STABILITY OF MIND-MINDEDNESS ACROSS THE TRANSITION TO MOTHERHOOD AND ITS LONGITUDINAL ASSOCIATION WITH CHILDREN'S THEORY OF MIND & EXECUTIVE FUNCTION

by

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DISSERTATION ABSTRACT

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Title: Stability of Mind-Mindedness Across the Transition to Motherhood and its Longitudinal Association with Children's Theory of Mind & Executive Function

Parental mind-mindedness refers to caregivers' propensity to attribute mind-like and intentional qualities in their interactions with or representation of their young children. It is proposed to be associated with positive developmental outcomes in children's social understanding, executive functioning (EF), and language abilities. The present dissertation focused on the temporal characterization of maternal mind-mindedness across the transition to motherhood, examined its longitudinal association with children's theory of mind (ToM) and EF, and investigated potential mechanisms of influence in a sample of socioeconomically diverse first-time mothers. A secondary data analysis was conducted using a longitudinal dataset with 104 women from which maternal mind-mindedness was coded at three timepoints (prenatally during the third trimester of pregnancy, 5-, and 17- months post birth). Children's cognitive and behavioral outcomes (language, ToM, and EF) were examined at 5 years of age.

Results revealed that although prenatal mind-mindedness was not significantly associated with postnatal mind-mindedness, some individual, and possibly trait-like, stability in mothers' mind-mindedness was present between 5- and 17-months post birth. In addition, mothers' mind-mindedness at 17 months (but not prenatally or at 5 months)

significantly predicted children's EF at age 5, and the effect persisted beyond maternal education and children's concurrent language ability. Further, children's concurrent language ability had a significant indirect effect on the association between mind-mindedness and children's EF; meanwhile, the direct effect of mind-mindedness on children's EF remained. Finally, in contrast to some other findings in the literature, mind-mindedness did not predict children's ToM in the current sample, although it was indirectly associated with ToM through children's concurrent language ability.

These findings suggest that mothers' mind-mindedness towards their infants (a) is dynamic during the transition from pregnancy to early motherhood with individual stability seen between infancy and toddlerhood, and (b) may play an important role in children's emerging executive and language abilities. Future research should further characterize prenatal mind-mindedness and whether it may be equivalent to postnatal mind-mindedness, evaluate the interchangeability between the interview and free play measure of the mind-mindedness construct, and further investigate potential pathways through which mind-mindedness may influence children's language and executive abilities.

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Antovich, D. M., Gluck, S. C., Goldman, E. J., & Estes, K. G. (2020). Specificity of representations in infants' visual statistical learning. *Journal of experimental child psychology*, 193, 104772.

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Duh, S., Paik, J. H., Miller, P. H., Gluck, S. C., Li, H., & Himelfarb, I. (2016). Theory of Mind and executive function in Chinese preschool children. *Developmental psychology*, *52*(4), 582.

Estes, K. G., Gluck, S. C., & Grimm, K. J. (2016). Finding patterns and learning words: Infant phonotactic knowledge is associated with vocabulary size. *Journal of experimental child psychology*, 146, 34-49.

Graf Estes, K., Gluck, S. C., & Bastos, C. (2015). Flexibility in statistical word segmentation: Finding words in foreign speech. *Language learning and development*, 1-18.

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CHAPTER I

INTRODUCTION

In 1997, to better characterize the quality of early caregiver-child interaction, Elizabeth Meins coined the term parental mind-mindedness to refer to caregivers' propensity to attribute internal mental states to their young children. To Meins, this mind-minded awareness enables the caregivers to interpret their child's behaviors as intentional and meaningful, which allows for subsequent appropriate responses from the caregiver. Grounded in Bowlby's attachment theory, Ainworth's construct of maternal sensitivity, and Vygotsky's zone of proximal development, Meins proposed that it is the sensitive caregiver's mind-mindedness during parent-child interaction that promotes secure-attachment relationships and children's later higher mental functions (e.g., social understanding).

Over the years, interest in mind-mindedness has grown as parental mind-mindedness has been associated with positive developmental outcomes for children including secure caregiver-child attachment relationships (Laranjo et al., 2008; Meins et al., 2001), greater mentalizing abilities or theory of mind (Devine & Hughes, 2016), executive function (Cheng et al., 2018), language abilities (Aldrich et al., 2021), and school readiness (Bernier et al., 2017). More recently, video-feedback (Schacht et al., 2017) and smartphone intervention (Larkin et al., 2019) have increased parental MM (in both clinical and non-clinical caregivers) and improved children's developmental outcomes (e.g., attachment security), further elucidating the application of the construct in promoting positive parent-child relationships.

Given that a caregiver's capacity to interpret the child's perspective and to regard the child as an individual agent may serve as foundation for children's subsequent cognitive development, the overarching goal of this dissertation is to examine the stability of maternal

mind-mindedness across the transition to motherhood and its association with children's later theory of mind and executive functioning. The dissertation will employ a secondary data analysis of a longitudinal study conducted between 2004 to 2010, "From Pregnancy to Parenting Your First Baby Project" (FPP; PI: Jennifer Ablow, Ph.D.) that examined a group of socioeconomically diverse primiparous women at risk for parenting maladjustment across their transition to parenthood.

In what follows, I provide background information and elaborate on the proposed aims of my dissertation. First, I begin with an overview of the theoretical origin and operationalization of caregiver mind-mindedness, followed by an evaluation of the nature of the construct and its temporal stability. I then review parent factors that may relate to individual variations in mind-mindedness and evaluate research on children's social-cognitive outcomes associated with caregiver mind-mindedness.

Second, I present a secondary data analysis of the longitudinal dataset that addresses my research questions concerning the stability of mind-mindedness over time and its longitudinal association with children's theory of mind and executive functioning. In this research, I also examine potential caregiver characteristics (e.g., socioeconomic status and maternal risk condition) that may influence the effects of mind-mindedness on children's social-cognitive development along with potential mechanisms of association (e.g., children's language ability and executive functioning).

Last, I provide a summarizing discussion of the overall findings of my dissertation, its contribution to the literature, strengths and limitations, and potential avenues for future research.

Mind-Mindedness: Theory and Operationalization

Parental mind-mindedness refers to a caregiver's spontaneous proclivity to attribute mind-like qualities (relating to an individual's mental life, will, mind, imagination, interests, intellect, and/or metacognition) in their interaction with or representation of their child, and the tendency to interpret behavior in line with these mental state attributes (Meins & Fernyhough, 2015). Meins' (1997) conceptualization of mind-mindedness is rooted in Bowlby's attachment theory (Bowlby, 1958) and Ainsworth's construct of maternal sensitivity (Ainsworth et al., 1974), a caregiver's ability to accurately perceive, interpret, and respond to the signals from her infant.

While the sensitive caregiver may fulfill an infant's physical and emotional well-being (e.g., respond when the infant cries, comfort the infant when upset), Meins (1997; 2001) proposed that it is the sensitive caregiver's propensity to focus on infants' cognitive well-being (e.g., interpreting the infant's action as meaningful, treating the infant as an intentional agent) that is at the core of effective, sensitive parenting. For example, if a mother and her infant are playing with a mirror toy, a mother who does not engage in mind-minded behavior may say "Who is that in there? Is that you?" In contrast, a mother who is considered mind-minded may say "Who do you think that is? Do you think that might be you?". While both mothers engaged in sensitive interaction with their infant, there is a difference in proclivity to reference the infant's mind that Meins argues would demonstrate individual differences in the caregiver's representation of their infant's mental states, such that a more mind-minded caregiver may provide developmentally appropriate opportunities that encourage the infant to see themselves and others as mental agents (Meins, 2001).

The conceptualization of the construct was also informed by Vygotsky's sociocultural theory (Vygotsky & Cole, 1978) that children's development is influenced by their social environment and relationships, specifically the adult caregiver's language and scaffolding during interaction. Meins (1997) put forth that a mind-minded caregiver-child interaction within Vygotsky's zone of proximal development – the distance between actual development when alone and potential development if scaffolded by a more knowledgeable partner – facilitates the acquisition of higher mental functions, in particular social understanding (e.g., theory of mind).

Mind-Mindedness, Sensitivity, and Attachment

From the aforementioned theoretical origins, early research on mind-mindedness sought to demonstrate the association between mind-mindedness and attachment constructs (e.g., maternal sensitivity, attachment security) as well as children's later social cognitive development (e.g., theory of mind). Maternal sensitivity has been defined as the mother's appropriate perception, interpretation and response to infants' behavior (Ainsworth et al., 1972; 1974). Sensitivity is commonly measured via observation of caregiver-infant free play and the interaction is then assigned a global rating on a 9-point scale scored from (1) highly insensitive to (9) highly sensitive. The evaluation is based on the caregiver's appropriate physical, verbal and emotional response towards the infant's cues (e.g., responds to distress, monitors infant behavior, attention towards infant's cues, etc.; Ainsworth et al., 1971). Meins (2013) argued that since Ainsworth's seminal work, the operationalization and coding of sensitivity has become too broad – as reflected in the low variance explained by sensitivity in predicting children's attachment security (DeWolff &VanIjzendoorn, 1997) – and proposed a need to return to Ainsworth's original conception of sensitivity, specifically the caregiver's ability to

appropriately recognize the cues from the infant, represent the infant's needs and wishes, and monitor the infant's response to ensure that she has interpreted the cues correctly.

In the development of the construct, Meins was particularly influenced by Ainsworth's description of the sensitive mother as "capable of perceiving things from the baby's point of view" and who regards the baby "as a separate person; she also respects his activity in progress and thus avoids interrupting him" (Ainsworth et al. 1971). From Ainsworth's description, Meins (1997; 2013) defined mind-mindedness as a cognitive component of sensitivity – expressed through caregiver language – with the mind-minded caregiver characterized as being able to treat her infant as a mental agent, capable of intentional action. According to Meins (1997; 2013), mind-mindedness quantifies a specific aspect of the caregiver's behavior and can be a complement to the more global assessment of sensitivity. Since mind-mindedness was developed as a refinement of maternal sensitivity, with particular focus on the caregiver's attunement towards the infant's internal state, it can be theorized that mind-mindedness should be related to, albeit distinct, from sensitivity, and provide additional contribution to that of sensitivity in explaining attachment security.

Mind-mindedness has been linked to more global caregiver sensitivity (Arnott & Meins, 2008; Meins et al., 1998, 2001) with correlations between .41 and .28 (Laranjo et al., 2008; Rosenblum et al., 2008, respectively) while controlling for confounding variables such as caregiver education. Most of the studies on mind-mindedness and caregiver sensitivity focused on children younger than 2 years of age and used the interactional (free play observation) measure of mind-mindedness. Studies with the representational measure of mind-mindedness (which entails an interview and will be described in greater detail below; Farrow & Blissett, 2014; Lok & McMahon, 2006) generally showed a similar small to moderate correlation with

sensitivity between .20 and .30. However, in two studies (Demers et al., 2010; McMahon & Meins, 2012), a significant correlation with maternal sensitivity was only obtained when looking at positively-valenced mind-minded comments. Overall, there appears to be substantial evidence to support the theoretically expected association between mind-mindedness and sensitivity, with the caregiver-child interaction method providing stronger and more consistent results compared to the interview method.

Given the shared theoretical origin of mind-mindedness and sensitivity, it is perhaps not surprising that the results for the contribution of mind-mindedness beyond sensitivity in explaining attachment security are mixed. For example, Meins et al. (2001) found that mind-minded comments and maternal sensitivity at 8 months predicted attachment security at 12 months with mind-mindedness accounting for greater variance (12.7%) than sensitivity (6.5%; n = 70). On the other hand, Lundy (2003; n = 24) and Laranjo et al. (2008; n = 50) found that while mind-mindedness predicted attachment security, the effect was not significant once maternal sensitivity was included in the model.

In their review, McMahon and Bernier (2017) noted that the mixed findings for the relative contribution of mind-mindedness and sensitivity in explaining attachment may be partially attributed to differing methods and approach to measuring attachment (e.g., Attachment Q Sort, Strange Situation Procedure) and sensitivity (e.g., Maternal Behavioral Q Sort, Ainsworth's Global Rating Scale) and whether sensitivity was examined concurrently with mind-mindedness (e.g., coding of mind-mindedness and sensitivity from the same free play interaction). Researchers have also proposed that caregiver sensitivity or caregiver responsiveness may mediate the association between mind-mindedness and attachment security (Miller et al., 2019). For example, through sequential mediation analysis, using a sample of 102

participants, Miller and colleagues (2019) found support for a path from maternal mind-mindedness at 7 months to children's attachment security at age 10 mediated through responsiveness at 15 months and then attachment security at age 2. Lastly, another suggestion in the literature is that mind-mindedness may be a precursor to sensitivity (Laranjo et al., 2008) given that representational mind-mindedness can conceivably exist prior to birth (prenatal mind-mindedness is currently an understudied period with one published study from Arnott & Meins, 2008, which is discussed further in the "Temporal Stability" section below).

The consistent associations among mind-mindedness, sensitivity, and attachment may provide evidence to suggest: (a) that mind-mindedness is a theoretical construct relevant in understanding the development of attachment and/or (b) that mind-mindedness is confounded with sensitivity such that the relative contribution and interplay of each variable (mind-mindedness, sensitivity and attachment) requires further research. The current operationalization of mind-mindedness is presented next, followed by an evaluation of mind-mindedness coding.

Current Operationalization of Mind-Mindedness

Mind-mindedness is described by Meins (2013) to be at the interface of representation and behavior, as a mind-minded caregiver must represent her infant's mental states and then respond to this representation. Two approaches are currently used to measure mind-mindedness and both rely on analysis of verbatim transcripts from caregiver discourse (the "interactional" method discussed next also includes examination of the caregiver-child interaction video). The first method, called "interactional" by Meins and Fernyhough in the *Mind-Mindedness Coding Manual* (2015), assesses the amount of caregiver verbal reference to the infant's mental states during a filmed caregiver-child free play interaction. The second method, called "representational," examines caregivers' spontaneous tendency to focus on their child's mental

characteristics when given an open-ended invitation to describe their child during an interview. The interactional measure captures parents' representation and behavior directed at the child while the representational measure only captures what parents say about their child when the child is not present.

In both measures, caregivers' utterances related to their child are coded and divided into mind-related comments (e.g., thoughts, beliefs, and desires) and non-mind related comments (e.g., comments on behavior or physical features). A crucial distinction between the two measures is that the interactional measure can also be further coded to assess the behavioral accuracy (*appropriate* vs. *non-attuned*) of the mind-related comment made by the caregiver by examining the video recording of the free play interaction. For example, upon seeing an infant reach for a rattle, a caregiver may comment appropriately and say "you want the rattle" while a non-attuned comment may be "you do not like that" while moving the rattle away (see Chapter II of the "Method" section below for a detailed description of coding of mind-mindedness in the present study).

Evaluation of Mind-Mindedness Coding

While both measures of mind-mindedness stem from a caregiver's representation, there appear to be fundamental differences between the interactional and representational assessments. Both measures involve the caregiver thinking of their child as a mental agent, but only the interactional measure can assess whether the caregiver actually *treats* their child as an intentional agent. Further, the accuracy of the caregiver behavior can also be assessed in the interactional measure, although it can be argued that the criterion for accuracy rests solely on the researcher coding the interaction with very little opportunity for validation beyond interrater reliability. The representational measure is reflective, and it may also be more likely to be influenced by the

desire on the part of the caregiver to provide socially desirable responses or by factors such as parent education and SES (see "Parental Factors Associated with Mind-Mindedness" below for more details). For the interactional and representational measures of mind-mindedness to be considered equivalent, there is an underlying assumption that the caregiver's representation should translate into behavior such that the two measures should be highly correlated and equally predictive of mind-mindedness related developmental outcomes.

Given the different age recommendation for each mind-mindedness measure – under 24 months for interactional, over 24 months for representational – very few studies have directly compared the two measures (Illingworth et al., 2016; Meins et al., 2003). As there was no established coding scheme for interactional mind-mindedness in older children at the time of publication, Illingworth et al. (2016) adapted the Mind-Mindedness Coding Manual to code for interactional mind-mindedness in caregivers of older children. More recently, recognizing the need for a measure that captures the caregivers' tendency and appropriateness to treat their older children as individuals with minds, Meins' and her colleagues developed a coding scheme for interactional mind-mindedness in older parent-child dyads (Fishburn et al., 2022).

In a longitudinal study, Meins et al. (2003) found a significant correlation between interactional mind-mindedness at 6 months and representational mind-mindedness when children were 4 years of age (r = .40) in a sample of 52 mother-child dyads. In contrast, Illingworth et al. (2016) examined older and younger sibling pairs from the same family (n = 32) and did not find significant longitudinal association across 9 months between representational and interactional mind-mindedness for the older sibling (r = -.21, p = .28) and younger sibling (r = -.22, p = .24; n = 32). When it comes to mind-mindedness and children's developmental outcomes, a meta-analysis conducted by Devine and Hughes (2018) found that the use of interactional and

representational measures of caregiver mind-mindedness resulted in similar overall effect size for the association between mind-mindedness and children's ToM, suggesting some level of congruence across the two measures of mind-mindedness as related to children's ToM. A more recent meta-analysis by Aldrich and colleagues (2021) also found equivalent effect sizes for association between mind-mindedness and children's developmental outcomes (social cognition, language, executive function) for the interactional and representational measure of mind-mindedness. In sum, while both the interactional and representational measures of mind-mindedness appear to demonstrate similar effect sizes with children's developmental outcomes, less is known regarding concurrent or longitudinal association between the two measures within the same parent-child dyad.

Mind-Mindedness: Temporal Stability, Continuity and Nature of the Construct

While there is substantial literature that examines the developmental outcomes associated with caregiver mind-mindedness (discussed further below in the "Child Outcome" section), the temporal stability, continuity, and nature of the construct is less understood, with a majority of studies being conducted cross sectionally. Early in the development of the construct, Meins (1999) raised the need to establish whether mind-mindedness was "specific to attachment related constructs or simply a general trait in certain people" (p. 338). Mind-mindedness has been put forth as a relational construct (Larkin et al., 2020; Meins et al., 2014), or a relational construct influenced by cognitive-behavioral traits within the caregiver (Meins et al., 2011), suggesting a certain degree of individual stability. The study of development can be characterized by both group mean level continuity (vs. discontinuity) and individual order stability (vs. instability; Bornstein et al., 2017). For example, while there may be a decrease in caregivers' group mean level of mind-mindedness across the first two years of life (discontinuity), an individual may

remain consistent in their level of mind-mindedness relative to others (individual order stability). Thus, the examination of both continuity and stability of caregivers' mind-mindedness may provide a pattern of development for the time period examined.

If mind-mindedness is trait-like, one could predict that mind-mindedness should be relatively stable across time, generalize across relationships and be independent of child characteristics (e.g., individuals who are considered high in mind-mindedness will exhibit a higher level of mind-mindedness regardless of whom they are interacting with). If mind-mindedness is relational, one could predict that mind-mindedness should be unique to each relationship with mind-mindedness reflecting a person's capacity to reflect mentally on others' behavior when forming attachment relationships (e.g., an individual should be more mind-minded towards someone they have a close relationship with). Evidence in support of the relational quality of mind-mindedness includes findings that: adults are more mind-mind when describing a close friend, romantic partner or their child compared to their descriptions of a celebrity or a painting (Meins et al., 2014); caregiver mind-mindedness is decreased in the context of disrupted caregiver-child relationship such as adoptive or foster parents (Fishburn et al., 2017); and intervention aimed to increase caregiver mind-mindedness showed improvement in caregiver-child relationship (e.g., attachment security; Larkin et al., 2019). Furthermore, caregiver mind-mindedness may change and fluctuate depending on how the caregiver-child relationship unfolds over time and mind-mindedness may be particularly prone to change during the transition to parenthood (e.g., are expectant parents already building a mentalized concept of their unborn child or does this only occur after the child is born? Will mind-mindedness increase initially during the first year of life as infants mature physically and cognitively followed by a decrease in mind-mindedness once toddlers become more verbal?).

A challenge in examining the relational versus trait-like quality of mind-mindedness is the inherent confounded nature of the typical caregiver-child relationship such that finding stability of mind-mindedness over time could be attributed to both caregiver traits and the potentially unchanging relationship between caregiver and their child. Further, most studies on mind-mindedness generally focus on mind-mindedness towards one target (e.g., a specific child); thus, the consistency of mind-mindedness across different targets with varying levels of relationship closeness is rarely investigated. In what follows, I will review published works that examined the individual stability and group level continuity of caregiver-child mind-mindedness.

Meins et al. (2011) found moderate individual temporal stability (r = .53) in the proportion of maternal mind-related comments towards their infants at 3 and 7 months of age with a sample of 41 mothers.The study also revealed that as a group, mothers made significantly more mind-related comments at 7 months (9.81%) than at 3 months (5.47%), suggesting group level discontinuity. Similar to Meins et al. (2011), McMahon et al. (2016) also found individual temporal stability, albeit to a smaller magnitude (r = .23), in a larger sample (n = 150) that examined the proportion of maternal mind-related comments when infants were 7 and 19 months of age. In contrast to Meins et al. (2011), McMahon et al. (2016) found that mothers made significantly fewer mind-related comments at 19 months (3.71%) than at 7 months (8.05%). In another sample of 104 mothers and fathers, Colonnesi et al. (2019) found that mothers' use of mind-related comments was stable from 4 months to 12 months (r = .23) and from 12 months to 30 months (r = .22) but were not significantly related between 4 and 30 months (r = -.01, p = n.s.). Father's use of mind-related comments was stable from 4 months to 12 months (r = .18) but not from 12 months to 30 months (r = .04, p = n.s.). Similar to Mcmahon et al. (2016), mothers and fathers combined in Colonessi et al. (2019) made significantly fewer mind-related

comments across the three time points as the infant got older (7.74%, 5.32% and 3.88%, respectively, at each time point). Last, a recent study (Siletti et al., 2022) with 93 Italian mothers measured mind-mindedness at 3, 6, 9 and 12 months and found significant individual temporal stability between pairs of mind-related comments score over time (*r*s between .25 to .44) with an overall decrease or discontinuity in mean mind-related comments over time (11.64%, 9.07% ,8.37% and 7.22% mind-related comments respectively at each time point for mothers). Of note, additional analysis in Silettie et al. (2022) revealed that family income moderated individual differences in this linear decrease such that a small subset of mothers below the poverty threshold (*n* = 14, 15% of participants) had mind-minded comments that remained low across all four time points. Siletti and colleagues (2022) further discussed that the overall higher percentage of mind-related comments produced by the Italian mothers compared to other published reports of European and North American mothers alludes to the possibility of a cultural context where a highly reactive and socially active infant is valued.

