

# Linguistic Acquisitional Style and Mentalising Development: The Role of Maternal Mind-mindedness

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We investigated three main questions: (a) Is there consistency over time in mothers' *mind-mindedness* (the proclivity to treat one's child as an individual with a mind)? (b) Does mind-mindedness relate to children's subsequent mentalising development? and (c) Is mentalising development related to children's linguistic acquisitional style? Two measures of early vocabulary—proportion of common nouns and proportion of frozen phrases—were obtained at 20 months. Three measures of maternal mind-mindedness were taken: (a) mothers' reports of nonstandard words in their children's vocabularies; (b) mothers' meaningful interpretations of their children's early vocalizations; and (c) mothers' propensity to focus on their children's mental attributes at age 3. Children's mentalising abilities were assessed using the "false belief and emotion" task (Harris, Johnson, Hutton, Andrews, & Cooke, 1989) at age 5. There was clear evidence for consistency in mind-mindedness between 20 months and 3 years. All three measures of mind-mindedness were positively related to children's performance on the false belief and emotion task, but children's linguistic acquisitional style was not related to subsequent mentalising ability. These findings are interpreted as providing support for the view that caregivers' behavior is critical in helping children acquire a "theory of mind."

Research into the development of mentalising abilities has recently begun to address the question of how individual differences in early social experience might

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influence the child's acquisition of a "theory of mind." Among the factors that have been suggested as important in this respect are experiences of mental state causal talk (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991), language skills (Jenkins & Astington, 1996), security of attachment (Meins, Fernyhough, Russell, & Clark-Carter, 1998), and family size and structure (Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, & Berridge, 1996; Perner, Ruffman, & Leekam, 1994; Ruffman, Perner, Naito, Parkin, & Clements, 1998). A number of theoretical accounts has begun to emerge for explaining these findings. Some have argued that social influences on mentalising development can be usefully explained in terms of Vygotskian concepts of tutoring and enculturation (Astington, 1996; Vygotsky, 1978), whereas others have argued for a more radical Vygotskian internalization account (Fernyhough, 1996; Meins et al., 1998). Others have suggested that such influences can be accounted for in terms of the opportunities they give children for building up a "database" of mentalising experience (Perner et al., 1994). In addition, accounts of mentalising development that emphasize the importance of experience of self-other equivalence through imitation (Gopnik & Meltzoff, 1994) or shared attention (Barresi & Moore, 1996), or experience of patterned intersubjective relations with other people (Hobson, 1993), would seem to have some use in explaining the emerging data.

Despite this growing recognition that social interactive experiences are important in mentalising development, there has to date been little consideration of the role of individual differences in social experience *in infancy*, particularly as they relate to caregivers' involvement in initiating, maintaining, and controlling interactions with their infants. In particular, little attention has been paid to the ways in which caregivers' *interpretations* of their infants' acts may influence the development of an understanding of other minds. The argument that infants come to understand themselves as intentional agents by being *treated* as intentional agents has been discussed in a variety of contexts (e.g., Bruner, 1986; Lock, 1980; see Zeedyk, 1996, for a review). However, this approach has not to date been used in specifying the types of early interaction that may encourage the development of mentalising skills. Such shortcomings in the existing literature led Tomasello (1995) to complain that "by choosing to focus purely on the cognitive (metarepresentational) side of the process, theory of mind theorists miss both the commonality among different social skills during infancy and the developmental continuities and discontinuities of infancy and early childhood" (p. 125).

In an attempt to counter this cognitivist bias in discussions of precursors of mentalising abilities, Meins (1997) argued that children's understanding of other minds is related to their caregivers' *mind-mindedness*: the proclivity to treat one's child as an individual with a mind from an early age. In support of this argument, Meins et al. (1998) found that children whose mothers were more likely to describe them at age 3 in terms of their mental attributes (rather than their behavioral tendencies or physical appearance) were more successful on standard mentalising tasks at ages 4 and 5. These results suggest a positive relation be-

tween maternal mind-mindedness in early childhood and children's subsequent performance on tasks requiring an understanding of other minds.

In the study reported here, we extended Meins and colleagues' findings in two ways. Our first aim was to establish whether maternal mind-mindedness as indexed by mothers' mentalistic descriptions at age 3 was related to indices of mind-mindedness occurring earlier in the child's life. Second, given the observed relation between mind-mindedness at age 3 and children's performance on standard mentalising tasks, we sought to investigate whether mind-mindedness earlier in the child's life is related to subsequent mentalising abilities. Language acquisition is one context that appears to be pertinent to both of these lines of investigation. Despite the fact that many researchers consider the child's acquisition of language as a gradual progression from single words to complex word combinations (e.g., Chomsky, 1965), there is considerable evidence for individual differences in the routes children take into the language system. These individual differences have been extensively studied using the *referential-expressive* distinction proposed by Nelson (1973, 1981). Referential style is characterized by early vocabularies containing a high proportion of common nouns and single word utterances. In contrast, children who acquire language expressively have fewer common nouns but a higher proportion of *frozen phrases*. Frozen phrases are multi-word utterances that contain at least one word that has not previously occurred *singly* in the child's vocabulary; frozen phrases can thus be distinguished from flexible, original word combinations that children produce.

