Minding the children: A longitudinal study of mental state talk, theory of mind and behavioural adjustment from age 3 to age 10.

Abstract

Mothers' use of mental state talk (MST) is linked to young children's performance on false belief tests of Theory of Mind (ToM) and to their behaviour in social contexts. However, little is known about MST beyond the early years. This investigation is the first to examine continuity in both mother and child MST from preschool (age 3-4 years) to middle childhood (age 10) and examines the role of early maternal MST in children's later ToM and use of MST. We examine the novel association between MST and children's behavioural adjustment from pre-school into late childhood. Participants were mother-child dyads from a seven-year longitudinal study. Measures of MST, ToM, and language were administered at home when children were 3 and 4 years old and again at age 10. Also at age 10 behavioural adjustment was measured using the Strengths and Difficulties Questionnaire. Mother and child MST were highly stable from preschool to later childhood. Early maternal MST accounted for unique variance in later child MST and behavioural adjustment at 10 years of age; children whose mothers used more MST, specifically references to cognitions, when they were 3 or 4 experienced fewer behavioural difficulties (externalising behaviour) when they were 10 years old.

Keywords; Adjustment; Internalising/Externalising; Theory of Mind; Parent-Child Communication; Longitudinal Studies.

Children's conversations within the family are a primary context for social development (Dunn, 2000; Harris, 2006). In particular, conversational references to mental states between mother and child facilitate children's developing understanding of the mind (Dunn, Brown, Slomkowski, Tesla & Youngblade, 1991; Ruffman, Perner, & Parkin, 1999). By 5 years old, typically-developing children are usually able to pass false belief tasks which measure children's ability to reason about the beliefs of an actor, even when that actor holds a belief about the world that is incorrect (Wellman, Cross & Watson, 2001). This marks an important developmental milestone in social understanding and signals the acquisition of a mature theory of mind (ToM) (Perner, 1991). Mothers' use of mental state language is a particularly important source of individual differences in children's ToM development; several longitudinal studies spanning infancy through to the pre-school period demonstrate a robust link between mothers' early use of mental state talk (MST), in a range of contexts, and children's later false belief understanding (Devine & Hughes, 2016). Mothers who make more frequent early reference to mental states in everyday interaction have children who demonstrate advanced ToM when they are 2 or 3 (Dunn et al, 1991; Taumoepeau & Ruffman, 2008), 4 (Ensor & Hughes, 2008; Ruffman, Slade, & Crowe, 2002), 5 (Meins, Fernyhough, Russell, & Clark-Carter, 1998; Symons, Fossum, & Collins, 2006), and 6 years old (Adrian, Clemente, Villanueva, & Rieffe, 2005; de Rosnay, Pons, Harris, & Morrell, 2004; Hughes, Ensor, & Marks, 2011). Furthermore, mothers' mental state is also linked to the frequency of children's own use of MST at around 3 (Dunn, et al, 1991; Furrow, Moore, Davidge, & Chiasson, 1992; Taumoepeau & Ruffman, 2008), and 4 years of age (Jenkins et al., 2003; Ruffman et al., 2002).

Taken together the evidence suggests that mother mental state language is not merely associated with ToM, but plays a direct and causal role in its development (Ruffman et al., 2002). However, very little is known about the role of mental state language after the early milestones of ToM have been reached, as children move beyond the early school years into more diverse and varied social contexts. A key question is whether there is stability in mothers' use of MST over time. Ensor, Devine, Marks, and Hughes (2014) measured maternal mental state language at age 2 and age 6 in two different types of task. At age 2, children and parents were observed in the home for 30 minutes while preparing a meal together.

At age 6, there was a further home observation, this time a 10-minute task in which mothers and children looked at a picture book together. This study was the first that has addressed continuity in observed mother mental state language over an extended period beyond the preschool years and across different types of tasks. Given the large differences between a 2- and 6-year-old, and the possibility that child characteristics at least partially drive maternal MST, it was plausible that there might be little consistency over time. In fact, the aus found a moderate level of stability for mother references to cognitions (r = .22), but not to other types of MST, over this four-year period.

However, it still remains unclear from this single study whether continuity is a feature of talk about cognitions in particular or whether there is stability in mothers' general use of MST over time, and whether continuity extends further into later childhood up to age 10. If maternal MST is largely determined by child readiness or child characteristics, then we might again expect little stability through to later childhood. For instance, Taumoepeau and Ruffman (2008) found that mothers talked more about the child's desires at 15 months of age, but more about cognitions when the same children were 24 months of age. Stability might therefore only be evident in general use of MST rather than in specific types of MST and only picked up if similar tasks are used to measure this over time. However, if maternal MST stems from a maternal characteristic, then we might expect to see higher levels of stability in general MST and through into later childhood. The first aim of the current investigation was to examine continuity in MST from the preschool years to age 10, measuring MST in both mother and child during an interactive picture-describing task used at both time points.