Together, the studies reviewed suggest some level of individual stability in caregivers' mind-mindedness across infancy and toddlerhood; at the same time, the rapid developmental changes (i.e., language, cognition, motor function, parent-child interaction) that unfold across the first two years of life may influence the overall extent to which caregivers comment on the infant's internal states with evidence thus far supporting an overall decrease or discontinuity in the amount of interactional mind-minded comments over time during infancy and toddlerhood. Furthermore, as proposed by Siletti et al. (2022), early on when infants' mental states are more challenging to decipher, mind-mindedness may rely more on a caregivers' stable orientation towards others' mental states. As infants become older and the caregiver-child relationship

lengthens and evolves, mind-mindedness may adapt to better reflect the infants' development and functioning.

A closer examination of the temporal stability of mind-mindedness also raises a question regarding the emergence of mind-minded representation and whether mind-mindedness may be present prior to birth. To date, only one study has examined mind-mindedness prenatally. Arnott and Meins (2008) examined 25 expecting couples with mixed results such that only the *overall* number of comments (not number of *mentalistic* comments) made prenatally about the unborn child correlated with caregivers' appropriate mind-related comments when the child was 6 months old. Given the difficulty for caregivers to provide any mentalistic comments about the unborn child (more than half of the caregivers did not provide a mentalistic comment), Arnott and Meins (2008) put forth that prenatal mind-mindedness may be a function of a caregiver's ability to represent any characteristics of what the child may be in like in the future rather than specific characteristics related to the child's internal state.

The initial study by Arnott and Meins (2008) establishes groundwork and the need for further examination of temporal stability in mind-mindedness as expectant parents' willingness to represent the internal states of the unborn child may make theoretical and applied contributions. Theoretically, the presence of prenatal mind-mindedness and later individual stability across infancy may suggest that mind-mindedness as a construct emerges during pregnancy and is generally determined by caregiver rather than child characteristics. On the other hand, both individual instability and group level discontinuity in mind-mindedness across the transition to parenthood may suggest that mind-mindedness is subject to change as the parent-child relationship unfolds during the transition to parenthood. From an applied perspective, the prenatal period may provide opportunity for intervention on mind-mindedness aimed at

improving caregiver-child relationship outcomes (e.g., attachment security). Currently, video-feedback (Schacht et al., 2017) and smartphone intervention (Larkin et al., 2019) to increase parental mind-mindedness postnatally have demonstrated improved infant-parent attachment security. Thus, the first aim of the dissertation was to examine the temporal stability and continuity of maternal mind-mindedness across the transition to motherhood at three time points: prenatally in the third trimester of pregnancy, and when infants are 5 and 17 months of age.

Parental Factors Associated with Mind-Mindedness

As mind-mindedness is a construct focused on caregiver language and behavior, studies have examined whether individual differences in caregiver mind-mindedness may be related to demographic variables such as socioeconomic status (SES), or caregiver characteristics such as psychological maladjustment.

Socioeconomic Status and Education

Since mind-mindedness is coded from caregiver language related to abstract mental states, it is likely that mind-mindedness be influenced to a certain extent by verbal IQ and education. While no studies have directly examined caregiver general cognitive abilities and mind-mindedness, most studies on mind-mindedness generally report on parent education and/or SES and include these variables as covariates in their analysis. Results on the association between mind-mindedness and parent education/SES have been relatively evenly split between significant (*r*s between .20 and .30; Centifanti et al., 2016; Lundy, 2013) and non-significant associations. It should be noted that some studies with non-significant correlations between mind-mindedness and parent education/SES may be due to small sample sizes and/or restricted ranges, with the majority of the sample being from high education/SES background (Barreto et al., 2016; Illingworth et al, 2016). A meta-analysis that examined the association between

caregiver mind-mindedness and children's developmental outcomes (social cognition, language, executive function) found larger overall effect size in families classified as Higher SES (r = .23) compared to families classified as either Middle (r = .13) or Lower SES (r = .11; Aldrich et al., 2021).

Beyond the association that is present between mind-mindedness and family SES, four studies to date have specifically compared mind-mindedness across differing SES groups or families at risk for adversity, with two studies from Meins et al. (2013; 2019) that utilized the same group of participants over time and the remaining studies from Hughes et al. (2017) and Silletti et al. (2022). Meins and colleagues found that only in low SES families did higher levels of maternal mind-mindedness at 8-months mitigate children's behavioral problems during the preschool years (Meins et al., 2013) and were associated with higher reading and math abilities at age 7 and 11 (Meins et al., 2019). Similarly, higher levels of maternal mind-mindedness were significantly associated with a reduction in pre-adolescents' disruptive behaviors in families classified as high in adversity but not in families classified as low in adversity (Hughes et al., 2017). On the other hand, Italian mothers below the income poverty threshold produced a consistently lower number of mind-related comments towards their infants across four time points in the first year of life compared to mothers above the poverty threshold (Silletti et al., 2022). To further contribute towards our understanding of the potential influence of SES on caregiver mind-mindedness, the current dissertation included a socioeconomically diverse sample of first-time mothers to examine developmental outcomes associated with mothers' early mind-mindedness.

Psychological Maladjustment

A caregiver's capacity to be mind-minded towards their infant may be impaired if the caregiver experiences psychological maladjustment, particularly maladjustment in domains that impact mentalizing ability, relational capacity or mood regulation, as deficiencies in these domains can negatively affect a caregiver's behavior and the caregiver-child relationship. As the current dissertation oversamples for mothers at risk of parenting maladjustment (not clinically diagnosed), a brief review of the current literature on mind-mindedness and psychological maladjustment is included.

Current findings relating mind-mindedness and psychological maladjustment are mixed, typically from studies with small sample sizes, with no consistent support that psychopathology is associated with lower mind-mindedness. Adults (n = 20) diagnosed with Autism Spectrum Disorder (ASD) provided fewer mind-minded comments for the self and others compared to adults with no diagnosis (Kristen et al., 2014). Mothers diagnosed with Borderline Personality Disorder (BPD) used fewer mind-minded comments compared to mothers with no diagnosis when describing their 4-year-olds (n = 20 mothers; Schacht et al., 2013). In contrast, Marcoux et al. (2017) only found increased frequency of *non-attuned* mind-minded comments but no differences in overall frequency for mothers with BPD compared to mothers without psychiatric diagnosis (n = 10) during interaction with their 12-month old infants, suggesting that mothers with BPD were still able to represent their children in a mind-minded manner albeit less accurately. Although the few findings of the association between mind-mindedness and mentalizing ability in neuroatypical adults were not significant, future work on mind-mindedness and adults with ASD or BPD may contribute to theoretical understanding of the construct of

mind-mindedness given the deficiency in mentalizing involved in ASD and challenge in emotion regulation found in BPD.

Relatedly, the broader construct of parenting stress was negatively associated with mind-mindedness with more mind-minded mothers reporting less parenting stress (average r = -.30; Demers et al., 2010; McMahon & Meins, 2012; Walker et al., 2012). In one study that examined mind-mindedness and anxiety, adults and older children (8- to 12- year olds) with a higher frequency of mind-minded comments toward a close social partner also tended to report higher social anxiety (r = .21 and r = .45, for adults and children respectively; Pequet & Warnell, 2020). For depression, some studies report no significant correlation between mind-mindedness and depressive symptoms (e.g., Demers et al., 2010; Meins et al., 2013) while others report significant negative correlations of moderate effect size (average r = -.30; Lok & McMahon, 2006; Schacht, 2013). In summary, while some findings are mixed with small sample sizes, psychological maladjustment appears to negatively influence a caregiver's level of mind-mindedness towards their child or lead caregivers to misattribute their child's internal state.

Mind-Mindedness and Child Outcomes

From the onset, influenced by Vygotsky's sociocultural theory, Meins (1997) was interested in the caregivers' role in shaping children's cognition. According to Vygotsky, children's development is a process embedded in culture that occurs in two planes: first socially between individuals and later psychologically as thoughts become internalized by the child. Meins (1997) proposed that a caregiver who is attuned to the mental states of their infant may provide developmentally appropriate opportunities that encourage children to see themselves and others as mental agents. More specifically, a mind-minded caregiver is able to recognize the zone of proximal development for their infant and provide conceptual and linguistic scaffold to

facilitate internalization of mental representations (Meins et al., 2003). Accordingly, there has been a large empirical focus on the association between mind-mindedness and children's social understanding (e.g., theory of mind). More recently, studies on the outcome of mind-mindedness have also focused on children's executive function or self-regulation, language development, and school readiness.

Mind-Mindedness and Child Theory of Mind

Research in the past two decades has suggested that greater maternal mind-mindedness in infancy is associated with greater theory of mind (ToM) understanding in childhood. For example, maternal mind-mindedness when infants are 6 months old significantly accounted for 11% of the variance in the child's ToM performance at age 4, while maternal sensitivity, education, number of older siblings, and attachment style were not significant predictors (Meins et al., 2002). A meta-analysis with 14 studies (comprising 1,261 preschool aged children) revealed a moderate but significant correlation between parental MM and children's later ToM ($r = .19$, 95% CI [.13, .24]) after controlling for children's verbal ability (Devine & Hughes, 2016). Of note, the meta-analysis also found no difference in effect size as a function of the method used to measure parental MM (i.e., interview vs. observation).

While the association between MM and ToM is robust, less is known about the mechanism underlying this association with few studies to date examining potential developmental pathways. It is possible that MM in infancy is an overall indicator of general parental competency and language use or the pathway linking MM and ToM may be indirect, through its effect on children's subsequent language and self-control behavior (discussed further below). Through path analysis, Meins et al. (2003) found that early interactional mind-mindedness at 6 months, along with children's receptive vocabulary but not representational

mind-mindedness at 48 months, exerted a direct relation on children's theory of mind performance at 48 months (mother's early interactional and later representational mind-mindedness were correlated at r = .40 with a sample of 52 mother-child dyads). Similarly, in Meins et al.'s (2013) study, the best fit path analysis model revealed a direct link between interactional mind-mindedness at 8 months and children's theory of mind at 51 months, along with an indirect link between interactional mind-mindedness and theory of mind through children's concurrent receptive vocabulary at 51 months. In the same model, interactional mind-mindedness at 8 months did not have a significant path to children's internal state language and symbolic play measured at 25 months.

Findings from Meins (2003; 2013) suggest that the relation between early mind-mindedness (e.g., 6- and 8-months) and children's ToM appears to be direct and not through later mind-mindedness (48 months). Further, there is some evidence that children's language in general rather than specific internal state language mediates the relation between early mind-mindedness and children's ToM (Meins et al., 2013). Research on the relation between children's language and their ToM performance has found support for the contribution of children's general language ability, syntactic ability (combining words into sentences) and semantic ability (understanding word meaning such as knowledge of internal state words and measures of receptive vocabulary) with meta-analytic effect sizes of association between 0.48 - 0.56 (Milligan, Astington & Dack, 2007). Longitudinally, Astington and Jenkins (1999) found evidence that children's early general language and syntactic ability (but not semantic) predicted their later ToM performance, but children's earlier ToM did not predict later language performance.

Methodologically, it should be noted that in the one longitudinal mind-mindedness study on children's early internal state language and later ToM (Meins et al., 2013), the authors' measure of children's internal state language differed from standard assessments used in the literature. Meins et al. (2013) utilized a caregiver self-reported questionnaire - the MacArthur Communicative Development Inventory (MCDI; Fenson et al.,1993) - of their 26-month-olds' receptive vocabulary and identified 14 words in the MCDI related to internal states as an index of children's internal state language. The parent-report method and younger age of internal state language assessment differs from most studies on children's language and ToM where typically older children (3 years and up) are administered a standardized language assessment such as the Test of Early Language Development (Hresko et al., 1999) or the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997). Thus, opportunities remain to clarify the effects of caregiver mind-mindedness on children's internal state language through more direct measures of children's language ability, including internal state language. While the contribution of early mind-mindedness to children's language and subsequent ToM understanding warrants further attempts at replication, another potential candidate that may mediate the relation between mind-mindedness and children's ToM is children's executive function (discussed further below).

Mind-Mindedness and Child Language

Given that mind-mindedness assesses the linguistic behavior of the caregiver, it can be theorized that mind-related language occurs within a broader context of rich caregiver discourse such that having a mind-minded caregiver may facilitate children's own language development generally or their mental state language specifically. While some studies on mind-mindedness and developmental outcomes control for children's vocabulary, only a few studies have directly examined the association between mind-mindedness and children's language development.

Maternal mind-mindedness measured at 12-months predicted children's (N = 84) expressive vocabulary at 2 years of age as assessed by mother report of child language (MCDI; Laranjo & Bernier, 2013). Preschoolers (n = 36) whose parents scored high on mind-mindedness used more mental-state language during a parent-child problem solving task; both parental mind-mindedness and children's own mental-state language use were highly correlated with children's performance on false-belief tasks (r = .44 and .48 respectively; Lundy & Fyfe, 2016). In a Hong Kong sample, Wang et al. (2017) found that the proportion of parental mind-minded descriptions of their 3- to 6-year-olds (n = 96) was positively correlated with child age and child concurrent verbal ability. In contrast, a recent study with highly educated Swedish parents (n = 63; Nyberg et al., 2021) found no significant association between 9-months mind-mindedness and parent report of child vocabulary at 9-months and 25-months. The authors attributed the non-significant association partially to the wide range of variability and lack of stability in early language development during infancy. In sum, while it is important to control for parental and child vocabulary when studying developmental outcomes associated with mind-mindedness, future work may benefit from examining more fully the influence of parental mind-mindedness on children's language development as it is possible that there is a bidirectional relationship between caregiver mind-mindedness and children's concurrent language ability.

Mind-Mindedness, Child Executive Function and School Readiness

Following Vygotsky, it has been proposed that caregivers can serve as external regulators of children's self-control behavior by providing scaffolding, stimulating activities, and sensitive responding during caregiver-child interaction (Carlson, 2009). A meta-analysis of 42 longitudinal studies published between 2000 and 2016 found a modest association between earlier parenting behaviors and children's later composite executive function (EF; Valcan et al.,

2018). Specifically, positive (e.g., sensitivity, warmth, responsiveness; r = .25), negative (e.g., intrusive, detached and controlling; r = -.22) and cognitive (e.g., cognitive stimulation, autonomy support, scaffolding; r = .20) parenting behaviors were all significantly associated with children's later EF (Valcan et al., 2018). Theoretically, research in the domain of parenting and children's EF have been grounded in the attachment and Vygostkian sociocultural framework, such that the caregiver behavior – for example, a responsive attuned caregiver during joint engagement with their child may be able to direct attention away from irrelevant information, recognize and assist the child to switch their attention and scaffold the child to update their working memory by thinking out loud – may facilitate the internalization of the child's self-regulatory process.

With the aforementioned shared theoretical origins, there has been a growing interest in the association between caregiver mind-mindedness and children's EF or self-control. Bernier and colleagues (2010) found in a group of educated mothers (80% with college degree, n = 80) that quality of caregiver-child interaction – maternal sensitivity, mind-mindedness, and autonomy support – predicted toddler's EF. Specifically, higher maternal mind-mindedness was associated with greater performance on a working memory task when their toddlers were 18 months and the effect remained controlling for the toddlers' general cognitive development. A longitudinal study with 96 mother-infant dyads found that maternal mind-mindedness measured when infants were 9 months of age predicted children's later inhibitory control at age 2 and 3, independent of family income, parents' education and maternal sensitivity (Cheng et al., 2018). In a group of lower income mothers recruited from Early Head Start (n = 95) and using a modified representational mind-mindedness interview (mothers were asked to describe their toddler in three words), Senehi et al. (2018) found that higher mind-minded descriptions about

their 2-year-olds was associated with better child performance on a delay of gratification task 6 months later.

Throughout the literature review on caregiver mind-mindedness and children's EF, several recent studies have either solely focused on fathers' mind-mindedness and children's self-regulation (Gagne et al., 2018; Regueiro et al., 2022) or have only found significant effects of fathers' but not mothers' mind-mindedness and children's EF (Nikolic et al., 2022). In a study that only examined paternal mind-mindedness, Gagne et al. (2018) found that fathers' use of appropriate mind-minded comments during free play at 18 months was related (r = .28) to children's inhibitory control at 3 years, as measured with a snack delay of gratification task. Further, the effect remained after controlling for children's temperament. Another study that focused on fathers' mind-mindedness (Regueiro et al., 2022) found that fathers' (n = 108) use of appropriate mind-related comments during freeplay at 18 months predicted 7.84% of the variance in children's EF difficulties as rated by their kindergarten teachers (using the Behavior Rating Inventory of Executive Function), after accounting for attachment security and family SES. In a more recent study with 125 educated mothers and fathers (67% and 52% with a university degree respectively), fathers' (but not mothers) mind-mindedness at 12- and 30-months predicted greater child temperamental effortful control, measured with the Child Behavioral Questionnaire, and behavioral self-regulation, measured with one delay of gratification task at 4.5 years of age (Nikolic et al., 2022). Further, in Nikolic et al. (2022), higher levels of non-attuned mind-minded comments from both mothers and fathers predicted lower levels of physiological self-regulation measured through heart rate variability and temperamental effortful control. In their discussion, Nikolic and colleagues (2022) raised the possibility that mothers' mind-mindedness may play a role in children's self-regulation early on

in infancy and toddlerhood while the relationship between the father-child dyad may continue to evolve later in development, leading to a greater impact of paternal mind-mindedness on preschoolers' self-control.

Combining the influence of mind-mindedness on children's EF and language outcomes, Bernier and colleagues (2017) examined the developmental pathway through which early mind-mindedness, EF, and children's language ability influence children's later school readiness. A six-year longitudinal study with 204 mother-child dyads found a significant association between maternal mind-mindedness at 12 months and school readiness in kindergarten that was mediated by language ability at age 2 and effortful control at age 3 and 4, after controlling for children's initial cognitive ability, maternal sensitivity, family SES, and child gender (Bernier et al., 2017). Results of the longitudinal study provide a potential mechanism through which family environment (e.g., mind-mindedness) relates to children's later school readiness through intermediate influence on children's language and self-control.

In summary, while substantial evidence supports the relation between mind-mindedness and children's social understanding (e.g., ToM), more attention is needed towards the role of mind-mindedness in promoting children's cognitive development (e.g., language, EF) and the long-term effect of early maternal and parental mind-mindedness. Towards this aim, the current dissertation examined the longitudinal association between early mind-mindedness and children's later EF and explored whether children's language ability and/or EF mediates the association between mind-mindedness and ToM.

Dissertation Aims

With the increase in level of interest in the construct of mind-mindedness, there remains substantive inconsistency regarding stability across time, association with parental factors,

mechanism of influence on developmental outcomes, and generalizability across socioeconomically diverse samples. This dissertation thus aimed to 1) examine individual stability and group-level continuity of maternal mind-mindedness in three time points across the transition to motherhood (last trimester in pregnancy, 5 months, and 17 months post birth) in a socioeconomically diverse sample, 2) investigate the longitudinal association between early maternal mind-mindedness and children's age 5 theory of mind and executive functioning, and 3) explore whether children's language ability and/or executive function mediates the association between early mind-mindedness and children's theory of mind.

Aim 1. Examine the temporal stability and continuity of maternal mind-mindedness across the transition to motherhood in a sample of socioeconomically diverse first-time mothers.

I examined whether the interview-based measure of maternal mind-mindedness collected prenatally is stable over time with the interaction-based measure of mind-mindedness assessed when infants are 5 months and 17 months of age. Whether caregiver characteristics such as maternal education and/or socioeconomic status (SES) influenced mind-mindedness was also examined and controlled for in the analysis.

Hypothesis 1a: For temporal stability, I predicted the interaction-based measure of mind-mindedness assessed at age 5 months would be correlated with interaction-based mind-mindedness assessed at age 17 months. Temporal stability would be demonstrated if the overall number of mentalistic comments made by the mother was correlated to mothers' appropriate mind-related comments between age 5 months and 17 months.

No specific prediction was made for the prenatal interview-based measure of mind-mindedness as this method of asking caregivers to describe how their child may be like in the future has only been used prenatally in one published study (Arnott & Meins, 2008). I examined

whether the *overall* number of comments and number of mentalistic comments made prenatally about the unborn child will be related to interaction-based mind-mindedness measured at infant age 5 months and 17 months.

Hypothesis 1b: For temporal continuity or discontinuity (i.e., average group level mind-mindedness across time), following past research (Arnott & Meins, 2008; Colonnesi et al., 2019; Meins et al., 2011), I predicted a main effect of time (discontinuity) such that mothers would have an overall lower proportion of mind-related comments prenatally compared to their proportion of appropriate mind-related comments at 5 months and 17 months. Furthermore, the proportion of mind-related comments would remain similar or lower at 17 months, as compared to the number of mind-related comments at 5 months.

Aim 2: Investigate the longitudinal association between early maternal mind-mindedness and children's executive function in a sample of socioeconomically diverse first time mothers.

Aim 2 contributes to emerging research on the longitudinal association between maternal early appropriate mind-related comments and children's later executive functioning (Cheng et al., 2019; Gagne et al., 2018; Regueiro et al., 2022). Mothers' education, and children's language ability were included as control variables.

Hypothesis 2: Maternal mind-mindedness would predict children's age 5 EF after controlling for children's concurrent language ability and mothers' demographic variables.

Exploratory Analysis for Aim 2: If Hypothesis 2 is supported, exploratory analysis will be conducted on whether mind-mindedness is associated with specific aspects of children's EF: working memory, inhibition, and planning. Control variables (mothers' education and children's language ability) would also be included in the examination of this association.

Aim 3: Replicate the longitudinal association between early maternal mind-mindedness and children's theory of mind as found in past research.

Hypothesis 3: Replicating past research (Meins et al., 2002; 2013), early maternal mind-mindedness will predict children's age 5 theory of mind.

Aim 4: Explore whether children's language ability and/or executive function mediate the association between early maternal mind-mindedness and children's theory of mind.

