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No concurrent correlations between parental mental state talk and toddlers' language abilities

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(Received 29 March 2022; revised 12 September 2023; accepted 27 September 2023)

Abstract

Mental State Talk (MST) is utterances describing invisible mental aspects. The first aim of this study was to investigate the characteristics of Parental MST and Child MST and their concurrent association in a Swedish population, and the second aim was to relate these MST measures to the children's general language abilities. Seventy-seven dyads of parents and their 25-month-old toddlers participated. MST was assessed by videotaping the dyads during free-play sessions in a laboratory and general language abilities were based on parental reports. Forty-nine toddlers did not produce MST, while all parents used MST. Child MST was positively associated with vocabulary and grammar. Parental MST was not associated with Child MST nor the children's general language abilities. In exploratory analyses, Parental MST referred to another than the child was positively correlated with vocabulary and grammar. Further studies are needed to confirm these findings and continue studying MST in different linguistic contexts.

Keywords: internal state language; language ability; mental state talk; parent-child interaction; toddler

Introduction

In early childhood, an essential component of language development is parental talk with their young child (e.g., Anderson et al., 2021). A specific type of parental input children are exposed to is MENTAL STATE TALK (MST), which refers to terms an individual utters to describe invisible and intangible referents such as desires, beliefs, cognitions, and emotions (Slaughter et al., 2009). MST is typically divided into three different types: Desire/Volition, Emotion/Disposition, and Cognition (e.g., Slaughter et al., 2009; Symons, 2004; Tompkins et al., 2018), though in some cases it has been divided into ten different types (Farkas et al., 2018). Exposure to parental MST has previously been positively linked not only to children's own use of MST (Jenkins et al., 2003; Symons et al., 2006), but also to their cognitive development (Baptista et al., 2017), socially adapted behaviors (Bekar et al., 2018), prosocial behavior (Drummond et al., 2014), emotion understanding (Taumoepeau & Ruffman, 2006, 2008) and theory of mind (Racine et al.,

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2007). To date, studies investigating the association between parental MST and children's general language abilities are few (e.g., Ruffman *et al.*, 2020) and findings are inconclusive. In this study, therefore, we investigate the relation between parental MST and child MST as well as how MST is related to general language abilities. Parent-child free play sessions provide the data for our study and MST is coded into the three categories: Volition, Cognition, and Disposition. The current study presents findings from a Swedish sample, and thus provides a much-needed addition to the literature which has predominantly been based on English-speaking contexts. Investigating MST within different linguistic contexts is essential if we are to better understand the extent to which mental state terms vary across languages and cultural contexts.

Child MST

Children produce simpler non-MST (i.e., words that do not refer to mental states) earlier than when they start to produce MST. Typically, two-year-old Swedish toddlers produce between 58 and 568 different words (10th and 90th percentiles; Berglund & Eriksson, 2000a), whereas research outside Sweden have shown that production of MST begins at around 2 to 3 years of age (Kristen *et al.*, 2012; Razuri *et al.*, 2017). MST is thus more challenging for young children to learn than non-MST due to its abstract and intangible nature (Slaughter *et al.*, 2009). Usually, the first production of MST refers to the children themselves (Kristen *et al.*, 2012; Razuri *et al.*, 2017). Moreover, in English and German-speaking contexts, the first type of MST to appear is often Desire/Volition (e.g., 'want'), potentially because simple desires are not distinct from reality whereas MST about cognitive states requires meta-representation to understand (Kristen *et al.*, 2012; Razuri *et al.*, 2017). Child MST referring to another person follows a similar developmental pattern, with Desire/Volition as the first type of MST to be produced (Razuri *et al.*, 2017). It is important to highlight, however, that child production of MST is not equivalent to a child's understanding of the underlying mental state. For example, even though young children might use the words 'think' and 'know' from an early age, it is argued that they do not understand the difference between these two words until around 4 or 5 years of age (Johnson & Maratsos, 1977; Razuri *et al.*, 2017).

Parental MST

Parental MST differs depending on factors such as the task being performed and cultural and linguistic context. For example, book-reading is a narrower task than free-play and has in some studies been shown to elicit even more parental MST than a free-play setting (Farkas *et al.*, 2018). The content of Parental MST also differs between these two settings, where parental MST referring to Emotion was more frequent whilst Desires was less frequent during book-reading compared to free-play (Drummond *et al.*, 2014; Farkas *et al.*, 2018).

Further, since the current study examines MST in a Swedish context, it adds to our understanding of how the cultural and linguistic contexts might affect MST. For example, a study assessing MST in a US sample consisting of European American mothers and Chinese immigrant mothers found that European American mothers uttered more MST referring to thoughts and emotions compared to Chinese mothers, who instead uttered more comments related to behavior than the European American mothers (Doan & Wang, 2010). Similarly, a cross-cultural study found that Iranian mothers used more

Desire MST compared to New Zealand mothers, and conversely that New Zealand mothers used more MST referring to thoughts, knowledge, and beliefs (Taumoepeau et al., 2019). Finally, bilingual English–Mandarin Singaporean mothers used more Cognition MST speaking English compared to speaking Mandarin, and more Desire MST in the latter (Cheng et al., 2020). Cheng et al. (2020) therefore suggested that parental expectations about which functions a language serve might influence the use of MST and how parents socialize their child to understand the different functions of each language. These three studies all found that Cognitive MST was more common in the subgroups representing individualism and two of the studies found more Desire MST in the subgroups representing collectivism. This demonstrates the significance of continuing MST research in different cultural and linguistic contexts to better understand which MST characteristics are unique to a context and which characteristics occur in several contexts. The current study contributes to our understanding of MST in a Swedish context.

