Let's talk

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Let's Talk: Parents' Mental Talk (not Mind-Mindedness or Mindreading Capacity) predicts Children's False Belief Understanding

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Abstract

While one might expect parents' mind-mindedness (MM; the propensity to view children as mental agents) to relate to everyday mental-state talk (MST) and theory-of-mind capacity, evidence to support this view is lacking. In addition, both the *uniqueness* and the *specificity* of relations between parental MM, parental MST and children's false belief understanding (FBU) are open to question. To address these three gaps, this study tracked 117 preschoolers (60 boys) and their parents across a 13-month period (M_{age} = 3.94 years, SD = 0.53, at Time 1). Parental MM, MST and theory-of-mind capacity showed little overlap. Both MM and MST were weakly associated with children's concurrent FBU, but, in line with social constructivist accounts, only MST predicted later FBU.

Let's Talk: Parents' Mental Talk (not Mind-Mindedness or Mindreading Capacity) predicts Children's False Belief Understanding

For over a quarter of a century researchers have attempted to illuminate how family environments shape young children's understanding of others' minds, referred to as 'mindreading' or 'theory of mind' (Hughes & Devine, 2015a). The most widely studied aspect of children's theory of mind is false belief understanding (FBU). In early childhood this is typically assessed by asking a child to use a story character's (false) beliefs about the location or identity of an object to predict or explain his or her behavior (Wellman et al. 2001). Since the late 1990s the emphasis of research on young children's FBU has shifted focus from identifying when this capacity emerges (as evidenced by passing or failing the false-belief task) to understanding the origins and consequences of normative individual differences in young children's mindreading (as measured by children's scores on a battery of false-belief tasks) (Hughes & Devine, 2015b). The purpose of the current longitudinal study of 117 preschool children and their parents was to elucidate the origins of individual differences in children's FBU by examining: (1) relations between different parental characteristics (i.e., parental mind-mindedness, mental-state talk and parental theory-of-mind capacity) associated with children's FBU; and (2) the uniqueness and specificity of their developmental relations with later individual differences in children's FBU.

Alongside support for developmental associations between early language ability, executive function and later FBU (e.g., Milligan, Astington & Dack, 2007; Devine & Hughes, 2014) researchers have accumulated evidence linking early family experiences with children's FBU (Devine & Hughes, 2017). Unlike linguistic and executive accounts of FBU (which overlook children's social experiences), social constructivist or enculturation accounts emphasise the role of social interactions with more skilled members of the culture in the development of FBU (Carpendale & Lewis, 2006; Heyes & Frith, 2014; Wellman, 2017). If social experiences matter for children's FBU, then social interactions should predict FBU over time and above more general abilities (e.g., verbal ability) (Devine & Hughes, 2017).

Researchers have studied a wide range of family correlates of children's FBU, such as family socio-economic status (SES) (e.g., Cutting & Dunn, 1999), family size (i.e., the number of siblings a child has) (e.g., Peterson, 2000), and parental characteristics, such as the frequency of parents' use of mental-state talk (MST) (e.g., Dunn et al., 1991; Ruffman et al., 2002) and parents' tendency to view their children as individuals with their own thoughts, feelings and desires or mind-mindedness (MM) (e.g., Meins, Fernyhough, Russell & Clark-Carter,1998). Devine and Hughes (2017) recently integrated the evidence for four of the most widely studied family correlates of young children's FBU in a meta-analysis: two distal family characteristics (SES and number of siblings) and two aspects of parent-child interaction (MM and MST). Each of the two distal characteristics of children's families showed weak correlations with children's FBU: higher SES, $r = .18$, and the presence of child-aged siblings (i.e., siblings ranging from ages 2 to 12), $r = .14$, were associated with better FBU.

Before reporting on associations between FBU and parental MST and MM, a brief note on how these constructs are measured is needed. Research on parental MST (e.g., Dunn et al., 1991; Ensor & Hughes, 2008; Ruffman et al., 2002) involves recording the number of times that parents use words referring to cognitions (e.g., believe, think, know), desires (e.g., want, like), and emotions (e.g., happy, upset) during interactions with their children. Parental MM, which refers to a parent's tendency to view their child as a mental agent (e.g., Meins, Fernyhough, Wainwright, Clark-Carter, Das Gupta, Fradley & Tuckey, 2003) can be measured in two different ways depending on the age of the child. In infancy parental MM is measured ‘online’ during parent-child interactions in which attuned mental-state comments (i.e., comments that accurately reflect the infant’s current state of mind) are recorded (Meins, Fernyhough, Fradley & Tuckey, 2001; Meins, Fernyhough, Arnott, Leekam & DeRosnay, 2013). Beyond infancy, parental MM is measured using an ‘offline’ or representational measure in which parents’ descriptions of their child are transcribed and parental MM is indexed by the number of references to the child’s mental life, relative to the overall number of attributes described (Meins et al., 1998). In their meta-analysis, Devine and Hughes (2017) found weak but significant correlations between children’s FBU and both parental MST, $r = .21$, and parental MM, $r = .16$. These associations remained significant even after verbal ability was taken into account. The available longitudinal data indicated a moderate correlation between parental MST and later FBU, $r = .29$, and a weak correlation between parental MM and later FBU, $r = .12$.

The meta-analysis conducted by Devine and Hughes (2017) revealed three notable gaps in the literature on the relations between parental MST, parental MM and children’s FBU. First, very few studies in the meta-analysis (6 out of 28 datasets for MST and 3 out of 14 for MM) included data on children’s FBU from more than one time point. This is a notable omission because auto-regressive analysis is a cornerstone of establishing the existence of *developmental* relations (e.g., Ruffman et al., 2002). To use auto-regressive analysis to test whether there is a developmental association between either MST or MM and children’s later FBU, stability in the dependent variable (i.e., FBU) must be taken into account (Menard, 2002).

Second, while one might expect parental representational MM and parental MST to be associated, this view has yet to be tested as no study has yet included both measures. Given the dearth of longitudinal studies that control for prior levels of FBU, it follows that researchers have yet to establish whether there are unique developmental associations between parental MM, parental MST and children's later FBU. Third, although the meta-analysis indicated that concurrent correlations persisted even when verbal ability was controlled statistically, it is unclear whether parental MST and parental MM show *specific* developmental relations with FBU in particular or exert more *general* influences on children's cognitive development.

Relations Between Parental MM and MST

At first glance, parental MST and MM appear to be closely related constructs. Indeed, both measures rely on recording parents' use of mental-state language. In the case of MST, mental-state references occur within an interaction between a parent and child (e.g., Ensor & Hughes, 2008); in the case of the representational measure of MM, mental references appear in a parent's descriptions of the child (Meins & Fernyhough, 2015). While the consistency of parents' use of mental-state language across these different contexts has yet to be established, findings from two longitudinal studies deserve note. First, parents' use of appropriate mental-state language in free play with their infants at age 6 months is moderately correlated with the proportion of mental descriptions provided in interviews about their children at 48 months (Meins et al., 2003). Second, there is also a moderate correlation between individual differences in parent-to-child MST at age 2 and at age 6 (Ensor, Devine, Marks & Hughes, 2014). That said, Meins, Fernyhough and Harris-Waller (2014) have argued that variation in mental-state language use is not 'trait like', because adults' proportional use of mental descriptions was consistent when describing their partner and their close friend but not when describing a famous person.