A second important question is whether early maternal MST relates to children's ToM and own use of MST at a much later age. Typically, the link between maternal talk and child ToM has been examined within a relatively short time period of one year or less (e.g., Ruffman et al., 2002). Only Ensor et al. (2014) have examined this relationship over a much longer period. They found that mothers' use of cognitive references at 2 years and at 6 years old predicted individual differences in ToM concurrently at those ages and even at age 10, suggesting a continued causal role for early maternal MST in ToM understanding well beyond the early school years. The second aim of the current study was to test the link between mothers' early use of MST in the preschool years and children's ToM at 10 years old, and to extend this by investigating the association between mothers' early use of MST and children's own proclivity to use MST in later childhood.

Studies are also beginning to emerge that suggest the developmental significance of early involvement in mental state conversation extends beyond simply conceptual tasks of social understanding, but may also play an important role in children's social behaviour and regulation (Ruffman, Slade, Devitt, & Crowe, 2006). False belief understanding has been linked to higher levels of social competence (Slaughter, Imuta, Peterson, & Henry, 2015; Watson, Nixon, Wilson, & Capage, 1999), although not consistently so (Hughes, White, Sharpen, & Dunn, 2000), and mothers' MST with their children seems to play a direct role in facilitating children's social adjustment and behaviour over and above ToM (Ruffman,et al., 2006).

In one of the first studies examining associations between maternal MST, social understanding *and* social behaviour, Ruffman et al. (2006) demonstrated that as well as predicting later ToM performance, maternal MST at 3 years of age uniquely predicted children's prosocial behaviour observed during interactions with a peer one year later. Specifically, when mothers made more frequent references to mental states when looking at pictures with their 3-year-olds, the children displayed higher levels of cooperation and lower levels of conflict when playing with a peer one year later. Interestingly, this study found that children's ToM at 3 years did not predict observed cooperative behaviour at 4 years of age, suggesting MST, but not child ToM, facilitates children's prosocial behaviour. Nevertheless, these effects were only measured over a very short period from 3 to 4 years old.

Meins, Centifanti, Fernyhough, and Fishburn (2013) demonstrated a link over a 4-year period between maternal mind-mindedness at 1 year and children's externalising behaviour at 3 years and 5 years, measured using the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). In their study, maternal mind-mindedness in the first year of life predicted lower levels of externalising when children were 3 and also when the same children were 5 years old. However, this effect was moderated by socio-economic status (SES) and only found in a low SES group. The authors argue that mind-mindedness may act as a protective factor in children's social and behavioural adjustment. A recent study has found a comparable effect of maternal mind-mindedness on social adjustment in 12 year old children (Hughes, Aldercotte, & Foley, 2017). However, to the best of our knowledge, no study has measured the effect of *early* MST on behavioural adjustment beyond the early years. Thus, the third aim of the current study was to investigate the relation between maternal MST at age 3-4 and children's prosocial behaviour and behavioural adjustment (externalising and internalising) at age 10.

In summary, this study had three main aims. First, we examined stability in mother and child MST from early to late childhood. We hypothesized that individual differences in MST would remain relatively stable in both mother and child in line with suggestions from previous research (e.g., Ensor et al 2014). Our second aim was to examine the relation between early maternal MST and children's ToM and MST up to age 10. Following the clear pattern of results from studies of younger children, we hypothesized that maternal MST would be positively related to children's ToM and own use of MST at age 10, both concurrently and longitudinally from age 3 to 4. Our third aim was to test the longitudinal relation between early maternal MST and reported child adjustment at age 10. Previous research has addressed this association within the preschool years (Meins, et al, 2013) and cross-sectionally at 12 years old (Hughes et al, 2017) but not examined the longitudinal relationships between these ages. For the current study we hypothesized that early maternal MST at age 3 to 4 would act as a protective factor against externalising and internalising behaviour at age 10. In addressing these aims we extend two previous published studies – Ruffman, Slade & Crowe (2002) and Ruffman, Slade, Devitt & Crowe (2006) – by including a 7-year follow-up of this sample of families when children were 10 years old.

Method

Participants

Participants were mother-child dyads from the Social Understanding and Mental State Talk project, a longitudinal study of social development from 3 to 10 years of age. Initial recruitment included

82 mother-child dyads from middle- and upper middle-class rural and urban areas and were predominately Caucasian, reflecting the population from which they were drawn. (see Ruffman, et al., 2002).

Data were initially collected at three time points over the course of the first year of the study. At the first visit there were 82 children (41 girls and 41 boys; *M* = 3.01 years), at the second visit there were 79 children (40 girls, 39 boys; *M* = 3.41 years) and at the third visit there were 72 children (36 boys and 36 girls; *M* = 4.04 years). Findings from these first three time points are published in Ruffman, et al. (2002) and Ruffman et al. (2006).