Parental MST and children’s general language abilities

To understand the potential benefits of parental MST for children’s language development, Rowe and Snow’s (2020) model can be applied. Grounded in Vygotsky’s thinking, they proposed that the crucial aspect is that the parent operates within the child’s zone of proximal development and that the most advantageous dimension of linguistic input therefore changes with factors such as age, language ability, and cultural factors. We suggest that parental MST is an example of a specific type of linguistic input that is conceivably advantageous for children during their second year of life, both for the child’s own use of MST as well as general language ability. Parental MST is assumed to be beneficial for child MST because the parent scaffolds language development by repeating MST in appropriate contexts and teaching the child that MST is important (e.g., Jenkins et al., 2003). In addition, the general language development might be indirectly facilitated because Parental MST helps to create a high-quality interaction while being attentive to the child’s current activity and mental world. The parent puts abstract and invisible terms into words and is transparent about what is happening here and now. Therefore, it is relevant to understand whether Parental MST independently scaffolds language abilities.

In recent decades, the relation between parental MST and child language abilities has mostly been focused on child MST. For example, Taumoepeau and Ruffman (2006, 2008) found that New Zealand mothers’ use of Desire MST and Think/Know MST when their child was 24 months of age were concurrently and positively correlated to child Emotion MST, and longitudinally that maternal Think/Know MST at 24 months predicted child MST at 33 months. In Canada, parental Cognition MST (Jenkins et al., 2003) and Cognition MST considered appropriate to the interactional context (i.e., parental MST was consistent with their child’s speech or behavior, e.g., the parent asks “Do you want to play with the car?” when the child reaches for a car and the child responds “Yes”; Symons et al., 2006) were found to be concurrently and positively associated with their two-year-old’s use of Cognition MST. Likewise, parental Desire MST considered appropriate was concurrently and positively associated with child use of Desire MST (Symons et al., 2006).

We are aware of only three studies presenting data on the relation between parental MST and general language abilities in young children. Ruffman et al. (2020) investigated maternal responsiveness in English-speaking households in New Zealand and its concurrent association with language abilities in toddlers aged 10 and 26 months. Maternal MST (measured during free-play in a laboratory setting as in our study) and their

10-month-old's productive language, receptive language, or receptive MST were not significantly correlated, and at 26 months, only maternal MST and child receptive MST were concurrently and positively correlated. However, maternal non-MST was concurrently correlated with child receptive MST at 10 months, which Ruffman *et al.* (2020) regard as an intelligible pattern because children need sufficient understanding of non-MST before they can understand the mental state word in an utterance. In the US, Olson and Masur (2020) investigated maternal MST and the child's development of internal state words in laboratory-based free-play sessions at 13 and 17 months. They found that maternal MST at 13 months was concurrently and positively correlated to child receptive lexicons and that maternal use of Volition MST at 13 months predicted both receptive abilities and internal state vocabularies at 17 months. Also, maternal use of Disposition MST at 17 months predicted child expressive disposition vocabulary later at 21 months. A third study comes from Farkas *et al.* (2018), who primarily compared parental MST in a storytelling setting versus a free-play setting in Spanish-speaking households in Chile. Parental MST was assessed twice at the nursery (using storytelling at 12 months and free-play at 30 months) and they found a predictive association between parental use of Desire MST at 12 months and the child's receptive abilities at 30 months. There were no concurrent associations between parental MST and the child's language abilities, except that parental Desire MST and expressive abilities at 30 months were negatively correlated.

Summarily, findings from studies investigating the relationship between parental MST and child language abilities are inconclusive. This might be explained by a combination of methodological differences in the studies (e.g., age of the child, task used to assess MST) and linguistic or cultural factors. To date, few studies have been conducted in non-English speaking families and to our best knowledge, there is no published study conducted in Sweden that specifically focuses on the relation between parental MST and child MST or general language abilities.

Aims of the current study

This study adopts a social-constructivist framework and emphasizes the importance of social interaction for child development. This framework is a common approach in MST studies (e.g., Farkas *et al.*, 2018; Taumoepeau & Ruffman, 2008; Tompkins *et al.*, 2018). Specifically, we investigate the concurrent association between parental MST and child MST as well as general language abilities at 25 months. This is an age of interest since 25-month-olds typically are in the early stage of using MST on their own. By conducting this study in Sweden, we extend the understanding of parental and child MST to another linguistic context than previously investigated. Since MST is language-based it becomes essential to investigate MST in different cultural and linguistic contexts.

This cross-sectional study had two aims. First, we investigated the characteristics of Parental MST and Child MST at 25 months and their concurrent association in a Swedish sample. We hypothesized that Parental MST and Child MST would be significantly and positively associated (e.g., Jenkins *et al.*, 2003; Ruffman *et al.*, 2020; Taumoepeau & Ruffman, 2006). Second, we investigated the concurrent association between these MST measures and general child language abilities at 25 months. Based on previous work (e.g., Olson & Masur, 2020), we hypothesized that Parental MST, as well as Child MST, would be significantly and positively associated with child language abilities (*viz.*, the three sections in SECDI-w&s, Vocabulary Checklist, the Pragmatic Scale, and the Grammar

Scale). In addition, we exploratorily investigated these associations divided into MST types (Volition, Cognition, and Disposition) and MST referent (child or another).