Why should linguistic acquisitional style provide a context for assessing caregiver mind-mindedness? First, we should note that infants' early vocalizations may bear little resemblance to the standard words they are trying to produce. To comprehend the infant's vocalization, the listener may have to perform a considerable amount of interpretation, using context, past knowledge of the child, concurrent gestures, and so on. It seems likely that one factor that may impact upon this process of interpretation is the listener's mind-mindedness. For example, the first step in the process of understanding what an infant is trying to say is to recognize that the infant is actually *intending* to convey some message by using language. In other words, the listener must demonstrate mind-mindedness in attributing intent to the infant's vocalization. Recently, Meins (1998) has reported such individual differences in maternal attribution of meaning to children's early vocalizations. Maternal attribution of meaning was assessed in two ways: (a) mothers' inclusions in their vocabulary lists of nonstandard English words used by their infants to which they could attribute a reliable meaning; and (b) mothers' reports of high incidences of infant vocalizations that they could not understand. Mothers were deemed more willing or able to attribute meaning to their infants' vocalizations if they included nonstandard words in their vocabulary lists, and also if they did *not* report an inability to understand their infants' utterances. If a mother's proclivity to attribute intention to her infant's behavior in the arena of language learning is indeed indicative of her mind-mindedness, one might pre-

dict that individual differences in this context would be related to indices of mind-mindedness later in the child's life.

Finally, language was chosen as the area of study since it has clear theoretical links to the second focus of our study: children's theory of mind development. For example, several researchers have commented upon the relation between mentalising abilities and children's linguistic competence (Jenkins & Astington, 1996), understanding of narrative (Lewis, 1994), and acquisition and use of mental state language (Brown, Donelan-McCall, & Dunn, 1996; Olson, 1988). However, no one has yet investigated whether individual differences in how language is *acquired* relate to children's subsequent understanding of other minds.

The longitudinal study reported below investigated the relation between language acquisition, maternal mind-mindedness, and children's mentalising abilities. The following hypotheses were tested: (a) mothers tending to attribute meaning to their infants' vocalizations will score highly on a later measure of mind-mindedness; and (b) children whose mothers attribute meaning to their early utterances will perform better on age-appropriate mentalising tasks. The relation between children's linguistic acquisitional style and subsequent mentalising abilities was also investigated.

## METHOD

### Participants

Participants were 33 children (13 girls and 20 boys) from the Cambridge area. Local practitioners and health visitors were used to recruit the sample, and 80% of mothers who were approached agreed to participate.

### General Social Factors

Children's birth status has been found to affect both their language acquisition and their performance on mentalising tasks. For example, first-born children are less likely to acquire frozen phrases (Pine, 1995), and singletons acquire a higher proportion of common nouns in their early vocabularies than their later-born peers (Meins, 1998). With respect to mentalising abilities, children's performance on mentalising tasks has been found to increase linearly with the number of older siblings (Ruffman et al., 1998). Accordingly, the number of older siblings of the children participating in the present study was included as an independent variable. Of the 33 children, 21 were first-born, eight were second-born, three were third-born, and one child was fourth-born. This variable was continuous, and scores ranged from 0 to 3.

Maternal educational level was also included as an independent variable. Mothers were given a questionnaire in which they were asked to identify their highest educational qualification by choosing one of six categories. Each mother

was awarded one of the following scores for educational level:<sup>1</sup> 0—no examinations; 1—CSEs (equivalent to high school up to age 16 for less academic students); 2—GCSEs or O-Levels (high school up to age 16 for more academic students); 3—A-Levels (high school up to age 18); 4—further qualification, not to degree level (e.g., nursing); 5—undergraduate degree; 6—postgraduate qualification. Of the 33 mothers: 3 scored 0; 3 scored 1; 8 scored 2; 0 scored 3; 8 scored 4; 7 scored 5; and 4 scored 6.