During a second wave of data collection, families were followed up seven years later. At this later visit there were 53 children (26 boys and 27 girls; *M* = 10.8 years). Attrition was primarily due to families who could not be traced rather than refusal to participate. There were no significant differences between the 53 families that remained in the study when children were aged 10 years and the original 82 families in: socio-economic-status, mother or child MST, child theory of mind or child language, 95% CIs [-.33, 1.09], [-10.93, 5.47], [-.94, 2.34], [-.54, .74], and [-.19, 3.01], respectively.

The current analysis examines the longitudinal relationships between early time points and the follow-up study conducted seven years later. Given the early measurement points took place very close together (three visits over one year) and displayed high internal reliability (see below) we calculated composite scores for each measure taken during the first three visits. These composites form our early time point (age 3 to 4) with our later time point comprising measures taken at the 7-year follow-up (age 10).

Procedure and Measures

At each visit a researcher visited families at home. The researcher worked with children to complete tasks while mothers completed questionnaires. Mother-child dyads also participated in interaction tasks together, which were audio- or video-recorded.

Picture task. This task was administered during all visits (age 3, 3.4, 4 and age 10) as a measure of both mother and child MST. At each time point, mothers and children were given a different set of 10 to 13 photographs of everyday situations involving one or more people (e.g., a woman holding a baby crossing a bridge, a family on the beach, a father and son sitting on a sofa). Mothers were given the photographs and asked, *'Can you look at these pictures with (child's name) like you would pictures in a book or magazine*?' The dialogue between mothers and children was audio-recorded and transcribed for coding. Transcripts were used to code utterances for mental state and non-mental state expressions (see Ruffman et al., 2002 for a full coding scheme). Mental state utterances included: cognitive terms (e.g., *think, know*), desire terms (e.g., *want, like*), emotion terms (e.g., *happy, sad*), general mental states (e.g., *remember, dream, imagine*) and modulations of assertions (*might, maybe perhaps*). Twenty-five percent of the transcripts were coded by a second trained rater. Cohen's kappas were used as a measure of inter-rater reliability and calculated for each category of utterance. All categories were found to have good to excellent reliability with kappas ranging from .70 to .97. In the current analysis we are interested in mothers' and children's overall use of mental state language as well as the most frequently occurring subtypes: emotion, cognitive and desire. We have thus reported a total MST variable for both mothers and children that sums the frequency of all MST terms as well as individual frequencies for emotion, cognitive and desire terms for mothers only.

Mothers' and children's MST was highly stable across the first three visits from age 3 to 4 with correlations ranging from .61 to .74 for mother total MST and .39 to .49 for child total MST. Internal reliability analyses across these first three visits yielded Cronbach's alpha scores of .82 and .70 for mother and child MST respectively. Composite scores were calculated by averaging MST across the first three visits for mother and child variables.

Theory of mind (ToM) tasks. During each of the first three visits, a battery of ToM tasks was administered. A false-belief translocation task based on Wimmer and Perner's (1983) study was given at all three visits. At the first visit, a desire-emotion (Wellman & Woolley, 1990) and an emotions-situations task (Denham, 1986) were also administered. During the second and third visit a false-belief contents task (Perner, Leekam & Wimmer, 1987) and a desire-action (Wellman & Bartsch, 1988) task were included. Finally, a further two tasks were included in the final visit; an ambiguity task based on Taylor (1988) and

Yuill, Perner, Pearson, Peerbhoy, and van den Ende's (1996) wicked desires task. Full descriptions of each task given at each of the first three visits are extensively documented elsewhere (see AUHTOR'S NAME REMOVED 2002 for full details). At each of these first three visits, individual ToM tasks were given an equal weighting by calculating a proportional score, with these scores then summed to give a composite ToM task score for each visit. At age 3, the maximum ToM score was 3 points, at the second visit (age 3.4) the maximum was 4 points, and at the third visit (age 4.1) the maximum was 8 points. Correlations between ToM scores across these first three visits ranged from .48 to .60 and showed good internal reliability (α = .71). A composite score for early ToM performance was calculated by averaging each ToM composite across the age 3 to 4 time points.