Method

General procedure

All families were part of a larger longitudinal study. The first wave of data collection was in 2017 and all families in a selected region of Sweden with a 9-month-old infant received an invitation to participate in the longitudinal study (see previous publications for detailed description, e.g., Nyberg et al., 2020). Written informed consent was obtained from each participating parent before the data collection at 9 months. The first follow-up collection period was at 25 months of age. The research procedure was approved by the Regional Ethical Board in Linköping (2016/490-31).

Participants

The final sample included 77 parent-toddler dyads. The toddlers' (33 girls) mean age on the day for the free-play session was 25.53 months ($SD = 0.32$, $Min = 24.76$, $Max = 26.43$). All except one family reported normal Apgar scores five minutes after birth and all except one toddler were born full-term ($M = 40.66$ weeks, $SD = 1.27$). Mean birth weight was 3565.27 g ($SD = 437.09$) and mean birth length was 50.99 cm ($SD = 1.94$). All except one parent that took part in the free-play session reported Swedish as the main language they spoke with their child. However, since this parent was fluent enough in Swedish and had no observable problem using Swedish we did not exclude this parent-child dyad. These sessions were all conducted in Swedish. In 41 families the toddler was the only child, in 31 families the toddler lived with one sibling and in 5 families with two siblings. Of the 77 parents who took part in the parent-toddler free-play, 53 were mothers and 24 fathers. Of these, all had at least finished secondary education and 58 had a university degree. Language ratings were collected within two weeks of the free-play session.

An additional 20 parent-toddler dyads were tested but excluded from the final sample. The reasons for exclusion were 1) the dyad did not use Swedish during the free-play session ($n = 2$); 2) technical problems with video recording ($n = 6$), and 3) incomplete language questionnaire ($n = 12$). There were no statistically significant differences between the group of included ($n = 77$) and excluded dyads ($n = 20$) regarding maternal educational level, $\chi^2(4) = 4.458$, $p = .348$, or paternal educational level, $\chi^2(4) = 5.020$, $p = .285$. Neither did the groups differ depending on the sex of the toddler, $\chi^2(1) = 0.945$, $p = .331$, or whether the toddler was the only child or lived with siblings, $\chi^2(1) = 1.647$, $p = .199$ (8 excluded dyads had missing data on sibling).

Measures: Mental state talk (MST)

Procedure

MST was assessed from videotaped free-play sessions, which is an activity where the dyad can freely choose what they play with and the parent has the opportunity to be responsive to the child's behavior and attention shifts (Meins et al., 2001). The free-play sessions lasted an average of 10.42 minutes ($SD = 0.73$, $Min = 7.63$, $Max = 12.22$) and were conducted on a mat in a child-adapted lab in which there was a box filled with age-

appropriate toys. The box contained wooden blocks, cars and a car mat, animals and a farmhouse, food and a tableware set, and a picture book. The dyad was instructed to play with whichever toys they wanted, and the parent was instructed to play with their toddler just as they would have done if they were at home. The experimenter waited outside the room during the free-play and the session ended when the experimenter opened the door after 10 minutes. The dyad was informed that they could open the door at any time if they had any questions or if for any other reason they wanted to stop the free-play session. Two children ceased playing and opened the door after approximately 8-9 minutes, and four dyads took a bathroom break during the free-play (two of these were at the end of the session and two continued playing afterwards).

Transcription and coding

Two coders transcribed and coded the free-play recordings. Parental utterances were orthographically transcribed, and toddler utterances were also transcribed verbatim but as the words were pronounced (e.g., *gunga* 'swing' could be transcribed as *kunga* depending on pronunciation). This means that the child's utterances needed to be clear enough for the coder to distinguish them as MST. Unintelligible utterances would not be coded as MST whereas utterances that were mispronounced but intelligible were coded as MST. All MST were coded as such without judging whether the utterance was referring to a genuine mental state or not (e.g., whether the child was just mimicking the parental utterance). We adapted the coding scheme used by Slaughter *et al.* (2009) to a Swedish context. Both parent and child utterances were classified as MST when they explicitly referred to one of three types: Volition, Cognition, or Disposition. Volition included terms that explicitly referred to desire or intention (e.g., "*Do you want the horse*" or "*I also want a drink*"). Cognition included terms that explicitly referred to cognitive states or actions such as think, believe, remember, or know (e.g., "*Do you think the horse can swing*" or "*Do you know what this is*"). Dispositional included terms that explicitly referred to emotional states or preferences such as like or love (e.g., "*I don't like the farm*" or "*You are really happy*"). If the same MST utterance included words from different types, it was coded once in each type (e.g., "*Do you think the horse likes to swing*" was coded as both Cognition and Disposition). MST was further divided into referent, meaning if the uttered MST referred to the child or to another. If the same MST referred to both the child and another (e.g., "*We like horses*"), it was coded separately in both categories. If it was unclear who the MST was referring to, it was categorized as another.

