaviour.

There is, to date, little empirical evidence for a link between security of attachment and children's understanding of other minds. Main (1991) reported some preliminary findings on the relationship between early security of attachment and children's subsequent metacognitive abilities. She found that 6-year-olds who had been securely attached in infancy were more likely to acknowledge that other people could not read their thoughts, and realised that a particular situation could give rise to different emotional responses in different people. Fonagy, Redfern and Charman (1997) reported a similar relationship between 3- to 6-year-olds' performance on the Separation Anxiety Test (Klagsbrun & Bowlby, 1976), and a task which required an understanding of the relation between belief and emotion. However, Fonagy et al.'s study only investigated the *concurrent* relationship between security of attachment and mentalising abilities, addressing neither the question of whether children's

security of attachment *in infancy* is related to their mentalising abilities in early childhood, nor which features of this relationship might be important. One aim of the studies reported here is to establish whether one such feature is a mother's proclivity to treat her child as a mental agent.

The studies reported below attempted to trace the longitudinal development of symbolic and mentalising abilities with respect to infantile security of attachment. The mothers and children who took part in these studies were recruited into a research project in infancy, at which time their security of attachment was assessed using the strange situation procedure (Ainsworth & Wittig, 1969). Four follow-up studies were performed: (a) an assessment of pretend play at 31 months (Study One); (b) an investigation at age 3 into mothers' tutoring sensitivity and tendency to describe their children in mentalistic terms (Study Two); (c) an assessment of children's performance on the unexpected transfer task at age 4 (Study Three); and (d) administration at age 5 of a task requiring an understanding of informational access, and one relating belief and emotion (Study Four). Study Two's assessments of mothers' tutoring sensitivity and tendency to describe their children's mental characteristics were taken as measures of maternal proclivity to treat the child as a mental agent. In order to control for the possible confounding effects of socio-economic status and general cognitive ability, measures of these variables were also taken.

Our main hypothesis was that mothers of securely attached children would show a greater tendency to treat their children as individuals with minds, which would in turn influence children's ability to engage with other people on a mental level. The following specific hypotheses were tested: (a) children classified as securely attached in infancy would show a greater ability to incorporate the verbal suggestions of an experimenter into their sequences of pretence (Study One); (b) secure group mothers' greater proclivity to treat their children as mental agents would be reflected in their sensitivity to their children's current level of functioning (as measured in a tutoring context), and their proclivity to describe their children in terms of their mental characteristics (Study Two); and (c) children receiving a secure attachment classification in infancy would perform better than their insecurely attached peers on tasks requiring an understanding of other minds (Studies Three and Four). It was predicted that support for the main hypothesis would be demonstrated by meaningful correlations between these variables.

### **Study One<sup>1</sup>**

The purpose of the first study was to examine whether children classified as securely attached in infancy would be better able to incorporate the verbal suggestions of another person into their pretend play. This hypothesis followed from the work of Belsky et al. (1984) and Slade (1987) on the relation between security of attachment and symbolic play.

#### *Method*

*Participants.* Participants were 33 children (13 girls and 20 boys) from the Cambridge area who had been assessed on the strange situation procedure as part of an earlier longitudinal study (Meins, 1992). Mothers and children were recruited via local general practitioners and health visitors, and 80% of mothers who were approached agreed to participate.

*Assessment of security of attachment.* Children were assessed on the strange situation procedure (Ainsworth & Wittig, 1969) at 11 or 13 months. Children's security of attachment was assessed at one of two ages since these infants were originally recruited onto a cross-sectional study on the relationship between security of attachment and early cognitive development. One group of participants ( $n = 16$ ) was tested at 11 months, and the other ( $n = 17$ ) at 13 months. Of the 33 participants, 19 (9 boys, 10 girls) were classified as securely attached (Type B) and the remaining 14 (11 boys, 3 girls) as insecurely attached (Types A, C and D). The breakdown of the insecure group was as follows: 6 children were insecure-avoidant (Type A); 4 children were insecure-resistant (Type C); and 4 children were insecure-disorganised (Type D).<sup>2</sup> All of the tapes were scored by the first author<sup>3</sup> and a random quarter was coded for a second time by an independent trained rater. Cohen's Kappa ( $\kappa$ ) for inter-rater agreement was 0.81, and the remaining disagreements were resolved by discussion.

*Assessment of socio-economic status (SES).* The measure of SES was based on maternal education, mother's present/previous occupation and father's occupation (Mueller & Parcel, 1981). That is, a family was considered to be 'status 1' if both parents had manual/unskilled jobs and the mother had left school at the minimum leaving age, or 'status 2' if both parents were in professional/managerial positions and the mother had either gone on to further education or had qualified to do so. No problematic combinations arose in the sample. Of the 33 participants, 13 (8 from the secure and 5 from the insecure group) were classified as status 1, and 20 (11 secure and 9 insecure) as status 2. A chi-square test showed no relationship between security of attachment and SES,  $\chi^2(1, N = 33) = 0.14$ , n.s., suggesting that these two factors are independent in this sample.

*Assessment at 31 months: symbolic play.* The mean age of the children at this testing phase was 31 months (range: 30 months to 33 months). Data on symbolic play were not available for one of the children (insecure, status 2), since there was a technical problem during the recording of this play session. The set of objects used in the symbolic play task consisted of two representational toys (a toy car and a female doll) and a selection of 'junk' objects, such as a toilet roll inner tube and a piece of aluminium foil (see Table 1).

The study was performed in the child's home, and involved two types of play session. The *introductory play session* started the moment the child made the first intentional contact with a toy or junk object and ended after approximately five minutes. The introductory session was immediately followed by the *structured play session*, which involved two types of structured play: *elicited* and *instructed*. In the elicited condition, the child was given either the car + an object or the doll + an object and was asked 'What can you do with these?'. When the child had performed some action with the objects in question, or if it became clear that no action would be performed, the experimenter asked the child to perform a specific act, such as using the aluminium foil as a mirror for the doll—this was the instructed condition (see Table 1).

The order of presentation of the toy-object pairs was randomised, and the sessions were video-taped. All of the sessions were scored by the first author, and 19 sessions were randomly selected and scored by a second coder, who was blind to the attachment classifications of the children. The inter-rater agreement for the level of sophistication of play (see below) was  $\kappa = 0.91$ .