At age 10, children were given the Strange Stories task (Happé, 1994; O'Hare, Bremner, Nash, Happé, & Pettigrew, 2009). Children were presented, via narrated power point presentation, with short scenarios in which a story character says something that is not literally true and the child is asked to explain why the character behaved in such a manner. We presented 12 vignettes (adapted from Banerjee & Yuill, 1999; Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999, Happé, 1994, Keenan & Qugley, 1999 see O'Hare et al., 2009), which tapped children's ability to understand situations involving double bluff, white lie, self-presentation, faux pas, sarcasm and belief-based misunderstanding. For example, for belief-based understanding, children were told a story about an old lady who does not like walking home in the dark because she is afraid she will be attacked and robbed. As she is walking home, a man steps out of the shadows. He wants to ask her the time and walks towards her. The old lady misunderstands the man's intention and tells him to take her purse and not hurt her. After a comprehension control question, participants were asked the test question (for example, why the character said what they said). Responses were audiotaped, transcribed verbatim and scored on a 3-point scale (0 for an incorrect response, 1 for a response that partially referred to psychological states, and 2 for an answer that fully referred to psychological states, see O'Hare et al, 2009). A second coder independently coded 20% of transcripts, Cohen's kappa = .88. Some children did not complete all vignettes, and in these cases scores were adjusted proportionally. Maximum score was 24.

Maternal education. Maternal education was coded at recruitment as a measure of socioeconomic status (SES). Education levels were as follows: 0 = no secondary education (dropped out before 16, 2%), 1 = Certificate of Secondary Education (high school up to age 16, with a focus on applied topics, 2%), 2 = General Certificate of Secondary Education or O-Levels (high school up to age 16 with a focus on academics, 16%), 3 = A-Levels (high school up to age 18 with a focus on academics, 7%), 4 = vocational/professional training (e.g., nursing, teaching, 24.4%), 5 = university undergraduate (28%), and 6 = university postgraduate (17%).

Language. A measure of child language was taken at each visit. At the first three visits, the Linguistic Concepts subtest of the Clinical Evaluation of Language Fundamentals – Preschool test was used (Wiig, Secord, & Semel, 1992). This subtest measures children's ability to interpret, recall, and execute oral commands of increasing complexity. Correlations between early time points on the CELF measure ranged from .59 to .73 and internal reliability was high (α = .85). An early language composite was therefore calculated by averaging CELF scores across the first three time points. At age 10, the British Picture Vocabulary Scale (Dunn, Dunn, Whetton, & Burley, 1997) was administered. The BPVS is a measure of receptive vocabulary with children asked to indicate which picture out of a possible four options relates to a target word. In the current analysis we use both the CELF and the BPVS as a measure of children's general language ability at early and later time points respectively.

The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The SDQ was administered at age 10. It is a 25-item questionnaire designed to measure emotional and behavioural adjustment in children aged 3 to 16 years old. Mothers were asked to rate whether each item is 'Not True' (0), 'Somewhat True' (1) or 'Certainly True' (2) of their child. The SDQ provides scores on five subscales by summing five items per scale. The scales include: hyperactivity-inattention (e.g. '*restless, overactive cannot stay still for long'*), emotional symptoms (e.g., *'has many fears, is easily scared'*), conduct problems (e.g., *'often has temper tantrums or hot tempers'*), peer problems (e.g., '*gets on better with adults than with other children'*) and pro-social behaviour (e.g., '*considerate of other people's feelings'*). The hyperactivity-inattention and conduct problems scales combine to form an externalising score while the emotional symptoms and peer problems scales combine to form an internalising score. Cronbach's alphas for externalising, internalising and pro-social behaviour scales were .72, .76 and .82 respectively.

Results

Preliminary analysis.

Means and standard deviations for all study variables are displayed in Table 1 and correlations between the early (age 3-4) and later (age 10) time points in Table 2. An initial check showed that gender was not related to any of the predictor or outcome variables and was therefore excluded from further analysis.

Continuity of mental state talk and ToM from age 3-4 to age 10.

Our first aim was to assess the longitudinal stability of MST (mother and child) from age 3 to 4, to age 10. Correlations displayed in Table 2 reveal moderate to high stability coefficients for general maternal MST (r = .60, p < 0.01) and child MST (r = .42, p < .01) over the 7-year period. We also assessed stability in each of the sub-types of MST for mothers and found moderate to high stability coefficients for all maternal MST categories; emotion (r = .32, p < 0.05); cognitive (r = .59, p < 0.01) and desire (r = .42, p < 0.01). We also found stability in mother total utterances (r = .40, p < 0.01) and child general language (r = .46, p < 0.01) over the same period. Therefore, in order to rule out the possibility that stability in MST may be driven by stability in more general language abilities or verbosity we conducted further partial correlations. We controlled for mothers' total utterances and children's general language at age 3-4 in testing the longitudinal stability of mother and child MST, respectively. Results from the partial correlations show continued moderate stability in general maternal MST (r = .43, p < 0.01) including the subtypes desire (r = .41, p < 0.01) and cognitive ((r = .45, p < 0.01) talk when controlling for early maternal verbosity as well as stability in child MST (r = .40, p < 0.01) when controlling for early child general language.