MST variables

PARENTAL MST was calculated as the percentage of total words uttered by the parent. The same procedure was used for the type and referent level. We followed previous work (e.g., Jenkins *et al.*, 2003; Taumoepeau & Ruffman, 2008) and used proportional counts instead of frequency counts. Some argue that frequency counts are more accurate than proportional counts (e.g., Olson & Masur, 2020; Symons *et al.*, 2006), but we argue that it is important to distinguish between verbosity and MST to be able to investigate the specific impact MST might have on child outcomes. For control purposes, we also computed a partial correlation analysis with parental MST defined as uttered MST divided by time (i.e., corrected for the different duration the free-play sessions lasted) and the variables of child outcome, and controlled for parental verbosity. The interpretations remained the

same (all $ps \geq .083$, one-tailed). CHILD MST was calculated as frequency counts since the children in the current study were in their very beginning of producing MST. That is, we wanted to assess the child's tendency or ability to produce MST at all and not in comparison to their production of non-MST. However, the free-play sessions differed in time, and therefore Child MST was computed by dividing produced MST with time for the free-play.

Inter-rater reliability

Before coding began, the two coders trained carefully at the coding scheme. During the coding phase, the coders were blind to both the hypotheses of the current study and to the toddler's scores at other measures such as language ability ratings. A total of 14 (18.18%) randomly chosen transcripts were double-coded by both coders and the obtained Cohen's kappa (Cohen, 1960) was .97 for Parental MST and .93 for Child MST. Disagreements noticed after the inter-coding were resolved by discussion.

Measures: Language abilities

The Swedish adaptation of the MacArthur-Bates Communicative Development Inventories (MB-CDI; Eriksson & Berglund, 2002; Fenson et al., 1994) was used. The Swedish Early Communicative Development Inventories – words and sentences (SECDI-w&s) is a reliable and valid parent report instrument aimed to describe communicative abilities in toddlers ages 16 to 28 months (Berglund & Eriksson, 2000a, 2000b). Three sections were used in the current study: a Vocabulary checklist, the Pragmatic Scale, and the Grammar Scale. The Vocabulary checklist consisted of 711 items and was calculated by adding the number of items marked as “says”. The Pragmatic Scale consisted of five items that had a rating scale of not yet-sometimes-often (scored as 0-1-2). The Grammar Scale consisted of six items that had a rating scale of not yet-sometimes-often (scored as 0-1-2). The maximum score for the section Vocabulary checklist was 711, the Pragmatic Scale 10, and the Grammar scale 12. The scoring was according to the Swedish manual (Eriksson & Berglund, 2002) and compared to Swedish norms (Berglund & Eriksson, 2000a).

Data analysis

Analyses were run in the Statistical Package for Social Sciences 26.0 (SPSS). First, we calculated descriptive statistics for Parental MST, Child MST, and SECDI-w&s. Group differences were investigated using Student's t-test, Welch's t-test, or Mann-Whitney U-test depending on the assumptions the variables met. Second, we computed parametric correlations among the variables. To control for the potential effects of skewness and kurtosis, non-parametric correlations (Kendall's Tau) were also computed. Since these led to similar interpretations as the parametric correlations, the parametric correlations are reported. One-tailed correlations were computed in those cases where we had specified an a priori hypothesis (e.g., an association between Parental MST and Child MST)¹ and two-tailed correlations in those cases where we did not have a hypothesis. Potential confounders were controlled for in correlational analyses. The alpha level

¹Using two-tailed tests would not alter the basic findings reported.

was .05 in analyses where we had hypotheses and was not corrected for multiple comparisons. In the exploratory analyses, we applied a small correction for multiple comparisons and used an alpha level of .01. Our correction can be considered liberal, but we have stated the exact *p*-values to enable for alternative interpretations.

Results

Potential confounders

We computed two-tailed correlations to identify potential confounders. Pearson's correlations were computed with educational level of the parent that took part in free-play, household income, child age at the date for free-play, and point-biserial correlations were computed with siblings (0-no, 1-yes), child sex (0-boy, 1-girl) and parental language (0-one parent speaks Swedish, 1-both parents speak Swedish). Neither the variable Parental MST nor Child MST had a statistically significant correlation with any of the six potential confounders (all *ps* \geq .142). A few language measures did, however, show associations with some of the potential confounders. Vocabulary was correlated with parental language ($r_{pb} = -.252, p = .027$), the Pragmatic Scale with parental educational level ($r = -.300, p = .008$) and child sex ($r_{pb} = .235, p = .040$), and, finally, the Grammar Scale with sibling ($r_{pb} = -.285, p = .012$). The remaining were not statistically significantly correlated (all *ps* \geq .064). Finally, we computed one-tailed partial correlations between MST measures and language ability ratings and controlled separately for each identified significant correlation. All interpretations of the correlations remained the same as presented below in the results section.

Parental and Child MST (first aim)

Parental MST

Parents uttered an average of 580 words (SD = 159, Min = 153, Max = 951), where the number of words depended on the duration of the free-play session (M = 10.42 minutes, SD = 0.73, Min = 7.63, Max = 12.22). An average of 1.99% of the words per session were classified as MST (SD = 0.85%, Min = 0.61%, Max = 4.55%). All parents uttered at least some MST. Maternal MST and paternal MST did not differ significantly using Welch's *t*-test, $t(39.348) = -0.208, p = .837$. Similarly, using Student's *t*-test, Parental MST did not differ as a function of whether they talked to a girl or a boy, $t(75) = 0.279, p = .781$. As shown in [Table 1](#) and [Table 2](#), the most common of all coded Parental MST belonged to the type Cognition (54%) and the most frequent MST words were *want* (part of Volition) and *believe* (part of Cognition). Of all Parental MST, 54% referred to their child. See [Table A](#) in Supplementary material for the uttered Swedish words and the corresponding English translations.