To resolve this matter the current study investigated concurrent links between parents' use of mental terms when talking *about* and *to* their preschool child. To deepen this investigation we also examined whether the putative link between parents' MST and MM reflected individual differences in parents' own theory of mind capacity. To date, two studies have examined the links between theory-of-mind capacity and MM finding no link between parents' mental descriptions of their child and their performance on age-appropriate measures of theory of mind (Barreto, Fearon, Osorio, Meins & Martins, 2016) or between 7- to 9-year-old children's performance on vignette-based theory-of-mind measure and mind-minded descriptions of their best friend (Meins, Fernyhough, Johnson & Lidstone, 2006). These null findings, although acknowledged to be preliminary due to the small sample sizes and the use of a single measure of theory-of-mind capacity in each study, have been used to suggest a competence-performance gap (i.e., mental-state language during non-interactional or offline contexts is unrelated to the underlying capacity to reason about others' minds).

In the present study we sought to extend the existing literature by examining the relations between parents' performance on a novel battery of theory-of-mind tasks, parental representational MM and, for the first time, parents' online use of MST during parent-child interactions with preschool children. While offline descriptions of a familiar person might not draw on the same capacities as the ability to actively reason about the behavior of others, online mental-state language use during face-to-face interactions might require different capacities. In an effort to build upon previous work we recruited a larger sample than previously used by others and, stimulated by recent developments in the measurement of theory of mind beyond early childhood (e.g., Devine & Hughes, 2016; Devine, White, Ensor & Hughes, 2016; Dodell-Feder et al., 2013, Hughes & Devine, 2015b), we used a novel battery of age-appropriate theory-of-mind tasks designed to capture variation in parents' ability to reason about others' minds. These measures used different modalities (i.e., film, picture and animation) to capture variation in parents' ability to reason about emotions, desires, intentions and beliefs. While our parental measures required participants to reason about a wide range of mental states, to aid comparison with prior studies, our children's measures focused specifically on the ability to reason about beliefs. We therefore distinguish between parental 'theory of mind' and children's 'false belief understanding' (FBU) throughout this manuscript.

Parental Predictors of Children's FBU: Uniqueness and Specificity

The absence of longitudinal studies examining the relations between parental MST, parental MM and children's FBU means that it is unclear whether these parental characteristics make unique contributions to growth in young children's FBU. Social constructivist theorists posit that increased exposure to talk about mental states provides children with more opportunities to learn about others' minds or the 'data' to test and revise their theory of mind (e.g., Jenkins et al., 2003; Ruffman et al., 2002; Wellman, 2017). We would therefore expect that children exposed to the greatest amount of MST during parent-child interactions at Time 1 would should superior FBU at Time 2 relative to their peers. Extending this idea, it is possible that parents' offline mental descriptions of their children during the MM interview reflect the degree to which parents use MST during online interactions with their preschool children (e.g., Meins et al., 1998). If true, we would also expect developmental relations between representational MM and later FBU. Alternatively, parental MM could reflect the quality of the parent-child relationship. From this perspective, mind-minded parents might have more consistent and sensitive interactions with their child providing regular opportunities for children to learn about others' thoughts, feelings and emotions (e.g., Meins et al., 1998). If parental MM and online parental MST show unique associations with children's FBU, then this would suggest that these two parental characteristics measure distinct aspects of the parent-child relationship.

According to an alternative account, Sabbagh and Seamans (2008) have argued that the relations between parental MST, parental MM and children's FBU might be explained by the intergenerational transmission of parents' own theory-of-mind capacity. Sabbagh and Seamans (2008) have speculated that parents who excel at theory-of-mind tasks might be more likely to use MST during parent-child interactions or provide more mind-minded descriptions of their children. Indirect support for the intergenerational transmission account comes from evidence showing a moderate correlation between 44 parents' performance on the Reading the Mind in the Eyes Task (in which respondents attribute emotions to pictures of eyes) (Baron-Cohen et al., 2001) and 3-year-old children's FBU (Sabbagh & Seamans, 2008). This finding has yet to be replicated. If the intergenerational account holds, then the addition of parental theory-of-mind scores should attenuate any links between parental MST, parental MM and children's FBU. In contrast, if there is a competence-performance gap (Meins et al., 2006), then parental MST and parental MM will remain associated with children's FBU regardless of parental theory of mind.

We also sought to examine the specificity of any detected associations. The 'domains' view of socialisation emphasises the need to identify specific aspects of parental behavior that act on specific domains of development (Davidov, 2013; Grusec & Davidov, 2010). Individual differences in verbal ability are robustly related to children's FBU (Milligan, Astington & Dack, 2007) and, much like FBU, are reliably related to a range of parental factors, such as SES and the quality of parent-child talk (Hoff, 2006). Although meta-analytic findings suggest that the relations between parental MST, parental MM and children's FBU are independent of verbal ability (Devine & Hughes, 2017), it is unclear whether these two parental characteristics show longitudinal associations with children's verbal ability (independently of FBU). Existing findings concerning the relations between parental MM and children's VA are mixed (e.g., Meins et al., 2013; Meins et al., 2003) but there is evidence for a weak-to-moderate correlation between parental MST and children's verbal ability (e.g., Ensor et al., 2013). If parental MM and parental MST show unique associations with children's later verbal ability (when controlling for FBU and prior verbal ability) then these parental characteristics might have general as opposed to specific effects on children's socio-cognitive development. We therefore compared the strength of longitudinal associations between parental MST, parental MM and children's later FBU and verbal ability.

Summary of Aims

The two-generational design of this longitudinal study of preschoolers and their parents enabled us to address three aims. Our first aim was to examine, for the first time, the strength of associations between parents' representational MM, MST and parental theory of mind. Our second aim was to assess the *uniqueness* of these three measures as predictors of variance children's FBU across a 13-month period. Our third aim was to conduct parallel analyses focused on gains in children's verbal ability to assess the *specificity* of the relations between parental MM, parental MST and children's FBU.

Method

Participants

One hundred twenty parent-child dyads (recruited from nurseries and playgroups in the East of England) participated at Time 1 as part of an international study of children's social cognition (Hughes, Devine & Wang, 2017). Two additional parent-child dyads were recruited but were excluded from further testing due to failure on control questions on the false-belief tasks. One hundred seventeen dyads (60 boys) agreed to be contacted for a follow-up study. Participants were highly educated (81% of parents had a degree level education) and ethnically diverse (66% White British). All of the families were contacted at Time 2. Two families were no longer eligible to participate as they had left the country. Of the 115 eligible families, 103 (90%) took part at Time 2 approximately 13 months later, *SD* = 1.65 months, range: 11 - 17 months. At Time 1 children were aged 3.94 years, *SD* = 0.53, range: 3 – 4.95 years. There were 30 children aged from 3.00 – 3.49 years, 30 children aged from 3.50 – 3.99 years, 40 children aged from 4.00 – 4.49 years, and 17 children aged from 4.50 – 4.95 years. At Time 2 children had a mean age of 5.11 years, *SD* = 0.54, range: 4 – 6.10 years. There were 16 children aged from 4 – 4.49 years, 26 children aged from 4.50 to 4.99 years, 33 children aged from 5.00 – 5.49 years, and 25 children aged from 5.50 – 6 years. Due to scheduling difficulties three children were aged from 6.08 – 6.17 years at Time 2. To reduce data loss we retained these children in the sample and controlled for variation in age in our primary analyses. Non-returners did not differ from those who returned in age, gender or cognitive ability but were marginally more likely to have low parental education, OR = 3.05, *B* = 1.12, *SE* = 0.64, *p* = .08.