While the association between early mind-mindedness and ToM is robust (Laranjo et al., 2014; Meins et al., 2002; 2013), less is known about the mechanism underlying this association and whether mind-mindedness plays a direct or indirect role in children's later ToM. Past studies provide a potential mechanism through which mind-mindedness relates to children's theory of mind through intermediate influence on children's language (Meins et al., 2013) and self-control (Bernier et al., 2017). I expanded on these past research studies by including executive function, a variable that has been previously associated with mind-mindedness (Cheng et al., 2019; Gagne et al., 2018; Regueiro et al., 2022), as a potential mediator in the association between early mind-mindedness and children's later ToM. Mothers' education and SES were included as control variables.

Hypothesis 4a: Following Meins et al. (2013), children's language ability measured at 5 years of age will mediate the association between early maternal mind-mindedness and children's ToM performance.

Hypothesis 4b: Children's executive function measured at 5 years of age will mediate the association between early maternal mind-mindedness and children's age 5 ToM performance.

Hypothesis 4c: Given the direct association between early mind-mindedness and later ToM (Meins et al., 2013), mind-mindedness will continue to exert a direct path on children's

ToM after controlling for both language ability and executive function such that early mind-mindedness remains a significant predictor of children's ToM performance.

CHAPTER II

METHOD

Participants

The dissertation employed a secondary data analysis of four waves of data from a longitudinal dataset collected between 2004 to 2010, the "From Pregnancy to Parenting Your First Baby Project" (FPP; PI: Jennifer Ablow). This longitudinal study examined primiparous women at risk of parenting maladjustment and their transition to parenthood from their third trimester of pregnancy until their children were five years old. Mothers were assessed once prenatally during the third trimester of pregnancy (T1; N = 104, M_{age} = 23.94 years, SD = 4.66) and three times postnatally with their child: at 5 months (T2; N = 93, M_{age} = 24.50 years, SD = 4.68), 17 months (T3; N = 86, M_{age} = 25.85 years, SD = 5.04), and 5 years (T4; N = 76, M_{age} = 29.74 years, SD = 5.48) after birth. At T4, children (N = 76, 45 girls, 31 boys, M_{age} = 5.07 years, SD = .19) were also administered behavioral tasks in the research lab. Pregnant women were recruited through childbirth education classes, hospitals and local public assistance organizations.

At T1, participants' self-reported demographic information indicated that the sample was 78% White, 6% Hispanic, 4% American Indian, 3% Black or African American, 1% Asian, and 8% mixed-race. This breakdown generally reflects the demographics of the population from which the sample was drawn. Seven percent of the participants reported completing some high school, 29% had a high school diploma or GED, 43% some college or two-year degree, 11% a four-year degree, and 9% an advanced degree. Twenty-one percent reported a total annual household income less than USD $9,999, 35% between $10,000-$20,000, 36% between $21,000-$40,000, and 8% above $40,000 (the 2004 median household income for the county in

which the data were collected was $37,905; Federal Reserve of St. Louis, 2022). With regard to marital status, 18% were unmarried and not living with a partner, 41% were unmarried and living with their partner, and 41% were married. As the original study intended to oversample for at risk mothers, 96% of the participants at T1 scored in the elevated risk range on the Screening Scale for Problems in Parenting (11 or higher out of possible 25; Avison, Turner & Noh, 1986), and 27% scored in the elevated risk range in the Center for Epidemiologic Studies - Depression Scale (12 or higher out of possible 36; CESD, Radloff, 1977).

Caregiver Measures

Mind-Mindedness Assessment

As data collection for the project had already been completed prior to this dissertation, sessions of maternal interview and mother-infant free play were identified from the dataset that most closely matched sessions used for the mind-mindedness assessment developed by Meins and Fernyhough (2015). Prenatal representation-based mind-mindedness was assessed through an interview held during the third trimester of pregnancy when expectant mothers were asked about their experience transitioning to motherhood. Specifically, the answers to the question "based on your experience so far with your pregnancy, what are your impressions of your baby?" and the follow-up question "Do you have a sense of whether your baby will be more like your baby's father or like you?" were coded for mentalistic references (i.e. mind-mindedness, following criteria from Meins & Fernyhough, 2015) concerning the unborn child. Interaction-based mind-mindedness was assessed through mother and infant free play at the research lab when the infants were 5 months (5 min free play with toys) and 17 months of age (10 min free play; 5 min with toys and 5 min without toys). For the maternal mind-mindedness measure,

prenatal interviews were completed by 104 mothers during pregnancy. Mother-infant free play was completed by 90 mothers at 5 months and 81 mothers at 17 months.

Mind-related comments during the interview and mother-infant free play sessions were coded for representational and interactional mind-mindedness respectively, following the procedures outlined in the Mind-Mindedness Coding Manual (Meins & Fernyhough, 2015). The frequency and proportion of mind-related comments (at the third trimester of pregnancy) and of appropriate mind-related comments (at 5 months and 17 months) were used as measures of mothers' mind-mindedness (more details in Indices of Mind-Mindedness section).

Representational Mind-Mindedness. Mothers' response to the transition to parenthood interview questions was transcribed verbatim and divided into single phrases or adjectives. Each phrase was then placed into the following four exclusive and exhaustive categories with mental comments being considered mind-minded. Given the representational nature of this measure, repetitions of attributes were only coded once because Meins and Fernyhough (2015) reasoned that repetitions in this case do not provide additional description or representation of the child.

1. Mental: mental comments are considered indicators of mind-mindedness and these encompass any comment that refers to the mental life, relating to will, mind, interests, pretense, imagination, intellect, knowledge, memory, metacognition of the person. For example: "intelligent", "opinionated", "loving towards people", "she's gonna be her own, her own person". In addition, references to shared mental characteristics were also coded as mental (e.g., "we're on the same wavelength").

2. Behavioral: comments on activities or interactions with others that could be interpreted on a purely behavioral level. Examples of behavioral comments include “lively”, “moves all the time”, and “aggressive”.
3. Physical: comments that include physical attributes, characteristics, age, position in the family, such as: “blond”, “dark eyes”, or “three feet tall”.
4. General: any comments relating to the child that do not fit into the above categories or any non-specific value judgements (e.g., “lovely child”; “nice”).

Interactional Mind-Mindedness. The mother and infant free play session was transcribed verbatim and the transcripts were divided into single phrases or comments based on temporal (1 second pause) or semantic discontinuities. The divided transcripts were then dichotomously coded as either containing or not containing a mind-related comments, defined as: (a) any comments that use explicit internal state terms to reference what the infant may be thinking, feeling, or experiencing, e.g., “You like putting things in your mouth”; “You want the car”; “you’re getting frustrated”; “you're just not very happy today, huh?” or (b) ‘puts words into the infants’ mouth’ such as the caregiver talking on the infant’s behalf. Comments in the latter category do not necessarily have to contain internal state (although they often did), but should clearly be a dialogue intended to be spoken by the infant (e.g., “That’s a car, mommy”).

After all mind-related comments were identified, each mind-related comment was then dichotomously coded as either appropriate or non-attuned based on the video recording of the free play session. Mental comments were coded as appropriate if the coder judged that the comments were consistent with the observed behavior (e.g., “You want the frog” while the infant reaches toward the frog toy); linked current activity with similar events in the past or future (e.g., “Do you want to go on the train tomorrow” while the infant plays with a toy train); or clarified

how to proceed if there was a lull in the interaction (e.g., “do you want to play with the car?” if the infant has been gazing around for a few seconds with no focus on any particular object). Mental comments were coded as non-attuned if the caregiver appears to misread the infant’s internal state (e.g., “You are bored with that one” referring to a toy with which the infant is still actively playing); if the comment referred to a past or future event with no clear relation to the current activity; or if the referent for this internal state was unclear (e.g., “You like that” when the infant is not actively playing with or attending to any particular object).

Indices of Mind-Mindedness. In work by Meins, the index of mind-mindedness is expressed either as a proportion of mental comments relative to the total number of comments made or as the frequency of mental comments while controlling for overall verbosity, with higher scores taken as an indicator of greater mind-mindedness. Some researchers have argued that using only the proportion of mental comments may inflate parents’ mind-mindedness ranking (Hughes et al., 2018; Laranjo et al., 2014; Pequet & Warnell, 2020). For example, a parent who gives one mental description and two non-mental descriptions and another parent who provides 20 mental descriptions and 40 non-mental descriptions would receive the same proportion score. The Mind-Mindedness Coding Manual acknowledges that frequency score can also be used so long as overall verbosity is controlled, though it can be argued that the absolute frequency of mind-minded comments may also be important to examine based on the aforementioned example. Some authors publish their results with both the proportion and frequency score, although not all controlled for overall verbosity (Bernier et al., 2017; Hill & McMahon, 2016; Hughes et al., 2018; Laflamme et al., 2022; Pequet & Warnell, 2020). For the dissertation, data were analyzed with the absolute frequency score (not controlling for overall verbosity) and proportion score (mental comments/total comments).

A trained research assistant who was blind to all other measures in the study coded the transcripts for mind-related comments following the Mind-Mindedness Coding Manual (Meins & Fernyhough, 2015). A randomly selected 20% subset of the participants at each time point was coded by the author to assess coder agreement. Interrater reliability for the number of mind-minded comments at Time 1 (prenatal) was Cohen's kappa = 0.96; at Time 2 (5 mos) kappa = 0.91; and at Time 3 (17 mos) kappa = 0.92.

Parent Report of Children's Effortful Control

Mothers completed the 94-item Children's Behavior Questionnaire - Short Form (CBQ; Putnam & Rothbart, 2006) when children were 5 years of age. The CBQ assesses children's temperament – individual differences in reactivity and self-regulation in response to changes in internal and external stimuli – and is developed for use in children between 3 to 8 years of age. Three dimensions of temperament are extracted from the CBQ: negative affectivity, extraversion/surgency, and effortful control. The dimension Effortful Control was used as a parent-report measure of children's executive function (EF). It consists of four subscales: Attentional Focusing, Inhibitory Control, Low-Intensity Pleasure, and Perceptual Sensitivity. Parents rated their children on a 7-point scale with 1 = "extremely untrue of your child" to 7 = "extremely true of your child". Sample items from the four effortful control dimension include: "When practicing an activity, has a hard time keeping her/his mind on it" for Attentional Focusing; "Has trouble sitting still when s/he is told to (at movies, church, etc.)", reverse coded for Inhibitory Control; "Enjoys "snuggling up" next to a parent" for Low-Intensity Pleasure, and "Is quickly aware of some new item in the living room" for Perceptual Sensitivity (see Appendix A for full Effortful Control questionnaire).

The overall effortful control score was calculated as the average scale score of the child's self-regulatory capacity from the four subscales: attention focusing, inhibitory control, low-intensity pleasure, and perceptual sensitivity (possible range 1 to 7, with higher scores indicating better effortful control). Cronbach's α for the four CBQ subscales of children's effortful control was .75 (corrected item-total correlations between .45 to .61) and the subscales were also all moderately intercorrelated (*r*s ranging from .34 to .58, all *p*s < .01)

Demographic Information and SES

Mothers completed a demographic questionnaire at each time point that asked about age, race and ethnicity, education attainment, marital status, family income, and occupation. For educational attainment, mothers were asked "what is the highest level of education you have completed?" with response options as follow: Some high school; High school diploma or GED; Some college or 2-year degree; 4-year college graduate; Some school beyond college; or Professional or graduate degree. For household income, mothers were asked "What is your total yearly household income?" with the response options: Less than $4,999; $4,999 - $9,999; $10,000 – $20,000; $21,000 - $40,000; $41,000 – $60,000; $61,000 – $90,000; or More than $90,000.

Child Measures

Children were administered a series of behavioral tasks at a university campus laboratory when the children were 5 years old (time 4 of the study). The tasks were administered in the following order: general cognitive ability including language, executive function, and theory of mind.

Language Ability

Children's general cognitive ability, including language, was measured using the NEPSY, a developmental neuropsychological assessment (Korkman et al., 1998). The NEPSY language subscale was used to examine children's language ability, with each of three tasks designed to assess a different component of language comprehension, production, and utilization (see Appendix B).

1. Body Part Naming. Assesses children's expressive language. Children were asked to name 11 parts of the body that the experimenter pointed to (i.e., ear, chin, ankle, etc…) on a figure. If a child was unable to name the body part on the figure, the experimenter followed up by pointing to the corresponding body part on the child prior to moving on to the next trial. The task was discontinued if children failed four consecutive trials. Children received a score of 2 for a correct response using the figure and a score of 1 for a correct response using their own body with a possible maximum score of 22.

2. Phonological Processing. Assesses children's language and phonemic awareness. The experimenter named three items on a booklet (e.g., "pencil, window, ice cream") followed by a phonetic segment of a word (e.g., "-indow"). Children were asked to identify the correct item that corresponded to the phonetic segment (e.g., the picture of the window in the example above). There were 14 trials and the task was discontinued if children failed five consecutive trials. Children received a score of 1 for every item identified correctly with a possible maximum score of 14.

3. Comprehension of Instructions. Assesses children's receptive language, and direction following. The child is asked to point to an appropriate target in response to increasingly complex oral instructions. Thirteen simple items involved pointing to rabbits of

different sizes, colors, and facial expressions (e.g., “show me a big bunny”; “... a bunny that is small and blue”; “... a bunny that is big, yellow and sad”). Fifteen complex items involved pointing to shapes by color, position, and relationship to other figures (e.g., “point to the white one and a circle”; “... all the crosses and then to a red circle”). The task was discontinued if children failed four consecutive trials. Children received a score of 1 for every item identified correctly with a possible maximum score of 28.

Children’s language subscale scores were moderately intercorrelated (Cronbach’s alpha = .43), with the exception of the correlation between Phonological Processing and Body Part Naming (r = .03, n.s.). Given the moderate correlation between Phonological Processing and Comprehension of Instruction (r = .26, p = .03) as well as between Comprehension of Instruction and Body Part Naming (r = .38, p = .001), a language composite score was calculated based on the standardized and averaged child performance on the three language measures.

Executive Function

A battery of six widely used executive function tasks were administered in the following order: NEPSY Statue, Tower of Hanoi, Working Memory, Grass/Snow receptive Stroop task, Day/Night expressive Stroop task, and Dimensional Change Card Sort (see Appendix C).

1. NEPSY Statue. Assesses children’s physical inhibition and impulse control. Children were asked to maintain a body position (left arm placed on the side of a table, right hand bent at the elbow with hand in a fist as if holding a flag, with their eyes closed) for 75-seconds while inhibiting response to sound distractors. Four sound distractors (experimenter drops their pencil, coughs, knocks on the table twice, and says “Ho Hum!”) were introduced during the 75-second period. Children were scored for the number of movement errors made during each 5-second interval with a total of 15 intervals. Errors included body movement, eye opening and/or

vocalization. Children received a score of 2 for each error-free interval, a score of 1 for each interval with only one error and a score of 0 for each interval with two or more errors, yielding a maximum score of 30.

2. Tower of Hanoi (Welsh et al., 1991). Assesses children's planning and problem solving. Using a wooden-based structure with three pegs and two to three discs (two discs for levels 1-3, three discs for levels 4-6; all children started at level one) stacked in decreasing sizes, children were asked to recreate the experimenter's structure by moving the discs from the left-most peg to the right-most peg following the rules that only one disc can be moved at a time, the discs have to remain on the peg, and the larger disc cannot be placed on top of a smaller disc. The task was introduced using an instructional story about a family of 'monkeys' (rings) of different sizes (Daddy, Boy, and Baby Sister) that jump among the 'trees' (pegs). There were a total of six levels and each level had a minimum number of moves (range: 1 to 4 moves) required to successfully move the discs while adhering to the rules. Children were given two trials at each level to successfully move the discs and the task was discontinued if children failed the second trial. The total number of levels completed was calculated with a possible maximum score of 6.

3. Working Memory. There were three levels in the working memory task and each level contained three trials. In level one and two, which more closely resembled short term memory assessment, children were asked to repeat the statement that the experimenter said with an increase in complexity from level 1 to level 2 (e.g., level one "Trees are big"; level two "The little child would not stop crying"). At level three, which was more aligned with working memory assessment (requiring holding the information in mind while manipulating the material), children were asked to respond to a question posed by the experimenter while also remembering the last word in each question. For example, the experimenter asks the child "Do cars go fast?",

"Do dogs bark?", followed by "In order, tell the last word in each question". The correct response is "fast" and "bark". The task was discontinued if children scored two or fewer points in a level. Children received a score of 2 for each correct response, a score of 1 for response with a single error and a score of 0 if more than two errors were made with a possible maximum score of 18.

4. Day/Night Expressive Stroop Task (Gerstadt, Hong, & Diamond, 1994). Assesses children's shifting and inhibition of prepotent responses. The experimenter and children engaged in conversation about when the sun (in the day) and moon (in the night) came out. Children were shown cards depicting the sun and the moon and were told that they would be playing a game where they have to say "night" for the sun and "day" for the moon. Sixteen trials of the test cards were presented. Children received a score of 1 for each trial answered correctly with a possible maximum score of 16.

5. Grass/Snow Receptive Stroop Task (Carlson & Moses, 2001). Assesses children's shifting and inhibition of prepotent responses. Children were asked to place their hands on top of two hand prints that were centered below a white card and a green card on the table. Similar to the Day/Night task, the experimenter asked children to name the color of the grass (green) and snow (white). Children were then told that they will now play a silly game where they should point to the white card when the experimenter says "grass" and point to the green card when the experimenter says "snow". Sixteen trials of the test cards were presented. Children received a score of 1 for each trial answered correctly with a possible maximum score of 16.

6. Dimensional Change Card Sort (DCCS; Zelazzo, 2006). Assesses children's shifting and inhibition of prepotent responses. Children were presented with two sorting trays that had a target card affixed to each tray (a blue rabbit and a red boat). In the pre-switch trial, the

experimenter presented a series of cards (red and blue rabbits and boats) and instructed children to sort by one dimension (e.g., if playing the color game, all the blue cards will go in the tray with the blue rabbit and all the red cards will go in the tray with the red boat). In the post-switch trials, children were told that they will now sort by the other dimension (the shape game: all the rabbit cards will go in the tray with the blue rabbit and all the boat cards will go in the tray with the red boat). There were six trials pre-switch and six trials post-switch. If children successfully sorted five or more cards in the post-switch trial, then they continued to the border trial. In the border trial (12 trials total), children were told that when they see the card with a black border, they were to play the color game and if there is no black border they were to play the shape game. Children received a score of 1 for each correct response with a possible maximum score of 24.

Children's EF task scores were moderately intercorrelated (*r*s ranging from .20 to .49, Cronbach's alpha = .64, corrected item-total correlations between .27 to .53), with the exception of the correlation between the Tower of Hanoi and Day Night Expressive Stroop Task ($r = .06$). Given that the Tower of Hanoi task was moderately intercorrelated with the remaining EF tasks (*r*s range from .19 to .25), the task was retained for combined analysis. Children's performance on the six EF tasks were standardized and averaged to form an EF composite score.

Theory of Mind

Children's ToM was measured with two widely used tasks administered as follows: Diverse Desires and Contents False Belief (all adapted from Wellman & Liu, 2004; see Appendix D). In the Diverse Desires task, children were told that a story protagonist has a choice of either a cookie or a carrot for a snack and the children were asked which of the two snacks they would like (e.g., the child selects the cookie). Children were told that the protagonist likes

the other snack, the one that the child did not choose (e.g., the carrot). Children were then asked to predict which snack the protagonist would choose (the correct answer being carrot for this example). In the Contents False Belief task, a band-aid box was revealed to have an unexpected content (a toy pig). Children were asked about what a naïve other would think is in the box (the correct answer being band-aids). As a memory check, they were also asked what was really inside the box. A score of 1 was given for Diverse Desires if the child answered the test question correctly and a score of 1 was given for Contents False Belief if the child answered both the test and memory control questions correctly (maximum possible score of 2). Contents False Belief trial on which children failed the memory control question was excluded.

For Diverse Desires, 67 children passed the task and 9 children failed the task. For Contents False Belief, 30 children passed the task, 31 children failed the task and 15 children failed the memory control question. Diverse Desires and Contents False Belief performances were not significantly correlated ($r = -.21$, $p = .11$). This non-significant association may be attributed to the ceiling effect exhibited by the Diverse Desires task from the 5-year-olds (88% passing) in the current study, as Diverse Desires is generally considered the earliest form of ToM reasoning (Wellman & Liu, 2004). The ToM score was then the mean number of correct tasks after exclusions with possible range between zero to 1.

CHAPTER III

RESULTS

Analytic Strategy

Research questions, hypotheses, data description, and analytic strategies for the dissertation were pre-registered on the Open Science Framework (osf.io/wamj2). The analysis R code was not pre-registered but is available at the same pre-registration site.

Aim 1. Temporal Stability and Continuity of Mind-Mindedness

To examine the temporal stability of maternal mind-mindedness from the third trimester of pregnancy to 17 months post birth, an autoregressive model was analyzed using structural equation modeling. In this autoregressive model, a later mind-mindedness score is regressed onto an earlier mind-mindedness score to examine whether prior levels of mind-mindedness are associated with the later measure of mind-mindedness. For the prenatal period, following the analysis from Arnott and Meins (2008) the *overall* number of comments made about the unborn child was also analyzed in addition to the number of mental comments. To examine the temporal continuity or discontinuity (group mean level) of maternal mind-mindedness across the transition to parenthood, multilevel models were constructed with Time (3 levels) as a fixed effect and subject (mothers) as a random effect to compare maternal mind-mindedness score at each Time (T1, T2, T3).

Aim 2. Prediction of Children's Executive Function

Structural equation path analysis was conducted to examine whether maternal mind-mindedness prenatally, at 5 months, and at 17 months post birth predicts children's EF at 5 years of age. The outcome variable was a reflective[1] latent EF variable that consisted of children's

[1] A reflective latent EF construct was formed (arrows pointing away from the latent variable towards indicators) to suggest that each EF indicator (e.g., each EF task) is influenced by (i.e., an effect of) the latent EF construct, such

standardized average behavioral EF score and parent report of children's effortful control. An additional model with control variables, mothers' education and children's language, was assessed to examine possible confounds.

Aim 3. Prediction of Children's Theory of Mind

Following past research (Meins et al., 2002; 2013) and prior to mediation analysis (Aim 4), path analysis was conducted to examine whether maternal mind-mindedness prenatally, at 5 months and at 17 months post birth predicts children's ToM at 5 years of age.