Child MST

The average Child MST per minute was 0.10 (SD = 0.21, Min = 0.00, Max = 1.23). Of all 77 toddlers, 49 (63.60%) did not utter any MST during the entire free-play session. Instead, the seven children (9.09%) who uttered the most MST accounted for 57.69% (45 of 78) of all Child MST. Child MST did not differ significantly between boys (*Mdn* = 0.00) and girls (*Mdn* = 0.00) using the Mann-Whitney U-test, $U(N_{\text{boys}} = 44, N_{\text{girls}} = 33) = 601.00, z = -1.49, p = .135$, two-tailed. The most common type was Volition (64%; see

Table 1. Frequencies and percentages of total Mental State Talk (MST) uttered by parents (N = 77) and 25-month-old children (N = 77) divided into categories by type and referent

	Parental MST Frequency (%)	Child MST Frequency (%)
Total raw coded MST	877 (100%)	78 (100%)
Volition ¹	315 (36%)	50 (64%)
Referent child	200 (23%)	31 (40%)
Referent another	115 (13%)	19 (24%)
Cognition ²	471 (54%)	22 (28%)
Referent child	216 (25%)	19 (24%)
Referent another	255 (29%)	3 (4%)
Disposition ³	91 (10%)	6 (8%)
Referent child	61 (7%)	3 (4%)
Referent another	30 (3%)	3 (4%)

Note. ¹Eight parents and 56 children did not utter any Volition.

²Five parents and 68 children did not utter any Cognition.

³Thirty-four parents and 71 children did not utter any Disposition.

Table 1 and Table 2). The most frequent MST words were *want* (part of Volition) and *know* (part of Cognition). Of all Child MST, 68% referred to the child itself.

Parental MST and Child MST

Since 49 of 77 toddlers did not utter any MST, we dichotomized the variable Child MST as uttered MST (coded as 1) or not uttered MST (coded as 0) in all subsequent correlational analyses if not otherwise stated. As shown in Table 3 and Figure 1, Parental MST was not significantly correlated with Child MST ($p = .246$, one-tailed). For control purposes, we also calculated the correlation between Parental MST and Child MST (not dichotomous) in a subsample of toddlers who did utter at least one MST, $r = .279$, $p = .080$, one-tailed, $n = 27$ (one toddler data deviating more than +3SD was excluded from the analysis).

MST and its relation to general language ability (second aim)

General language ability

According to SECDI-w&s, the toddlers' mean Vocabulary score was 315.83 (SD = 151.18, Min = 48, Max = 586), the mean Pragmatic score was 7.82 (SD = 1.80, Min = 2, Max = 10), and the mean Grammar score was 5.68 (SD = 3.24, Min = 0, Max = 12).

MST and general language ability

Parental MST was not significantly correlated with children's general language abilities (all $ps \geq .132$, one-tailed; see Table 3 and Figure 1). Child MST was positively correlated with two out of three language ability sections – namely, Vocabulary ($r_{pb} = .407$, $p < .001$,

Table 2. Specific words observed in Mental State Talk (MST). In parenthesis, the number of times the word was coded among all free-play sessions

	Parental MST		Child MST	
	Referent child	Referent another	Referent child	Referent another
Volition	Want (183)	Want (97)	Want (31)	Want (17)
	Need (17)	Need (15)		Need (2)
		In the mood for (3)		
Cognition	Believe (138)	Believe (156)	Know (14)	Pretend (2)
	Know (28)	Know (42)	Believe (3)	Think (1)
	Think (17)	Pretend (20)	Recognize (1)	
	Remember (11)	Think (16)	Pretend (1)	
	Pretend (9)	Understand (8)		
	Recognize (4)	Wonder (5)		
	Be sure (4)	Be sure (2)		
	Decide (3)	Come up with (2)		
	Guess (1)	Forget (2)		
	Plan (1)	Remember (1)		
		Recognize (1)		
Disposition	Like (29)	Like (15)	Love (1)	Sad (1)
	Funny (13)	Happy (4)	Funny (1)	Like (2)
	Happy (6)	Funny (5)	Like (1)	
	Love (4)	Love (2)		
	Exciting (3)	Angry (1)		
	Interesting (1)	Cozy (1)		
	Boring (1)	Satisfied (1)		
	Grumpy (1)	Exciting (1)		
	Care (1)			
	Difficult (1)			
	Feel good (1)			

Note. The participants uttered all the words in Swedish and we translated them into compatible words in English. The nuance could not be captured for some of the words, and therefore, each of the words Decide, Like, Understand, Think, and Funny include two separate (but closely related) words in Swedish.

one-tailed) and Grammar ($r_{pb} = .244$, $p = .016$, one-tailed), but not for Pragmatics ($r_{pb} = .168$, $p = .072$, one-tailed).

Exploratory analyses

The exploratory analyses between Parental MST and Child MST at type or referent level showed no significant correlations (all $ps \geq .114$, see Table 4). Parental MST at type level

Table 3. One-tailed correlations between Mental State Talk (MST) and child language ability

	Parental MST	(<i>p</i> -value)	Child MST	(<i>p</i> -value)
MST				
Parental MST	–			
Child MST	.080	(.246)		
Language ability				
Vocabulary	.109	(.172)	.407	(<.001)
Pragmatic Scale	.049	(.335)	.168	(.072)
Grammar Scale	.129	(.132)	.244	(.016)

Note. Point-biserial correlations are computed in analyses where Child MST (dichotomized as uttered any MST or none, coded as 1-0) are included. Other analyses are Pearson's correlations.

was not significantly correlated to language abilities (all $ps \geq .05$). Regarding Parental MST at the referent level, only referent to another was positively correlated with Vocabulary ($r = .306, p = .007$) and the Grammar Scale ($r = .302, p = .008$).