**Table 1. Questions for Instructed Pretend Play**

Selection of toys	Instructed question
Car + cardboard box	Make the car go in the garage
Car + cardboard strip	Make the car drive along the road
Car + coffee jar lid	Make the car go round the roundabout
Car + inner tube	Make the car go through the tunnel
Car + 7 bricks	Make a car park for the car to park in
Doll + lunch box	Make the doll have a bath
Doll + bun case	Make the doll eat her dinner off the plate
Doll + aluminium foil	Make the doll look at herself in the mirror
Doll + blue napkin	Make the doll go for a swim in the pool

*Coding of symbolic play.* The child's play was scored for each car-junk object and each doll-junk object pair following criteria adapted from Lewis and Boucher (1988). Scores ranged from 0 to 4 for each toy-object pair (a sample of the scoring criteria are shown in Table 2). For example, the child received a score of 0 if he or she played with only one of the objects, such as pushing the car along the floor. To receive a score of 2 or 3, the child had to show a meaningful interaction between the toy and the junk object, but fall short of understanding the finer details of what was required. For example, when given the car and the toilet roll inner tube, the child may have held the tube at right angles to the floor and then dropped the car into the tube. To score a maximum 4, the child had to place the tube on its side on the floor, push the car into the tube, and then 'drive' the car out of the other end. The same scoring criteria were used for both the elicited and instructed play conditions. It was therefore possible for a child to receive a maximum score in the elicited condition, if he or she performed the criterial sequence of actions. In practice, children rarely received a maximum score on any of the toy-object pairings in the elicited condition.

Each child was given two scores: the first was the total from the elicited play condition; the second the total from the instructed play condition. For example, if a child had received a score of 1 for all nine of the toy-junk object pairs in the elicited condition (see Table 1), then his or her total elicited play score would be 9. If this child then received a score of 4 for all nine toy-object pairs in the instructed play condition, the total instructed play score would be 36. Thirty-six was the maximum total score that any child could receive. In order to control for the possibility of inflated improvement measures among children scoring very low on the elicited condition, the potential number of levels through which the child could advance from the elicited play level for each pair of objects was recorded and totalled. Thus, in the above example, the potential number of levels through which the child could advance in order to receive a maximum score would be 27 (i.e.  $3 \times 9$ ). Following Belsky et al. (1984), these measures were expressed as a single total for each child, using the formula:

$$\frac{\text{Total score instructed play} - \text{Total score elicited play}}{\text{Total number of levels remaining above elicited play levels}}$$

Belsky et al. (1984) used the term 'executive capacity' to describe this composite score, in that it provides a measure of 'the infant's capacity to execute, in a self-initiated manner, his or her most advanced level of functioning' (p. 407).

**Table 2. A Sample of the Scoring Criteria Used in the Symbolic Play Task**

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<i>Toy car</i>	
Inner tube 'tunnel'	0 pushes car along floor
	1 pushes car over the tube, or some other interaction between the two objects
	2 tube held upright on floor, car dropped in
	3 tube on floor on its side, car pushed along into it
	4 as 3, but 'drives' car out
<i>Toy doll</i>	
Lunch box 'bath'	0 plays with doll
	1 places box in correct orientation
	2 some interaction between doll and box
	3 places doll in box
	4 prepares doll for bath and places her in box, or 'splashing/ washing' doll when in box

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### Results

Table 3 shows the mean scores for elicited and instructed play and executive capacity for the two attachment and two SES groups. A 2 (security of attachment)  $\times$  2 (SES) analysis of variance was performed on the executive capacity scores. This resulted in a main effect of security of attachment,  $F(1, 28) = 17.61$ ,  $MS_{treatment} = 0.86$ ,  $p < .001$ , with no effect of SES,  $F(1, 28) = 0.01$ , n.s., and no interaction between SES and security of attachment.

Actual levels of play under the two conditions were then analysed. A 2 (security of attachment)  $\times$  2 (SES)  $\times$  2 (type of play) mixed analysis of variance resulted in main effects of security of attachment,  $F(1, 28) = 5.06$ ,  $MS_{treatment} = 247.6$ ,  $p < .05$ , and type of play,  $F(1, 28) = 60.74$ ,  $MS_{treatment} = 1376.5$ ,  $p < .001$ , with a significant interaction between these two factors,  $F(1, 28) = 11.29$ ,  $MS_{treatment} = 255.9$ ,  $p < .005$ . There was no main effect of SES,  $F(1, 28) = 0.40$ , n.s., and no other interactions. *Post hoc* comparisons using the Bonferroni adjustment of  $\alpha$  showed a difference between the secure and insecure groups on instructed play,  $t(30) = 3.44$ ,  $p < .005$ , but no difference on elicited play,  $t(30) = 0.26$ , n.s.

The results showed that securely attached children attained higher executive capacity scores than their insecurely attached peers, and seemed to be more able or willing to respond to the pretence suggestions of the experimenter. These differences between the secure and insecure groups were not due to differences in SES, nor any difference in the two groups' sophistication of solo (elicited) play.

**Table 3. Mean Play Scores as a Function of Security of Attachment and SES**

	Attachment classification		SES	
	Secure (n = 19)	Insecure (n = 13)	Status 1 (n = 13)	Status 2 (n = 19)
Elicited Play				
<i>M</i>	7.53	7.08	6.15	8.16
<i>SD</i>	4.64	4.87	3.76	5.12
Instructed Play				
<i>M</i>	21.26	12.54	17.08	18.16
<i>SD</i>	6.81	7.41	5.31	9.81
Executive Capacity				
<i>M</i>	0.55	0.16	0.39	0.40
<i>SD</i>	0.25	0.23	0.28	0.33

*Note.* Maximum play score = 36 (i.e. 9 toy-object pairs  $\times$  4 play levels).

### Study Two<sup>4</sup>

The purpose of Study Two was to investigate whether there were any differences between the two attachment groups in maternal behaviour on a tutoring task. Mothers who met the criteria for sensitive tutoring were, by definition, better able to pitch their interventions at the child's 'zone of proximal development' (Vygotsky, 1978), which was assumed to require an attunement to the child's ongoing difficulties and areas of competence. Our hypothesis was that secure group mothers would be more sensitive tutors, and that this greater sensitivity would be due in part to their proclivity to treat their children as mental agents. This proclivity was also assessed in a brief maternal interview, where mothers were simply asked to describe their children. It was hypothesised that secure group mothers would be more likely to describe their children in terms of their mental characteristics, rather than behavioural or physical attributes.

#### *Method*

*Participants.* Participants were 30 of the original sample who took part in Study One: 17 (8 girls, 9 boys) were securely attached and 13 (2 girls, 11 boys) were insecurely attached. With respect to SES, 12 (7 secure and 5 insecure) were status 1 and 18 (10 secure and 8 insecure) were status 2. The mean age of the children was 37 months (range: 35 months to 38 months). Both of the assessments at age 3 were conducted in a single laboratory session.