### General Procedure

Mothers were recruited into the study when their infants were 11 or 13 months. Children's language acquisition was followed until the children reached a mean age of 20 months (range: 20–20.5 months). Assessments of infants' language acquisition were made using data from the mothers' vocabulary diaries. Although this method relies on maternal report, it has been found to be a reliable and valid technique, with high, positive correlations with direct observations of infant language (e.g., Dale, Bates, Reznick, & Morisset, 1989; Pine, 1995; Snyder, Bates, & Bretherton, 1981). When mothers were first seen at the university, they were interviewed about their infants' language production and briefed on the procedure for keeping a diary of language development. This interview included a checklist of words that were grouped into eight categories: people, food and drink, animal names, furniture, modes of transport, clothing, action words, and adjectives (see Snyder et al., 1981). Each mother was asked to write down every new word that her child *produced*, rather than comprehended, along with all word combinations and routine phrases or expressions. In addition, mothers were encouraged to include any items that were not standard English words but to which they attributed a reliable meaning. Finally, mothers were asked to indicate how vocal their infants were, independent of whether the vocalizations could be understood (see later section on Mothers' Interpretations of Their Infants' Early Language).

The initial interview identified children's vocabulary size at the outset of the study (range: 0–22 items), and between this interview and 20 months, participants made three further visits to the university, during which their language diaries were discussed with the first author. At each of these visits, mothers were again asked to give their general impressions about their children's use of language, aside from the actual number of identifiable vocabulary items produced. Mothers were given an explanatory summary of the language measures to be included in their diaries, as well as the checklist categories used in the initial interview, to help them complete their language diaries at home.

### Infant Language Acquisition

The first 50 words in the vocabulary have typically been used in establishing children's acquisitional style (e.g., Lieven, Pine, & Dresner Barnes, 1992; Nel-

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<sup>1</sup>North American equivalents to the British educational system are shown in parentheses.

son, 1973). However, the majority of the children in the present study fell short of this mark. The criterion point was set at 25 vocabulary items, and thus only the first 25 items acquired by children whose vocabularies had exceeded this number were included in the infant language analyses.

Two infant language scores were obtained, based on the categories defined by Lieven et al. (1992). The categories used in the present study were the *common nouns* subcategory from the single-word utterances category and the *frozen phrases* subcategory from multi-word utterances. A single vocabulary item was defined as any single word or frozen phrase. Nonstandard words (see later section on Maternal Measures) to which mothers could attribute a reliable meaning were included as vocabulary items. Infants received two language scores:<sup>2</sup> (a) the proportion of common nouns in their 25 item vocabularies; and (b) the proportion of frozen phrases in their 25 item vocabularies.

### Maternal Measures

The aim of this category of measures was to assess maternal mind-mindedness, or mothers' proclivity to treat their infants as individuals with minds.

***Mothers' Interpretations of Their Infants' Early Language.*** The two dichotomous measures of mind-mindedness relating to mothers' tendency to attribute meaning to their children's early vocalizations were taken from Meins (1998).<sup>3</sup> The first of these measures utilized maternal reports of nonstandard words in the infants' 25 item vocabularies. Following Meins, nonstandard words were defined as any vocalization that the child used systematically to replace a given English word. Mothers were placed into one of two groups on the basis of their reports of at least one nonstandard word: (a) *nonstandard present*; or (b) *nonstandard absent*.

The second language-based measure of mothers' mind-mindedness was obtained from their reports of their children's vocality, independent of the quantitative vocabulary score. Meins' (1998) scheme of *vocal but meaningless* (VBM) speech was employed to categorize the mothers' reports. VBM speech is defined as frequent vocalizations that the mother reports are indecipherable and cannot be understood; mothers typically described their children's speech as "double Dutch" or "gobbledegook." Mothers were placed into one of two groups according to whether they reported their children engaging in VBM speech *at any age between 11 and 20 months*: (a) *VBM speech present*; or (b) *VBM speech absent*. No distinction was made between the occurrence of VBM speech at different

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<sup>2</sup>Five children were reported by their mothers to have acquired five or fewer words by the time they reached 20 months of age. These children's vocabularies were deemed to be too small to be coded for the proportion of common nouns and frozen phrases, and they were therefore excluded from the vocabulary content analyses.

<sup>3</sup>The five children who had acquired five or fewer words were included in these analyses, since their small vocabularies did not preclude the presence of nonstandard words or their being very vocal.

ages, since in practice maternal report of such speech remained stable throughout the study; that is, every mother who reported the presence of VBM speech at the initial interview continued to do so at 20 months.

The inclusion of nonstandard words in vocabulary lists, and the failure to report VBM speech, were both regarded to be indices of maternal mind-mindedness.