Discussion

The first aim was to investigate the characteristics of Parental MST and 25-month-old's MST in a Swedish sample and the concurrent association of these measures, while the second aim was to relate these MST measures to concurrent child language abilities. We hypothesized that Parental MST and Child MST would be significantly and positively associated and that these MST measures also would be significantly and positively associated with child language abilities.

MST characteristics

In the current sample, 63.6 percent (49 of 77) of the toddlers did not utter any MST during the 10-minute free-play session. This is comparable to Symons et al. (2006), who found "very low levels" (p. 683) of child MST at two years when they assessed MST in a 10-minute free-play session, and Razuri et al. (2017), who found that 68.6% (24 of 35) of the children did not utter MST at 26 months during a problem-solving task. In line with previous research (e.g., Kristen et al., 2012; Razuri et al., 2017), the majority of Child MST in the current study referred to the child itself, and the most common type was Volition. The most frequent words, after translation to English, were *want* ('vilja' in Swedish as shown in Table A in Supplementary material, part of Volition) and *know* ('veta' in Swedish, part of Cognition). In short, the characteristics of Child MST in the current study seem to follow the same pattern as previous studies conducted in other linguistic contexts.

All parents uttered at least some MST but the individual variations in Parental MST were large, which is in line with previous research (Farkas et al., 2018; Jenkins et al., 2003). The most coded type of Parental MST was Cognition (although Volition was also frequent), and the most frequent words were *want* ('vilja' in Swedish, part of Volition) and *believe* ('tro' in Swedish, part of Cognition). This is not in line with previous research

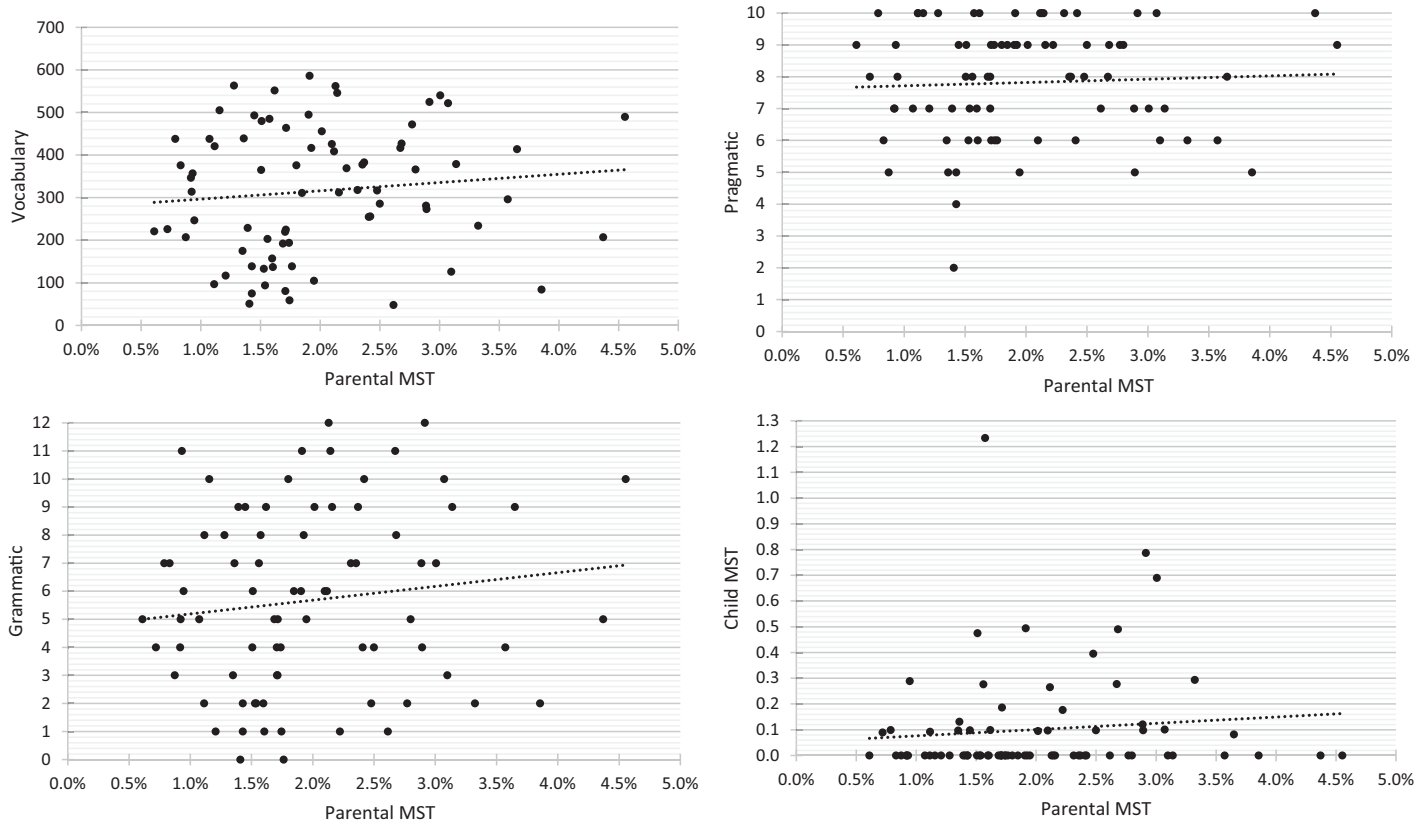


Figure 1. Scatterplots of the association between Parental Mental State Talk (MST) and child outcomes. Parental MST = percentage of the total number of uttered words. Child MST = the number of MST divided by time of free-play.