Aim 4. Mediation Analysis

To examine whether children's language ability and/or executive function mediate the association between early maternal mind-mindedness and children's later ToM, structural equation path analysis models were constructed to test the proposed hypotheses. Models were also compared with each other to determine the model with the best statistical fit.

Inference criteria

A cut-off value of $p < .05$ was set for significance and two-tailed tests were used for analysis. For SEM analysis, common criteria for evaluation of model fit found in the mind-mindedness (Meins et al., 2013) and model comparison (Kline, 2016) literature were followed to assess model fit. These criteria included a non-significant chi-square test of model fit, cumulative fit index (CFI) and Tucker-Lewis index (TLI) $\geq .90$, root mean square error of approximation (RMSEA) $\leq .08$, and standardized root mean square residual (SRMR) ≤ 0.08. Path analysis models were also compared with each other to determine the model with the best statistical fit.

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that changes in the latent EF construct are reflected by changes in the EF indicators (Freeze & Raschke, 2007). This is in contrast to a formative construct (arrows pointing towards the latent variable from the indicators) where the indicators are thought to cause the latent construct. Further, a reflective latent EF approach is generally employed in the developmental literature that examines children's self-control (Romeo et al., 2022; Senehi et al., 2018).

Missing Data

Mothers who remained at each postnatal wave of data collection did not differ from mothers who only provided data prenatally (Time 1) in terms of their Time 1 education (Welch's t-test, 5 months, $t(17.98) = -.60$, $p = .56$; 17 months, $t(33.50) = -.14$, $p = .89$; 5 years, $t(53.63) = -1.88$, $p = .07$); Time 1 age (Welch's t-test, 5 months, $t(18.62) = .20$, $p = .85$; 17 months, $t(26.16) = 13$, $p = .90$; 5 years, $t(18.10) = -1.41$, $p = .89$); and Time 1 frequency of mind-minded comments (Welch's t-test, 5 months, $t(18.71) = 1.05$, $p = .31$; 17 months, $t(34.31) = .48$, $p = .64$; 5 years, $t(50.80) = .13$, $p = .90$). Thus, a maximum likelihood (ML) approach was employed in subsequent SEM analysis to account for missing data.

Preliminary Analyses and Descriptive Statistics

Table 1 provides descriptive statistics for all mother and child variables. Skewness and kurtosis values as well as boxplots were obtained to examine the distribution of study variables. All variables were approximately normally distributed (see Figure 1 for boxplot) with the exception of one extreme outlier that was beyond a lower outer fence (3 times the interquartile range) of the boxplot – identified in children's working memory task with the child scoring on the lower-end of the distribution. Following the pre-registration, the extreme outlier value was winsorized by modifying its value to the closest observed value that fell within the lower fence of the boxplot. Analysis with and without the extreme outlier did not change the overall interpretation and pattern of results; thus the winsorized data were used for all subsequent analyses.

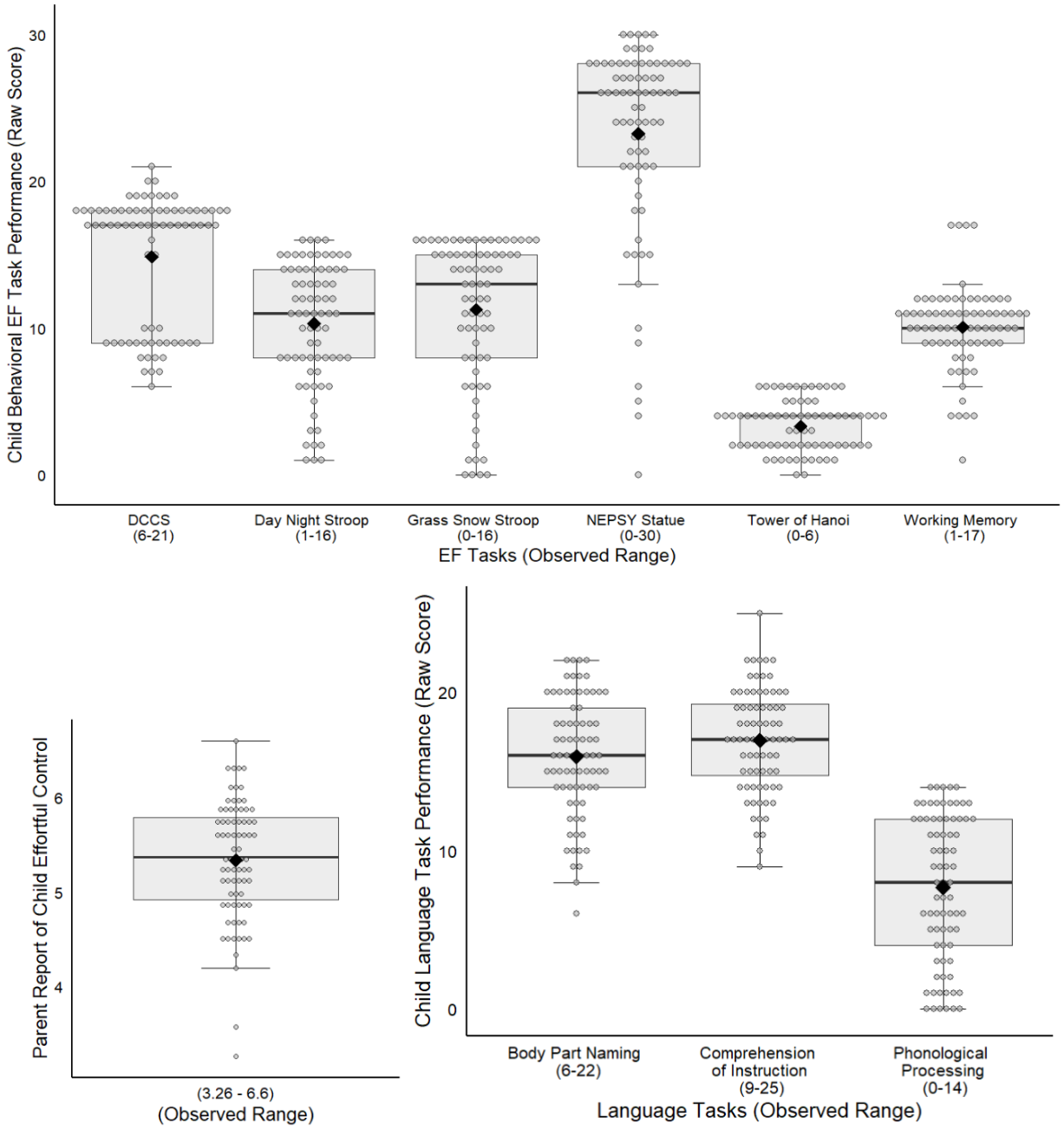
Table 1

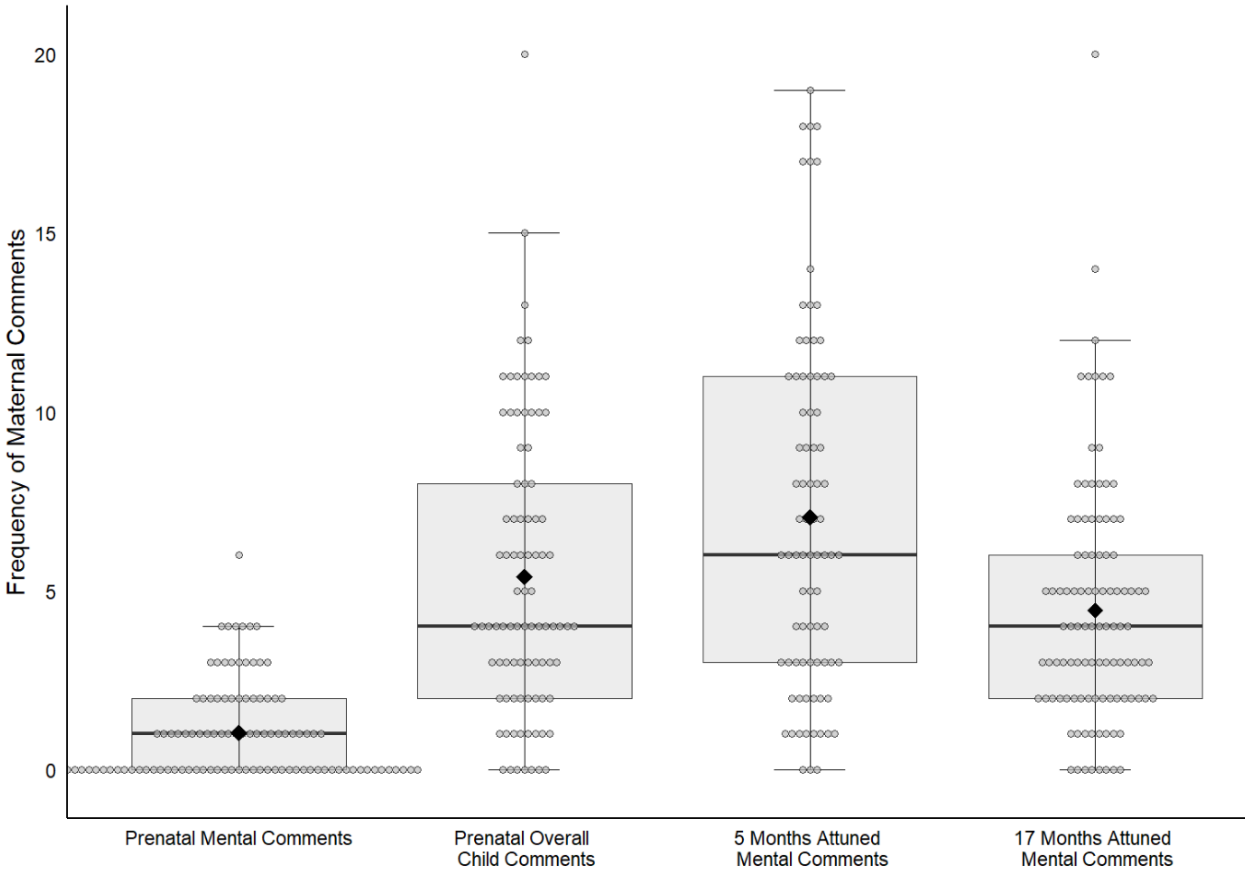
Descriptive Statistics for Study Variables

Variable	Mean	*SD*	Observed Range	*n*
Maternal variables				
Prenatal - mental comments (freq)	1.03	1.32	0 - 6	104
Prenatal - mental comments (prop)	0.08	0.1	0 - 0.33	104
Prenatal - total describe child comments	4.46	3.39	0 - 20	104
Prenatal - total comments	13.12	7.58	2 - 36	104
5 mos - mind-related comments (freq)	6.56	4.41	0 - 22	90
5 mos - attuned mind-related comments (freq)	5.39	4.02	0 - 20	89
5 mos - attuned mind-related comments (prop)	0.06	0.04	0 - 0.22	90
5 mos - non-attuned mind-related comments (freq)	1.21	1.38	0 - 5	89
5 mos - total comments	85.32	30.21	19 - 157	90
17 mos - mind-related comments (freq)	8.53	5.89	0 - 25	81
17 mos - attuned mind-related comments (freq)	7.06	5.02	0 - 19	81
17 mos - attuned mind-related comments (prop)	0.05	0.04	0 - 0.13	81
17 mos - non-attuned mind-related comments (freq)	1.47	1.86	0 - 10	81
17 mos - total comments	128.67	31.94	45 - 195	81
Child variables (age 5 years)	Mean	*SD*	Observed Range	*n*
Parent report of child effortful control (CBQ)	3.26	6.6	3.26 - 6.6	76
Executive function - standardized composite	-0.01	0.64	-1.85 - 1.05	76
EF - NEPSY statue	23.24	6.67	0 - 30	76
EF - tower of hanoi	3.32	1.73	0 - 6	75
EF - working memory	10.05	2.83	1 - 17	76
EF - day/night expressive stroop task	10.31	4.27	1 - 16	75
EF - grass/snow receptive stroop task	11.26	5.06	0 - 16	74
EF - dimensional change card sort	14.87	4.43	6 - 21	76
Theory of mind	0.64	0.27	0 - 1	76
Language - standardized composite	0	0.69	-1.51 - 1.63	76
Language - body part naming	15.93	3.74	6 - 22	76
Language - phonological processing	7.67	4.63	0 - 14	76
Language - comprehension of instructions	16.97	3.28	9 - 25	76

Figure 1

Boxplot Distribution for Key Study Variables





Note. The black horizontal line represents the median of the group, black diamond represents the mean of the group and dots represent individual responses. The shaded region denotes the interquartile range (IQR) and the upper and lower whiskers represent the smallest and largest individual responses that fall within the IQR.

Similar to Arnott and Meins (2008; the only published study to date on prenatal mind-mindedness), half of the expecting mothers (50%, n = 51) in the current study did not provide any mentalistic comment when describing their child prenatally. Further, expectant mothers on average produced 4.46 (SD = 3.39) overall comments to describe their child prenatally. The frequency and proportion of attuned mental comments (Table 1) from this socioeconomically diverse sample at 5- and 17-months were similar in mean levels to past findings from both highly-educated mothers (Arnott & Meins, 2008; Colonnesi et al., 2019; McMahon et al., 2016;

Nikolic et al., 2022) and socioeconomically diverse mothers (Brophy-Herb et al., 2022; Meins et al., 2019).

Lastly, with regard to maternal demographic characteristics, mind-mindedness was not related to maternal age, total household income or child gender at any time point; however, maternal education was significantly positively associated with the frequency of attuned mental comments at 17 months (r = .23, p = .041). Further, maternal education was positively associated with parent reports of children's effortful control, children's behavioral EF, and children's language at 5 years (all rs> .23). Main analyses were therefore conducted with and without controlling for maternal education.

Maternal Risk Condition

As the study oversampled for at-risk mothers – 96% and 27% of mothers at Time 1 scored in the elevated risk range for problems in parenting and depression respectively – correlations and independent sample t-tests were conducted to examine the potential effect of maternal risk conditions. Problems in parenting scores were significantly positively correlated with maternal depression (r = .41, p < .01) and negatively correlated with maternal education (r = -.35, p < .01). However, no significant association was found between problems in parenting and maternal mind-mindedness measured at any point in the study (rs between -.12 and .06, n.s.).

Maternal depression was negatively correlated with maternal education (r = -.21, p = .03) and attuned mental comments at 5 months (r = -.23, p = .03). Mothers who scored in the elevated risk range for depression (n = 24) produced fewer attuned mental comments, at 5-months post birth (M = 3.79, SD = 2.99) compared to not-at-risk mothers (M = 5.98, SD = 4.20), Welch's t-test, t(57.72) = 2.73, p = .008. No additional association emerged between maternal depression and mind-mindedness. Maternal depression was not associated with the total number of

comments made by mothers at any time point. Children's behavioral outcomes were not associated with problems in parenting or maternal depression. The analyses that include attuned mental comments at 5 months were thus conducted with and without controlling for maternal depression.

Bivariate Correlations

Zero-order correlations were examined next for all study variables after the outlier was winsorized (Table 2 and Table 3). Contrary to Arnott and Meins (2008), who found a correlation of .52 (n = 28) between prenatal 'describe your child' *overall* comments and attuned mental comments at 6 months; expecting mothers' mental and overall comments describing their unborn child did not correlate with postnatal mind-mindedness at 5- and 17- months in our study. Postnatally, the frequencies of attuned mental comments were significantly correlated at 5- and 17- months (r = .28, p = .016), while proportion of attuned mental comments were not (r = .09, p = .46). These initial associations suggest that mind-mindedness may not be highly stable across the transition to motherhood in our sample.

Table 2

Inter-Correlations Among Mind-Mindedness Variable

	Variable	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Prenatal - mental comments (freq)	.82**	.37**	0.16	0.1	-0.03	.21*	0.15	0.2	0.17	0.13	0.17	0.17	-0.11	0.02
2	Prenatal - mental comments (prop)	-	0.02	0.17	0.13	0.02	0.16	0.17	0.06	0.04	0.04	0.06	0.05	-0.04	-0.06
3	Prenatal - overall child comments		-	0.05	0.04	-0.01	0.04	0.1	0.17	0.16	0.14	0.11	0.11	-0.03	0.01
4	5 mos - mind-related comments (freq)			-	.95**	.75**	.42**	.44**	.35**	.31**	.26*	.29*	.24*	0.17	0
5	5 mos - attuned mind-related comments (freq)				-	.83**	0.12	.42**	.33**	.28*	.24*	.27*	0.21	0.18	0.01
6	5 mos - attuned mind-related comments (prop)					-	0	-0.06	0.11	0.09	0.09	0.12	0.06	0.11	0.06
7	5 mos - non-attuned mind-related comments (freq)						-	0.17	0.19	0.17	0.16	0.13	0.14	0.02	-0.07
8	5 mos - total comments							-	.32**	.30*	0.2	0.21	.36**	.25*	-0.02
9	17 mos - mind-related comments (freq)								-	.95**	.84**	.59**	.45**	0.21	0
10	17 mos - attuned mind-related comments (freq)									-	.91**	.32**	.40**	.23*	0.02
11	17 mos - attuned mind-related comments (prop)										-	0.19	0.04	0.19	0.04
12	17 mos - non-attuned mind-related comments (freq)											-	.36**	0.05	-0.05
13	17 mos - total comments												-	0.13	-0.03
14	Prenatal - maternal highest education													-	.33**
15	Prenatal - total household income														-

Note. ** p <.01; *, p <.05, two-tailed

Table 3

Inter-Correlations Among Maternal and Child Variable

	Variable	2	3	4	5	6	7	8	9	10	11	12	13
1	Prenatal - mental comments (freq)	.82**	.50**	0.1	-0.03	0.17	0.13	-0.11	-0.17	0	-0.06	0.03	0.08
2	Prenatal - mental comments (prop)	-	.26**	0.13	0.02	0.04	0.04	-0.04	-0.1	0.03	-0.13	0.04	0
3	Prenatal - overall child comments		-	0.04	-0.01	0.16	0.14	-0.03	-0.1	-0.03	0.03	-0.1	0.14
4	5 mos - attuned mind-related comments (freq)			-	.83**	.28*	.24*	0.18	0.09	0	.25*	-0.08	0.19
5	5 mos - attuned mind-related comments (prop)				-	0.09	0.09	0.11	0.02	-0.05	0.18	-0.13	0.11
6	17 mos - attuned mind-related comments (freq)					-	.91**	.23*	0.2	-0.12	.40**	0.06	.27*
7	17 mos - attuned mind-related comments (prop)						-	0.19	0.1	-0.12	.41**	0.04	.28*
8	Prenatal - maternal highest education							-	.34**	0.13	.24*	0.04	.23*
9	Parent report of child effortful control (CBQ)								-	-0.11	.50**	0.2	.36**
10	Child gender (male = 1, female = 2)									-	-0.15	0.18	-0.12
11	Child executive function										-	.40**	.66**
12	Child theory of mind											-	.36**
13	Child language												-

Note. ** p <.01; *, p <.05, two-tailed

For children's developmental outcomes at age 5, prenatal mind-mindedness and mothers' overall comments describing their unborn child did not correlate with children's behavioral measures. Moreover, postnatally, contrary to previous studies (Devine & Hughes, 2016), maternal mind-mindedness was not correlated with children's theory of mind performance. At 5 months, only frequency of attuned mental comments was correlated with children's EF (r = .25), while at 17 months, both frequency and proportion of attuned mental comments were correlated with children's EF (rs > .40) and language (rs > .27).

These preliminary associations, along with 50% of mothers who did not make any mental comments about their unborn child, raise the possibility that many of the expecting mothers in our sample may not be representing their unborn child as an individual agent with references towards their internal states or alternatively our measure of prenatal mind-mindedness may not have probed expecting mothers sufficiently to elicit these mental representations. Lastly, while no association was found between postnatal mind-mindedness and ToM, there appears to be strong association between postnatal mind-mindedness and children's language and EF, pointing to a potential area for further investigation in the dissertation (Table 3).

Main Analyses

Aim 1. Temporal Stability and Continuity of Mind-Mindedness

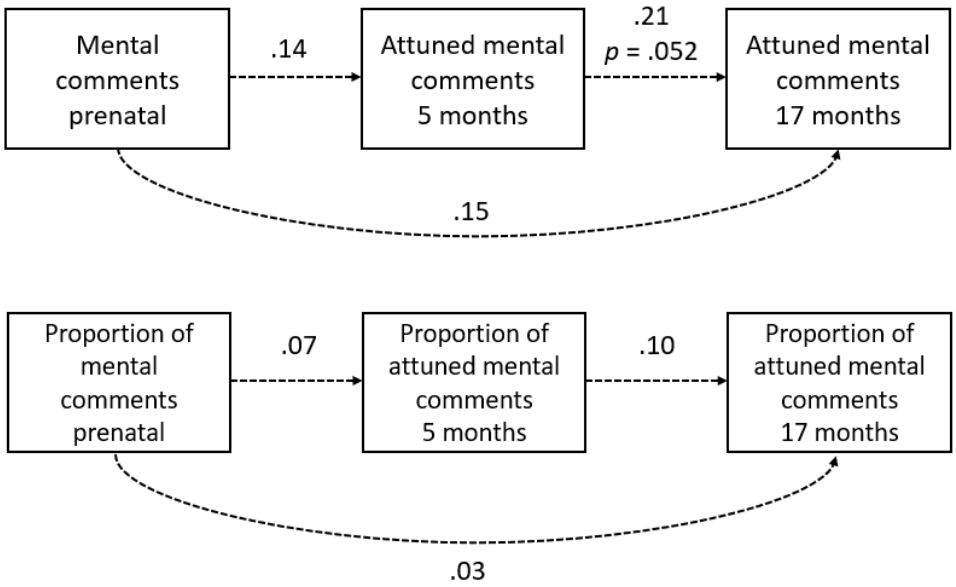
Temporal Stability. To examine individual-order stability of maternal mind-mindedness (e.g., whether mothers who were more mind-minded at an earlier time point will remain high in mind-mindedness at a later time point), an autoregressive structural equation model was constructed where later mind-mindedness scores were regressed onto earlier measures of mind-mindedness. Autoregressive analyses were conducted with expectant 1) mothers' mentalistic comments about their child and 2) mothers' overall number of comments made prenatally about

the unborn child, following Arnott and Meins (2008). In Arnott and Meins (2008), caregivers' *overall* number of comments (not number of *mentalistic* comments) made prenatally about the unborn child correlated with caregivers' appropriate mind-related comments when the child was 6 months old.