Procedures

Parents and children took part in two laboratory visits lasting up to 75 minutes in length approximately 1 year apart. At both time points children completed a battery of tasks designed to measure FBU and verbal ability. Child testing lasted up to 30 minutes. The children completed the task battery in a fixed order format such that no two tasks from any domain were completed alongside one another. At Time 1 (April – September 2013), parents were observed interacting with their child for up to 15 minutes. At Time 1 and Time 2 (May – September 2014) parents completed a short questionnaire booklet and interview in an adjoining room while children completed the task battery. At Time 2 parents also completed a short battery of theory-of-mind tasks. At the end of each session parents were debriefed and provided with £15 and a small gift for their child.

Measures

Parental Mind-Mindedness. We used a brief interview (in which parents were asked to describe what kind of person their child is and how they get along together) to obtain a representational measure of parental MM (Meins & Fernyhough, 2015). We assigned each statement describing the child (excluding repetitions) into one of four exclusive categories: mental (i.e., comments referring to the child's mental life), behavioral (i.e., comments referring to the child's behavior or routines), physical (i.e., comments referring to the child's appearance) or general (i.e. vague or unclear comments about the child not fitting the other three categories) (Meins & Fernyhough, 2015). The inter-rater reliability (based on 25% of the transcripts) for coding each comment was acceptable, $\kappa = .79$, $p < .001$. Intra-class correlations (ICC) for the total number of comments in each category were all significant, all $ps < .001$, indicating acceptable inter-rater reliability for the total number of mental descriptions (ICC = .92), behavioral descriptions (ICC = .91), physical descriptions (ICC = .83) and general descriptions (ICC = .83) identified by each rater. We calculated a proportional MM score by dividing the total number of mental comments by the total number of comments overall (Meins & Fernyhough, 2015).

Parental Mental-State Talk. We recorded parents and children while going through a commercially available wordless picture book (Meyer, 1969) for up to 10 minutes (M_{Duration} = 7.24 minutes, *SD* = 1.96) and while playing together with a Hasbro Playdoh ® Sweets Lunchbox play set for up to 5 minutes (M_{Duration} = 5.01 minutes minutes, *SD* = 0.40). Video transcripts were analysed using a bespoke 'dictionary' in Linguistic Inquiry and Word Count (LIWC) (Tausczik & Pennebaker, 2010). The dictionary was based upon existing coding schemes for studying MST (e.g., Ensor & Hughes, 2008) and contained an extensive list of terms referring to cognitions (e.g., think, know, wonder), emotions (e.g., happy, angry, sad), and desires (e.g., want, hope). To ensure that 'like' was not counted when used as a preposition, we programmed the dictionary to count only phrases such as 'I like', 'You like', 'He/She likes', and 'would like' in the desires category. In addition, conversational uses of 'you know' (*N* = 8) or 'know what' (*N* = 3) were discounted by checking each use of these terms manually. To evaluate the reliability of this dictionary for coding MST, we selected a sample of 25% of the transcripts and coded them manually and with the software. The raters exhibited acceptable inter-rater reliability identifying the total frequency of cognitions, ICC = .85, emotions, ICC = .85, and desires, ICC = .98. The software also exhibited acceptable levels of reliability with the raters for identifying the total frequency of cognitions, ICC = 0.82, emotions ICC = 0.82, and desires ICC = 0.96. The remaining transcripts were coded using LIWC. Cognitive terms accounted for 60.1% of all mental-state terms used by parents. This was followed by desire (20.4%) and emotion terms (19.5%). The most frequent cognitive term was 'think' (i.e., think, thought, thinks, thinking), which accounted for 69.7% of all cognitive terms. The most common desire term was 'want' (i.e., want, wanted, wants, wanting), which accounted for 68.3% of all desire terms. 'Happy' was the most commonly used emotion term accounting for 28.8% of all emotion terms. We calculated the total frequency of mental-state terms uttered by the parent across the two tasks (Ruffman et al., 2002). We also calculated the total number of parental utterances to control for verbosity (Ensor & Hughes, 2008).

Parental Theory of Mind and Verbal Ability. In the *Triangles Task* (Abell, Happé & Frith, 2000) parents described what happened in three short clips depicting two cartoon triangles moving about against a white background, which were designed to imply instances of encouraging, teasing, and surprising. Parents were awarded an appropriateness score ranging from 0 to 2 (i.e., the degree to which responses matched the events of the story) and an intentionality score ranging from 0 to 5 (i.e., the degree to which parents described the behavior exhibited by the triangles as deliberate) (Castelli et al., 2000). Based on double-coding 25% of the sample, the intentionality scale, $.81 \leq \text{ICC} \leq 1$, and the appropriateness scale, $.70 \leq \kappa \leq .76$, showed acceptable levels of reliability.

In the *Silent Film Task* (Devine & Hughes, 2013; 2016) parents answered six questions about a character's behavior in five short clips from a classic silent film depicting instances of mistaken belief, deception and mistaken identity. Participants' responses received a score of 0 (incorrect), 1 (partial credit) or 2 (fully correct) (Devine & Hughes, 2013). Participants' answers were also scored using a new coding scheme based on that developed by Ronald, Viding, Happé and Plomin (2006) to reflect the number of mental-state terms used by participants in response to the Strange Stories task. Participants received a score of 0 if they used no mental words, 1 if they used one, 2 if they used two or 3 if they used three or more mental words. Participants' references to their own mental states were not included. The inter-rater reliability co-effecients (based on 25% of the sample) were acceptable, $.71 \leq \kappa \leq 1$.

In the *Reading the Mind in the Eyes Task* (Baron-Cohen et al., 2001) parents viewed 28 of pictures of eyes and selected one of four words to describe the emotion shown. Correct responses were summed together to give a total possible score of 28. Parents also completed the *Similarities Test* from the Wechsler Abbreviated Scale of Intelligence (WASI-II) (Wechsler, 1999) to provide an index of verbal ability. Parents completed 20 trials in which they were stated why two words were alike. Responses for each trial were scored on a scale from 0 – 2 and summed.

Children's FBU. The children completed a task battery to measure FBU at Time 1 and Time 2. Note that the Time 1 battery differed from the Time 2 battery. Pilot work revealed that the second-order false-belief tasks and emotion-based false belief tasks were too challenging for the youngest children in our sample at Time 1. Likewise the unexpected contents and unexpected identity tasks were too easy for the oldest children in our sample at Time 2.

Change-of-location false belief task (Perner et al., 2011). At Time 1 and 2 the children completed two separate change-of-location tasks ('Change of Location 1 & 2'). Both tasks were administered using picture stimuli depicting two sets of characters. The children witnessed a character placing an object in one location before going out to play. In the character's absence another character entered the scene and placed the object in a different location. The children answered three forced-choice questions to assess their memory for the events in the story (e.g., 'Where is the book now). If children failed any of these three initial questions, the experimenter re-read the first part of the story. If the participant continued to fail any one of these items, testing was discontinued (*N* = 2 at Time 1). The story continued with the character returning to the scene. The children then answered the false-belief prediction question (e.g., 'Where will Sally look for her book?'). Children scored 1 point for a correct response and 0 points for an incorrect response. The children then answered the false-belief explanation question (e.g., 'Why did Sally look for her book in the cupboard?'). Correct answers (i.e., implicit and explicit explanations) received 1 point and incorrect answers (i.e., references to information about the character's desires or irrelevant facts) received 0 points (Perner et al., 2011). Prediction and explanation scores were summed giving a total possible score of 2 points for each task.