***Mothers' Mentalistic Descriptions of Their Children.*** The final measure of maternal mind-mindedness was taken when this sample of mothers and children were followed up at age 3 (range: 35–38 months). Three of the infant-mother pairs were unable to participate at this age. Of those mothers who did not take part when the child reached age 3, none of them had reported nonstandard words in their children's early vocabularies, but one of these mothers reported her child using VBM speech. Mothers were given a short interview in the department's developmental laboratory as part of a battery of follow-up measures. The aim of the interview was to establish mothers' proclivity to describe their children's mental characteristics. Mothers were asked: "Can you describe [child] for me?" They were given no guidance on what type of answer was required, and if they sought clarification, they were told that there were no right or wrong answers and that they could describe their children in any way they wished. The interviews were audio taped and transcribed verbatim. Meins et al.'s (1998) criteria were used to assess mothers' proclivity to describe their children's mental characteristics. Attributes of the child that were mentioned by the mother were placed into one of four exhaustive and exclusive categories:

1. *Mental*: Any reference to the child's mental life, in terms of his/her will, mind, intellect, metacognition, imagination; any comments relating to desires, wishes, and emotion. This category did *not* include references that were merely comments on the child's likes and dislikes or behavioral tendencies, such as "he loves playing games."
2. *Behavioral*: Any reference to behavior, such as games and activities enjoyed by the child or interactions with others on a behavioral level. The following characteristics mentioned by the mothers were also included in this category, since they may be interpreted in a purely non-mentalistic fashion: *lively, talkative, boisterous, aggressive, passive, friendly, restrained, outgoing, naughty*.
3. *Physical*: Any physical attributes, the child's age, and descriptions relating to the child's position in the family.
4. *General*: Any descriptions that did not fit into the above categories.

Each mother received a score for the number of mental attributes used to describe her child as a proportion of the total number of descriptors produced (Pment). Proportional scores, rather than raw frequency scores, were used to control for any differences in verbosity between mothers. The anonymous transcrip-

tions were coded by the authors, who were at that time blind to the infant and maternal language measures. Inter-rater agreement for the assignment of a comment to one of the four categories was  $\kappa = 0.91$ .

There were thus three measures of maternal mind-mindedness: the dichotomous variables of nonstandard words and VBM speech taken in infancy; and the continuous variable of the proportion of mentalistic descriptions given at age 3.

### **False Belief and Emotion (FBE) Task**

All of the 33 children were followed up at age 5 (range 60–63 months), when their ability to integrate a character's belief with previous knowledge about the character's preferences to predict an emotional response was assessed using the "false belief and emotion" (FBE) task (Harris et al., 1989).

This task centered on four toy animals and their individual preferences for a certain type of food or drink. Children were told that another animal, Charlie the Crocodile, was going to play a trick on each of the other characters. In two of the stories, the animal got an unpleasant surprise when it discovered that a container of favorite food or drink actually contained something that the animal did not like. In the other two stories, the animal got a pleasant surprise when it investigated the contents of a container of non-favorite food or drink. The four stories were presented in a fully randomized and counterbalanced fashion. One of the stories was as follows: "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 then left the scene, at which point the child watched as Charlie the Crocodile replaced the milk in the carton with Coke. Two questions were then asked: "What is Penny's favorite drink?" (memory control); and "What is actually in the carton now?" (reality control). The scenario was briefly recapped if either of these questions was answered incorrectly. Penny then returned to the scene, and the child was asked the following questions: (1) "How does Penny feel when she is first given the carton? Does she feel happy, or does she feel sad?" (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?"

Performance on the FBE task was measured by the number of correct answers to Question 1 (maximum score = 4). Children who showed a general positive or negative response bias to the control question (Question 2) were excluded from the analysis. Children were also asked to justify their answers to each of the test questions, to ensure that they had not forgotten the animal's preference or the nature of the trick. In practice, none of the children forgot any of this crucial information.

### **General Cognitive Ability**

To control for the effects of general cognitive ability, children were assessed using the British Picture Vocabulary Scale (Dunn, Dunn, Whetton, & Pintilie, 1982) at a mean age of 61.5 months (range 60–63 months).

## RESULTS

### Language Measures

With respect to the whole sample of 33 children, 10 were reported to have acquired at least one nonstandard word, and 8 were reported to use VBM speech. Only one of the 33 mothers reported that her child both used VBM speech and had acquired at least one nonstandard word. Sixteen mothers from the sample of 33 reported that their children neither used VBM speech nor had acquired any nonstandard words. There was no relation between maternal report of VBM and nonstandard words ( $\chi^2[1] = 0.67, ns$ ). When the five children who had acquired five or fewer words were excluded, the number of children reported to have acquired at least one non-standard word remained the same (10 children), but the number of children reported to use VBM speech was reduced from eight to six.