Table 4. Two-tailed correlations between Parental Mental State Talk (MST) divided by type and referent and child language abilities. P-values in parenthesis

	Parental MST				
	Type			Referent	
	Volition	Cognition	Disposition	Child	Another
Child MST					
Type					
Volition	.056 (.627)	.061 (.598)	.128 (.269)	.182 (.114)	-.025 (.825)
Cognition	-.101 (.383)	.034 (.772)	-.098 (.397)	-.025 (.830)	-.084 (.470)
Disposition	-.002 (.987)	-.017 (.881)	.129 (.262)	-.015 (.895)	.059 (.609)
Referent					
Child	.022 (.851)	.031 (.792)	.057 (.624)	.124 (.284)	-.059 (.611)
Another	.123 (.287)	.017 (.882)	-.015 (.897)	-.007 (.953)	.139 (.229)
Language ability					
Vocabulary	-.030 (.796)	.224 (.050)	-.090 (.435)	-.133 (.248)	.306 (.007)
Pragmatic Scale	-.015 (.895)	.108 (.351)	-.053 (.650)	-.111 (.336)	.195 (.089)
Grammar Scale	-.074 (.523)	.278 (.014)	-.058 (.615)	-.105 (.363)	.302 (.008)

Note. Point-biserial correlations are computed in analyses where Child MST (dichotomized as uttered any MST or none, coded as 1-0) are included. Other analyses are Pearson's correlations.

suggesting Desire MST as the most commonly uttered type by parents in interaction with their 2-year-old (Ensor et al., 2014; Jenkins et al., 2003) or 2.5-year-old child (Farkas et al., 2018). One possible explanation for this difference in parental MST could be pragmatic differences between linguistic contexts. For example, the word *believe* 'tro' was the most common (62.4%) of the coded words in the type Cognition, and a suggestion is that this word might be used more often and with different meanings in everyday conversations in a Swedish context compared to previous studied contexts. Another possible explanation might be found in how MST is assessed in different studies. For example, it could be due to the nature of the task as studies have found differences in Parental Cognition MST versus Desire MST depending on whether the task or setting is free-play or book-reading (e.g., Drummond et al., 2014; Farkas et al., 2018; Roby & Scott, 2022). Also, we categorized MST into the three commonly used types: Volition, Disposition, and Cognition (e.g., Slaughter et al., 2009). In practice, these types slightly overlap each other, and the coding rules vary a little across studies. For instance, we coded the word *think* ('tycka' and 'tänka' in Swedish) as MST every time it was uttered since we argue that we cannot assume to know when the utterer intended it to be MST. Even if it was possible for an adult coder to assume intentions from other adults' MST, it is likely that a toddler has not yet developed this skill and therefore could not make sense of this nuance. Therefore, it seemed more straightforward to code the word as it is. This coding of *think* is in line with some previous studies (e.g., Slaughter et al., 2009) but not with others (e.g., Symons et al., 2006). Our decision to not make other assumptions about MST than what is explicitly uttered also led us to *not* exclude immediately repeated MST utterances or utterances like "I don't know", as some previous research has done (e.g., Taumoepeau & Ruffman, 2008).

The most common type was not the same for toddlers and parents, but the word *want* (part of Volition) was the most common word for both groups.

Parental MST and Child MST

Unexpectedly, we found no statistically significant correlation between Parental MST and Child MST, either at the overall level or the category level. Previous studies in English-speaking contexts have found a positive correlation between parental MST and child MST when the child was two years (Jenkins *et al.*, 2003; Symons *et al.*, 2006; Taumoepeau & Ruffman, 2006, 2008). However, these did not report an overall measure of parental MST but instead reported at category level. Taumoepeau and Ruffman (2006, 2008) found that Desire MST and Think/Know was each correlated to child Emotion MST, and Symons *et al.* (2006) found positive correlations only for parental MST considered appropriate to the interactional context; an association between parental Cognition MST considered appropriate and child Cognition MST as well as between parental Desire MST considered appropriate and child Desire MST. We did not categorize MST as appropriate or non-appropriate, which is something that could be further investigated in a future study. Second, we measured child produced MST during a free-play session whereas for instance Taumoepeau and Ruffman (2006) used parental reports. That is, in the current study, only the toddlers' spontaneously produced MST during the free-play session was considered and the children's ability to pronounce words needed to be clear enough so that a coder (who was not familiar to the toddler) was able to decipher the utterance as MST.

Parental MST and child language abilities

Our finding that Parental MST child language abilities were not significantly correlated was not in line with our hypothesis. However, findings from both Ruffman *et al.* (2020) and Farkas *et al.* (2018) are in line with these results. In the former, maternal MST was concurrently correlated only with receptive MST abilities at 26 months and not with the child's non-MST language abilities at the same age. In the latter, positive associations between parental MST and child language abilities were of predictive nature from 12 to 30 months, whereas the concurrent associations were non-significant. Our findings are in contrast with Olson and Masur (2020), who found both concurrent and predictive correlations between maternal MST and child language abilities at 13 and 17 months in an English-speaking context. Therefore, it would be of relevance to further investigate MST both longitudinally, and in different linguistic contexts. It might be that the positive influence of parental MST on child outcomes is mainly predictive instead of concurrent.