*Maternal tutoring sensitivity (box construction task).* The aim of the box construction task was to obtain a measure of the mother's sensitivity to her child's needs within the context of a tutoring task. The task was to build a box identical to a model which had already been assembled, using eight *Polydron* squares which snapped



together. Each mother was told that the task would be too difficult for the child to accomplish alone, and that she could give as much or as little help as she liked. Participants were allowed to work on the box construction for as long as they wished, and the session only ended if they gave up or if the box was completed. All of the sessions were video-taped for later coding.

Each intervention made by the mother during the task was assigned a level of specificity, according to the following criteria: *Level 1*: orienting suggestions, focusing strategies, general rules and comments, e.g. 'Let's start with the bottom'; *Level 2*: suggestions about specific pieces, locations or actions, but not combinations of the three, e.g. 'Find a red one like this'; *Level 3*: solutions—suggestions indicating which piece should be used and where to put it, e.g. 'That piece fits in here'; *Level 4*: physical help—the mother physically aids the child in completing a section, e.g. holding one square in place whilst the child attaches another; *Level 5*: demonstration—the mother performs an operation by herself. Certain aspects of this scoring procedure were adapted from Bee, van Egeren, Pytkowicz Streissguth, Nyman and Leckie (1969) and Wood and Middleton (1975).

A mother's *sensitivity to feedback* was defined in terms of her ability to change the level of specificity of her instruction in response to the child's ability to follow the preceding instruction successfully, whilst obeying the rules below. In order for use of feedback to be successful:

1. if the child succeeds at a given level of specificity, the next instruction should be *at the same level or at a lower level* of specificity.
2. (a) if the child fails at a given level of specificity, the next instruction should be given *at a higher level* of specificity.
  - (b) if the child fails at a given level of specificity, the next instruction should be *no more than two levels* above the previous level of specificity.

Parts 1 and 2(a) are equivalent to Wood, Wood and Middleton's (1978) 'contingency rule'. In Part 2(b), we limited the permitted jump in specificity to two levels above that of the previous intervention. Maternal sensitivity scores were calculated according to how well the mother was able to follow this rule (see below). All of the tapes were coded by the first author, and a random quarter of the sessions was scored by a second rater who was blind to the attachment classifications. Inter-rater agreement for the level of specificity of instruction was  $\kappa = 0.96$ .

*Maternal interview.* The aim of the maternal interview was to assess mothers' inclination to use mental characteristics in describing their children. After the tutoring task had been completed, video recording was stopped and each mother was given a short interview. The mother was simply asked: 'Can you describe [child] for me?'. Mothers were given no guidance on how to respond, and if they asked for clarification on what kind of answer was required, they were told that there were no right or wrong answers, and that they could talk about any of their children's characteristics. These interviews were audio-taped, and mothers' answers transcribed verbatim. Criteria were then established to assess the extent to which mothers described their children in terms of mental, behavioural and physical characteristics. Each time the mother mentioned an attribute of her child, it was entered into one of the following categories:

1. *Mental*: Any reference to the child's mental life, relating to will, mind, imagination, interest, intellect, metacognition, e.g. 'caring'; 'he shows respect for other

- people'; 'she's got a mind of her own'. Any comments relating to desires, wishes and emotions (but not merely in terms of describing the child's likes and dislikes or behavioural tendencies) were also included, e.g. 'she'd like a baby brother or sister' would be classed as a mental characteristic, but 'he loves playing games' would not.
2. *Behavioural*: Any reference to behaviour, such as games, activities that the child liked to do and interactions with others on a behavioural level, e.g. 'she likes counting'; 'he prefers playing with other children than by himself'. The following characteristics were also deemed to be behavioural, in that a purely non-mentalistic interpretation was possible in each case: *lively, talkative, boisterous, aggressive, passive, friendly, restrained, out-going, naughty*.
  3. *Physical*: Any physical attributes, the child's age and descriptions relating to the child's position in the family, e.g. 'blond'; 'three feet tall'; 'he's my second son'; 'she's three years old'.
  4. *General*: Any general comments relating to the child which did not fit into the above three categories, e.g. 'he's a lovely little boy'; 'he's a child of extremes'.

These categories were both exhaustive and exclusive. The total number of attributes used by each mother to describe her child was computed. Mothers then received a score for their use of mental characteristics, expressed as the number of mental characteristics divided by the total number of attributes used to describe the child. This proportional score was intended to control for differences in verbosity between mothers. All of the interviews were coded by the first and second authors. In order to minimise bias due to the first coder's knowledge of children's attachment classifications, interviews were transcribed and coded anonymously, and were only subsequently integrated with attachment data. The second coder remained blind to the children's attachment classifications throughout. Inter-rater agreement for the assignment of a comment to one of the four categories was  $\kappa = 0.91$ .

## Results

*Maternal tutoring sensitivity.* The total number of interventions (physical and verbal) on the tutoring task was calculated for each mother. Scores for maternal sensitivity to feedback were obtained by dividing a mother's successful use of feedback (according to the rules outlined above) by her total number of interventions. The mean sensitivity scores for the security of attachment and SES groups were as follows: secure group  $M = 0.66$ ,  $SD = 0.23$ ; insecure group  $M = 0.45$ ,  $SD = 0.16$ ; status 1 group  $M = 0.59$ ,  $SD = 0.25$ ; status 2 group  $M = 0.56$ ,  $SD = 0.21$ . A 2 (security of attachment)  $\times$  2 (SES) analysis of variance showed a main effect of security of attachment,  $F(1,26) = 8.37$ ,  $MS_{treatment} = 0.36$ ,  $p < .01$ , with no effect of SES,  $F(1,26) = 0.07$ , n.s., and no interaction.

Mothers in the secure group were thus more likely to use feedback from their children's performance in order to gauge the level of specificity of their succeeding interventions. This difference between the mothers in the secure and insecure groups could not be explained in terms of SES.

*Maternal interview.* Table 4 shows the mean scores for the total number of attributes and for the proportion of mental attributes from the two attachment and two SES groups. For the mean total number of attributes, a 2 (security of attachment)  $\times$  2 (SES) analysis of variance showed a main effect of SES,  $F(1, 26) = 6.20$ ,  $MS_{treatment}$

= 69.5,  $p < .025$ , with more attributes given by status 2 mothers, but no effect of security of attachment,  $F(1, 26) = 1.13$ , n.s., and no interaction. For the mean proportional scores for mental attributes, a 2 (security of attachment)  $\times$  2 (SES) analysis of variance showed a main effect of security of attachment,  $F(1, 26) = 6.19$ ,  $MS_{treatment} = 0.40$ ,  $p < .025$ , with no effect of SES,  $F(1, 26) = 0.02$ , n.s., and no interaction.