The mean scores for the proportion of common nouns with respect to maternal report of nonstandard words and VBM speech were as follows: nonstandard words present group  $M = 0.61$  ( $SD = 0.21$ ); nonstandard words absent group  $M = 0.54$  ( $SD = 0.24$ ); VBM speech present  $M = 0.28$  ( $SD = 0.08$ ); VBM speech absent group  $M = 0.64$  ( $SD = 0.18$ ). The presence of nonstandard words was not related to the proportion of common nouns ( $t[26] = 0.77, ns$ , one-tailed) in children's vocabularies, but children who were reported to engage in VBM speech had a lower proportion of common nouns ( $t[26] = 4.78, p < .001$ , one-tailed). The mean scores for the proportion of frozen phrases with respect to the two language-based measures of maternal mind-mindedness were as follows: nonstandard words present group  $M = 0.02$  ( $SD = 0.03$ ); nonstandard words absent group  $M = 0.10$  ( $SD = 0.13$ ); VBM speech present  $M = 0.20$  ( $SD = 0.15$ ); VBM speech absent group  $M = 0.02$  ( $SD = 0.05$ ). Children who were reported not to have acquired nonstandard words had a higher proportion of frozen phrases in their early vocabularies ( $t[26] = 1.71, p < .05$ , one-tailed), as did children who were reported to have used VBM speech ( $t[26] = 4.86, p < .001$ , one-tailed).<sup>4</sup>

Table 1 shows the mean number of older siblings, maternal educational level, and BPVS scores with respect to the two language-based maternal mind-mindedness measures. Since only one mother reported her child using both VBM speech and having acquired a nonstandard word, it was not possible to conduct analyses of variance using VBM speech and nonstandard words as the two independent variables. While relying on *t*-tests may mask interesting interactions between the two language-based measures of mind-mindedness, these measures appear to be independent of one another (see earlier section).

Children with more older siblings were more likely to have mothers who reported VBM speech ( $t[31] = 2.37, p < .025$ , two-tailed), but the number of sib-

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<sup>4</sup>The relationship between these language measures is reported in Meins (1998), with a larger sample of children of which the children participating in the study reported here are a subgroup. The whole group effects remained the same for this subgroup.

**Table 1. Mean Scores for Number of Older Siblings, Maternal Educational Level and BPVS Score with Respect to Maternal Report of Nonstandard Words (NSW) and Vocal but Meaningless (VBM) Speech**

Designated group	Number of older siblings	Maternal education	BPVS score
NSW present (N = 10)	0.40 (0.70)	4.00 (1.83)	117.00 (14.17)
NSW absent (N = 23)	0.52 (0.79)	3.04 (1.89)	110.22 (13.17)
VBM present (N = 8)	1.00 (1.01)*	2.38 (1.77)	108.50 (17.48)
VBM absent (N = 25)	0.32 (0.56)	3.64 (1.87)	113.48 (12.34)

Standard deviations are shown in parentheses.

\*Difference between VBM present and VBM absent groups significant at the .025 level

lings was not related to mothers reporting the acquisition of nonstandard words ( $t[31] = 0.42$ , *ns*, two-tailed). Maternal educational level was not related to mothers' reports of nonstandard words ( $t[31] = 1.35$ , *ns*, two-tailed) or to VBM speech ( $t[31] = 1.69$ , *ns*, two-tailed). Children's BPVS score was not related to maternal report of nonstandard words ( $t[31] = 1.33$ , *ns*, two-tailed) nor to the use of VBM speech ( $t[31] = 0.90$ , *ns*, two-tailed). The number of older siblings was negatively correlated with the proportion of common nouns in children's early vocabularies ( $r[26] = -.39$ ,  $p < .025$ , one-tailed) and positively correlated with the proportion of frozen phrases ( $r[26] = .43$ ,  $p < .025$ , one-tailed). The more older siblings children had, the more likely they were to have early vocabularies with a low proportion of common nouns and a high proportion of frozen phrases. This finding thus extends those of Pine (1995) and Meins (1998) on the relation between birth status (first- versus later-born) and early vocabulary content. Maternal educational level was not related to the proportion of common nouns ( $r[26] = .13$ , *ns*, two-tailed) or frozen phrases ( $r[26] = -.27$ , *ns*, two-tailed) in children's early vocabularies. Finally, children's BPVS score was not correlated with the proportion of common nouns ( $r[26] = -.03$ , *ns*, two-tailed) nor with the proportion of frozen phrases ( $r[26] = -.28$ , *ns*, two-tailed).

### Mothers' Mentalistic Descriptions of Their Children

Table 2 shows the mean scores for the proportion of mental attributes (Pment) with respect to nonstandard words and VBM speech. The two language-based measures of mind-mindedness were both related to Pment: for the relation between nonstandard words and Pment,  $t[28] = 2.88$ ,  $p < .005$ , one-tailed; for VBM speech and Pment,  $t[28] = 2.06$ ,  $p < .025$ , one-tailed. Mothers who had reported nonstandard words and mothers who did not report the presence of VBM speech used proportionately more mental attributes to describe their children than did their counterparts, who reported that their children engaged in VBM speech and had not acquired any nonstandard words.