We also found a moderate level of stability between ToM at age 3-4 and later ToM at age 10 (r = .30, p < .05). However, given the strong association between early child language and theory of mind within the early time point as well as longitudinally, we conducted a further partial correlation controlling for child general language (p = ns). These results suggest that stability in ToM is not independent of child general language, which may be a driver of the relation between early and later ToM.

Associations between mental state talk and theory of mind

Our second set of hypotheses related to associations within and across time between MST and child ToM. First, we measured the concurrent relation between maternal MST and child ToM at age 10, and second we examined the relation between early maternal MST at age 3 – 4 and children's later ToM at age 10. Within the age 10 time point, neither mother nor child general MST were significantly related to child ToM ($p > .10$). However, there was a longitudinal relation between early maternal MST and later ToM ($r = .25$, $p < .05$) as well as early child MST and later ToM ($r = .28$, $p < .05$). This replicates the pattern of associations of MST and ToM observed in the pre-school years. However, we did not find the same independent effects of MST over time when controlling for early child language and ToM. Using regression analysis the only longitudinal predictor of later ToM was early child language ($\beta = .34$, $p < .05$); early ToM, early child MST and early Maternal MST did not contribute unique effects over time (ps > 0.1).

Consistent with patterns of findings in the preschool years we did find substantial associations between all early MST talk variables and later child MST (Table 2). Given the strong associations between maternal and child MST at each time point and the stability in child MST over time, we used hierarchical linear regression to test whether early maternal MST predicted later child MST whilst accounting for possible child-driven effects from early child general language, early ToM and early child MST (see Table 3, Model 1). The dependent variable was children's MST at age 10. In step 1, we entered child general language (age 3-4), in step 2 we entered ToM and child MST (age 3-4) and in step 3 we entered mother cognitive and emotion MST at age 3-4 (see Table 3, Model 1). This shows that neither early child language or ToM were significant predictors of later child MST. However, early child MST did significantly predict later child MST at age 10 ($\beta = .49$, $p < .01$). In addition, early maternal MST in step 3 accounted for an additional 10% of the variance, with early cognitive talk emerging as a significant predictor of later child MST over and above early child MST (β = .45, p < .05).

However, we also found associations between early child MST and later maternal MST (see Table 2) and therefore conducted a second hierarchical regression in order to test the extent to which early child MST may be driving the direction of effect. In this model we regressed early child MST and ToM on later maternal MST, whilst accounting for early maternal MST and early child language (see Table 3, Model 2). In this model only early mother cognitive talk uniquely predicted later maternal MST (β = .57, p < .001) accounting for a substantial 35% of the total variance. Adding early child MST talk and ToM in step 3 did not account for any additional variance in later maternal MST (p > .10).

These analyses suggest that maternal MST, in particular mothers' cognitive talk, has a unique role to play in children's MST over and above child-driven effects; children's early MST does not explain unique variance in maternal MST over this six- to seven-year period, whereas early mother cognitive talk at age 3 to 4 predicts child MST six years later at age 10. This pattern is consistent with that obtained by Ruffman et al. (2002) but over a six to seven-year period instead of just one year.

Associations between mental state talk and behavioural adjustment

Finally, we examined whether the established pattern of relations between mothers' mental state language and children's social adjustment in the preschool years (Meins et al., 2013; Ruffman et al., 2006) extends into later childhood. In order to test our third hypothesis we examined relations between child and maternal MST and children's externalising, internalising and prosocial behaviour using both cross-sectional and longitudinal data.

We started by examining cross-sectional data at age 10. Correlations in Table 2 show that within the age 10 time point, both mother and child MST was associated with externalising and prosocial behaviour. All MST variables at age 10 were negatively associated with children's externalising behaviour, with lower levels of MST related to higher levels of problem behaviour. Furthermore, child MST and mother emotion talk were positively associated with prosocial behaviour at age 10, with higher levels of both related to more prosocial behaviour. Both prosocial and externalising behaviour were related to mother total utterances but not to SES, general child language or ToM either within this time point or longitudinally. Internalising behaviour was not related to mother or child MST at either time point and was therefore excluded from further analysis.

Next, we tested for unique effects of mother and child MST on child adjustment at age 10. We conducted hierarchical linear regression analysis and specified two separate three-step regression models for each of our two outcome variables, externalising and prosocial behaviour. In step 1 of both models we entered child general language (age 10) as a control variable. Although child general language was not related to our outcome variables, there were some associations with MST so that we entered it into the regression in order to differentiate effects that are driven by general language ability from those that may be driven by MST specifically. In step 2 we entered child MST (age 10) and in step 3 we entered proportional measures of mother desire, emotion and cognitive talk (age 10) when examining children's externalising, and mother emotion talk (age 10) when examining children's prosocial behaviour, reflecting the pattern in the zero-order correlations (see Table 4). We used proportional measure of MST in order to control for maternal verbosity.