Unexpected contents false belief task (Gopnik & Astington, 1988). At Time 1 the children were shown a box of plasters containing crayons. The children were asked what was in the box. Following this, the children were then asked to look inside the box and tell the experimenter what was inside. After returning the crayons to the box the children answered three questions. First, children were asked the representational change question (i.e., 'Before you looked inside, what did you think was inside the box?'). This was followed by a reality control question (i.e., 'What's in the box really?) and false-belief question (i.e., 'Your mummy hasn't seen what's inside this box…what will she think is inside it?'). To pass either question, children had to pass the control question. Representational change and false belief responses were summed giving a possible score of 2 points ('False Belief Contents').

Unexpected identity false belief task (Hughes, 1998). At Time 1 the children viewed a pop-up picture book (Moerbeek, 1994) with a picture of an eye peeping through on each page. Upon turning the page, the picture was revealed to be an animal's eye. After five trials, the experimenter reached the penultimate page and pointed to the picture that appeared to be an eye and asked 'What's that?'. Upon turning the page the experimenter revealed that the picture was in fact a spot on a snake's back. The experimenter then turned back to the penultimate page and asked three forced-choice questions. First, children were asked a representational change question (i.e., 'What did you think it was before we turned the page?'). Next children were asked a reality control question (i.e., 'What is it really?') and a false belief question (i.e., 'Your mummy hasn't seen this book before… what will she think it is?'). To pass either question, children had to pass the control question. Representational change and false belief responses were summed together giving a possible score of 2 ('False Belief Identity').

Second-order false belief task (Sullivan et al., 1994). At Time 2 the children completed two picture-book tasks in which they had to make an inference about a character's beliefs about another character's beliefs ('False Belief Second Order 1 & 2'). In both stories the children were introduced to two characters (e.g., Peter and his Mum). First, the children saw one character in each story deceive another character (e.g., Peter's Mother tells him that she has bought him a toy for his birthday but she has really bought him a puppy). The children answered a forced-choice question about the deceived character's false belief (i.e., 'What did Peter think he was getting for his birthday?') and a reality control question (i.e., 'What was his mum giving him really?'). Next, the children saw the deceived character learn the truth in the other character's absence (e.g., Peter discovers the puppy hidden in the shed while he is outside playing). The children were then asked a forced-choice question in which they had to attribute a mistaken belief about another character's belief. These questions were followed by a justification question (i.e., 'Why does she say that?') and a comprehension question (i.e., 'Did mum see Peter go into the shed?') as well as a reality control question (i.e., 'What has Mum really got Peter for his birthday?').

Children received 1 point for crediting the character with the initial false belief if they answered both the false belief and reality control questions correctly. Children received 1 point for inferring the second order false belief and an additional 1 point for a correct justification. Children only received points for the second-order false belief and justification if they answered the control questions correctly. Children could receive up to 3 points for each story (i.e., 1 point for first-order false belief, 1 point for second-order false belief, 1 point for justification).

Emotions based on false beliefs task (Harris et al., 1989). At Time 2 the children completed two picture book tasks designed to test children's ability to infer a character's emotional state on the basis of his or her desires and beliefs ('False Belief Emotion Task 1 and 2'). In both stories the children were introduced to two characters (e.g., Monty the Monkey and Chris the Crocodile) and told about one of the character's preferences for a food or drink (e.g., Monty really loves oranges and he really doesn't like apples). In each situation the character must take either the preferred or disliked food in their lunchbox to school. The children then had to answer two comprehension questions about how the character feels when they get a particular food/drink (i.e., happy or not happy). Next, the children saw the other story character change the contents of the lunchbox in the first character's absence (e.g., the preferred food is replaced with the disliked food). The children answered a question about what the absent character would feel before opening his/her lunchbox (i.e., happy or not happy) and had to justify their response. Children received 1 point for each correct response if they had correctly answered the two comprehension questions. The children were then asked a false belief question about what the character thought was in his/her lunch box and a reality control question (i.e., 'What is in the lunchbox really?'). Children received 1 point if they answered both questions correctly. The children were asked a further comprehension question about how the character felt (i.e., happy or not happy) after opening the lunchbox and to explain why the character felt this. Children were only credited with attributing the emotion based on the false belief if these two questions were answered correctly. Children received up to 3 points for each story (i.e., 1 point for attributing an emotion based on false belief, 1 point for a correct explanation, 1 point for a correct false belief attribution).

Children's Verbal Ability. The children completed the *Receptive Vocabulary* task from the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III-UK) (Rust, 2003) at Time 1 and 2. The children were shown a color flipbook depicting 4 images on each page and asked to point to the picture that matched the word uttered by the experimenter. Children completed up to 38 trials and were awarded 1 point for each correctly response. Raw scores were used in all analyses.

Results

Analytic Strategy

We used a latent variable modelling approach to analyse our data in *Mplus* Version 7 (Muthèn & Muthèn, 2012). We began by testing a series of measurement models using confirmatory factor analysis (CFA) to evaluate the consistency of our diverse tests of children's FBU and parents' theory of mind. Next we examined the longitudinal relations between our parent and child variables using auto-regressive structural equation models. In auto-regressive models the dependent variable is regressed onto an earlier measure of that variable and the predictor variables of interest (Menard, 2002). The predictor variable is said to have a developmental influence on the dependent variable if it shows a significant association with the dependent variable when earlier scores are taken into account (Menard, 2002).

For each of the returning 103 participants, there were no missing data points for any of the FBU tasks or the verbal ability measures. We used a full information approach so that all cases with data at Time 1 could be included in the analyses. Instead of imputing missing values, *MPlus* estimates missing model parameters and standard errors using all of the available data (Enders, 2001). This approach is suitable for regression models and produces less biased estimates than traditional approaches to handling missing data (Enders, 2001). We used four primary criteria to assess each of our models: a non-significant χ^2 test of model fit, Cumulative Fit Index (CFI) and Tucker Lewis Index (TLI) ≥ 0.95, and Root Mean Square Error of Approximation (RMSEA) ≤ 0.08 (Brown, 2015). We calculated Bayes Factors for specific model parameters based on the difference between the BIC for a null hypothesis (BIC_{H0}) model in which the parameter of interest was constrained to 0 and the alternative hypothesis (BIC_{H1}) model in which the parameter of interest was freely estimated (Wagenmakers, 2007).

Data Reduction

Table 1 shows the descriptive statistics for each of the child and parent measures at Time 1 and 2. First we investigated the latent factor structure of the parental theory-of-mind task battery. There were weak-to-moderate correlations between each of the four task indicators (Table 2). Note that the four indicators showed little evidence of ceiling effects: 0% scored 28/28 on the Eyes Task, 12.5% scored 6/6 on Triangles Appropriateness, 1% scored 15/15 on Triangles Intentionality, and 0% scored 27/27 on the Silent Film Task. We examined the fit of a one-factor solution in which each of the four task indicators were loaded onto one single latent factor using a robust maximum likelihood estimator (Kline, 2011). This model provided an acceptable fit to the data, χ^2 (2) = 0.01, p = .99, CFI = 1.00, TLI =

1.06, RMSEA = 0, and the latent factor exhibited significant variance, un-standardized estimate = 3.09, $p < .001$. All items loaded onto the single theory-of-mind latent factor with standardized loadings ranging from .36 to .89, all *p*s < .001. The latent factor determinacy co-efficient was .92 indicating high internal consistency (Brown, 2015). We tested a further CFA model in which each indicator was regressed onto parents' scores on the Similarities Test. This model provided an acceptable fit to the data, $\chi^2(2) = 0.51$, $p = .78$, CFI = 1.00, TLI = 1.08, RMSEA = 0, and the latent factor continued to exhibit significant variance, un-standardized estimate = 3.59, $p < .001$. Even when parents' verbal ability was controlled, each item loaded significantly on the latent factor with standardized loadings ranging from .33 to .84, all *p*s < .01.