**Table 4. Mean Proportions of Mentalistic Attributes on the Maternal Interview as a Function of Security of Attachment and SES**

	Attachment classification		SES	
	Secure (n = 17)	Insecure (n = 13)	Status 1 (n = 12)	Status 2 (n = 18)
Total number of attributes				
<i>M</i>	6.53	7.77	5.08	8.39
<i>SD</i>	3.71	3.59	2.54	3.73
Proportion of mental attributes				
<i>M</i>	0.48	0.24	0.39	0.37
<i>SD</i>	0.28	0.18	0.27	0.28

Mothers of securely attached children were thus more likely than their counterparts in the insecure group to focus on mental characteristics when asked to give a description of their children. This difference appeared to be independent of SES, and could not be explained in terms of the secure group mothers being more verbose than those in the insecure group.

### Study Three

The purpose of Study Three was to investigate whether securely attached children would show an advantage over their insecurely attached peers in their understanding of the mental states of a story protagonist, as assessed on a version of Wimmer and Perner's (1983) unexpected transfer task. In this task, the participant hears a story about a character who hides a desirable object in one location and then leaves the scene. In the protagonist's absence, the object is moved from its original location to a second location. The child is first asked control questions to ensure that he or she remembers the details of the story, and is aware that the protagonist has not witnessed the transfer. Participants are then asked to predict where the protagonist will look for the hidden object. This task is taken to be a test of mentalising abilities because it requires the child to represent the mental states of another person in order to predict that person's subsequent behaviour.

#### Method

*Participants.* Twenty-five<sup>5</sup> of the children who had participated in Studies One and Two were available for testing at age 4. Fifteen (9 girls, 6 boys) of these children

were securely attached and 10 (2 girls, 8 boys) were insecurely attached. Eight (6 secure, 2 insecure) of these children were status 1 and 17 (9 secure, 8 insecure) were status 2. Children's mean age was 49 months (range 48 to 50 months).

*Unexpected transfer task.* Participants were introduced to a soft toy called Charlie the Crocodile and told that Charlie's favourite food was chocolate. The child witnessed a chocolate being placed in one of two small cardboard boxes, one red and the other white. The child was then told that Charlie was hiding his chocolate to keep it safe while he went for a swim. Charlie was then removed from the table, and it was announced that the experimenter and the child were going to play a trick on Charlie. The child watched while the experimenter took the chocolate out of the box in which it had been hidden and placed it in the other box, closing both lids. Participants were told that Charlie was about to return from his swim, and that he would be wanting his chocolate. The following control questions were then asked: 'Where was the chocolate in the beginning?' (memory control); 'Where is the chocolate now?' (reality control); and 'Does Charlie know where the chocolate is?' (knowledge control). If any of these questions was answered incorrectly, the story was briefly repeated and the three questions asked again, but the child was not explicitly corrected. Children who failed to answer correctly the second time were excluded from the analysis. When correct answers had been given on each of these three questions, the test question was asked: 'Where does Charlie think the chocolate is?'<sup>6</sup>

The children were divided into two groups, according to whether they passed or failed the test question. In order to be assigned to the 'pass' group, children had to indicate the box which, *in reality*, did not contain the chocolate.

## Results

Four children (3 secure and 1 insecure) failed to answer the 'knowledge' control question correctly on the second asking, and were therefore excluded from the analysis. Of the remaining participants, 10 out of 12 securely attached children (83%) answered the test question correctly, compared with 3 out of 9 insecurely attached children (33%). A Fisher exact probability test showed the effect of security of attachment to be significant at the 0.025 level.<sup>7</sup> Three of the 6 status 1 children (50%) answered the test question correctly, compared with 10 of the 15 status 2 children (66%), which represented a non-significant difference between the two SES groups.

Further analyses were performed to establish whether any of the measures obtained in Studies One and Two were related to performance on the unexpected transfer task. Mean executive capacity scores (Study One) for the pass and fail groups are shown in Table 5. A t-test showed the difference between the executive capacity scores of these two groups to be significant,  $t(18) = 2.79$ ,  $p < .01$ , one-tailed. Children who passed the unexpected transfer task at age 4 had been better able to incorporate the experimenter's suggestions during the symbolic play task at 31 months.

Table 5 also shows the mean scores for the measures taken from the maternal tutoring task and maternal interview in Study Two. T-tests showed a difference between the pass and fail groups on the maternal sensitivity scores,  $t(18) = 1.95$ ,  $p < .05$ , one-tailed, and on the mothers' proportional mental attribute scores,  $t(18) = 1.70$ ,  $p < .05$ , one-tailed. Children who passed the unexpected transfer task at age 4

**Table 5. Mean Executive Capacity, Maternal Sensitivity and Maternal Mental Attribute Scores Related to Performance on the Unexpected Transfer Task**

	Performance on unexpected transfer task	
	Pass	Fail
Executive capacity		
<i>M</i>	0.53	0.23
<i>SD</i>	0.22	0.26
Maternal sensitivity		
<i>M</i>	0.70	0.51
<i>SD</i>	0.23	0.20
Proportion of mental attributes		
<i>M</i>	0.46	0.25
<i>SD</i>	0.29	0.24

were more likely to have mothers who, at age 3, had been more sensitive tutors and tended to describe their children in terms of their mental characteristics.

#### Study Four

The purpose of Study Four was to follow up the mentalising assessments made in the previous study, by administering more complex mentalising tasks at age 5. The first of these tasks, the 'picture identification' task, was designed to assess children's understanding that one's knowledge about a state of affairs is constrained by the information available. The second task, the 'false belief and emotion' task, required participants to integrate information about a story protagonist's beliefs with information about the same protagonist's preferences, in order to predict the character's emotional response. Both tasks had previously been shown to be appropriate to children of this age. Study Four also presented an opportunity to assess participants' general cognitive ability, as measured by a test of receptive verbal intelligence.

#### Method

*Participants.* All 33 children who had taken part in Study One were available for the follow-up studies at age 5. Children's mean age was 61.5 months (range 60 to 63 months).

Participants were tested in two sessions a week apart. In the first session, the British Picture Vocabulary Scale (Dunn, Dunn, Whetton & Pintilie, 1982) was administered, followed by the picture identification task (Taylor, Cartwright & Bowden, 1991), described below. In the second session, the false belief and emotion task (Harris, Johnson, Hutton, Andrews & Cooke, 1989) was administered (see below).