In our first model predicting externalising behaviour, child MST at age 10 accounted for a significant 14% of the total variance in externalising. Children who used more mental state terms at age 10 tended to display fewer externalising behaviours. However maternal MST at this age did not explain any further unique variance. For prosocial behaviour, maternal MST accounted for a significant 8% of the total variance with mother emotion talk emerging as the single significant predictor of prosocial behaviour (β = .33, $p < .05$). Mothers who made more references to emotions during a concurrent parent-child interaction had children who displayed more prosocial behaviour at age 10.

Finally, we examined the longitudinal associations between early MST and later behavioural adjustment. We focused our analysis on children's externalising behaviour; although the pattern of correlations for prosocial behaviour was identical to that observed within the age 10 time point the magnitude of the association between MST and prosocial behaviour was much smaller over time and failed to reach significance. Correlations also show that mother (emotion and cognitive) and child MST at age 3-4 are negatively associated with later externalising behaviour at age 10. Again, in order to test the unique contribution of mother and child talk as well as testing the predictive properties of MST over time, we specified a third regression model (Table 5). In step 1 we entered child general language (age 3-4) and child MST (age 3-4), in step 2 we entered later maternal MST (age 10) variables (cognitive and emotion) to control for concurrent effects. Finally, in step 3 we entered measures of early maternal MST (emotion and cognitive talk at age 3-4). All maternal MST were proportional scores to control for verbosity.

The analysis showed that early child MST and general language accounted for a significant 17.2% of the total variance in later externalising behaviour with child MST (β = -.41., p < .05) independently predicting externalising behaviour over and above child language; children who used more MST when they were 3 to 4 years old displayed fewer externalising behaviour when they were 10. Adding later maternal MST (Cognitive and Emotion) in Step 2 did not contribute any further unique variance in externalising behaviour. However, early maternal MST added in step 3 accounted for a significant 18.8% of additional variance, with mother cognitive talk (β = -.60, p < .01), but not emotion talk, independently predicting externalising behaviour; mothers who used more cognitive talk when children were age 3 to 4 reported fewer externalising behaviours when children were 10 even when accounting for concurrent maternal MST and early child MST and general language.

Discussion

The current study assessed three aspects of the role of mental state talk (MST) between mother and child in the development of social understanding and social behaviour from the ages of 3 to 4 through to age 10. We first assessed the long-term stability of MST and found that for both mothers and children, references to mental states during interactions were relatively stable across this seven-year period. This is the first evidence of continuity in mother and child MST across this extended period from preschool to later childhood, a seven-year period and four years later than previous established relations up to age 6. Our results are consistent with and extend studies showing stability during infancy and early childhood. For example, short-term longitudinal studies have shown stability of mothers' MST with their child from 3 months to 7 months of age, from 12 to 24 months (Degotardi & Torr, 2007), and from 3 to 4 years of age (Ruffman et al., 2002). Studies over longer periods also suggest stability in use of MST by mothers, for example from 6 months to 4 years of age (Meins et al., 2003) and from 2 years to 6 years of age (Ensor et al., 2014). Likewise, we found that child MST shows moderate stability from preschool (3-4 years) into late childhood (10 years), over and above stability in general language ability. This novel finding is particularly noteworthy given the vast developmental changes over this same period. Thus, individual differences in mothers' and children's use of MST appear to reflect a relatively stable characteristic of the mother-child relationship.

Second, we tested the predictive value of early maternal MST for children's later social understanding at age 10, a time interval comparable to that used by Ensor et al. (2014). We found a direct relationship between maternal MST at age 3 to 4 and children's ToM performance at age 10. However, in our sample this effect was primarily driven by child language and thus we only partially replicated Ensor et al.'s findings. We did find a strong and significant relationship between early maternal MST and child MST at age 10. Regression analyses suggested that children's MST at age 10 was influenced by the frequency of mother-to-child mental state references experienced in early childhood, over and above the influence of the child's own MST at 3 to 4 years. This is consistent with previous studies that show maternal MST uniquely predicting child MST from 3 to 4 years of age (Ruffman et al., 2002) and mothers' cognitive references at age 2 predicting children's MST at 6 years of age (Ensor et al., 2014). Our results extend such findings, suggesting that this effect is stable into middle childhood at age 10.

Though child mental state language and ToM correlated during preschool (age 3 to 4), they did not correlate later at age 10. This lack of correlation between mental state language and

ToM has also been shown in a similar age group by Meins et al. (2006) who suggested that this reflects the possibility that comprehension of mental state concepts may not necessarily relate to the proclivity to use such understanding in social interactions. Further work could elucidate any distinction between different conceptions of mental state language, such as MST and mind-mindedness.