With respect to the two language measures based on infants' vocabulary content, Pment was negatively correlated with the proportion of frozen phrases

**Table 2. Mean Scores for Proportion of Mental Attributes with Respect to Maternal Report of Nonstandard Words (NSW) and Vocal but Meaningless (VBM) Speech**

Designated group	Proportion of mental attributes
NSW present (N = 10) <sup>†</sup>	0.55 (0.20)
NSW absent (N = 20)	0.29 (0.26)
VBM present (N = 7)*	0.20 (0.08)
VBM absent (N = 23)	0.43 (0.28)

Standard deviations are shown in parentheses.

<sup>†</sup>Difference between NSW present and NSW absent groups significant at the .005 level.

\*Difference between VBM present and VBM absent groups significant at the .025 level

( $r[23] = -.40, p < .05$ , two-tailed) but was not related to the proportion of common nouns infants had acquired ( $r[23] = .35, ns$ , two-tailed).

The number of older siblings was negatively correlated with Pment ( $r[28] = -.38, p < .05$ , two-tailed). Pment was not related to maternal educational level ( $r[28] = .04, ns$ , two-tailed), nor to children's BPVS score ( $r[28] = .09, ns$ , two-tailed).

A multiple forward regression was carried out using SPSS to identify predictors of Pment. Only those independent variables identified as being significantly related to Pment in the above analyses were entered into the regression. The independent variables were: proportion of common nouns, proportion of frozen phrases, nonstandard words, VBM speech, and number of older siblings. No model for the regression was specified; rather, the program calculated which independent variables predicted a significant amount of variance in Pment and entered them into the regression in a stepwise fashion. Maternal report of nonstandard words in their children's early vocabularies was found to be the only predictor of Pment ( $\beta = 0.47, T = 2.58, p < .025$ ).

### False Belief and Emotion (FBE) Task

Three children were excluded from the analyses because of a response bias that led to incorrect answers to the control question (Question 2). None of these three children had mothers who reported nonstandard words or VBM speech. Two further children answered the control question incorrectly on one of the four stories. Rather than excluding these two children, the proportion of correct answers to the test question (Question 1) for the remaining three stories was calculated and then multiplied by 4 (maximum score = 4). Table 3 shows the mean number of correct answers on the FBE task with respect to nonstandard words and VBM speech. Children whose mothers had reported nonstandard words in their 25 item vocabularies performed better on the FBE task than did their peers who had not acquired nonstandard words ( $t[28] = 2.15, p < .025$ , one-tailed). The effect of the presence/absence of VBM speech on children's performance on

**Table 3. Mean Scores for Performance on the False Belief and Emotion (FBE) Task with Respect to Maternal Report of Nonstandard Words (NSW) and Vocal but Meaningless (VBM) Speech**

Designated group	FBE task score
NSW present (N = 10) <sup>†</sup>	2.60 (1.51)
NSW absent (N = 20)	1.63 (1.26)
VBM present (N = 8)*	1.17 (0.99)
VBM absent (N = 22)	2.24 (1.43)

Maximum score = 4. Standard deviations are shown in parentheses.

<sup>†</sup>Difference between NSW present and NSW absent groups significant at the .025 level.

\*Difference between VBM present and VBM absent groups significant at the .05 level

the FBE task was also significant ( $t[28] = 1.95, p < .05$ , one-tailed), with children whose mothers did not report VBM speech attaining higher scores on the FBE task. Neither of the infant vocabulary content measures was related to children's subsequent performance on the FBE task: for the proportion of common nouns,  $r[23] = .06, ns$ , two-tailed; for the proportion of frozen phrases,  $r[23] = -.26, ns$ , two-tailed.  $P_{ment}$  was positively correlated with children's performance on the FBE task ( $r[25] = 0.48, p < .025$ ).<sup>5</sup> Maternal educational level was also related to task performance ( $r[28] = .56, p < .01$ , two-tailed), with children being more likely to score highly on this task if their mothers had spent longer in the educational system. Finally, no significant correlations were found between children's performance on the FBE task and number of older siblings ( $r[28] = -.28, ns$ ), nor between task performance and BPVS score ( $r[28] = .20, ns$ ). (The latter correlation was previously reported in Meins et al., 1998.)

Table 4 shows the correlation matrix for all of the measures taken in this study. To identify predictors of children's performance on the FBE task, a multiple forward regression was carried out using SPSS. As before, only those variables that were identified as being significantly related to FBE task performance were entered into the regression, and no model was specified. The independent variables were as follows: nonstandard words, VBM speech, maternal educational level, and  $P_{ment}$ . The program entered maternal educational level on the first step of the regression ( $\beta = 0.38, T = 2.97, p < .01$ ), and  $P_{ment}$  on the second step ( $\beta = 0.42, T = 2.68, p < .025$ ). Thus, maternal educational level is the best predictor of children's performance on the FBE task, but the proportion of mental attributes used by mothers to describe their 3-year-olds predicts a significant amount of variance in task performance after maternal educational level has been taken into account.