*Picture Identification Task.* The purpose of this task was to assess children's understanding of how an individual's knowledge is constrained by informational access. Participants were first introduced to a soft toy called Freddy the Frog and the box in which he lived. Freddy was placed in his box, and participants were told that they were going to see some pictures. Each of six pictures had been glued to the inside of an opaque folder, with a 2.5 inch square 'window' cut from its front cover, allowing one of three kinds of view. For two of the pictures, the visible part was sufficient to allow the child to identify the picture (for example, if the picture was of a dog, the dog's head was visible in the window). In the second pair of pictures, the visible part of the picture was insufficient to allow identification ('nondescript' view). In the final pair of pictures, the window was cut so that no part of the picture was visible.

The order of presentation of the pictures was randomised. The closed folder was shown to the child, who was asked what he or she thought was in the picture. The experimenter then opened the folder to show what was actually in the picture, and closed the folder again. Freddy the Frog was then taken out of his box and placed in front of the closed folder. The child was asked: 'Does Freddy know what's in the picture?'

The number of 'no' responses to the nondescript views was taken as a measure of the child's understanding of the relation between informational access and knowledge of picture content. Children who demonstrated a general negative or positive response bias (i.e. answering all questions with 'yes' or 'no') were excluded from the analysis.

*False belief and emotion task.* The final task assessed young children's ability to understand not only a character's current belief, but also to integrate this information with previous knowledge about the character's preferences and desires in order to predict an emotional response. Children were introduced to four named toy animals, and told that another character, Charlie the Crocodile, was going to play a trick on each of the animals in turn. For each animal, participants heard a story about one of the animal's favourite food. For example, participants were told, 'Penny the Penguin wants a drink, but she only likes one kind of drink, and that's milk (pointing to a carton of milk). She doesn't like Coke (pointing to a can of Coke); she only likes milk'. Penny the Penguin was then removed from the table, and Charlie the Crocodile was seen to pour the milk from its carton and replace it with the Coke. All of the containers used in the experiment were opaque. The child was then asked: 'What is Penny's favourite drink?' (memory control); and 'What is actually in the carton now?' (reality control). If either of these questions was answered incorrectly, the scenario was briefly redescribed. Penny was then returned to the table, and the following questions asked: Question 1: 'How does Penny feel when she is first given the carton? Does she feel happy or does she feel sad?' Question 2: 'How does Penny feel when she looks inside the carton and finds there is Coke instead of milk inside? Does she feel happy or does she feel sad?'

The measure of performance was the number of correct answers to Question 1 (maximum score = 4). Any children who showed a general bias towards positive or negative answers were excluded from the analysis. In addition, children were asked to justify their answers to Questions 1 and 2. If these justifications suggested that the child had forgotten the animal's preference or the nature of the trick, the salient information was repeated and the questions reiterated. Within each testing session, two of the animals were given an unpleasant surprise (as in Penny's case), while the

other two were given a pleasant surprise (the container of non-favourite food was found to contain a favourite food). Presentation of the stories was fully randomised and counterbalanced.

## Results

*General cognitive ability.* Security-based and SES-based differences on the BPVS were investigated. The mean standardised scores were as follows: secure group  $M = 113.3$ ,  $SD = 12.5$ ; insecure group  $M = 110.9$ ,  $SD = 15.5$ ; status 1 group  $M = 105.2$ ,  $SD = 12.9$ ; status 2 group  $M = 116.9$ ,  $SD = 12.4$ . A t-test showed no effect of security of attachment on BPVS scores,  $t(31) = 0.48$ , n.s. The difference between the two SES groups was significant,  $t(31) = 2.60$ ,  $p < .01$ , one-tailed, with children from status 2 families attaining higher scores. Table 6 shows the correlations between the BPVS scores and the other measures taken in the four studies reported here.

*Picture identification task.* Five children (3 secure and 2 insecure) were excluded from the analyses because of a negative response bias, and 3 children (1 secure and 2 insecure) were excluded due to a positive response bias. Two further securely attached children gave a single incorrect answer to the control question, and were excluded. Of the remainder, 11 out of 13 securely attached children (85%) received a maximum score of two correct answers for the nondescript views, compared with 5 out of 10 insecurely attached children (50%). This difference was significant,  $\chi^2(1, N = 23) = 3.20$ ,  $p < .05$ , one-tailed. The mean correct scores for the two attachment groups on the two nondescript pictures were as follows: secure group  $M = 1.77$ ,  $SD = 0.60$ , insecure group  $M = 1.10$ ,  $SD = 0.99$ . Given the non-continuous nature of the dependent variable, non-parametric tests were used in analysing these data. A Mann-Whitney U-test showed the difference between the two groups to be approaching significance,  $U(10, 13) = 41$ ,  $p = .07$ , one-tailed. No differences were found between the two SES groups on mean correct answers or number of children receiving a maximum score.

*False belief and emotion task.* Two children from the secure group were excluded from the analysis because of a negative response bias which led to incorrect answers to Question 2. Two children in the insecure group answered Question 2 incorrectly on one of the four stories. Rather than excluding them from the analysis, the proportion of correct Question 1 answers for the remaining three stories was calculated and then multiplied by four (maximum score = 4). The mean number of correct answers given by the two groups were as follows: secure group  $M = 2.25$ ,  $SD = 1.44$ ; insecure group  $M = 1.62$ ,  $SD = 1.33$ . Again, given the nature of the dependent variable, non-parametric tests were used in analysing these data. A Mann-Whitney U-test showed the difference between the two groups to be non-significant,  $U(14, 16) = 86$ , n.s.

The mean number of correct answers of the two SES groups were also compared: status 1 group  $M = 1.11$ ,  $SD = 0.80$ ; status 2 group  $M = 2.52$ ,  $SD = 1.45$ . This represented a significant difference,  $U(12, 18) = 43.5$ ,  $p < .01$ , two-tailed. In order to identify the best predictor of children's performance on the false belief and emotion task, a multiple forward regression analysis was performed, incorporating six factors: security of attachment, SES, executive capacity, proportion of mental attributes, performance on the unexpected transfer task, and BPVS score. This analysis showed that, when these other variables were entered into the equation, SES did not

remain a significant predictor of children's performance on the false belief and emotion task. The best predictor of performance on this task was performance on the unexpected transfer task at age 4 ( $T = 2.16$ ,  $p < .05$ ).