Building on previous studies of children's FBU (e.g., Devine et al., 2016), we tested a single latent factor representing children's performance on the FBU task battery at Time 1 and Time 2 using a mean- and variance-adjusted weighted least squares estimator (WLSMV). Polychoric correlations (Table S1) revealed that the four Time 1 indicators of FBU task performance were significantly inter-correlated. Our first single latent factor solution in which each FBU task indicator at Time 1 loaded onto a single latent variable provided a poor fit to the data, $\chi^2(2) = 11.91$, $p = .003$, CFI = 0.97, TLI = 0.93, RMSEA = .20. Inspection of the modification indices revealed that there was a significant correlation between the error terms of the two change-of-location tasks. A second model, where the error terms for the change-of-location tasks were correlated, provided an acceptable fit to the data, $\chi^2(1) = 1.61$, $p = .20$, CFI = 0.99, TLI = 0.99, RMSEA = .07. The latent factor exhibited significant variance, un-standardized estimate = 0.34, $p = .007$, and each of the task indicators loaded significantly onto the latent factor with standardized loadings ranging from .59

to .83, all *p*s < .001. The total information curve revealed that, for participants with an average level of ability, the latent factor showed high levels of reliability, .93.

Polychoric correlations (Table S1) showed that the six Time 2 indicators of FBU were significantly inter-correlated. A single latent factor model, in which the error terms of the two change of location FBU tasks were correlated, provided an acceptable fit to the data, χ^2 (8) = 10.12, p = .26, CFI = 0.98, TLI = 0.97, RMSEA = .05. The latent factor exhibited significant variance, un-standardized estimate = 0.26, p = .02. Each task indicator loaded significantly onto the latent factor with standardized loadings ranging from .51 to .75, all *p*s < .001. Inspection of the total information curve revealed that, for participants with an average level of ability, the latent factor showed high levels of reliability, .84.

We created factor scores for children's FBU latent factor at Time 1 and 2 and parental theory-of-mind latent factor at Time 2 by imputing plausible values for each latent variable using Bayesian estimation in *Mplus*. Bayesian plausible values are preferable to factor scores created using the regression method (Skrondal & Laake, 2001) and provide reliable estimates of the true scores on latent factors that can be used to build models for secondary analysis (Asparouhov & Muthèn, 2010).

Relations Between Measures of Parental Theory of Mind, MM and MST

Correlations between parental theory of mind, MM and MST were uniformly close to 0 (Table 2). Since statistically non-significant correlations do not automatically favor the null hypothesis (Wagenmakers, Verhagen & Ly, 2016), we calculated Bayes Factors for each of these correlations using JASP Version 0.8.1.1 (JASP Team, 2017). For these correlations we assigned a uniform prior for *r* ranging from -1 to 1 indicating our belief that each value of *r* was equally likely before seeing the data. Bayes Factors can be interpreted in terms of the strength of evidence they provide in favor of the alternative (BF_{10}) or null hypothesis (BF_{01}) (e.g., Wetzels & Wagenmakers, 2012): anecdotal 1 < *BF* < 3, moderate 3 < *BF* < 10, strong 10 < *BF* < 30, very strong 30 < *BF* < 100, or extreme *BF* > 100.

The correlation between MM and MST provided moderate evidence in favor of the null hypothesis. Likewise, the correlations between parental theory of mind, MST and MM also provided moderate evidence in favor of the null hypothesis. Note that the evidence favored the null hypothesis even when we examined the correlations between parental MST, parental MM and each of the four indicators of parental theory-of-mind tasks separately. Turning to the correlations between parent and child measures, there were weak-to-moderate concurrent and longitudinal associations between parental MST and children's FBU. The Bayes Factors indicated that the correlations provided moderate to strong evidence in favor of the alternative hypothesis. In contrast, there was only a weak correlation between parental MM and children's FBU at Time 1 (providing anecdotal evidence in favor of the alternative hypothesis) and a correlation close to 0 between parental MM and FBU at Time 2 (providing strong evidence in favor of the null hypothesis). The correlations between parental theory of mind and FBU at Time 1 and 2 were close to 0 favoring the null hypothesis. Taking each parental theory-of-mind task separately, the pattern of findings remained the same for the Silent Film and Triangles Tasks with the Bayes Factors again providing moderate to strong evidence in favor of the null hypothesis. In contrast, there was a weak correlation providing anecdotal evidence for a non-zero correlation between performance on the Eyes Task and children's FBU at Time 2. Note, the correlations between children's verbal ability at Time 1 and 2 and parental theory of mind provided moderate to strong evidence in favor of there being an association between these variables.

Uniqueness of Longitudinal Relations with Later FBU and Verbal Ability

To examine the concurrent and longitudinal relations between each of our parental measures and children's FBU and verbal ability we regressed children's Time 2 FBU and verbal ability scores onto Time 1 FBU scores, Time 1 verbal ability scores, parental theory-of-mind scores, parental MM and parental MST. To control for possible confounds, we regressed the Time 2 variables onto Time 2 Age, the total number of parental utterances and parental education. This model (Figure 1) provided an acceptable fit to the data, χ^2 (1) = 0.16, p = .69, CFI = 1.00, TLI = 1.11, RMSEA = 0, BIC = 5284.53 (i.e., BIC_{H1}), explaining 54% of the variance in FBU and 53% of the variance in verbal ability at Time 2. Table S2 shows all unstandardized and standardized parameter estimates.

Children's FBU scores showed moderate rank-order stability over time. MST and parental MM were concurrently related to children's FBU at Time 1 but only MST showed a significant unique longitudinal association with later FBU at Time 2 accounting for 4% of the variance in children's FBU at Time 2. Comparing the BIC for the baseline (alternative hypothesis) model with a null model in which the path between parental MST and FBU at Time 2 was constrained to 0, BIC_{H0} = 5289.45, revealed moderate-to-strong evidence in favor the alternative hypothesis that MST predicts children's later FBU, BF_{10} = 11.71. In contrast, there was moderate evidence in favor of the null hypothesis of no longitudinal association between parental MM and later FBU, BIC_{H0} = 5279.90, BF_{01} = 10.12. A Wald Test of Parameter Constraints showed that the longitudinal relation between MST and FBU was marginally stronger than the link between MM and FBU, ω (1) = 3.77, p = .052. Model comparison revealed that there was anecdotal evidence for a difference in the strength between these two paths, BIC_{H0} = 5285.16, BF_{10} = 1.37. Parental theory of mind was not correlated with FBU at Time 1 or Time 2. The data provided anecdotal evidence in favor of the null hypothesis, BIC_{H0} = 5282.15, BF_{01} = 3.29.

Verbal ability also exhibited moderate levels of rank-order stability over time. There were concurrent associations between Time 1 verbal ability and parental MSTbut not parental MM. There were unique longitudinal associations between parental MST and Time 2 verbal ability providing anecdotal evidence in support of the alternative hypothesis, BIC_{H0} = 5287.21, BF_{10} = 3.82. In contrast, the association between parental MM and Time 2 verbal ability provided anecdotal evidence in favor of the null hypothesis, BIC_{H0} = 5282.13, BF_{01} = 3.32. A Wald Test of Parameter Constraints showed that these two paths were not significantly different in strength, ω (1) = 0.20, p = .65, BIC_{H0} = 5279.95, BF_{01} = 9.89.