Third, we looked at the relation between MST and children's behavioural adjustment at age 10. The data suggest that higher levels of mother and child MST at 10 years of age were related to more prosocial behaviour and fewer behavioural difficulties at the same age. In particular, mother reference to emotion predicted children's prosocial behaviour at age 10. This is consistent with recent findings linking mothers' emotion talk and prosocial behaviour in infancy (Brownell, Svetlova, Anderson, Nichols, Drummond, 2013), but extends such findings by showing a comparable association in middle childhood. However, more crucially, we found a longitudinal relation between maternal MST at age 3 to 4 and behavioural difficulties at age 10, such that children of mothers who made more frequent reference to cognitive states when the children were 3 and 4 experienced fewer behavioural difficulties when they were 10. This supports and extends Meins et al.'s (2013) finding that maternal mind-mindedness in infancy predicts lower levels of behavioural difficulties at age 3 and age 5, also measured using the Strengths and Difficulties Questionnaire. Our findings over a seven-year period have important consequences as they suggest that early maternal MST may act as a protective factor against problem behaviour well beyond the preschool years into later childhood. Furthermore, we extend this finding to a novel SES group. In the Meins et al. study, the link between mind-mindedness and behavioural adjustment was moderated by SES, and only evident in their lower SES group, where behavioural difficulties were relatively high. The current study shows a similar effect in a sample of middle- to upper-middle class families in which children demonstrated relatively low levels of behavioural difficulties. Together, the results suggest that early maternal MST, in particular reference to cognitive states, has the potential to play an important protective function with regard to children's behavioural adjustment.

A limitation of our study is that we could not account for children's earlier behavioural adjustment at 3 to 4 years old, as equivalent measures were not taken at this earlier time point. We cannot, therefore, assume that early behavioural difficulties did not play a role in the extent to which mothers used MST at the early time point. It may be that children who exhibit higher levels of problem behaviour when they are young may have led mothers to engage in less mentalizing dialogue. However, we note that Meins et al. (2013) did not find support for this possibility in their study, in which they controlled for earlier behavioural difficulties (see also, Hughes et al., 2017). In addition, Ruffman, et al., (1999) found that mothers frequently said they used more MST when their child transgressed, not less. Nevertheless, future research must determine if this relation holds in larger and more diverse samples, and address differences and similarities between MST as measured here, and the assessment of related concepts such as maternal mind-mindedness. It would also be valuable to have other measures of behavioural adjustment, both from other raters, such as teachers, and through behavioural measures. Finally, it would be useful to assess MST outside the mother-child dyad, to allow for the possibility that mothers and children who get on better show more MST in their conversations than across conversations with other agents (Brown, Donelan-McCall & Dunn, 1996).

In sum, our study shows remarkable consistency in use of mental state talk in both mother and child across an extended period of time, and highlights the predictive value of early maternal MST for child MST 7 years later. Furthermore, we found links between mother's concurrent emotion talk and children's reported prosocial behaviour, and longitudinally mother's use of cognitive talk and lower frequency of reported behavioural difficulties at 10. The novel findings highlight the significance of mental state talk through early development of social understanding and social behaviour.

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Tables

Table 1

Means (M) and standard deviations (SD) for mental state talk, theory of mind, language and behavioural adjustment measures

	Early composite Age 3-4	Age 10 *N* = 53
	M (*SD*)	*M* (*SD*)
Mother Emotion	3.79 (2.95)	3.80 (3.77)
Mother Cognitive	13.65 (8.43)	25.56 (16.04)
Mother Desire	2.90 (2.45)	5.31 (3.79)
Mother Total MST	28.75 (16.36)	53.28 (32.10)
Mother Total Utterances	112.49 (38.99)	147.84 (76.38)
Child Total MST	3.26 (3.22)	30.44 (20.58)
ToM	2.30 (1.28)	18.05 (3.87)
Child General Language	12.11 (3.37)	24.34 (2.91)
SDQ: Externalising		4.00 (2.73)
SDQ: Internalising		2.96 (2.68)
SDQ: Prosocial		8.51 (1.80)

Note. MST = mental state talk. ToM = Theory of Mind. SDQ = Strengths and Difficulties Questionnaire.

Table 2.