**Table 6. Correlations between Measures from Studies One, Two, Three and Four**

	Security	Excap	MS	Pment	UT	FBE	BPVS
Security	1.00						
Excap	0.63††	1.00					
MS	0.55†	0.46**	1.00				
Pment	0.42**	0.54†	0.30	1.00			
UT	0.51**	0.55**	0.42*	0.37	1.00		
FBE	0.23	0.16	0.29	0.48**	0.41*	1.00	
BPVS	0.09	0.43*	0.09	0.09	0.47*	0.20	1.00

*Note.* Security = security of attachment, Excap = executive capacity, MS = maternal sensitivity, Pment = proportion of mental attributes, UT = unexpected transfer task, FBE = false belief and emotion task, BPVS = British Picture Vocabulary Scale.

\* $p < .05$ ; \*\* $p < .025$ ; † $p < .005$ , †† $p < .001$ . Significance levels are for one-tailed tests, *except* those involving the BPVS scores (two-tailed).

### Path Analysis

Table 6 shows the correlations between the measures taken in the four studies reported above. Children's performance on the picture identification task was found to be correlated with only one of the measures taken on the other tasks reported here: the proportion of mental attributes on the maternal interview (see Study Two), where  $r(21) = 0.40$ ,  $p < .025$ , one-tailed. For the purposes of simplicity of analysis, scores on the picture identification task were not entered into the further analyses described below.

In light of the observed relationships between these measures, path analyses were used to determine more precisely the nature of the relationship between infantile attachment security and later symbolic and mentalising abilities. Using the data from Studies One to Four, Pearson product moment correlations were calculated using pairwise deletion of missing values (see Table 6). A path analysis was conducted on the data using LISREL 7.17 (Jöreskog & Sörbom, 1989). The data were entered as a covariance matrix with pairwise deletion of missing values. Two models were tested, as described below.

#### Model 1

Our prediction of a relationship between security of attachment and later symbolic and mentalising abilities stemmed from previous suggestions that mothers of securely attached children are: (a) more sensitive to their children's needs and current levels of functioning (measured here as maternal sensitivity on a tutoring task); and (b) more likely to treat their children as individuals with minds (measured here in terms of mothers' proclivity to use mental attributes to describe their children).



Model 1 (see Figure 1) shows a possible pathway between these variables, illustrating how they might in turn be related to children's ability to incorporate the suggestions of another into their symbolic play. Our assumption, which needs to be tested by future research, is that mothers' tendency to treat their children as mental agents is relatively stable over the preschool years, allowing us to extrapolate back into infancy from the 'mental attributes' measure taken at age 3. This model also illustrates a possible direct link between the security of the attachment relationship and children's later mentalising abilities. This model fitted the data using the maximum likelihood criteria,  $\chi^2(10) = 16.45$ ,  $p = 0.09$ . The goodness of fit index was 0.908 and the stability index was 1.326.

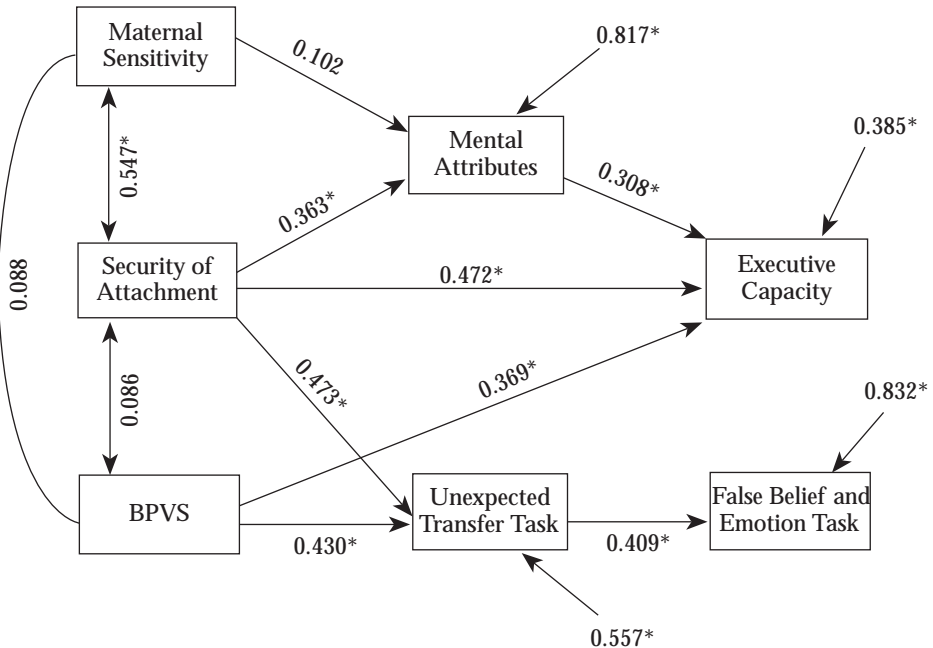


Figure 1. Model 1: Developmental pathways from infantile security of attachment to symbolic and mentalising abilities in early childhood

### Model 2

One implication of Model 1 was that the role of caregivers in the development of mentalising abilities is primarily mediated by the security of the attachment relationship, rather than by any direct influence on children's developing understanding of other minds. However, it is also plausible that there might be a more direct effect of caregivers' proclivity to treat their infants as individuals with minds. Accordingly, two extra paths were added to Model 1: from maternal mental attributes to both the unexpected transfer task and to the false belief and emotion task (see Figure 2). The values which have been altered between the two models are shown in bold print.

The new model showed an improved fit to the data, using the maximum likelihood criteria,  $\chi^2(8) = 8.6$ ,  $p = .38$ . The model had a goodness of fit index of 0.946 and a stability index of 5.13. This model provided a significant improvement on the earlier model,  $\chi^2(2) = 7.85$ ,  $p < .02$ .