Specificity of Longitudinal Relations with Later FBU and Verbal Ability

We compared the relative strength of parental predictors of children's FBU scores and verbal ability at Time 2. A Wald Test of Parameter Constraints showed the path between Time 1 parental MST and Time 2 FBU scores was significantly stronger than the path between Time 1 parental MST and Time 2 verbal ability, ω (1) = 5.79, p = .016. There was anecdotal evidence in favor of a difference between these paths, BIC_{H0} = 5285.68, BF_{10} = 1.78. A Wald Test of Parameter Constraints showed that the path between Time 1 parental MM and Time 2 verbal ability was marginally stronger than the path between Time 1 parental MM and Time 2 FBU scores, ω (1) = 3.84, p = .05. There was moderate evidence in favor of the null hypothesis that there was no difference between the strength of these two paths, BIC_{H0} = 5282.32, BF_{01} = 3.02.

Discussion

Parental MM, Parental MST and Parental Theory of Mind

Our first aim was to examine the association between parental MM (measured offline during an interview) and parental MST (measured online during a parent-child interaction). Our results showed little overlap between these two constructs. Moreover, consistent with previous reports of a competence-performance gap (e.g., Meins et al., 2006; Barreto et al., 2016) neither MM nor MST was related to parents' performance on age-appropriate theory-of-mind tasks. From a methodological standpoint, this study extended previous work by adopting a novel adult theory-of-mind battery and by using Bayes Factors to examine the relations between measures.

Our adult battery built on research showing marked variation in mindreading in neuro-typical adults (e.g., Dodell-Feder et al., 2013) and studies showing that individual differences in theory-of-mind capacity can be measured through multi-measure task batteries in middle childhood and adolescence (e.g., Devine et al., 2016; Devine & Hughes, 2016). None of the four indicators of adult theory of mind showed ceiling effects suggesting that these tasks were age appropriate. Our results showed that the battery was reliable and that the items loaded onto a single latent factor even when the potentially confounding influence of verbal ability was taken into account. Further work is required to replicate these results in a larger sample.

Our use of Bayes Factors was important because the absence of a statistically significant correlation does not necessarily imply the absence of a correlation (e.g., Wagenmakers, Verhagen & Ly, 2016). Previous studies of the relations between parental MM and theory of mind have taken failure to reject the null hypothesis as evidence for accepting the null hypothesis (e.g., Barreto et al., 2016). Using Bayes Factors we were able to quantify the likelihood of the null hypothesis being true in light of the available evidence (e.g., Wagenmakers, Morey & Lee, 2016). Our results therefore provide the first positive evidence that both parental MM and MST are unrelated to parental theory-of-mind capacity.

From a theoretical standpoint, our results challenge the view that parents who excel at formal theory-of-mind tests are more likely to describe their child in a mind-minded way or use MST when interacting with their children (e.g., Sabbagh & Seamans, 2008). Even though each of our parental measures had superficial methodological similarities (relying to some extent upon tallying parents' use of mental-state words), there was very little rank-order stability across parental MM, MST and theory-of-mind task performance. Parents' MM or MST during interactions with their child might therefore reflect distinct aspects of the quality of the parent-child relationship (Meins et al., 2014). Supporting this view, despite longitudinal rank-order stability in parental MST to a specific child across time (Ensor et al., 2013), there is evidence that the choice of interlocutor might drive MST. For example, preschool children make significantly more references to mental states when talking with friends and siblings than when talking with their parents (Brown et al., 1996). Examining parents' descriptions of children and their siblings will provide further evidence of how MM reflects a quality of specific relationships rather than a general propensity to use mental language.

Bolstering the view that there is a performance-competence gap (Meins et al., 2006), parents' theory of mind capacity had no bearing on MM or MST. Instead MM and MST might best be conceived as emergent properties of a particular relationship as opposed to correlates of parental theory of mind. Social interactions do not necessarily depend on mental-state attribution especially in the context of strong social norms, social scripts or high levels of familiarity (Ratcliffe, 2007). Future work examining the unique correlates of parents' MM and MST (e.g., parental stress) and identifying child-driven effects on both parental MM and parental MST (e.g., children's own propensity to use MST) is needed to test this hypothesis. Reflecting calls for understanding the neuro-cognitive mechanisms underpinning parental behavior (e.g., Deater-Deckard & Sturge-Apple, 2017), future work should consider the ways in which parental theory of mind might underpin other aspects of parental behavior that are likely to require reasoning about others' mental states, such as strategies for resolving conflict. Note that our results do not rule out the possibility that parental theory-of-mind capacity could be related to online or interactional MM. Observational measures of MM were not designed for studying children aged over 12 months (Meins & Fernyhough, 2015). It is therefore conceivable that parents who show superior performance on measures of theory of mind might also be highly skilled at accurately labelling and interpreting their children's mental states on a moment-to-moment basis during parent-child interactions. Further work is therefore required to investigate the links between parental theory-of-mind capacity and online measures of parental MM in infancy.

Unique Influence of Parental MST on Children's FBU

To our knowledge, our study is the first to assess parental MM and MST in tandem as predictors of developmental gains in preschool children's FBU. This is important given the paucity of longitudinal studies of parental influences on children's FBU (Devine & Hughes, 2017) and the limited understanding of the links between these two parental correlates of children's FBU. Our longitudinal model showed that while both MM and MST exhibited weak concurrent associations with children's FBU, only parental MST showed a unique longitudinal association with children's FBU over time. Moreover the links between MST and children's FBU were marginally stronger than those between parental MM and children's FBU. Note that our concurrent correlations between MST, MM and FBU were consistent in magnitude with those reported in the meta-analysis by Devine and Hughes (2017). The longitudinal associations between MST and later FBU were also similar in strength to those reported in the meta-analysis even though our analyses included more covariates. Our longitudinal correlation between representational MM and later FBU were also consistent with reported by Dore and Lillard (2014).

Our results underscore the distinctiveness of parental MM and MST and shed light on the potential mechanisms underpinning correlations between these constructs and children's FBU. Consistent with the social constructivist account, children exposed to high levels of MST outperformed their peers in FBU at Time 2. Parental MST could therefore provide the relevant experiences necessary for children to learn about mental states (Wellman, 2017). This learning could, according to Gopnik and Wellman (2012), occur through probabilistic Bayesian learning in which children use evidence from their experiences (for example, when talking with their parents) to revise and/or replace their initial hypotheses about others' minds.

Do our results challenge the view that parental MM matters for children's FBU? It is possible that using an interview-based measure of parental MM limited the conclusions that can be drawn from our study. That is, our results regarding both the associations between parental MM and parental MST and theory-of-mind capacity on the one hand, and children's FBU on the other, are limited to what is measured by the MM interview. There are at least two challenges to this argument. First, underlying the convergent validity of observation and interview-based measures of parental MM, individual differences in interaction-based measures of parental MM at 6 months are robustly correlated with interview-based measures of parental MM at 48 months (Meins et al., 2003). Second, in their meta-analysis, Devine and Hughes (2017) found no effect of the method of measuring MM (i.e., interview or observation) on the reported correlation between parental MM and children's FBU. Age-appropriate observation-based measures of appropriate and non-attuned parent-child talk for children aged over 12 months are currently lacking (Meins & Fernyhough, 2015) and so it is not possible to examine the relations between interactive or online MM and children's FBU in preschool children. That said, we cannot rule out the potentially important role of early exposure to mind-minded interactions in infancy for children's later FBU (e.g., Laranjo et al., 2014). The creation of developmentally-appropriate measures of observational MM for use with preschool children would be useful, not only to examine convergent validity between interview- and observation-based measures of MM but also to assess the relative importance of MST generally or mind-minded MST specifically to individual differences in children's FBU (Meins, Fishburn & Fernyhough, 2017). At the very least, our results challenge the view that *representational* MM might influence children's FBU via MST (Meins et al., 1998). The presence of concurrent (but not developmental) links between representational MM and FBU reported in the current study raises the possibility of child-driven influences on parents' propensity to describe their child as a mental agent. That is, parents who recognise that their children as skilled mindreaders might describe their children in more mentalistic ways (e.g., 'He's very aware of what others feel'). Cross-lagged longitudinal designs are therefore needed to clarify the causal direction of relations between representational MM and FBU.