Correlations between all study variables

	Age 3 - 4								Age 10										
	Em	Cg	Ds	Mt	Ct	ToM	Lang	Mu	Em	Cg	Ds	Mt	Ct	ToM	Lang	Mu	Ext	Int	Pro
Age 3 - 4																			
SES (maternal education)	.25*	.13	.31*	.33*	.33**	.21*	.23*	.21*	.11	.25*	.23^{t}	.33*	.18	.12	.28*	.32*	-.10	-.01	-.04
Mother Emotion (Em)		.46*	.48*	.64*	.52**	.21*	.20	.60*	.32*	.47*	.24*	.39*	.28*	.12	.22	.28*	-.28*	.03	-.01
Mother Cognitive (Cg)			.58*	.90*	.65**	.45**	.35**	.67*	.37*	.59*	.24*	.58*	.47*	.20	.18	.50*	-.43**	-.15	.15
Mother Desire (Ds)				.70*	.58**	.50**	.32**	.59*	.27*	.35*	.42*	.42*	.24*	.05	.38**	.35*	-.20	.15	.07
Mother Total MST (Mt)					.70**	.53**	.38**	.78*	.30*	.59*	.30*	.60*	.46*	.25*	.32*	.51*	-.37**	-.10	.08
Child Total MST (Ct)						.40**	.27*	.54*	.21	.40*	.14	.44*	.42*	.28*	.35**	.37*	-.33**	-.08	.13
ToM							.66**	.26*	.22^{t}	.22^{t}	.42*	.32*	.10	.30*	.47**	.27*	-.10	.06	.10
Child General Language								.02	.30*	.27*	.22^{t}	.31*	.24*	.39**	.46**	.26*	.09	-.16	.03
Mother Total Utterances (Mu)									.32*	.43*	.18	.45*	.37*	.13	-.05	.40*	-.40**	-.03	.18
Age 10																			
Mother Emotion (Em)										.55*	.33*	.65*	.42*	-.13	.04	.67*	-.30*	-.10	.37**
Mother Cognitive (Cg)											.62*	.94*	.71*	.18	.18	.87*	-.34**	-.09	.18
Mother Desire (Ds)												.65*	.39*	.18	.29*	.62*	-.26*	.06	.22
Mother Total MST (Mt)													.71*	.13	.19	.95*	-.37**	-.18	.29*
Child Total MST (Ct)														.16	.06	.69*	-.37**	-.07	.25*
ToM															.21	.06	.13	.16	-.19
Child General Language																.09	.13	.19	-.10
Mother Total Utterances (Mu)																	-.42**	-20	.30*
Externalising (Ext)																		.19	-.44**
Internalising (Int)																			-.31*
Prosocial (Pro)																			

Note. $^{t}p < .07$, $*p < .05$, $**p < .01$, one-tailed.

Table 3

Hierarchical linear regression predicting mental state talk

	Age 10					
	Model 1 Child MST			Model 2 Maternal MST		
Age 3 to 4	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
Child General Language	.24	.27	.20			
Child ToM		-.27	-.32			
Child Total MST		.49**	.28			
Mother Emotion			-.16			
Mother Cognitive			.45*			
Mother Desire			.08			
Child General Language				.31	.06	.04
Mother Emotion					-.04	-.02
Mother Cognitive					.57**	.58**
Mother Desire					.16	.14
Child ToM						.05
Child Total MST						-.03
Model *F*	2.55	4.32**	3.25*	4.43*	7.80***	4.95**
Δr^2	.06	.19	.10	.09	.35	.01
ΔF^2		4.96*	1.89		8.15**	.04
(*df*)		(2, 39)	(3, 36)		(3, 38)	(2, 36)

Note. Standardized beta weights appear in the top half of the table and model summary statistics appear in the bottom.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4

Cross-sectional hierarchical linear regression predicting behavioural adjustment

	Cross-sectional models					
	Externalising Age 10 (n = 47)			Prosocial Behaviour Age 10 (n = 47)		
Variable	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
Child general language	.12	.15	.20	-.11	-.13	-.12
Child MST		$-.38^{**}$	-.24		-.26	.11
Mother Emotion			-.13			$.33^{*}$
Mother Cognitive			.03			-
Mother Desire			-.15			-
Model F	.68	4.05^{*}	2.02	.51	1.77	2.73^{*}
ΔR^2	.02	.14	.04	.01	.07	.08
ΔF		7.31^{*}	.72		3.02	4.38^{*}

Note. Standardized beta weights appear in the top half of the table and model summary statistics appear in the bottom.
* $p < .05$, ** $p < .01$.

Table 5

Longitudinal hierarchical linear regression predicting behavioural adjustment

	Longitudinal model		
	Externalising Age 10 (*n* = 39)		
Variable	Step 1	Step 2	Step 3
Child general language	.11	.23	.32*
Child MST		-.41**	-.07
Maternal MST (Age			
Mother Emotion			-.08
Mother Cognitive			-.49**
Mother Desire			-
Model *F*	4.09	3.89*	4.38**
ΔR^2	.01	.15	.15
ΔF		7.21**	4.23*

Note. Standardized beta weights appear in the top half of the table and model summary statistics appear in the bottom.
* *p* < .05, ** *p* < .01.