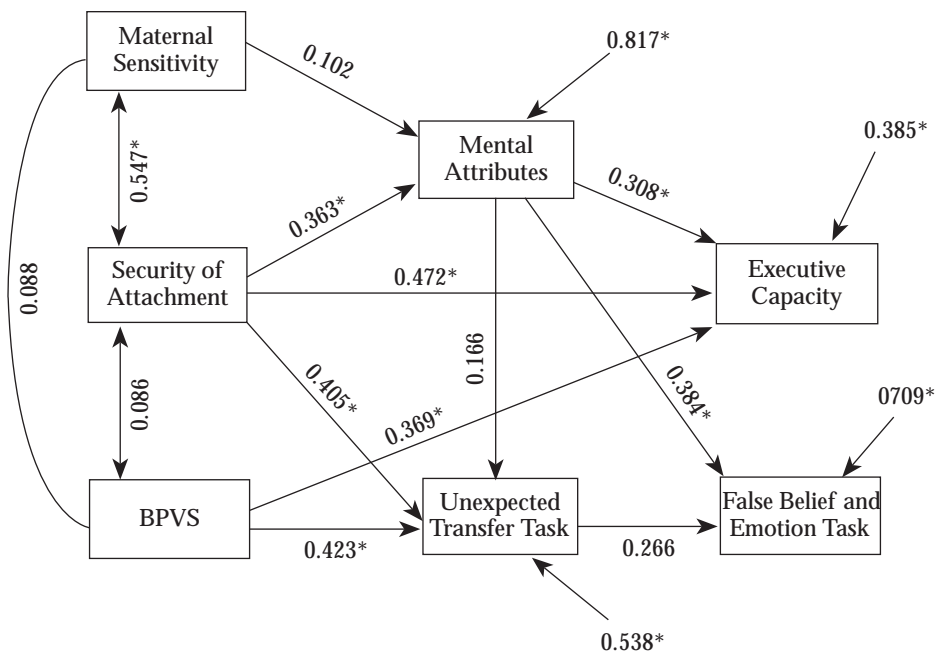


Figure 2. Model 2: Developmental pathways from infantile security of attachment to symbolic and mentalising abilities in early childhood

These exploratory analyses provide some support for the suggestion that mothers' willingness to treat their children as mental agents (as determined from their descriptions of their children at age 3) directly influences the later development of mentalising abilities. In turn, this willingness is strongly related to the security of the attachment relationship. This tentative conclusion should be considered in light of the need for further research, particularly concerning whether this differential willingness on the part of mothers can be detected in infancy. An obvious problem in interpreting these analyses is the low statistical power resulting from the size of the sample. One might expect that even if the data did deviate significantly from the model, such a deviation would not show up due to the small sample size. That said, the highly significant correlations shown in Table 6, coupled with the significant improvement observed in Model 2, suggest that power was sufficient if not optimal.

## General Discussion

The studies reported above showed that: (a) children who received a secure attachment classification in infancy were better able to incorporate the pretence suggestions of an experimenter into their play sequences at 31 months, despite no group differences in the level of sophistication of play *before* the experimenter intervened; (b) mothers of securely attached children adopted more sensitive tutoring strategies on a collaborative task at age 3; (c) mothers of securely attached children were more likely to describe their children in terms of their mental characteristics, rather than their physical or behavioural qualities; (d) children who were securely attached in infancy were more likely to pass a version of the unexpected transfer task at age 4; and (e) when assessed at age 5, securely attached children were more likely than their

insecurely attached counterparts to give the maximum number of correct answers on a task requiring an understanding of informational access, while group differences on a task relating belief and emotion were non-significant. These security-based differences could not be explained in terms of general cognitive ability or SES. Although a difference between the SES groups was found on the false belief and emotion task (Study Four), a multiple regression analysis showed that, when the other main independent variables were entered into the equation, SES did not remain a significant predictor of children's performance.

Lastly, the path analyses shed some light on the developmental pathways which may link security of attachment and later symbolic and mentalising abilities. Security of attachment accounted for a significant amount of the variance in the proportion of mental attributes in mothers' descriptions of their children, and both of these variables were strong predictors of executive capacity scores on the symbolic play task. In addition, children's initial security of attachment was a strong predictor of performance of the unexpected transfer task at age 4, which, together with mothers' proclivity to describe their children in mentalistic terms, in turn predicted performance on the more advanced mentalising task at age 5.

Before considering the significance of these findings, it should be pointed out that the results of the tasks administered at ages 4 and 5 are in line with those of previous researchers, in terms of the proportion of children passing at each age (Harris et al., 1989; Taylor et al., 1991; Wimmer & Perner, 1983). The failure to find a relation between security of attachment in infancy and general cognitive ability is also consistent with the findings of other studies (see van IJzendoorn, Dijkstra & Bus, 1995). The results of our longitudinal study suggest that the security of the attachment relationship in infancy, and those mother-centred variables which characterise a secure attachment relationship in early childhood, have an important influence on children's later ability to engage with another person on a mental level. This engagement may either be with an experimenter's suggestions for symbolic play (Study One), maternal instructions on how to build a box (Study Two), or with the beliefs, emotions and desires of a range of story characters (Studies Three and Four). Our findings suggest that, from midway through the third year of life, securely attached children are better able to recognise and act upon the alternative perspectives of another person.

What implications do our findings have for the four theoretical approaches outlined in the Introduction? First, they would appear to present something of a challenge to the 'modularist' account of mentalising development. Indeed, *any* finding of meaningful relationships between early social variables and later mentalising abilities would appear to present problems for an account which views such abilities as stemming from a primarily biological endowment (Baron-Cohen, 1995; Leslie, 1991). An obvious line of argument for the modularist would be to say that we are mistaken in our description of the direction of causation, and that some infants' biological endowment simply matures earlier, resulting in a greater early responsivity which is picked up by the caregiver and leads to the development of a secure attachment relationship. However, such an interpretation seems unlikely for at least two reasons. First, mothers would have to be sensitive to early precursors of mentalising abilities well before such abilities are thought, on the modularist account, to mature. Secondly, such an interpretation would be at odds with findings that infants may be differently attached to different caregivers within the same family (e.g. Belsky & Rovine, 1987; Lamb, Hwang, Frodi & Frodi, 1982; Main & Weston, 1982).

The other three main theoretical alternatives are better placed to explain the apparent social influences on the development of mentalising abilities. There are a number of ways in which sensitive caregivers and older family members might 'scaffold' (Wood, Bruner & Ross, 1976) children's developing understanding of other minds. For example, an adherent to the theory-theory might argue that mothers' use of mental state terms when interacting with their children might scaffold the acquisition of the corresponding concepts, which go on to play a role in a fully-fledged theory of mind. A similar, and not necessarily exclusive, view might be taken of children's entry into the folk psychology of the culture, with such a development being seen as a process of 'apprenticeship' in which active participation by the child is encouraged by the more senior members of the culture (Astington, 1996; Lewis et al., 1996). An enthusiast for the simulation account might argue that exposure to the mental states of others, such as would result from a secure attachment relationship, might accelerate the acquisition of a sufficiently extensive database from which to simulate the mental states of others. Finally, the sort of sensitive reciprocal interaction which characterises the secure attachment relationship might be causal in allowing children to internalise mediated interpersonal exchanges and, through the development of dialogic modes of thinking, actively reconstruct social situations on a dialogic level (Fernyhough, 1996).