Our results challenge the inter-generational transmission account proposed by Sabbagh and Seamans (2008). Consistent with their findings we found weak correlations between parents' performance on the Eyes Task and children's FBU at Time 2. In contrast, we found no evidence for a correlation between parental theory-of-mind capacity (as measured by the Silent Film and Triangles Tasks separately and by the theory-of-mind latent factor) and children's FBU. Our analyses went further than those reported by Sabbagh and Seamans (2008) by more than doubling the size of their original sample and examining whether parental theory of mind capacity made a unique contribution to children's FBU when controlling for children's verbal ability. This is important because any potential association between performance on the Eyes Task and children's FBU could be due to the intergenerational transmission of verbal ability rather than theory of mind *per se*.

Specificity of the Relations between MST and Children's FBU

To our knowledge, this was the first study to examine the specificity of the relations between parental MST, MM and children's FBU. Supporting a domain general perspective (Davidov, 2013), parental MST exhibited longitudinal associations with both children's FBU and verbal ability. That said, our post-hoc analyses revealed that the relations between parental MST and later FBU were significantly stronger than those between parental MST and later verbal ability.
In contrast, (and somewhat unexpectedly) parental MM showed a marginally stronger longitudinal association with children's verbal ability than with children's FBU.

These differential patterns of association are open to at least four interpretations. The first of these hinges on child-driven effects. That is, parents might use more MST or exhibit higher levels of MM in response to children with superior language skills. Cross-lagged longitudinal analyses will be required to test this possibility. Second, parents using MST during interactions with their child might also use grammatically more complex speech because English mental-state verbs and verbs of communication typically take tensed complements (DeVilliers, 2007). The use of this elaborate syntax could explain the overlap between MST and children's later verbal ability. Third, the pragmatic context of MST may also help children to improve their verbal ability. Ensor and Hughes (2008) found that MST often occurred within ‘connected conversations’ (i.e., speaker that turns are semantically related to the partner’s previous utterance or action). Connected talk requires parents to tune in to their child and so may reflect parental MM and be especially effective in facilitating learning. Fourth, beyond these domain-general effects, a mediation model also deserves attention. Specifically, parental MST might act upon children’s FBU by enhancing verbal ability. Future studies incorporating at least three time points will be required to test mediation hypotheses (Cole & Maxwell, 2003).

There now exists ample evidence for an association between FBU and executive function in early childhood that is moderate in size (for a meta-analytic review, see Devine & Hughes, 2014). Much like FBU, there is a growing body of evidence that parental factors predict early individual differences in children’s executive function (e.g., Hughes & Devine, 2018). Preliminary findings indicate that there may be weak-to-moderate correlations between parental MM and preschool children’s executive function (Bernier, Carlson, Deschenes, & Matte-Gagne, 2012). Likewise a recent study reported a weak but significant unique association between maternal MST and children’s EF (Baptista, Osorio, Martins, Castiajo, Barreto, Mateau, Soares & Martins, 2017). While these findings have yet to be replicated or investigated developmentally, it is possible that there could be complex relations between parental MM, MST, FBU and executive function. For example, children’s executive function might moderate the relations between parental MST and FBU in that children who are better able to attend to environmental stimuli might benefit more from environments rich in MST (Hughes & Devine, 2015a). Alternatively, parental MST might influence children’s developing FBU via its impact on children’s developing EF. Further work investigating the interplay between these constructs is therefore warranted.

Caveats and Conclusions

At least five limitations of the current study deserve note. First, our measure of children's theory of mind focused on the ability to represent others' false beliefs. Although our focus on children's FBU is consistent with previous literature in the field (Devine & Hughes, 2017), it is possible that parental MM, parental MST or parental theory of mind might show different patterns of association with broader measures of children's theory of mind (e.g., Dunn et al., 1991). Second, although we were able to control for prior levels of children's FBU, we were unable to conduct lagged longitudinal analyses on the relations between parental theory of mind and children's FBU because we did not measure parental theory of mind at Time 1. That said, our correlations between parental theory of mind and children's FBU were consistent whether the Time 1 or Time 2 measures of FBU were used. Third, it is possible that our measures of parental theory of mind were unrelated to the measures of parental MM or MST because they were not measured concurrently. However, Fernandez-Abascal et al. (2013) showed that adult performance on the Eyes Task was stable over a 12-month period indicating that individual differences in parental theory of mind might be trait like. Fourth, the parents in our study were primarily mothers (only five fathers identified themselves as primary carers). Very little research has examined the unique contributions made by fathers to young children's FBU (e.g., Lundy, 2013; LaBounty, Wellman, Olson & Lagattuta, 2008). This is a notable because fathers increasingly play an important role in childcareand may contribute in unique ways to children's FBU (LaBounty et al., 2008). Fifth, as noted by Devine and Hughes (2017), the observed associations between parental characteristics and children's FBU do not provide definitive developmental evidence in support of social constructivist accounts as so-called 'social' effects are confounded with genetic effects (e.g., Dale, Grazia-Tosto, Hayiou-Thomas & Plomin, 2015). At least two types of research will be required to overcome these potential confounds: (1) parent-mediated interventions testing the effect of increasing parental MST or MM on children's FBU; and (2) genetically sensitive studies comparing biologically related parent-child dyads with non-biologically related parent-child dyads (e.g., adopted children or children born using assisted reproductive technologies). Such studies would provide a strong test of social constructivist accounts.

Notwithstanding these limitations, our study makes three important theoretical contributions to the field and sets the stage for future investigations. First, our results showed that parents' representational MM and online MST with preschool children are distinct constructs with little overlap. Moreover, neither MM nor MST was related to parents' performance on a battery of age-appropriate theory-of-mind tasks. Second, our models revealed that how parents talked with their preschool children, specifically their use of MST, mattered more for the development of children's FBU than how parents described their preschool children or parents' performance on tests of reasoning about others' minds. Third, supporting a domain general view of parental influence, parental MST showed longitudinal associations with both children's FBU and verbal ability, raising important questions for future studies about the mechanisms underpinning the associations between parental MST and children's theory of mind.