<sup>5</sup>This correlation was previously reported in Meins et al. (1998).

**Table 4. Correlation Matrix for the Independent and Dependent Variables**

	CN	FP	NSW	VBM	Pment	FBE	Siblings	Education	BPVS
CN	1.00								
FP	-0.65***	1.00							
NSW	0.15	-0.32	1.00						
VBM	-0.69***	0.69***	-0.22	1.00					
Pment	0.35	-0.40*	0.48**	-0.36*	1.00				
FBE	0.06	-0.26	0.33*	-0.35*	0.48*	1.00			
Siblings	-0.39*	0.43*	0.08	0.39*	-0.38*	-0.28	1.00		
Education	0.13	-0.27	0.24	-0.29	0.04	0.56**	-0.29	1.00	
BPVS	-0.03	-0.32	0.23	-0.16	0.09	0.20	-0.12	0.41*	1.00

CN = proportion of common nouns.

FP = proportion of frozen phrases.

NSW = report of nonstandard words.

VBM = report of vocal but meaningless speech.

Pment = proportion of mentalistic descriptors.

FBE = false belief and emotion task.

Siblings = number of older siblings.

Education = maternal educational level.

BPVS = British Picture Vocabulary Scale score.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ . For tails of tests and *ns* for each correlation, see analyses in the text.

## DISCUSSION

The results of the present study largely supported our hypotheses on the relations between infants' linguistic acquisitional style (based on the first 25 vocabulary items), maternal mind-mindedness and children's subsequent mentalising abilities. The main findings were as follows: (a) maternal attribution of meaning to early infant vocalizations (in the form of reporting nonstandard words and no VBM speech) was related to mothers' proclivity to describe their children in terms of their mental characteristics (Pment) 16 months later; (b) higher Pment scores were also related to fewer older siblings and to having children who acquired few frozen phrases in their early vocabularies; (c) the three maternal mind-mindedness measures were positively related to children's performance on the FBE task at age 5; (d) children's early vocabulary content (proportion of common nouns and frozen phrases) was not related to subsequent performance on the FBE task. One finding from the language data is also of note, since it has not been previously documented: Number of older siblings was negatively correlated with the proportion of common nouns and positively correlated with the proportion of frozen phrases in children's 25 item vocabularies. Although previous studies have found a relation between first-born versus later-born status and early vocabulary content (Pine, 1995; Meins, 1998), no study has reported such a relation for the *number* of older siblings.

Before moving on to consider the meaning of these findings, we should sound a few notes of caution. First, the sample size for the present study was not large

(between 28 and 30 subjects for the analyses) due to attrition in numbers during the 4 years over which these data were collected. Consequently, our findings need to be replicated using a larger sample of children before any firm conclusions can be drawn. In particular, the two regression analyses should be viewed as exploratory, and their results treated with caution. Despite the comparatively small sample size, however, the present study's findings are in line with those of larger studies. For example, the findings on the relation between maternal attribution of meaning to early vocalizations and children's vocabulary content reported by Meins (1998) hold for our smaller sample. Moreover, the percentage of children passing the FBE task in the present study is in line with that reported by Harris et al. (1989), and our failure to find an association between general verbal ability and FBE task performance is also consistent with previous studies (e.g., Fonagy, Redfern, & Charman, 1997).

Given these caveats, the results reported here suggest that there are clear continuities over the first 3 years of life in maternal mind-mindedness—the proclivity to treat one's child as an individual with a mind. Mothers who were more willing or able to see their infants' early vocalizations as mindful behavior were more likely to focus on their children's mental characteristics when given an open-ended invitation to describe them at age 3. Furthermore, high scores on all three measures of maternal mind-mindedness employed in the present study were related to children's understanding of other minds at age 5.

How can one account for the observed link between children being treated as individuals with minds and their own developing understanding of other minds? This finding is consistent with theories that focus on the role played by parental interpretation of infant behavior in the development of intentionality. Such theories make different assumptions about the status of infant behavior with respect to its intentionality. For example, some theorists maintain that young infants are incapable of intentional behavior, but parents treat their actions *as if* they were meaningful (e.g. Kaye, 1982; Newson, 1979; Schaffer, 1984). Others afford early infant behavior intentionality and argue for a continuity between simple early social behaviors and more mature and elaborate patterns of behavior involving objects and clearly defined, goal-directed actions. Trevarthen's (1977, 1979) distinction between primary intersubjectivity and secondary intersubjectivity is an ideal example of such an account, laying greater emphasis on intentionality as an interpersonal phenomenon, rather than as a by-product of cognitive maturation (see Zeedyk, 1996, for a review of developmental accounts of intentionality).