Prenatal Mentalistic Comments. Individual differences in maternal mind-mindedness did not appear to be stable across the three time points for frequency of mind-minded comments as demonstrated by the non-significant paths in Figure 2, although the path between 5 months and 17 months mind-mindedness was close to significance ($\beta = .21$, $p = .052$), suggesting potential for some degree of individual stability. Similarly, for the proportion of mind-minded comments, there were also no significant paths in the autoregressive model, suggesting a lack of temporal stability in the proportion of mind-minded comments across the transition to motherhood (Figure 2). As the models were just identified – same number of observations as estimated parameters which results in 0 degree of freedom (Kline, 2016) – no model fit statistic was calculated.

Figure 2

Standardized Estimates for an Autoregressive Model Examining the Temporal Stability of Maternal Mind-Mindedness (Frequency and Proportion of Mental Comments) Over Time



Note. Dashed lines represent non-significant associations.

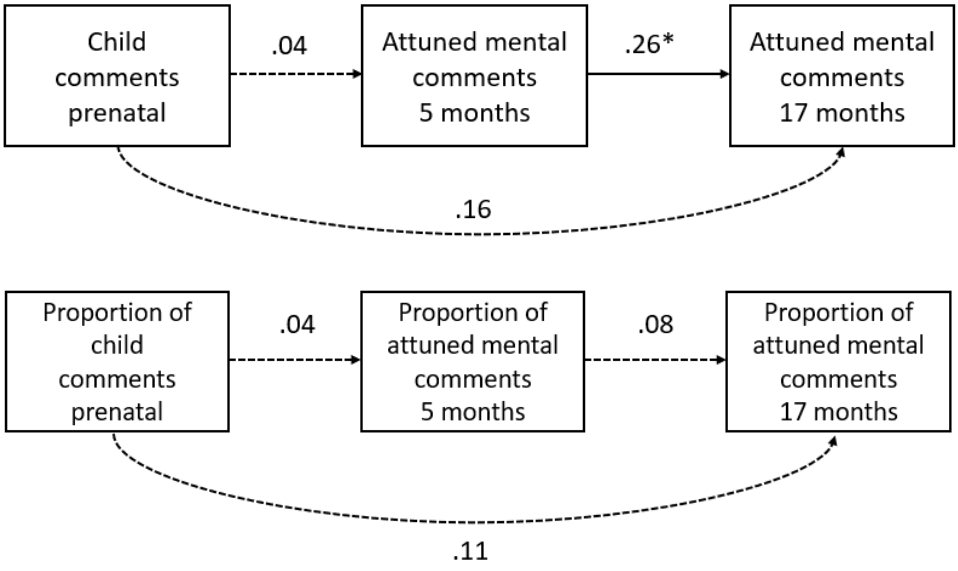
Two additional autoregressive models for frequency and proportion of mind-related comments were constructed to account for the effect of maternal depression at 5-months. Model fit was adequate for frequency, $\chi^2(1) = .70$, $p = .40$, CFI = 1, TLI = 1.16, RMSEA = 0, SRMR = .02, and proportion, $\chi^2(1) = .46$, $p = .50$, CFI = 1, TLI = 6.73, RMSEA = 0, SRMR = .02, of mind-minded comments. However, the addition of maternal depression as a covariate did not significantly improve model fit for frequency, $\Delta\chi^2 = .70$, $\Delta df = 1$, $p = .40$, or proportion, $\Delta\chi^2 = .45$, $\Delta df = 1$, $p = .50$, of mind-minded comments and all paths across time for mind-mindedness remained non-significant.

Prenatal Overall Number of Comments Made About Child. A second autoregressive analysis was conducted that utilized the *overall* number of comments (vs number of *mentalistic* comments in the previous analysis) made prenatally about the unborn child to examine

individual-order stability of maternal mind-mindedness (following the analysis conducted by Arnott & Meins, 2008). The overall number of comments made prenatally about the unborn child was not a stable predictor of mind-minded comments across time (Figure 3). For frequency (but not proportion) of attuned mind-minded comments, there was a significant positive association between 5-months and 17-months ($\beta = .26$, $p = .011$), in contrast to the analysis with the prenatal mental comments. As both autoregressive models were just identified – i.e., they included the same number of observations as estimated parameters, which results in 0 degree of freedom (Kline, 2016) – no model fit statistic was calculated.

Figure 3

Standardized Estimates for an Autoregressive Model Examining the Temporal Stability of Maternal Child Comments and Maternal Mind-Mindedness (Frequency and Proportion) Over Time



Note. Solid lines represent significant associations and dashed lines represent non-significant associations. ** $p < .01$.

An additional analysis that included maternal depression at 5-months as covariate yielded identical results as the analysis without the covariate, supported by a non-significant model fit improvement for frequency, $\Delta\chi^2 = 1.12$, $\Delta df = 1$, $p = .29$, and proportion, $\Delta\chi^2 = .34$, $\Delta df = 1$, $p = .56$, of child and mind-minded comments. For frequency of child and mind-minded comments ($\chi^2(1) = 1.12$, $p = .29$, CFI = .99, TLI = .94, RMSEA = .03, SRMR = .03), maternal depression at 5-months had a significant negative association ($\beta = -.25$, $p = .024$) with 5-months mind-mindedness, while the significant positive association between 5- and 17-months mind-minded comments remained ($\beta = .26$, $p = .011$). For the proportion of child and mind-minded comments ($\chi^2(1) = .34$, $p = .56$, CFI = 1, TLI = 6.51, RMSEA = 0, SRMR = .02), there was no significant effect of maternal depression at 5-months and no evidence of temporal stability.

Temporal Continuity. To examine group mean-level continuity (e.g., whether mothers as a group increased or decreased their overall amount of mind-minded comments towards their infant across the three time points), multilevel models were constructed with Time (3 levels) as a fixed effect and subject (mothers) as a random effect. Multilevel modeling allowed each subject to have a random intercept or differing "baseline" for initial mind-minded comments and a fixed slope for the effect of time on mind-minded comments. Frequency (controlling for overall verbosity) and proportion of attuned mental comments served as the dependent variables and Time 1 (prenatal) served as the index for the predictor Time such that Time 2 and Time 3 were compared in reference to Time 1. Overall verbosity was controlled in the current analysis for frequency of mind-minded comments due to the different length in time for the mind-mindedness assessment at Time 1 (maternal interview with response dependent on the time it took for mothers to answer the interview question), Time 2 (5 min freeplay), and Time 3 (10 min

free play). Only the subset of participants with complete data for all time points (n = 74) were included in the multilevel analysis.

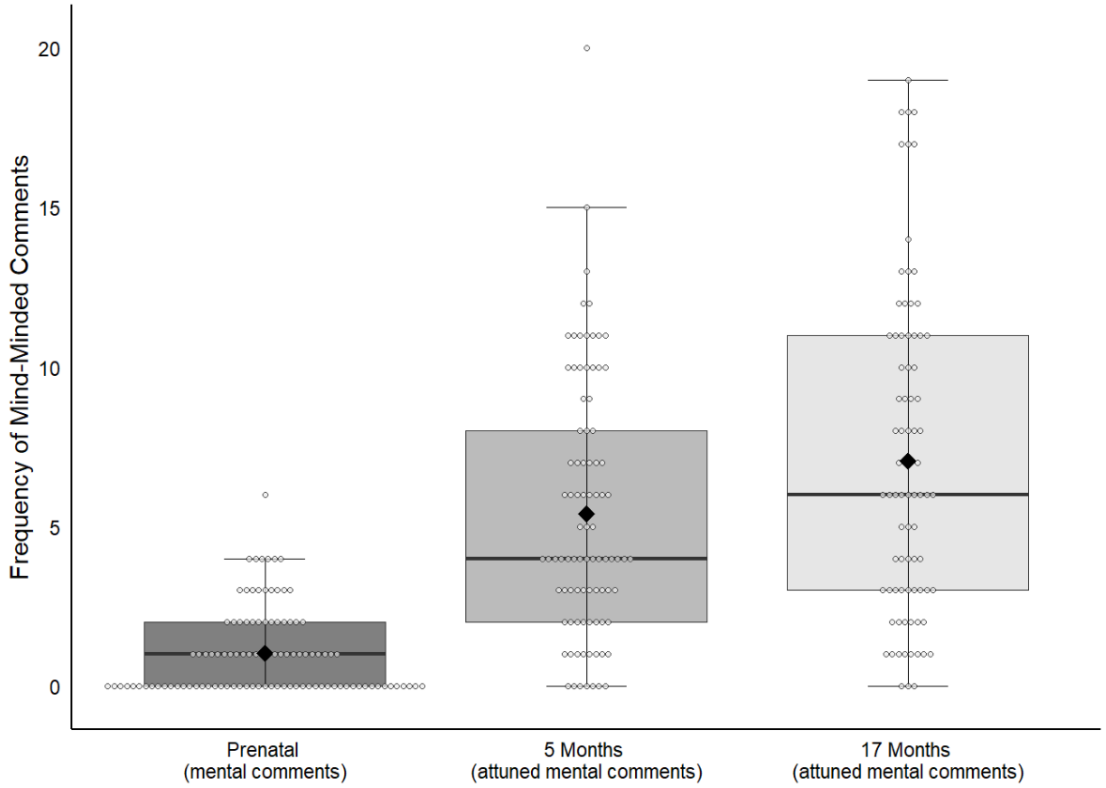
As shown in Table 4 and Figure 4, using frequency of mental comments controlling for overall verbosity, maternal mind-minded comments did not differ significantly across the three time points (i.e., there was no main effect of time). There was a significant main effect of maternal total comments on frequency of mental comments, b = 0.06, p < .001, 95% CI [0.04, 0.07]. For the proportion of mental comments (Table 5 and Figure 5), mothers' proportion of mental comments was significantly lower at Time 3 (17 months) compared to Time 1 (prenatal), b = -0.023, p = .022, 95% CI [-0.04, -0.00]. Post-hoc analysis found no significant difference in frequency (controlling for overall verbosity; $T2\text{-}T3_{difference}$ = .693, SE = .60, p = .477) and proportion of mind-minded comments ($T2\text{-}T3_{difference}$ = .009, SE = .01, p = .670) between Time 2 (5 months) and Time 3 (17 months). Overall, mothers as a group did not appear to differ across the three timepoints in their frequency (controlling for overall verbosity) of mind-minded comments (Figure 5), while the proportion of mind-minded comments was lower when infants were older (17 months, M = .05, SD = .04) compared to prenatally (M = .08, SD = .10; Figure 5).

At first glance, the temporal discontinuity in the proportion of mind-minded comments between prenatal and 17 months appears to suggest that mothers overall were more mind-minded towards their children prenatally than postnatally. Alternatively, a closer inspection of the prenatal mind-mindedness data revealed several mothers whose proportion scores were inadvertently inflated due to a small number of total comments made relative to mental comments, echoing points raised by researchers that are discussed above in the Method section. For example, a mother with a prenatal proportion score of .33 made only one mental comment and three total comments, whereas another mother who made one mental comment and nine total

comments received a proportion score of .11. As the prenatal interview did not contain a time restriction compared to the free play session (i.e., 5 min at 4-months and 10 min at 17- months), mothers could respond in as few or as many statements as they wished. The interpretation of results from the frequency score in prenatal mind-mindedness may be preferred over the proportion score or at the very least, results from the proportion score should be interpreted with the potential for inflated score in mind.

Figure 4

Boxplot Distribution for Frequency of Mind-Minded Comments Across Time (n = 76)



Note. The black horizontal line represents the median of the group, black diamond represents the mean of the group and dots represent individual responses. The shaded region denotes the interquartile range (IQR) and the upper and lower whiskers represent the smallest and largest individual responses that fall within the IQR.

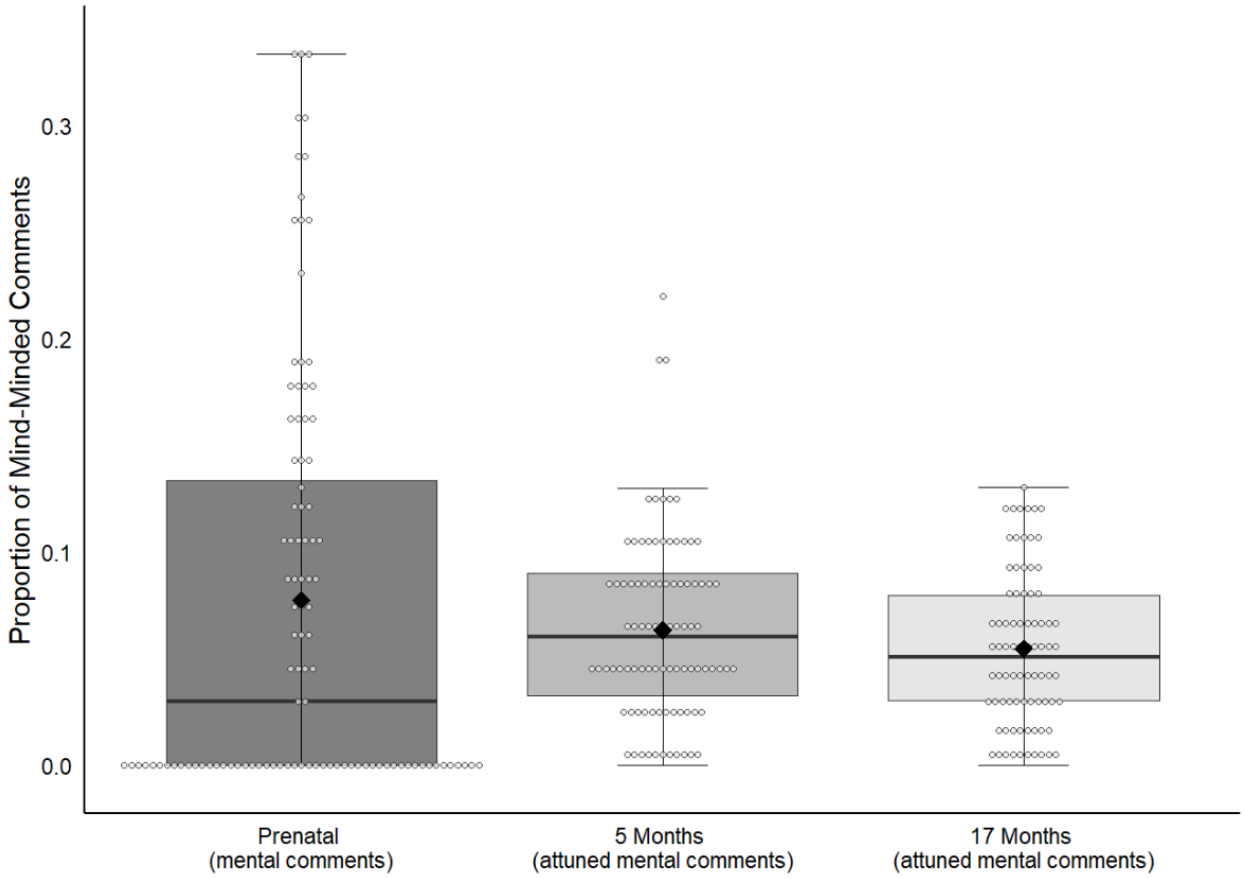
Table 4

Multilevel Model for Group Level Continuity in the Frequency of Mind-Minded Comments Across Time

	Frequency of Mental Comments		
Predictors	*Estimates*	*CI*	*p*
(Intercept) Time 1 - prenatal	0.29	-0.38 – 0.97	.394
Time 2 - 4 months	0.16	-1.34 – 1.66	.859
Time 3 - 17 months	-0.67	-2.78 – 1.43	.590
Total Comments	0.06	0.04 – 0.07	<.001**
Random Effects			
σ2 (within sub variance)	10.23		
τ00 subject (between sub var)	0.98		
ICC (between-sub variation)	0.09		
Marginal R2 (fixed effects)	0.438		
Conditional R2 (fixed + random)	0.487		

Figure 5

Boxplot Distribution for Proportion of Mind-Minded Comments Across Time (n = 76)



Note. The black horizontal line represents the median of the group, black diamond represents the mean of the group and dots represent individual responses. The shaded region denotes the interquartile range (IQR) and the upper and lower whiskers represent the smallest and largest individual responses that fall within the IQR.

Table 5

Multilevel Model for Group Level Continuity in the Proportion of Mind-Minded Comments Across Time

	Proportion of Mental Comments		
Predictors	*Estimates*	*CI*	*p*
(Intercept) Time 1 - prenatal	0.077	0.06 – 0.09	<.001**
Time 2 - 4 months	-0.016	-0.03 – 0.00	.085
Time 3 - 17 months	-0.023	-0.04 – -0.00	.022*
Random Effects			
σ2 (within sub variance)	0.0002		
τ00 subject (between sub var)	0.0042		
ICC (between-sub variation)	0.04		
Marginal R2 (fixed effects)	0.019		
Conditional R2 (fixed + random)	0.045		

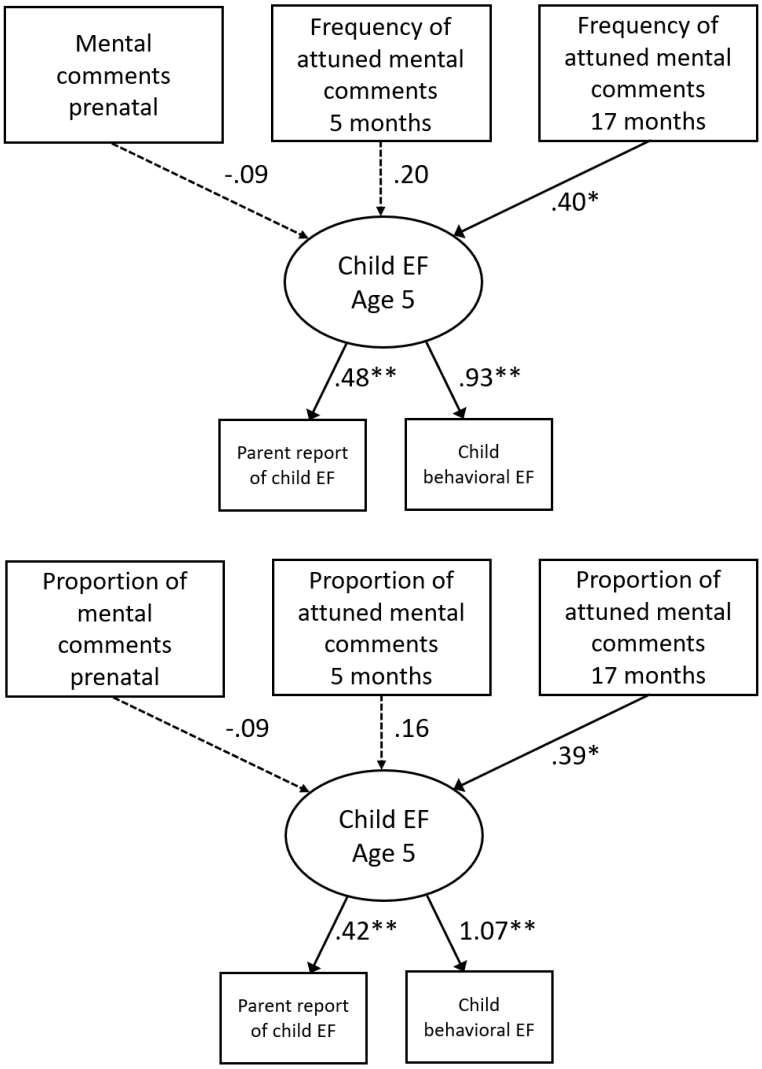
Aim 2. Prediction of Children's Executive Function

Structural equation path analysis was conducted with children's EF as a latent variable composed of children's standardized average behavioral EF score and parent report of children's effortful control. Maternal mind-mindedness prenatally, at 5-, and at 17- months were used to predict children's latent EF at age 5. The model fit was satisfactory for both frequency ($\chi^2(2) = .93$, $p = .63$, CFI = 1, TLI = 1.16, RMSEA = 0, SRMR = .02) and proportion of mind-minded comments ($\chi^2(2) = .56$, $p = .76$, CFI = 1, TLI = 1.21, RMSEA = 0, SRMR = .02). As shown in Figure 6, both frequency and proportion of attuned mind-related comments at 17-months significantly predicted children's latent EF at 5 years of age and the two models demonstrated

similar standardized regression path values (βs > .39). The regression path values were not significant for mind-related comments made prenatally and at 5-months.

Figure 6

Path Analyses Predicting Children's Age 5 EF from Maternal Mind-Mindedness (Frequency and Proportion) Across Time

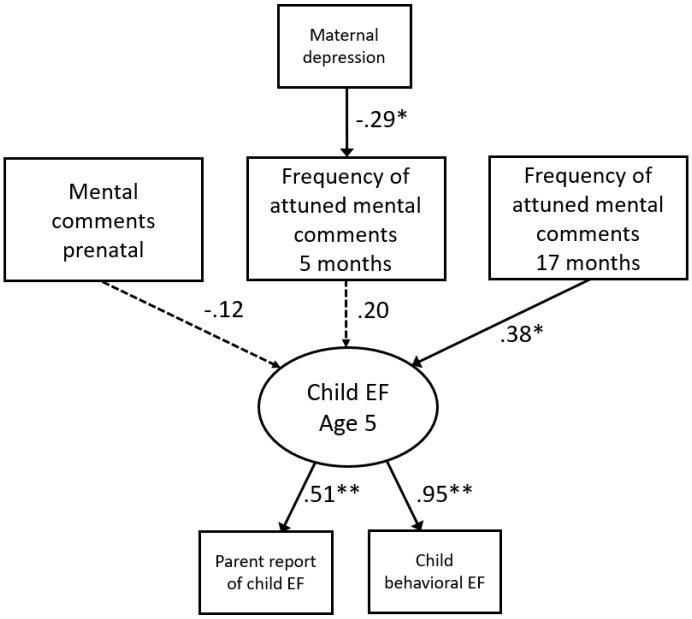


Note. Standardized regression coefficients are shown on the individual pathways. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

For frequency of mind-minded comments, an additional model that controlled for maternal depression at 5 months produced an adequate fit, $\chi^2(6) = 10.87$, $p = .09$, CFI = .86, TLI = .72, RMSEA = .10, SRMR = .07; see Figure 7. The addition of maternal depression as covariate significantly improved model fit, $\Delta\chi^2 = 9.94$, $\Delta df = 4$, $p = .04$, compared to the model without the covariate and indicated that maternal depression had a negative effect on maternal mind-mindedness at 5 months (β = -.29, $p = .02$). Frequency of attuned mind-related comments at 17-months continued to be the only significant predictor of children's EF, with a similar standardized loading as the model without maternal depression at 5-months as covariate (β = .38, $p = .017$).