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Table 1. *Descriptive Statistics*

	Time 1			Time 2		
	M (SD)	**95% CI**	**Range**	***M (SD)***	**95% CI**	**Range**
Child Measures						
Receptive Vocabulary	23.04 (5.12)	22.11, 23.97	8 – 31	27.08 (3.82)	26.34, 27.82	17 – 34
Change of Location 1	0.90 (0.79)	0.76, 1.04	0 – 2	1.35 (0.65)	1.23, 1.47	0 – 2
Change of Location 2	0.95 (0.81)	0.80, 1.10	0 – 2	1.43 (0.71)	1.29, 1.57	0 – 2
False Belief Contents	1.03 (0.86)	0.87, 1.19	0 – 2	-	-	-
False Belief Identity	1.01 (0.83)	0.85, 1.17	0 – 2	-	-	-
False Belief Second Order 1	-	-	-	1.33 (1.21)	1.09, 1.57	0 – 3
False Belief Second Order 2	-	-	-	1.42 (1.29)	1.17, 1.67	0 – 3
False Belief Emotion Task 1	-	-	-	1.22 (1.31)	0.97, 1.47	0 – 3
False Belief Emotion Task 2	-	-	-	1.55 (1.10)	1.33, 1.77	0 – 3
Parent Measures						
Mental State Terms	29.42 (15.19)	26.64, 32.20	3 – 97	-	-	-
Total Turns	63.18 (26.50)	58.32, 68.05	5 – 130	-	-	-
Mind-Minded Comments	13.12 (5.74)	12.08, 14.16	1 – 29			
Non-Mental Comments	33.79 (11.08)	31.77, 35.81	10 – 74	-	-	-
Silent Film Task	-	-	-	16.09 (3.05)	15.48, 16.70	5 – 23
Eyes Task	-	-	-	19.19 (3.57)	18.47, 19.92	10 – 26
Triangles Task Intentionality	-	-	-	11.09 (2.24)	10.64, 11.54	2 – 15
Triangles Task Appropriate	-	-	-	4.13 (1.34)	3.86, 4.40	0 – 6
WASI Verbal Ability	-	-	-	28.97 (5.62)	27.85, 30.09	13 – 39

Table 2. *Correlations between Parent and Child Measures (Pearson's r is shown below diagonal and Bayes Factor is shown above diagonal)*

	FBUT1	FBUT2	VA T1	VA T2	MST	Turns	MM	PTOM	Eyes	Silent	Tri. App	Tri. Int.	Edu.
FBU T1	-	1.06x10^{7}	33529	5.12x10^{6}	3.08	7.68	1.01	4.99	2.15	11.02	9.64	4.29	8.87
FBU T2	.55**	-	3.37x10^{6}	1.85x10^{7}	91.03	3.76	11.50	4.01	2.22	15.67	2.92	7.42	1.81
VA T1	.44**	.53**	-	2.81x10^{8}	2.32	11.57	11.12	269.20	56.39	2.48	127.18	42.56	1.49
VAT2	.54**	.55**	.59**	-	3.71	15.91	3.53	5.02	6.01	5.49	1.01	1.62	4.80
MST	.21*	.34**	.20*	.23*	-	1.2x10^{6}	8.37	3.55	5.02	7.50	1.01	4.33	8.23
Turns	.01	.08	-.04	-.11	.50**	-	4.43	7.23	5.95	7.23	5.77	7.44	3.44
MM	.16^{+}	-.01	.01	.12	.01	.11	-	6.72	7.50	7.70	3.86	7.89	3.86
PTOM	.05	.07	.37**	.24*	.13	-.05	-.06	-	2.29x10^{7}	49497.18	4.01x10^{43}	1.08x10^{67}	6.33
Eyes	.13	.22*	.34**	.26*	.10	-.08	-.01	.58**	-	1.82	34.84	11.51	3.64
Silent	-.05	-.12	.11	.04	.03	-.04	-.01	.48**	.15	-	23.90	13.04	2.12
Tri.App.	-.03	.10	.35**	.17	.21*	.08	-.12	.82**	.33**	.31**	-	4.54x10^{20}	1.52
Tri.Int.	.07	.01	.32**	.20*	.11	-.03	-.01	.87**	.29**	.29**	.71**	-	2.35
Edu.	-.01	.13	.18	.06	.03	-.13	-.14	.25*	.24*	.13	.15	.22*	-
Age	.55**	.53**	.51**	.46**	.15	.12	.02	.05	.10	-.13	-.01	.07	-.09

Note. ***p* < .01. **p* < .05. T1 = Time 1. T2 = Time 2. FBU = False Belief Understanding Latent Factor Scores. VA = Verbal Ability. MST = Parental Mental State Talk. Turns: Total Number of Utterances Made by Parent. MM = Parental Mind-Mindedness. PTOM = Parental Theory of mind Latent Factor Scores. Eyes = Reading the Mind in the Eyes Task. Silent = Silent Film Task. Tri. App. = Triangles Appropriateness Score. Tri. Int. = Triangles Intentionality Score. Edu. = Parental Education. Age = Child's Concurrent Age. Shaded cells show BF_{10} or Bayes Factor for alternative hypothesis of a positive correlation. These shaded cells show results that favor the alternative hypothesis. Unshaded cells show BF_{01} or Bayes Factor for null hypothesis of r = 0.

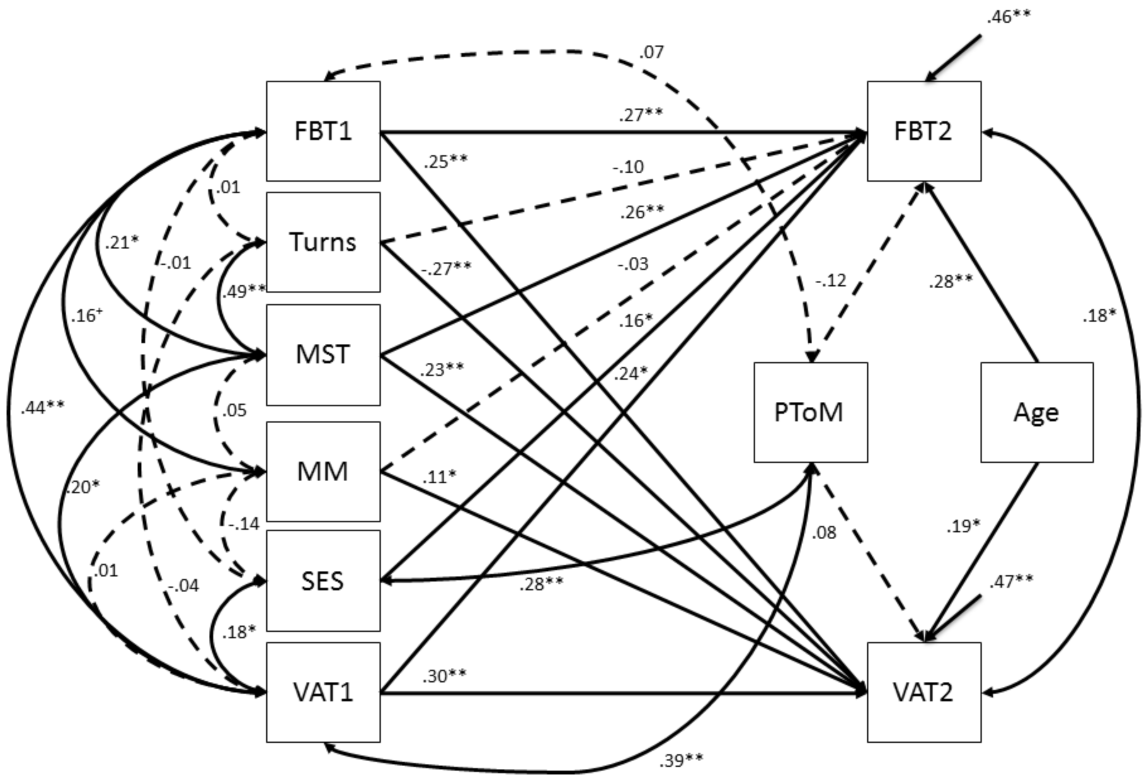

Figure 1. *Standardized Robust Maximum Likelihood Estimates for Longitudinal Structural Equation Model.*
Note. ***p*<.01. **p*<.05. FB = False Belief. MST = Parental Mental-State Talk. MM = Parental Mind-Mindedness. VA = Verbal Ability. PToM = Parental Theory of mind. Dashed lines represent non-significant paths.