The observed link between maternal mind-mindedness and children's mentalising abilities is also in line with the findings of researchers who have investigated the effects of familial interactions on theory of mind understanding. For example, Dunn et al. (1991) reported that children's ability to explain the feelings and actions of a puppet in terms of its false belief was related to their being involved in particular types of family interaction 7 months earlier. Specifically, family conversations about causality and people's feelings, as well as a tendency

for mothers frequently to attempt to control the behavior of older siblings, were related to subsequent theory of mind understanding. Dunn et al. (1991) argued that “the potential significance of family discourse about causality lies in the opportunity that such discourse provides for children to enquire, argue, and reflect about why people behave the way that they do” (p. 1354). The control of older siblings’ behavior also appeared to serve a similar function, since mothers often tried to resolve sibling disputes by pointing out how the behavior that caused this dispute was not performed intentionally but rather arose out of an erroneous belief. One could argue that mothers who employ such mentalistic strategies in dealing with disputes, rather than resorting to physical intervention or verbal scolding, are treating their children as mental agents and are thus demonstrating mind-mindedness.

Finally, some mention should be made of one area in which our findings diverge from those of previous researchers: the role played by siblings in children’s mentalising development. Perner et al. (1994) reported that children with siblings outperformed singletons on a battery of unexpected transfer tasks. More recently, Ruffman et al. (1998) reanalyzed these data and found that this facilitatory effect on theory of mind performance was restricted to the presence of *older* siblings. In contrast, our results found no evidence for such a relation between older siblings and children’s performance on the false belief and emotion task; indeed, we found a sizeable (though nonsignificant) negative correlation between these variables. It may be that this inconsistency results from a lack of power due to our small sample and the fact that the majority of the children were first-born. The present study also used a more complex mentalising task in older children, which may account for the difference between our data and those of the above studies that found a facilitating effect of siblings for 4-year-olds’ performance on simpler mentalising tasks. Alternatively, this diminution in the effect of older siblings on mentalising abilities at age 5 may be genuine and could reflect the increasing impact of social phenomena such as schooling and peers, rather than family members, on children’s cognition. However one interprets such a discrepancy, its existence does appear to open the way for a more detailed consideration of why the presence of siblings might aid children’s mentalising development. One possibility is that siblings are important because they are also capable of demonstrating mind-mindedness. This suggestion is supported by the finding that it is older, but not younger, siblings whose presence is related to precocity in mentalising abilities, since children younger than 4 or 5 years may be lacking in the social and cognitive sophistication necessary to treat others as mental agents (e.g., Wimmer & Perner, 1983; Tomasello, Kruger, & Ratner, 1993). The recent finding that Greek and Cypriot children who experienced daily interaction with a large number of adults and older children performed better than their counterparts from smaller extended families (Lewis et al., 1996) is also consistent with the present account. However, once maternal mind-mindedness (and other maternal factors, such as educational level) has been taken into account, the role of sib-

lings may become considerably less important. Indeed, since the vast majority of studies on children's mentalising development completely ignore variables relating to individual differences in the child's adult caregivers, this explanation cannot be discounted.

Other findings suggest that individual qualities of the child may also impact the facilitatory effect of siblings. For example, Jenkins and Astington (1996) reported that children's linguistic abilities interacted with the effect of siblings on their false belief understanding: The presence of siblings was more strongly associated with task performance in children with lower levels of language ability. The present study's finding that mothers who demonstrate lower levels of mind-mindedness have children more likely to acquire a higher proportion of frozen phrases in their early vocabularies is pertinent to Jenkins and Astington's results. Although there are obvious problems in pinpointing the direction of cause and effect in such cases, it may be more difficult for mothers to view their children as mental agents, capable of expressing intentions, if the child's use of language appears to be less flexible and dependent upon the types of well-learned sayings that define frozen phrases. Consequently, one could argue that factors relating to theory of mind understanding, such as poorer language ability and larger families, make it more difficult for mothers to demonstrate mind-mindedness given the greater pressure on time and attention, resulting in less one-to-one interaction between mother and child. The presence of others who are capable of treating the child as an individual with a mind may therefore become more important. Thus, our hypothesis is that siblings and family members will only help the child develop an understanding of other minds if they are willing or able to demonstrate mind-mindedness. Unfortunately, the data from the present study cannot address this suggestion, since the mind-mindedness of siblings was not measured. This hypothesis does, however, raise interesting questions for future research with respect to investigating mind-mindedness in family members beyond the primary caregiver. Such studies would address a neglected area of research relating to factors that govern the ways in which people interact with children, thus underlining not only the importance of social interactions in children's developing mentalising abilities, but also the crucial role played by people's *beliefs* about the child's mental agency, which may govern such interactions.

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