Figure 7

Path Analysis Predicting Children's Age 5 EF from Frequency of Mind-Minded Comments Across Time Controlling for Depression at 5 months

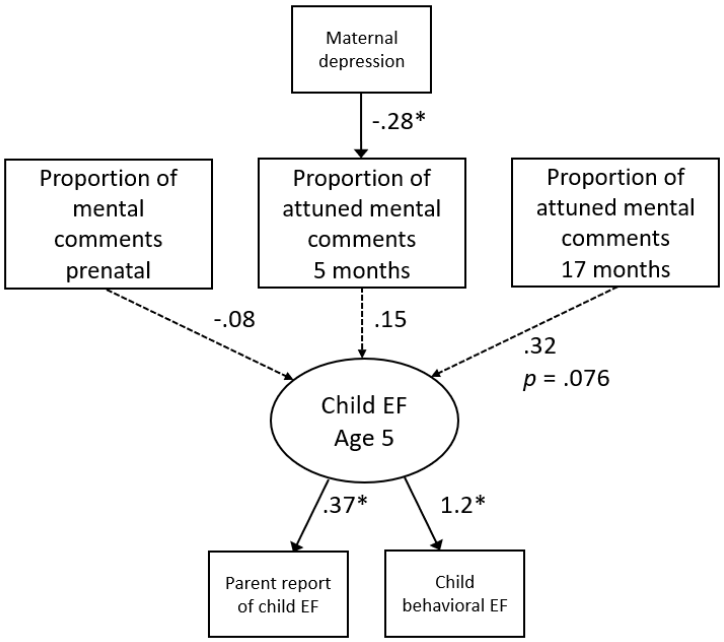


Note. Standardized regression coefficients are shown on the individual pathways. Solid lines represent significant associations and dashed lines represent non-significant associations. ** $p < .01$; *, $p < .05$.

In contrast, the proportion of mind-minded comments at 17-months did not significantly predict children's EF once maternal depression was controlled at 5-months (β = .32, p = .076; Figure 8), although the path was trending in the expected direction. While the overall model fit was adequate, $\chi^2(6) = 4.85$, p = .56, CFI = 1, TLI = 1.09, RMSEA = 0, SRMR = .04, inclusion of maternal depression as the covariate did not significantly improve model fit, $\Delta\chi^2 = 4.00$, $\Delta df = 4$, p = .41, compared to the model without the covariate for the proportion of mind-minded comments.

Figure 8

Path Analysis Predicting Children's Age 5 EF from Proportion of Mind-Minded Comments Across Time Controlling for Depression at 5 months



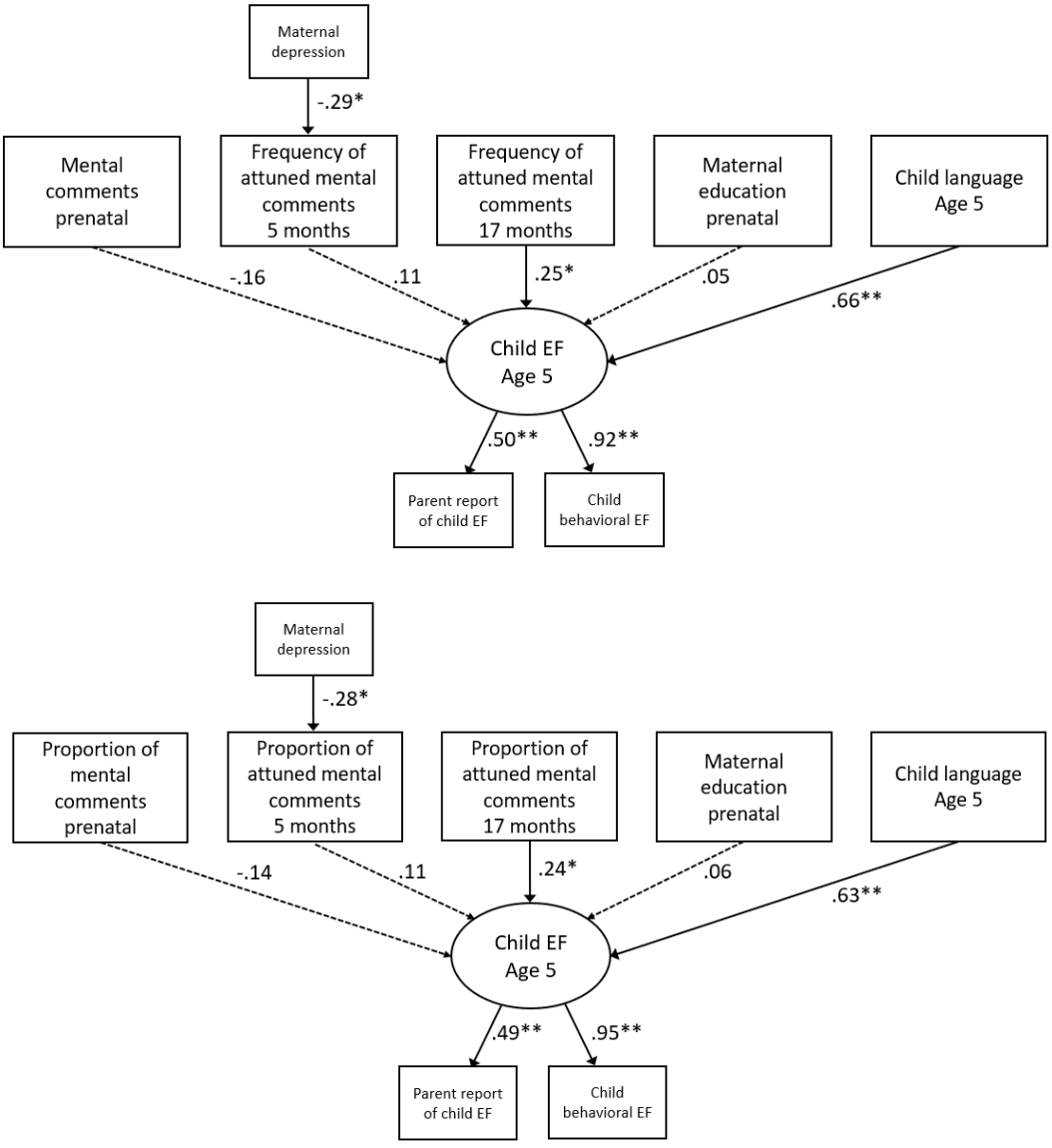
Note. Standardized regression coefficients are shown on the individual pathways. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

Prediction of Children's EF with Control Variables. As maternal mind-mindedness at 17- months significantly predicted children's EF at age 5, additional variables known to be associated with children's EF – children's own language ability (Fuhs et al., 2011) and maternal education (Lawson et al., 2018) – were added to the model to determine whether early mind-mindedness contributes unique variance towards children's later EF. Model fit was adequate for frequency (model fit, $\chi^2(10) = 11.64$, $p = .31$, CFI = .98, TLI = .96, RMSEA = .05, SRMR = .07) of mind-minded comments. As shown in Figure 9, Frequency of attuned mind-related comments at 17 months was significant at predicting child EF with maternal education, depression and child language controlled for. Similarly, the proportion of mind-related comments at 17-months significantly predicted children's EF ($\beta = .25$, $p = .032$; model fit $\chi^2(10) = 8.10$, $p = .62$, CFI = 1, TLI = 1.05, RMSEA = 0, SRMR = .05) beyond the effect of maternal education, depression and child language.

Association with Individual Executive Function Tasks. Given that 17-months mind-mindedness significantly predicted children's latent EF; exploratory correlation and partial correlation (controlling for mother's prenatal education and children's concurrent language) analysis were conducted to examine the association between 17-months mind-mindedness (frequency and proportion) and individual EF tasks. As shown on Table 6, frequency and proportion of mind-minded comments at 17-months were significantly associated with children's working memory, inhibition as measured by the Grass/Snow receptive stroop task and cognitive flexibility as measured by the Dimensional Change Card Sort task. The associations mostly remained after accounting for maternal education and children's own language ability (see Table 6 for the two non-significant partial correlation). Interestingly, while mothers' report of children's effortful control had a significant factor loading on the EF latent variable, 17-months mind-mindedness was not significantly correlated with mothers' report of children's effortful control.

Figure 9

Path Analyses Predicting Children's Age 5 EF from Maternal Mind-Mindedness Across Time Controlling for Maternal Depression, Education and Child Language



Note. Standardized regression coefficients are shown on the individual pathways. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

Table 6

Inter-Correlations Among Maternal Mind-Mindedness and Child EF

	Variable	MM prop	Child EC	NEPSY Statue	Tower of H	WM	Day/ Night	Grass/ Snow	DCCS
1	17 mos - attuned mind-related comments (freq)	.91** (.91**)	.20 (.07)	.21 (.08)	.13 (.08)	.39** (.26*)	.17 (.12)	.27* (.18)	.35** (.27*)
2	17 mos - attuned mind-related comments (prop)	-	.10 (-.04)	.15 (.01)	.18 (.13)	.39** (.26*)	.19 (.13)	.33** (.25*)	.31** (.21)
3	Parent report of child effortful control (CBQ)		-	.53** (.42**)	.23 (.18)	.36** (.10)	.27* (.20)	.13 (-.01)	.35** (.23)
4	EF - NEPSY statue (inhibition physical)			-	.25* (.18)	.43** (.18)	.31** (.24*)	.20 (.04)	.41** (.24*)
5	EF - tower of hanoi (planning)				-	.22 (.10)	.06 (.01)	.20 (.13)	.19 (.07)
6	EF - working memory					-	.27* (.16)	.20 (-.07)	.49** (.26*)
7	EF - day/night expressive stroop task (inhibition)						-	.29* (.23*)	.23* (.13)
8	EF - grass/snow receptive stroop task (inhibition)							-	.25* (.08)
9	EF - dimensional change card sort (cognitive flexibility)								-

Note. Value in parenthesis indicate partial correlation controlling for maternal prenatal education and children's age 5 language. ** p <.01;

*, p <.05, two-tailed

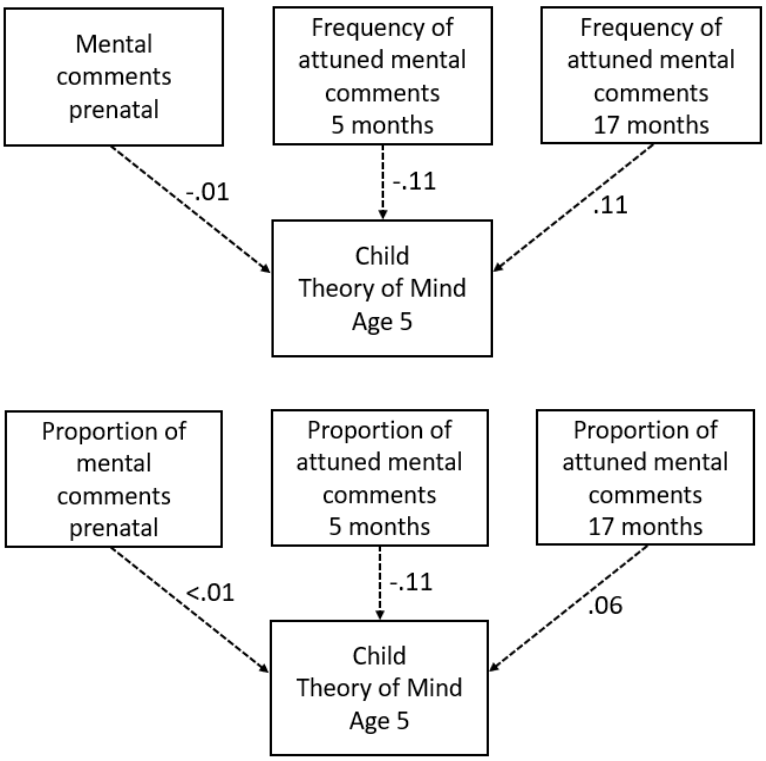
Aim 3. Prediction of Children's Theory of Mind

Structural equation path analysis was conducted to examine whether maternal mind-mindedness prenatally, 5-months post birth, and 17-months post birth predicted children's Theory of Mind (ToM; calculated as the mean number of correct tasks performed from the Diverse Desires and Contents False Belief task) at 5 years of age. Contrary to past findings (Meins et al., 2002; 2013), frequency and proportion of mind-minded comments did not significantly predict children's ToM (Figure 10). As both models were just identified – same number of observations as estimated parameters which results in 0 degree of freedom (Kline, 2016) – no model fit statistics (chis-quare test of model fit, CFI, TLI, RMSEA) were calculated. The non-significant effect remained in subsequent models that controlled for maternal depression at 5-months.

As only two uncorrelated ToM measures (Diverse Desires and Contents False Belief, r = -.21, p = .11; see Table 7 for intercorrelations among mind-mindedness and ToM variable) were available to form the composite ToM measure, an additional path analysis was conducted with mind-mindedness at all three time points predicting Diverse Desires and Contents False Belief separately. Similar to the results from the composite ToM measure and reflecting the lack of correlation between mind-mindedness and the individual ToM tasks in Table 7, maternal mind-mindedness at all three timepoints did not significantly predict children's performance on the Diverse Desires or Contents False Belief task

Figure 10

Path Analyses Predicting Children's Age 5 ToM from Maternal Mind-Mindedness (Frequency and Proportion) Across Time



Note. Standardized regression coefficients are shown on the individual pathways. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

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Table 7

Inter-Correlations Among Mind-Mindedness and Child ToM Variable

	Variable	T1 prop	T2 freq	T2 prop	T3 freq	T3 prop	ToM DD	ToM CFB	ToM Composite
1	T1, Prenatal - mental comments (freq)	.82**	0.1	-0.03	0.17	0.13	0.15	0.01	0.03
2	T1, Prenatal - mental comments (prop)	-	0.13	0.02	0.04	0.04	0.18	-0.03	0.04
3	T2, 5 mos - attuned mind-related comments (freq)		-	.83**	.28*	.24*	0.02	-0.16	-0.08
4	T2, 5 mos - attuned mind-related comments (prop)			-	0.09	0.09	-0.08	-0.1	-0.13
5	T3, 17 mos - attuned mind-related comments (freq)				-	.91**	0.04	-0.03	0.06
6	T3, 17 mos - attuned mind-related comments (prop)					-	0.02	-0.02	0.04
7	ToM - Diverse Desires (DD)						-	-0.21	.47**
8	ToM - Contents False Belief (CFB)							-	.80**
9	ToM Composite								-

Note. ** p <.01; *, p <.05, two-tailed

Aim 4. Mediation Analysis

While maternal mind-mindedness at each time point in our study did not significantly predict children's ToM at age 5, mediation analysis was conducted based on *a priori* prediction from the pre-registration and theoretical relevance supported by previous research (Meins et al., 2002; 2013). Meins and colleagues (2013) found that while children's concurrent language ability partially mediated the association between mind-mindedness at 8 months and children's ToM at age 4, caregiver mind-mindedness continued to exert direct contributions towards children's ToM beyond the indirect effect through children's language. Variables known to be associated with children's ToM were included as potential mediators in the current analysis: children's language (Milligan, Astington & Dack, 2007), and children's EF (Carlson & Moses, 2001). To improve model parsimony, the prenatal measure of mind-mindedness was omitted from all subsequent analysis given its nonsignificant association with the postnatal measure of mind-mindedness and children's developmental outcomes as demonstrated in the results from Aims 1 through 3.

Mediation Through Children's Language. Structural equation path analysis was conducted to determine whether children's concurrent language mediated the relation between 5- and 17-months postnatal mind-mindedness and children's ToM at age 5. As seen in Figure 11, there was an indirect path between frequency and proportion of mind-related comments at 17-months (but not at 5-months) and children's later ToM through children's concurrent language ability (frequency of mind-minded comments, indirect effect ab = .11, z = 1.86, p = .063, bootstrap 95% CI [.001, .014]; proportion of mind-minded comments, indirect effect ab = .12, z = 2.11, p = .035, bootstrap 95% CI [.28, 1.95]). As both models were just identified – same

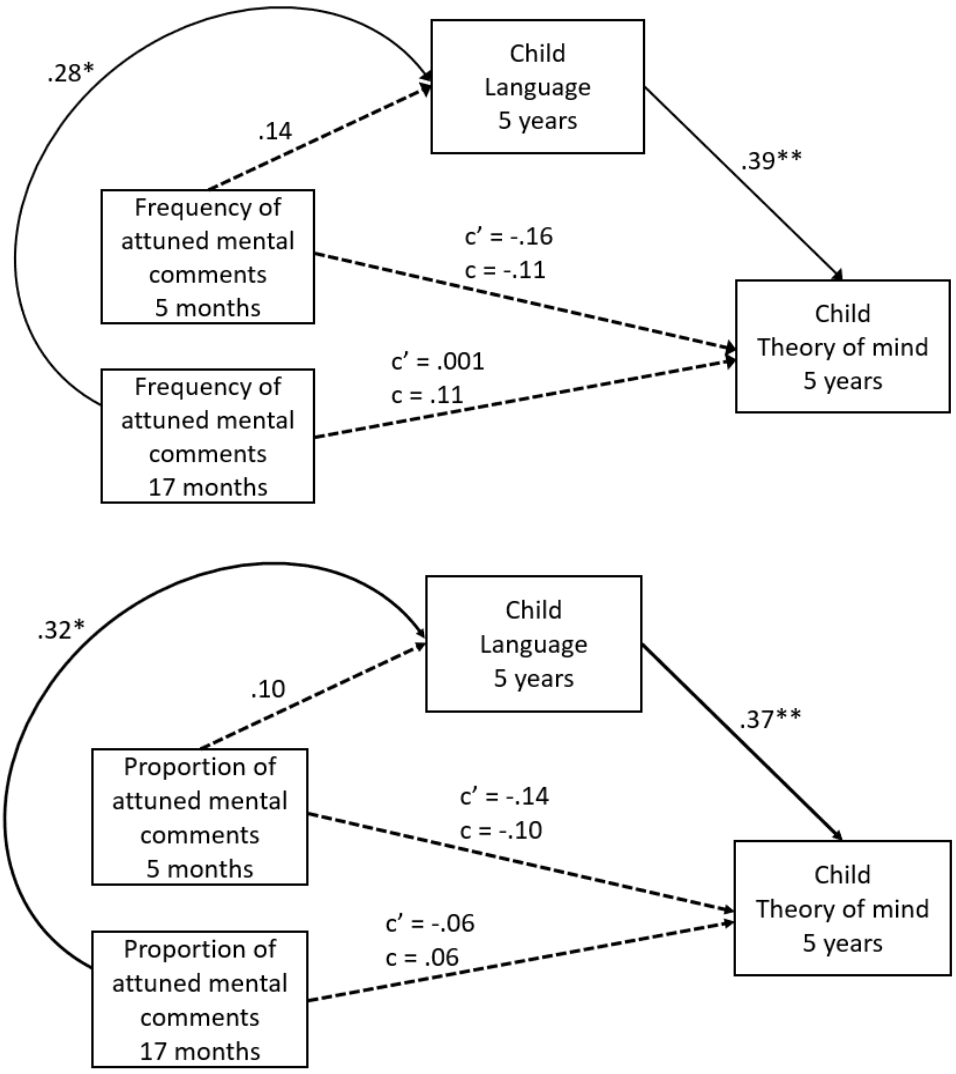
number of observations as estimated parameters which results in 0 degree of freedom (Kline, 2016) – no model fit statistics (chis-quare test of model fit, CFI, TLI, RMSEA) were calculated.

Given the non-significant association between 5-months mind-mindedness and children's language, the overall indirect effect of children's language remained unchanged when maternal depression was controlled for at 5-months. While Meins et al. (2013) found partial mediation through children's language between early mind-mindedness and children's later ToM with mind-mindedness continuing to exert direct effect towards ToM, the current finding suggests only an indirect path through children's language.

An additional exploratory model examined potential pathways of association between maternal *total* comments and children's ToM. As shown in Figure 12, there was no significant direct path between mothers' total comments and children's later ToM and no direct path between maternal total comments and children's later language ability. In conjunction with the pathway analysis above (Figure 11), these findings suggest a contribution of maternal mind-mindedness at 17-months beyond general overall caregiver discourse that exerts a direct influence on children's later language and indirect influence on children's ToM.