Which specific features of the secure attachment relationship might be important in accounting for the differences reported in this study? The most obvious explanation can be framed in terms of the different types of interaction which characterise secure and insecure attachments. As noted in the Introduction, mothers of securely attached infants are more sensitive (Ainsworth et al., 1971) and consistent in their patterns of caring (Isabella, 1993), qualities which may enable secure dyads to establish more effective and satisfying collaborative interactions which persist into childhood. Moreover, we hypothesised that one cause of these security-related differences is that mothers of securely attached children are more likely to treat their children as individuals with minds, showing sensitivity to their current levels of understanding, using mental state terms in their interaction with them, and so on. This propensity has been labelled 'mind-mindedness' (Meins, 1997b). However, since our data on mothers' mind-mindedness were not collected until the children were three years of age, we do not yet know whether this tendency was present in infancy. We should also be cautious in proposing any causal direction between these measures: a mother's mind-mindedness may be involved in the establishment of a secure attachment relationship; conversely, the type of interactions which result from having a securely attached child may cause a mother to focus more on her child's mental life. That said, the current evidence concerning the precursors of a secure attachment relationship (e.g. Ainsworth et al., 1971; Isabella, 1993) suggests that certain early patterns of interaction may be causal. Moreover, we would suggest that such patterns may themselves be dependent upon mothers representing their children at a mental level, and thus interpreting their actions with reference to their attendant beliefs, desires and intentions. Clearly, further research into the relationship between maternal representations of children in infancy and subsequent development is needed before this interesting question can be answered.

Perhaps we can be less tentative about the direction of causation between mothers' propensity to describe their children's mental attributes and children's subsequent performance on tasks measuring mentalising ability. Given the longitudinal nature of our study, we know that this proclivity on the part of the mother was pre-

sent at least a year before children were assessed on mentalising tasks. Assuming that maternal mind-mindedness is more or less stable over the first few years of life, it seems that focusing on one's child's mental characteristics over this period may make an important contribution to the child's developing understanding of other minds. This is not to say that early manifested differences in infant responsivity will have no effect on the quality of the developing attachment relationship; indeed, much more research is needed to determine the importance of such differences. Further, as Main (1991) suggests, a secure attachment relationship may confer other relevant benefits, such as allowing children more 'mental space' to explore the mental lives of others. In addition, it may be that mothers of securely attached children are more sensitive and attuned to their children *in general*, and that their greater mind-mindedness might be accompanied by an enhanced attunement to the infant in non-mental domains<sup>8</sup>.

Finally, some mention should be made of the reduction in the strength of the effect of security of attachment by the time children have reached 5 years of age. Whilst the difference between the secure and insecure groups on the unexpected transfer task at age 4 was significant, these differences were significant on only one of the measures (number of children producing maximum scores on the picture identification task) at age 5. This reduction in effect strength is probably due in part to the fact that these children will have started formal schooling, and will consequently have had much greater opportunities to interact with other children. As children get older, relationships beyond the boundaries of attachment figures and the family will take on a more important role, and the relationship between child and primary caregiver will become just one of many formative ties. This view is consistent with those which stress the importance of social relationships and interactions within the contexts of the immediate family (Dunn et al., 1991), extended family (Lewis et al., 1996) and school (Lalonde & Chandler, 1995) for the child's emerging understanding of other minds.

In summary, we suggest that our findings add weight to the view that certain features of early infant-caregiver relationships, particularly mothers' tendency to interact with their infants as individuals with minds, have an important influence on children's development of symbolic and mentalising abilities. These differences are manifested in children's ability to adopt the perspectives of an experimenter in exploring non-veridical orientations to reality, and in their later performance on laboratory assessments of mentalising abilities. Further research is required to determine the precise significance of maternal mind-mindedness in the establishment of the secure attachment relationship and the subsequent advantages shown by securely attached children. For example, we need more data on whether the effects of attachment security are direct or mediated by other variables. In the meantime, however, we can suggest that by treating their children as individuals with minds, rather than creatures with needs which must be fulfilled, mothers of securely attached children can provide a 'creative social mirror' (Fonagy et al., 1994, p. 247), which allows their children to develop a sense of themselves as sources of perspectives on the world, and thus 'to think of [themselves] as thinkers' (James, 1890, p. 296). Further investigation of the correlates and consequences of the secure attachment relationship represents an exciting opportunity to increase our understanding of how social contexts and cognitive endowments shape each other in early development.

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## Notes

1. The results of this study are published in full in Meins, E. and Russell, J. (1997).
2. In the studies reported here, security of attachment was treated as a dichotomous variable (secure versus insecure), since the numbers of children in the three insecure categories were too small for statistical analysis. Group means for the avoidant, resistant and disorganised categories were comparable for all of the measures reported here.
3. The first author was formally trained in the strange situation coding procedure, and was deemed to have reached the required level of competence. The second coder had previous experience in coding strange situations, and had reached agreement with other experienced coders.
4. The results of the box construction study are published in full in Meins, E. (1997a).
5. This shrinkage of the sample from Study Two was due to the necessity of administering the unexpected transfer task at an age when individual differences in performance were most likely to show up. Participants were thus only tested if they were within two months of their fourth birthday, an age at which floor and ceiling effects would be least likely to occur (Perner, 1991).
6. It might be argued that a better measure of mentalising ability would be obtained by asking the test question first, followed by the control questions. However, C. Lewis (unpublished data) has shown that reversing the order of questions has no effect on children's performance on this task. A further point of debate concerns the use of the 'knowledge' question as a control. We propose that a genuine failure to understand the representational nature of mind, as opposed to a failure to understand informational access, would require the subject to be aware that Charlie does not know where the chocolate is, while still predicting his search behaviour on the basis of its actual location.
7. Meddis (1984), among others, has argued that the Fisher exact test is inappropriate when marginal totals are not fixed, and presents an alternative test for  $2 \times 2$  contingency tables. The effect of security of attachment was significant on Meddis' test,  $Z = 2.28$ ,  $p < .025$ , and on a standard  $\chi^2$  test,  $\chi^2(1, N = 21) = 5.45$ ,  $p < .05$ . Despite the low sample size, the lack of skewness in the marginal totals means that the results of the  $\chi^2$  test can be assumed to be valid (Bradley, Bradley, McGrath and Cutcomb, 1979; Camilli and Hopkins, 1979; Howell, 1992).
8. We are grateful to an anonymous reviewer for making this interesting point.