In exploratory analyses at the referent level, Parental MST referring to another (but not referring to child) was positively correlated with both Vocabulary and the Grammar Scale. Taumoepeau and Ruffman (2008) reported a similar finding, that maternal MST referring to others' Think/Know was the most consistent correlate with later child MST. They suggested that references to the child are more important initially, whereas references to others become more important as the child grows older. That is, children first need to connect and understand their own mental states before they can focus on the abstract mental concepts of other persons. We could speculate that the toddlers in the current study who displayed more advanced abilities in productive vocabulary and grammar also

have parents who have switched focus from referring to child to instead referring to another. A question for further research is to investigate the causal direction of this association.

Child MST and child language abilities

As expected, Child MST was concurrently and positively associated with language abilities – namely, productive Vocabulary and the Grammar Scale (but not the Pragmatic Scale). These positive associations are reasonable since the child probably needs to have achieved a certain level of language production in terms of vocabulary and basic grammar before they are able to produce MST. This is because MST can be considered more challenging for young children to learn than non-MST language abilities due to the abstract, invisible, intangibility of the word (Slaughter et al., 2009). Further, we do not assume that child production of MST is equivalent to either child understanding of MST or child thinking about MST. Child MST was captured solely in terms of production.

Limitations

In the current study, the parents were higher educated compared to the average Swedish population (Statistics Sweden, 2018) and therefore the sample is not representative in terms of socio-economic status (SES). Of the 77 parents who took part in the free-play session, 58 had a university degree and all had at least finished secondary education. We controlled for this educational level as a potential confounder, and it was not significantly correlated with either Parental MST, Child MST, or child language abilities. However, this could be due to the narrow range of educational level. Further research should investigate the characteristics of parental MST and child MST in samples from different SES and whether the developmental pattern of MST in early childhood is comparable across SES.

This study intended to investigate Child MST, but the results showed that the majority of toddlers did not produce any MST. Only 28 of 77 toddlers uttered at least one MST. Therefore, we captured the very beginning of MST production, and this might be a reason for the null results. Future research should investigate child MST and its relation to parental MST again when a majority of the toddlers produce MST (for example, at 30 or 36 months) to analyze if the results remain.

The fact that the current study was conducted in Swedish is an advantage; though, it also comes with its drawbacks. In studies of language practices, the translation from Swedish to English may not be as flexible as the original language and may not capture all the nuances of the language. Detailed comparisons at word level between the current study and non-Swedish studies need to be done with caution. For example, we have throughout this study translated the Swedish word *tro* to 'believe' in English, but *tro* can be understood as either 'think' or 'believe' depending on the interactional context.

Finally, we investigated concurrent associations, meaning it will have bearing on our conclusions. Even if we would have found significant correlations between Parental MST and child outcomes, this is still a cross-sectional study, meaning that we would not have been able to draw causal inferences from this study alone.

Implications and future directions

We suggested that Parental MST would be especially beneficial for toddlers' language development, both in terms of MST and general language abilities. However, in the current study, Parental MST was not independently a salient factor associated with child language outcomes. Theoretically, one interpretation of the results is that MST in isolation (i.e., the quantity) is not sufficient and that the contextual circumstances in which MST occurs need to be considered, as well so the child is more attuned and thus able to process what is said. For example, the interactional appropriateness or timing has been found to be an important contextual factor in some previous studies (e.g., Laranjo & Bernier, 2013; Symons *et al.*, 2006). Further, to understand the potential benefits of MST, it should be investigated in other contexts. For example, future research could investigate the relation between Parental MST and child language abilities when more children spontaneously produce MST or when taking the appropriateness of the parental utterance into account. Also, MST studies conducted in Sweden using other methodologies than free-play are needed (e.g., parental-reported child MST or a book-reading task). Another research implication is to conduct further research in different linguistic and cultural contexts to better understand if the non-significant results in our sample were context-specific or comparable with studies conducted in other contexts.

Conclusion

This Swedish study extends the understanding of MST to other linguistic contexts than previously investigated. Nearly two-thirds of the 25-month-old toddlers did not utter a single MST. Among uttered Child MST, the most common type was Volition. Child MST and general language ability, specifically vocabulary and grammar, were positively associated. All parents uttered at least a few MST and the most common type was Cognition. Unexpectedly, Parental MST was not significantly associated with either their 25-month-old's use of MST or child general language abilities. In exploratory analyses, Parental MST referring to another (but not referring to child) was positively associated with child vocabulary and grammatical abilities. To gain a deeper understanding of the developmental pattern of MST and the potential advantageousness of Parental MST, especially referent, further longitudinal studies conducted in different linguistic contexts are needed.

Supplementary material. The supplementary material for this article can be found at <http://doi.org/10.1017/S0305000923000594>.

Funding statement. This study was funded by grants from the Swedish Research Council (2016-01033) and the Swedish Research Council for Health, Working Life and Welfare (2016-00048) to MH.

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Cite this article: Nyberg, S., Dahlström, Ö., Voinier, D., Bergström, K., & Heimann, M. (2025). No concurrent correlations between parental mental state talk and toddlers' language abilities. *Journal of Child Language* *52*, 117–134, <https://doi.org/10.1017/S0305000923000594>