Figure 11

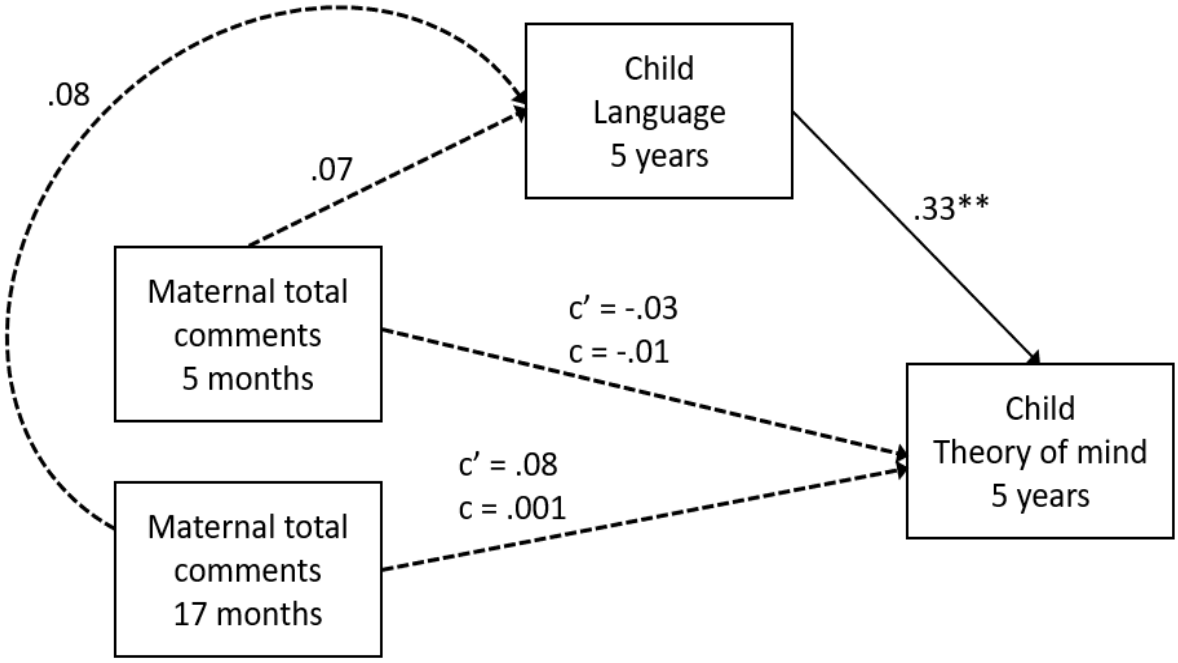
Path Analyses Examining the Direct and Indirect Association between Postnatal Mind-Mindedness (Frequency and Proportion) and Children's Age 5 ToM through Children's Language



Note. Standardized regression coefficients are shown on the individual pathways. c' = direct effect; c = total effect. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

Figure 12

Path Analysis Examining the Direct and Indirect Association between Maternal Overall Postnatal Comments and Children's Age 5 ToM through Children's Language



Note. Standardized regression coefficients are shown on the individual pathways. c' = direct effect; c = total effect. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

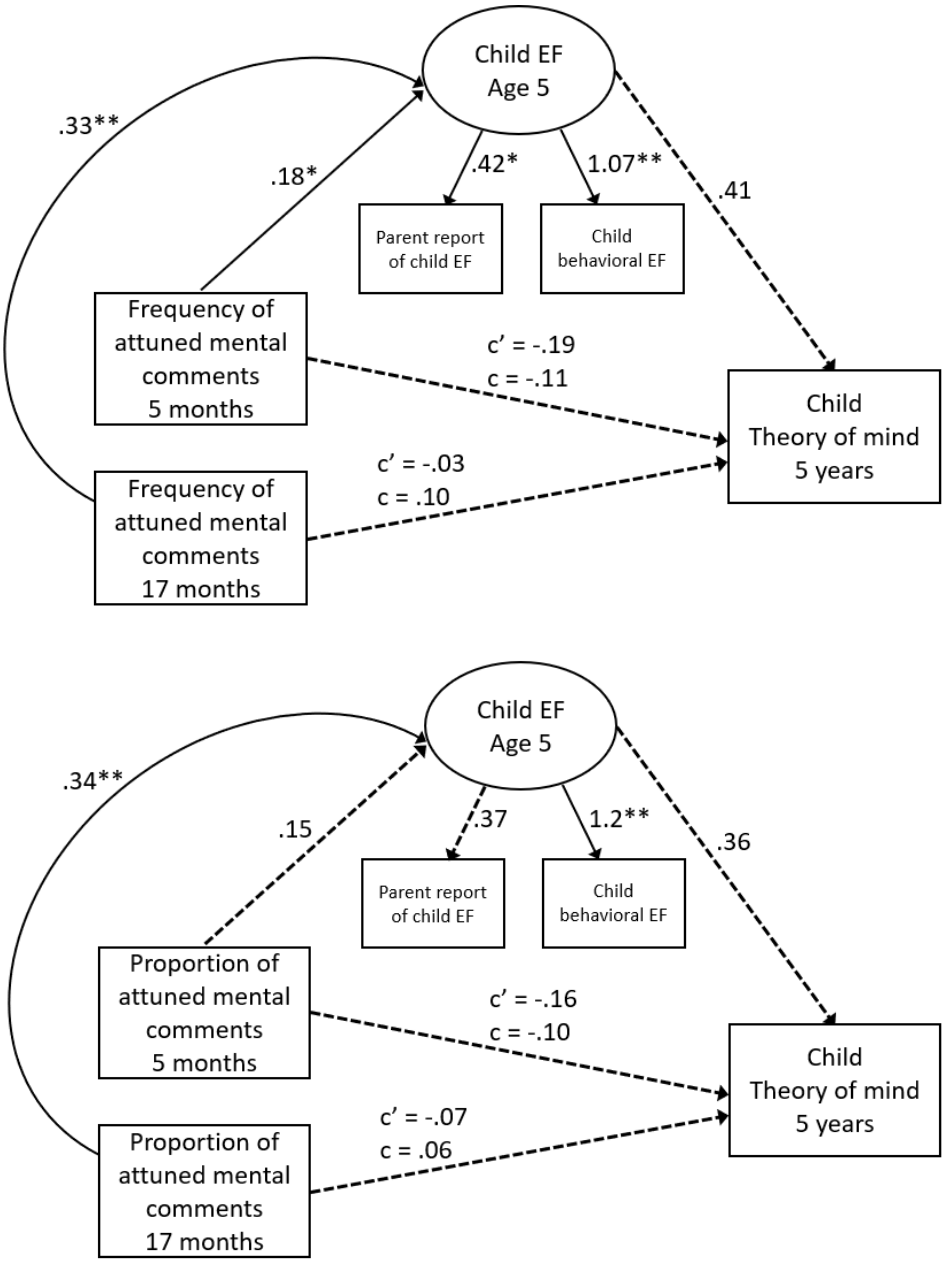
Mediation Through Children's Executive Function. Children's latent EF, composed of children's standardized average behavioral EF score and parent report of children's effortful control, did not significantly mediate the relation between mind-related comments (both frequency and proportion) postnatally and children's later ToM (for frequency of mind-related comments: all indirect effects ab > .08, z < 1.28, p > .20; for proportion of mind-related comments: all ab > .06, z < .60, p > .55; see Figure 13). Model fit for frequency of mind-minded comments, $\chi^2(2) = .78$, $p = .68$, CFI = 1, TLI = 1.16, RMSEA = 0, SRMR = .02; for proportion of mind-minded comments, $\chi^2(2) = .53$, $p = .77$, CFI = 1, TLI = 1.19, RMSEA = 0, SRMR = .02.

In the frequency model, both 5-months and 17-months mind-minded comments exerted significant direct effect on children's age 5 EF (this finding reflects the first order correlation of r = .25 between frequency of 5 months mind-minded comments and child EF). For the proportion model, only 17-months mind-minded comments exerted a significant direct effect on children's later EF. The direct effect of mind-related comments at 17-months on children's age 5 EF replicates findings from our earlier analyses (Aim 2).

The inclusion of maternal depression as a control variable at 5-months did not alter the non-significant mediation effect of children's latent EF on the relation between mind-mindedness and children's later ToM. Furthermore, both frequency (β = .30, p = .005) and proportion (β = .27, p = .001) of mind-related comments at 17-months continued to exert significant direct effect on children's later latent EF with maternal depression controlled at 5-months. The direct path between frequency of mind-minded comments at 5-months and child latent EF also continued to be significant (β = .18, p = .037) with the inclusion of maternal depression covariate.

Figure 13

Path Analyses Examining the Direct and Indirect Association between Postnatal Mind-Mindedness (Frequency and Proportion) and Children's Age 5 ToM through Children's EF



Note. Standardized regression coefficients are shown on the individual pathways. c' = direct effect; c = total effect. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

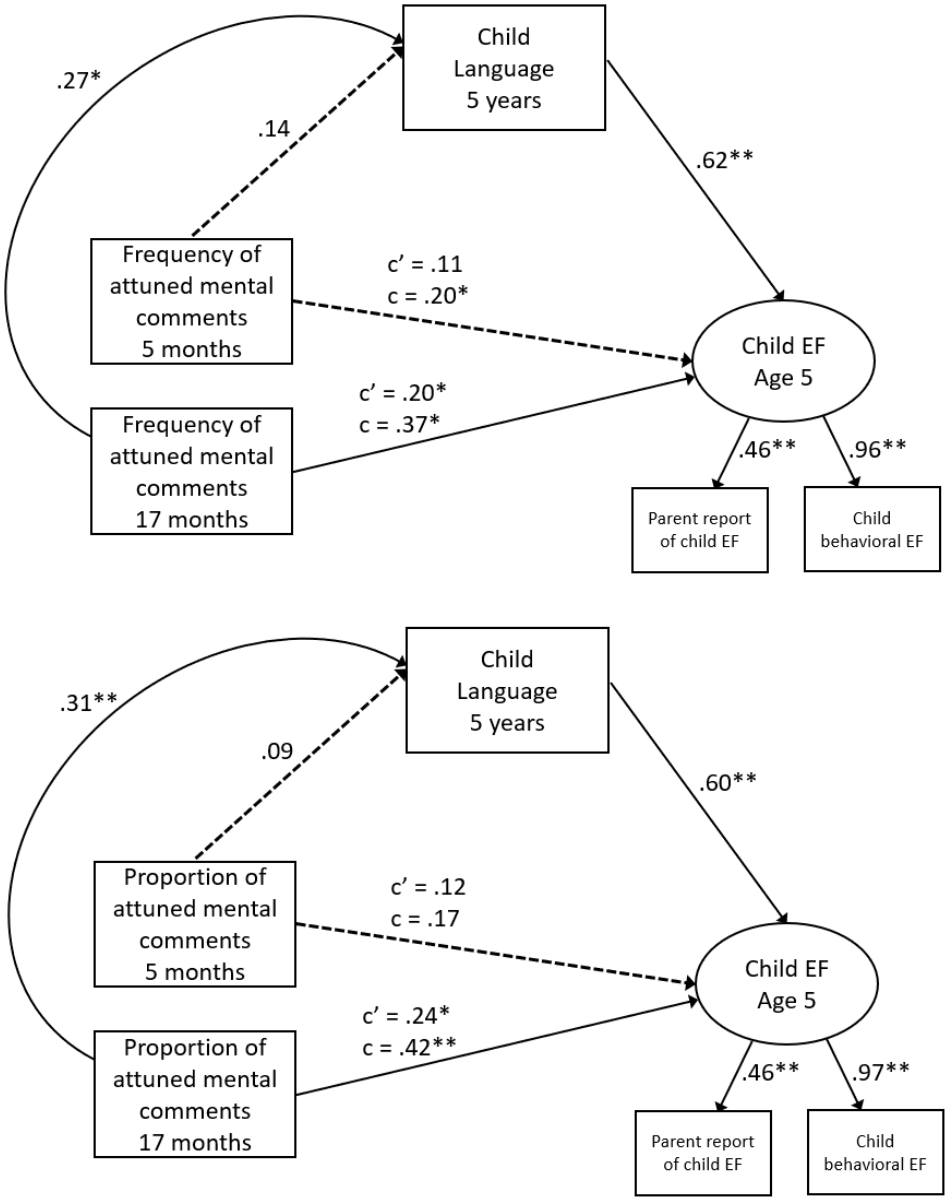
Exploratory Mediation Analysis for Mind-Mindedness and Child EF

Mediation Through Children's Language. As maternal mind-mindedness at 17-months significantly predicted children's later executive functioning (Aim 2), exploratory analysis was conducted to examine whether variables known to be associated with children's EF – children's concurrent language ability (Kaushanskaya et al., 2017) – may mediate this longitudinal association. First, a model that examined whether this association was mediated by children's language ability showed significant direct and indirect paths (see Figure 14), suggesting a partial mediation between 17-months mind-mindedness (frequency of mind-minded comments, indirect effect ab = .17, z = 2.16, p = .031, bootstrap 95% CI [.005, .042] and proportion of mind-minded comments, indirect effect ab = .19, z = 2.48, p = .013, bootstrap 95% CI [.96, 6.12]) and children's EF through children's concurrent language ability. Model fit statistics for frequency, $\chi^2(2)$ = .44, p = .80, CFI = 1, TLI = 1.12, RMSEA = 0, SRMR = .01, and proportion, $\chi^2(2)$ = .78, p = .68, CFI = 1, TLI = 1.09, RMSEA = 0, SRMR = .02, of mind-minded comments were appropriate.

Given the non-significant association between 5-months mind-mindedness and children's outcomes, the inclusion of maternal depression at 5-months did not alter the partial mediation effect of children's concurrent language in the association between 17-month mind-mindedness and children's later EF. In sum, while children's concurrent language partially mediated the association between 17-months mind-mindedness and children's EF at age 5, the direct path between 17-months mind-mindedness and children's EF remained significant with the inclusion of the mediator variable (child language), suggesting direct contribution of early maternal mind-mindedness towards children's later EF beyond its influence on children's concurrent language.

Figure 14

Mediation Through Children's Concurrent Language Ability for the Relation between Postnatal Mind-Mindedness (frequency and proportion) and Children's Age 5 EF.

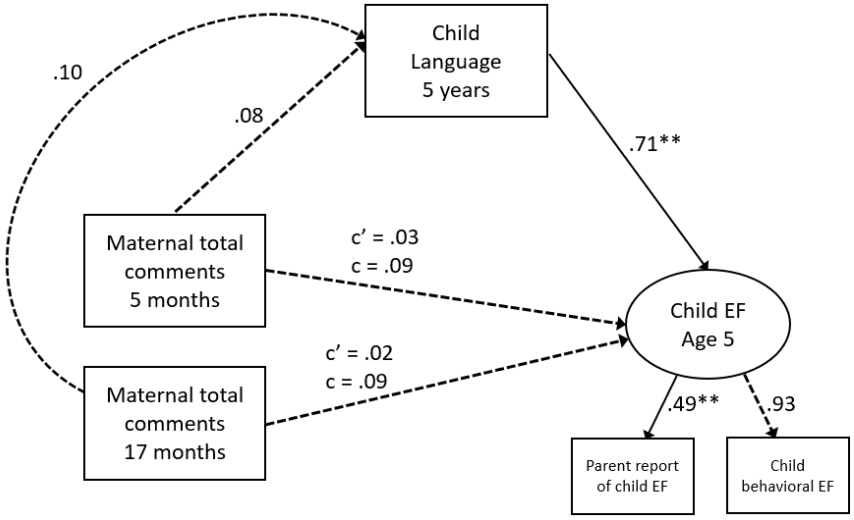


Note. Standardized regression coefficients are shown on the individual pathways. c' = direct effect; c = total effect. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

Further, a model that examined whether children's concurrent language mediated the association between maternal *total* comments made postnatally and children's EF found no significant direct path between maternal total comments and child language (model fit; $\chi^2(2) = .09$, $p = .96$, CFI = 1, TLI = 1.19, RMSEA = 0, SRMR = .01). The direct path between maternal total comments and child EF was also not significant (Figure 15). Taken together with the mediation result from above (Figure 14), these findings suggest a direct contribution of maternal mind-mindedness (specifically as measured at 17-months) beyond general overall caregiver verbosity that exerts direct and indirect influence on children's later language and EF.

Figure 15

Path Analyses Examining the Direct and Indirect Association between Maternal Overall Postnatal Comments and Children's Age 5 EF



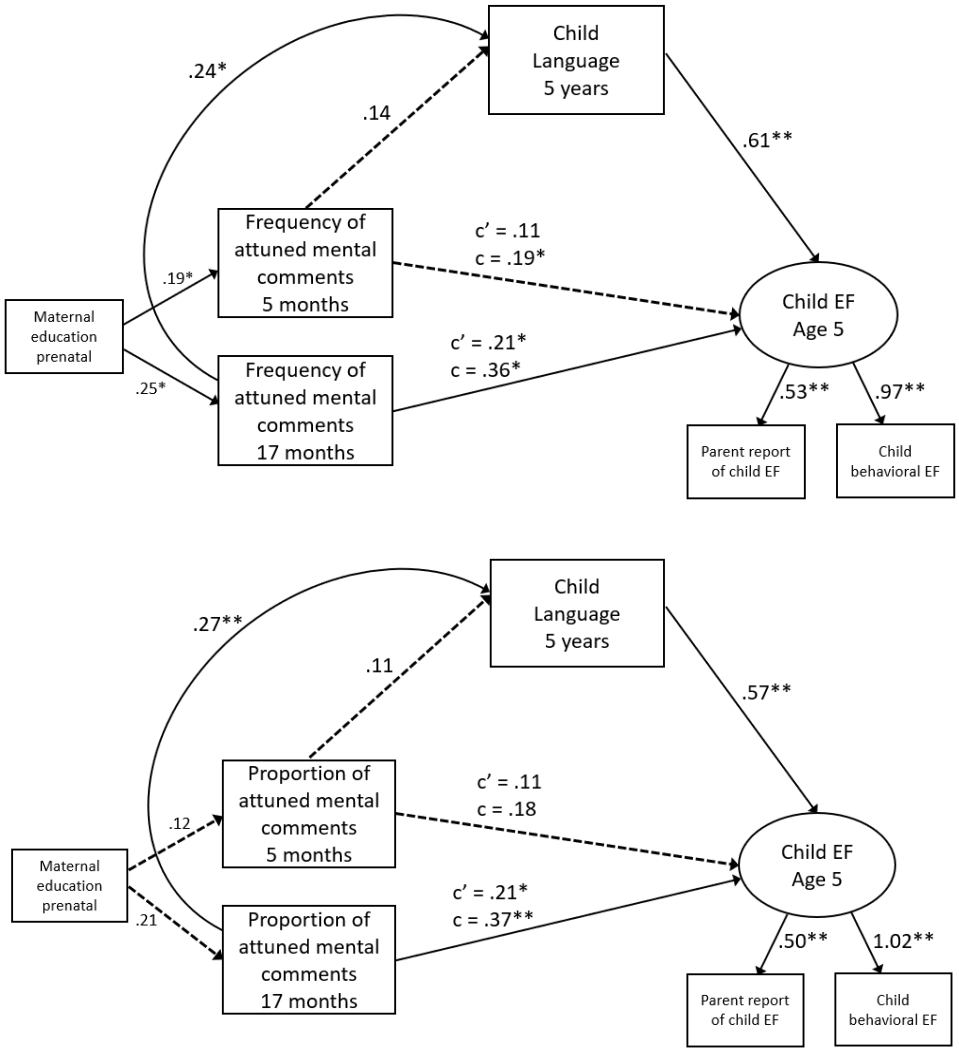
Note. Standardized regression coefficients are shown on the individual pathways. c' = direct effect; c = total effect. Solid lines represent significant associations and dashed lines represent non-significant associations. ** $p < .01$; *, $p < .05$.

A final mediation model that included the effect of maternal education on postnatal mind-mindedness revealed a similar pattern of partial mediation through language in the association

between mind-mindedness at 17-months (but not at 5-months) and children's later EF (Figure 16; frequency of mind-minded comments, indirect effect *ab* = .15, *z* = 1.97, *p* = .049, bootstrap 95% CI [.001, .039] and proportion of mind-minded comments, indirect effect *ab* = .16, *z* =2.15, *p* = .032, bootstrap 95% CI [.53, 5.82]). Moreover, the direct path between 17-months mind-mindedness and children's EF remained significant after accounting for the effect of maternal education on 5- and 17-months mind-mindedness. Model fit statistics for frequency, $\chi^2(6)$ = 13.17, *p* = .04, CFI = .92, TLI = .79, RMSEA = .11, SRMR = .08, and proportion of mind-minded comments, $\chi^2(6)$ = 11.14, *p* = .08, CFI = .93, TLI = .84, RMSEA = .09, SRMR = .08. The overall pattern of mediation and direct effect did not change when maternal depression was accounted for in mothers' 5-months mind-minded comments.

Figure 16

Path Analyses Examining the Direct and Indirect Association between Maternal Mind-Minded Comments (frequency and proportion) and Children's EF mediated by Children's Language Ability Controlling for Maternal Education



Note. Standardized regression coefficients are shown on the individual pathways. c' = direct effect; c = total effect. Solid lines represent significant associations and dashed lines represent non-significant associations. ** p <.01; *, p <.05.

CHAPTER IV

DISCUSSION

From the origin of mind-mindedness in attachment, sensitivity, and Vygotskian theory, a caregiver's capacity to interpret the child's perspective and to regard the child as an individual mental agent is argued to promote positive developmental outcomes in children's social understanding, executive functioning, and language abilities (Aldrich et al., 2021; Devine & Hughes, 2016). While interest in mind-mindedness as a construct has increased over time, opportunities remain to further examine its temporal stability, association with caregiver characteristics, its relation to children's self-regulatory and linguistic outcomes, and the mechanisms behind its influence. Hence, the overarching goals of this dissertation were to examine the temporal stability of maternal mind-mindedness across the transition to motherhood in a group of socioeconomically diverse first-time mothers and its longitudinal association with children's theory of mind and executive functioning. A secondary data analysis was conducted from a longitudinal dataset where maternal mind-mindedness was coded at three timepoints (prenatally during the third trimester of pregnancy, 5-, and 17- months post birth) and children's cognitive and behavioral outcomes (language, ToM, and EF) were examined at 5 years of age.

Aim 1. Temporal Stability and Continuity of Mind-Mindedness

In the early development of the construct, Meins (1999) has emphasized the need to establish whether mind-mindedness was a general tendency to focus on thoughts, feelings and intentions or more a more specific mental reflection of others' behavior when forming attachment relationships. To better understand the trait-like or relational quality of the construct, one aim of the dissertation was to characterize the developmental pattern of maternal mind-mindedness both individually (stability vs. instability) and at the group level (continuity vs.

discontinuity) during the transition to motherhood. Guided by past research (Arnott & Meins, 2008; Colonnesi et al., 2019; Meins et al., 2011), I hypothesized that postnatal mind-mindedness would show individual stability over time while no specific predictions were made for prenatal mind-mindedness given the lack of research in this period (only one published study by Arnott & Meins, 2008). Further, I hypothesized that mothers as a group would be less mind-minded prenatally compared to postnatally, and mothers would remain similarly or less mind-minded at 17 months compared to at 5 months when interacting with their infants (discontinuity).

The current findings provide mixed support for my hypotheses. Maternal mind-mindedness did not appear to be especially stable within individuals across the transition to motherhood although the absolute frequency of mind-minded comments between 5- and 17-months postpartum showed a trend toward modest individual stability. Across the three timepoints, mothers as a group did not appear to differ in their overall *frequency* of mind-minded comments, demonstrating continuity; in contrast, the *proportion* (score that accounts for overall verbosity) of mind-minded comments were higher prenatally compared to 17-months, suggesting discontinuity. Given the inconsistent results between the frequency and proportion of mind-minded comments, interpretation of the overall finding should be made with caution and take into consideration the potential presence of an inadvertently inflated proportion score for mothers' prenatal mind-mindedness. Further, there were slight methodological differences (discussed further below) in the current prenatal mind-mindedness interview compared to the prenatal interview used in Arnott and Meins (2008).

As discussed in the Method and Results section of the dissertation, researchers have argued that using only the proportion of mental comments may inadvertently inflate parents' mind-mindedness (Hughes et al., 2018; Laranjo et al., 2014; Pequet & Warnell, 2020). A closer

inspection of the current prenatal data echoes this point. For example, a mother in the study who received a prenatal proportion score of .33 made only one mental comment and three total comments when asked to describe her unborn child, whereas another mother who similarly made one mental comment but had nine total comments received a proportion score of .11. Since there was no time restriction in the prenatal interview compared to the postnatal freeplay session (5-min and 10-min at 4- and 17- months respectively), mothers could respond in as few or as many statements as they preferred. Thus, it may be preferable to interpret the prenatal mind-mindedness findings through the frequency score over the proportion score as discussed in the next paragraph.

Methodologically, as data collection had already been completed when this dissertation was begun, the current prenatal interview questions were not identical to the questions used in the Arnott and Meins (2008) prenatal mind-mindedness study. To recap, Arnott and Meins (2008) found in a group of 25 expectant couples that more than half of the caregivers did not provide a mentalistic comment about the unborn child, and only the *overall* number of comments (not number of *mentalistic* comments) made prenatally correlated with caregivers' appropriate mind-related comments when the child was 6 months old. In my dissertation, the questions that were selected asked mothers "based on your experience so far with your pregnancy, what are your impressions of your baby?" and the follow-up question "Do you have a sense of whether your baby will be more like your baby's father or like you?". In Arnott and Meins (2008) the interview question was "what do you think your baby will be like at 6 months of age?" which may have probed expectant parents to think more about the child as an infant. Arnott and Meins (2008) did not indicate in their manuscript whether a specific time duration was imposed on the caregiver's response, and the Mind-Mindedness Coding Manual (Meins & Fernyhough, 2015)

does not indicate that a time limit should be set for the caregiver interview. Compared to Arnott and Meinis (2008), there remains a possibility that the interview questions in my dissertation may not have probed expectant mothers enough to describe their unborn child with reference to their internal states. However, as discussed further below, the proportion of expectant mothers who did not provide any mentalistic comments about their unborn child (half of the mothers in the current dissertation) echoes the proportion found in Arnott and Meins (2008), pointing to the possibility that internal references towards an unborn child may not emerge in all expectant caregivers.

Examination of the frequency score suggests a modest level of stability such that mothers individually were consistent in the raw number of attuned mind-minded comments they made postnatally towards their infant between 5 and 17 months (but not prenatally) and this effect remained after controlling for maternal depression at 5 months. The current finding for individual stability is consistent with findings from past studies (Colonessi et al., 2019; McMahon et al. 2016; Siletti et al., 2022) and suggests a degree of trait-like stability in how mothers attribute internal states towards their infants. However, given the presumed close relationship level between a mother and her infant, the relational aspect of the construct cannot be ruled out. That would require a closer examination of caregivers' mind-mindedness towards multiple targets with varying levels of relationship closeness (e.g., spouse or partner, an acquaintance, a disliked person, etc…), a potential avenue for future research.

Prenatally, similar to Arnott and Meins (2008), more than half of the mothers in the current study did not provide any mentalistic descriptions of their unborn child and there was no individual stability between prenatal and postnatal mind-mindedness, suggesting that a representation of the unborn child's internal state, while present in some expectant mothers, may

not emerge prior to birth in all expectant mothers. In a separate analysis, Arnott and Meins (2008) found that caregivers' *overall* number of comments (both mental and nonmental descriptions of how their unborn child would be like in the future) but not number of *mentalistic* comments were positively associated with later mind-mindedness, leading the authors to propose that prenatal mind-mindedness may be a function of a caregiver's ability to represent any characteristics of what the child may be in like in the future rather than specific characteristics related to the child's internal state. Contrary to Arnott and Meins (2008), analysis that utilized the *overall* descriptions about the unborn child in the current study was not associated with mothers' later mind-mindedness.

While the current study did not find associations between prenatal and postnatal mind-mindedness, it does not rule out the possibility that interview questions asking expectant caregivers to elaborate more fully on the unborn child's characteristics may elucidate more references about the child (both mental and non-mental), an area of opportunity for future research. Further, as meta-analytic findings have indicated that expectant parents' general warmth or coherence in describing their unborn child is associated with higher quality of caregiver-child interaction post birth (Foley & Hughes, 2018), potential interventions aimed at increasing mind-mindedness during pregnancy could still be effective at promoting expectant mothers to think about their unborn child's internal state, which continues to be an understudied area in the literature.

Contrary to existing studies that have generally found a decrease or discontinuity in interactional mind-mindedness across infancy and toddlerhood (Colonnesi et al.; McMahon et al., 2016; Siletti et al., 2022), mothers as a group in the current study did not differ in their overall frequency of mind-mindedness (i.e., supporting developmental continuity) towards their

infants across the three time points examined. A decrease or discontinuity in overall mind-mindedness has been interpreted as support for the relational aspect of the mind-mindedness, such that as the caregiver-infant relationship unfolds over time and the infant matures physically and cognitively, the caregiver adjusts (in the case of mind-mindedness thus far in the literature, decreases) the extent to which they comment on the infants' internal state. Echoing Siletti et al. (2022), the current finding of group level continuity (rather than discontinuity) combined with postnatal individual stability may suggest that mind-mindedness is more trait-like during the early period of infancy and toddlerhood where infants' internal states may be more challenging to decipher.

However, a methodological challenge in the longitudinal measurement and interpretation of the continuity versus discontinuity of the construct is the difference in age recommendation for each mind-mindedness measure: under 24 months for the observation and over 24 months (or prenatally) for the interview method. Early on, it is possible that mind-minded caregivers, during interaction with their infants, may comment extensively on their preverbal infants' internal states. Then as the relationship lengthens between the dyads, and infants mature cognitively and verbally, caregivers may decrease the amount to which they need to explicitly comment or infer their infants' mental state. Throughout this cognitive and verbal maturation, it is also possible that a mind-minded caregiver will begin to describe their toddler or preschooler during an interview with increasing attributes towards their internal state even if their level of explicit comments during interaction may have decreased. While Meins et al. (2003) have proposed that the representational (interview) and interactional measure of mind-mindedness should be theoretically equivalent, there is scant research to date that specifically supports the

interchangeability of the two methods of assessment (see the "Evaluation of Mind-Mindedness Coding" in the Introduction for a brief review).

To better characterize the longitudinal continuity or discontinuity of mind-mindedness, future research could focus assessment of mind-mindedness on one method across infancy to early childhood or utilize both methods simultaneously to allow for comparison across methods. Recognizing the importance of measurement consistency, Meins' and her colleagues have recently developed a coding scheme to assess interactional mind-mindedness in older parent-child dyads (Fishburn et al., 2022). This extended coding scheme in older children can provide future researchers with methods to examine the interchangeability of the representational and international measure of the construct and contribute to our understanding of the stability and continuity of mind-mindedness across development.

Aim 2. Prediction of Children's Executive Function

Given the positive developmental outcomes in children's social cognition, executive functioning, and language ability associated with mind-mindedness (Aldrich et al., 2021; Devine & Hughes, 2016), a second aim of the dissertation was to determine whether the association between early caregiver mind-mindedness and preschoolers' executive functioning extends to age 5, as most published studies on mind-mindedness and EF outcome have centered on early childhood between 2 to 3 years of age (Cheng et al., 2018; Regueiro et al., 2022; Senehi et al., 2018). Based on past research, I hypothesized that mind-mindedness would significantly predict children's latent EF as measured through a multi-method and multi-informant approach composed of both child behavioral tasks and a parental report. Moreover, I hypothesized that this association would remain after taking into account mothers' education and children's language

ability, variables known to be associated with children's EF (Fuhs et al., 2011; Lawson et al., 2018).

In support of my hypothesis, mothers' mind-minded comments made at 17 months (but not prenatally or at 5 months) significantly predicted children's EF, and this effect remained with a modest effect size (all βs > .24) after controlling for maternal depression, education, and children's concurrent language. The current finding extends the age at which early caregiver mind-mindedness explains significant variance in children's later EF beyond toddlerhood and provides further support for the contribution of the caregiver environment to the development of children's self-regulation. While only mind-mindedness at 17-months was a significant predictor of children's EF over and above maternal education, depression and children's concurrent language, it should be noted that the first order correlation between 5-months mind-mindedness and children's EF was significant (Table 3), suggesting the potential role of caregivers' mind-mindedness in early infancy on children's later self-regulation.

An exploratory analysis that examined the association between 17-months mind-mindedness and individual EF tasks revealed that mind-mindedness was significantly associated with specific EF tasks that measured children's working memory, inhibition, and cognitive flexibility. Further, these associations remained after taking into account children's concurrent language ability, providing some preliminary evidence that the influence of mind-mindedness on children's EF is beyond its effect on children's general language ability, although it cannot be ruled out that mind-mindedness may have influenced children's early language development which in turn influences children's EF (Romeo et al., 2022). An additional analysis that examined children's concurrent language as a potential mechanism of influence is included further below in the Discussion section.

Aim 3. Prediction of Children's Theory of Mind

In order to examine potential mechanisms underlying the previously found association between caregiver mind-mindedness and children's ToM (see Aim 4 below; Laranjo et al., 2014; Meins et al., 2002; 2013), Aim 3 of my dissertation sought first to replicate the association. It was hypothesized that early caregiver mind-mindedness would predict children's later ToM. Contrary to past research (Devine & Hughes, 2016) and my hypothesis, early mind-mindedness did not significantly predict children's later ToM in the current sample. Only two uncorrelated behavioral measures of ToM were utilized in the study (Diverse Desires and Contents False Belief, r = -.21, p = .11), therefore additional analysis with each individual ToM task was also conducted, but these also did not reveal significant longitudinal association between early mind-mindedness and ToM performance.

While the reliability of my two ToM measures was low, it should be noted that the tasks fall at two opposing ends of difficulty levels in the Wellman and Liu (2004) ToM Scale, where Diverse Desires was considered the earliest form of ToM understanding and Contents False Belief was classified as the second most difficult task on the scale (just below Hidden Emotion). Indeed, echoing findings from the ToM Scale, 88% of the 5-year-olds in the current study passed the Diverse Desires task while only 39% passed the Contents False Belief task. The ceiling effect observed in the Diverse Desires task along with the use of only two tasks may have reduced the overall variability (e.g., a majority of the children passed one task and more than half failed the other) in children's performance such that meaningful individual differences could not be detected. However, even though mind-mindedness was not associated with children's ToM in the current study, children's composite ToM score was significantly associated with their concurrent EF and language ability in the expected magnitude and direction commonly seen in the literature

(Table 3; Carlson & Moses, 2001; Milligan, Astington & Dack, 2007), providing some evidence for the construct validity and variability of the ToM measures used in the current study.

Aim 4. Mediation Analysis for Mind-Mindedness and Child ToM

Studies that have examined potential mechanisms underlying the association between mind-mindedness and children's ToM have found that children's language ability partially mediated this association, with mind-mindedness continuing to exert a direct effect on children's ToM beyond children's language (Meins et al. 2003; 2013). Further, in one study published to date, children's internal state language and symbolic play ability at 2 years of age did not appear to mediate the association between early mind-mindedness and children's later ToM, raising the possibility that children's general language rather than specific internal state language mediates this association.

Based on the limited existing literature (Meins et al. 2003; 2013), a fourth aim was to attempt to replicate whether children's language would mediate the association between mind-mindedness and ToM. In addition, I further examined whether children's executive function could be another potential mediator in the association between mind-mindedness and children's ToM. I hypothesized that children's language and EF would each partially mediate the association between mind-mindedness and children's ToM. Moreover, replicating Meins et al. (2003; 2013), mind-mindedness would continue to exert a direct effect on children's ToM beyond the contribution of children's language or EF. As hypothesized, children's language showed a significant indirect effect on the association between proportion (but not frequency, albeit the effect for frequency was in the expected direction at $p = .063$) of mind-minded comments made at 17-months and children's later ToM. Contrary to my hypothesis and past research (Meins et al., 2003; 2013), there was no direct effect between mind-mindedness and

children's ToM in my model, although this null direct effect was, of course, unsurprising as mind-mindedness did not significantly predict children's ToM in my previous analysis (Aim 3).

While Meins and colleagues (2003; 2013) found that children's language partially mediated the association between early mind-mindedness and children's later ToM with mind-mindedness continuing to exert a direct effect on children's ToM, the current finding suggests an indirect effect in this association, such that mind-mindedness influences children's later ToM through its effect on children's concurrent language. This result should be interpreted with caution pending further replication. Future research should examine children's early language ability more generally and also children's early mental state language understanding more specifically, as it is possible that mind-mindedness may have a direct effect on children's early language ability, specifically children's understanding of mental state terms which has been found to be associated with ToM understanding (Taumoepeau et al., 2019). Lastly, the influence of early mind-mindedness on children's language and subsequent social understanding supports Vygotsky's sociocultural theory – a contributor in Meins' (1997) theorizing of the mind-mindedness construct – such that mothers' appropriate comments towards their infants' internal state may provide linguistic and conceptual scaffolding that facilitates the internalization of subsequent mental states.

In contrast to my hypothesis, a separate path analysis revealed that children's EF did not have a direct or indirect path in the association between mind-mindedness and children's later ToM, suggesting that association may not be through an intermediate effect of mind-mindedness on children's concurrent self-control. Of note, the direct effect between 17-months mind-minded comments and children's later EF remained significant in the mediation analysis with children's ToM, providing further support of the direct association between mind-mindedness and EF as

seen in the discussion of Aim 2 of the dissertation. Taken together with the aforementioned mediation analysis through children's language, it may be tempting to infer that the mechanism of association for mind-mindedness on children's ToM is exclusively through its influence on children's language rather than through children's EF; however further analysis and research is needed given the overlap and bidirectional association between children's EF and language ability (Guedes & Cadima, 2022; Romeo et al., 2022).

Exploratory Mediation Analysis for Mind-Mindedness and Child EF

As maternal mind-mindedness significantly predicted children's later EF (Aim 2 of dissertation) beyond maternal education, depression and children's language ability, an exploratory mediation analysis was conducted with children's concurrent language – a variable known to be associated with children's EF (Kaushanskaya et al., 2017; Romeo et al., 2022) – to examine whether children's language influenced this association. Mathematically, the prediction (Aim 2) and mediation model are equivalent as the same variables are utilized in both models whereas the paths assigned differ based on the research question. In the prediction model, children's concurrent language ability was considered a control variable such that its potential influence on children's EF was taken into account to examine whether mind-mindedness predicts children's EF beyond children's concurrent language. In the mediation model, children's language was examined as a potential variable that influences the relationship between mind-mindedness and children's EF and also to determine whether there are significant direct and indirect effects of children's language in the model.

Findings revealed that children's concurrent language ability partially mediated the association between 17-months mind-mindedness and children's age 5 EF such that the direct effect between mind-mindedness and children's EF remained significant with the inclusion of

child language as a mediator. An additional analysis that examined whether children's language mediated the association between maternal *total* comments made postnatally and children's EF was not significant. Taken together, these findings suggest that a mothers' proclivity to comment appropriately on their infants' inner states (specifically as measured at 17-months) and not the overall number of comments that mothers make while interacting with their infants that exert a direct and indirect influence on children's later EF through children's language. Interestingly, the direct effect between early mind-mindedness and children's later EF persisted beyond mind-mindedness' influence on children's concurrent language, supporting the proposal by Fonagy and Target (2002) that the quality of early caregiver-child relationship, in our case caregiver mind-mindedness, may serve as a foundation for children's subsequent internalization of their self-regulatory capacity. For example, a mind-minded caregiver, through their appropriate comments and response towards the infants' internal state may allow infants themselves to recognize, learn and acquire tools on how to self-regulate their distress and subsequent higher order self-control. Moreover, the linguistic scaffold afforded by the mind-minded caregiver may facilitate children's own language development generally or possibly their mental state language specifically (a potential area for future research) which may in turn further improve children's self-control and social understanding.

The Influence of Mind-Mindedness on Children's Language and Developmental Outcomes

Throughout my analyses, children's concurrent language ability emerged as a significant contributor of the intermediary influence in the association between mind-mindedness and children's developmental outcomes, specifically self-control and social understanding. Given the emphasis on caregivers' linguistic behavior in the assessment of mind-mindedness and the potential broader context of a language-rich environment in which mind-related language may

occur, having a mind-minded caregiver may facilitate children's own language development and later self-regulatory outcomes.

While children's language tends to be included as a covariate in the study of mind-mindedness and developmental outcomes, few studies have directly focused on the association between mind-mindedness and children's language development, with these studies typically finding a positive association (Laranjo & Bernier, 2013; Lundy & Fyfe, 2016; Wang et al., 2017). In my dissertation, mind-mindedness at 17 months (but not at 5 months) was significantly associated with children's later language ability, and children's language was further associated with children's developmental outcomes both directly and indirectly. Specifically, children's concurrent language partially mediated the association between mind-mindedness and children's EF and this result persisted after accounting for the effect of maternal education on early mind-mindedness. Further, children's language had an indirect path in the association between mind-mindedness and children's ToM. On the other hand, the total number of comments mothers made at each of the three time points was not significantly associated with children's later language, EF or ToM, suggesting that there may be specific aspects of a caregiver's mind-minded discourse (or possibly behavior influenced by the mind-minded discourse) that may be contributing to children's later language and cognitive development. It can also be reasoned that a higher number of mind-minded comments may not necessarily be accompanied by a greater amount of overall verbal input. This echoes past research on caregivers' language and children's vocabulary development, such that quality of the lexical input was more influential than quantity (Demir-Vegter et al., 2014).

With improvement in longitudinal data modeling and analysis, recent studies have revealed the advantage in ToM and EF development for children with high verbal ability (Romeo

et al., 2022; Shahaeian et al., 2022). For example, while children generally improved in their ToM and EF with age, children with higher level of language abilities had the greatest advantage in developing ToM understanding and EF (Shahaeian et al., 2023). Further, in a group of socioeconomically diverse children, Romeo et al. (2022) found evidence that the development of EF is driven by early language development and children's early language ability mediated the association between SES and children's EF skills, suggesting that SES disparity in EF can be explained in part by differences in children's early language ability. These findings also echo the results from Bernier et al. (2017) where the significant association between maternal mind-mindedness at 12 months and school readiness in kindergarten was mediated by children's language ability at age 2 and effortful control at age 3 and 4. The current dissertation did not include measures of children's early language ability, which limits the interpretations that may be drawn. Future studies on the developmental outcomes of mind-mindedness should incorporate early measures of children's language as a potential mechanism of influence. Moreover, it may be fruitful in future work to further characterize the mind-minded comments – for example, references towards traits, likes or dislikes, or desires versus references towards cognition, thoughts, or mind – to determine whether specific aspects of mind-minded comments may provide unique contributions in children's language, ToM and EF beyond overall references to an infant's internal state.

Parental Factors Associated with Mind-Mindedness

Socioeconomic Status

The current study contributes by examining the generalizability of mind-mindedness's correlates across a socioeconomically diverse sample. This study examined mind-mindedness in mothers with a wide range of education attainment and below median family income. Most

researchers acknowledge a lack of socioeconomic diversity in the study of mind-mindedness where samples tend to be drawn from mothers and fathers from highly educated middle to upper-middle class families (Bernier et al., 2010; Nikolic et al., 2022; Nyberg et al., 2021).

In the current study, maternal self-reported education collected during pregnancy was significantly associated with mind-mindedness at 17-months (but not prenatally or at 5-months) and also with children's behavioral EF and language at age 5, demonstrating the enduring effect of family SES on children's developmental outcomes (Bradley & Corwyn, 2002). On the other hand, maternal mind-mindedness across the three time points and children's developmental outcomes were not associated with family income in the current study. Of note, 93% of the mothers in the study reported family income less than the median income for the county in which the samples were drawn, potentially decreasing the variability in family income.

As this investigation did not set out to specifically compare mind-mindedness across differing SES groups, no definitive conclusion could be drawn on whether mind-mindedness may have a different magnitude in influence on children's language and self-control between lower and higher SES samples. In past research, family SES has been shown to moderate the effect of mind-mindedness and children's behavioral outcomes, such that higher maternal mind-mindedness was associated with a reduction in preschoolers' problem behavior only in families from lower SES backgrounds and not in families from higher SES backgrounds (Meins et al., 2013). In another study, greater maternal mind-mindedness was associated with a reduction in pre-adolescents' disruptive behavior in families classified as high in adversity but not in families classified as low in adversity (Hughes et al., 2017). There remains a possibility that the magnitude of effect for the longitudinal association between mind-mindedness and children's developmental outcomes, namely self-control and language, found in this study were more

pronounced as a result of the socioeconomically diverse or less diverse (i.e., lower SES) sample, although further replication and inclusion of a higher SES sample as comparison would be needed to examine the potential moderating role of family SES. The positive developmental outcomes afforded by the mind-minded caregiver in a socioeconomically diverse sample may provide a promising avenue for future development of interventions aimed at families at-risk for disruption in parent-child relationships.

Maternal Risk Condition

As the original study from which the current data were collected was intended to oversample first time mothers at-risk for parenting maladjustment (specifically problems in parenting and depression), care was made in the analyses to account for these potential maternal risk conditions. While the broader construct of parenting stress is negatively associated with mind-mindedness in the literature, with more mind-minded mothers reporting less parenting stress (average r = -.30; Demers et al., 2010; McMahon & Meins, 2012; Walker et al., 2012), in the current study, there was not an association between mind-mindedness and mothers' prenatal report of problems in parenting. Although similar to the family income measure, 96% of the mothers in the study scored in the elevated risk range for potential problems in parenting, possibly reducing the variability in the sample.

With regard to maternal depression, there was a negative association between mothers' prenatal self-reported depression and their postnatal 5 months mind-mindedness. Similar to past findings (Lok & McMahon, 2006; Schacht, 2013), mothers in the elevated risk range for depression made fewer mind-minded comments at 5-months compared to not-at-risk mothers, suggesting that the caregivers' capacity to infer their infants' internal state may be impaired if the caregiver experiences mood dysregulation which may impact the caregiver-child relationship

quality. However, interestingly, by 17-months, no significant association remained between prenatal depression and mind-mindedness such that mothers' prenatal depression status did not predict their overall mind-mindedness.

While no specific measure of postpartum depression was examined in the current dissertation, it is possible that the mothers in the current study who reported depressive symptoms during pregnancy were at most risk for developing postpartum depression, as one of the strongest predictors of postpartum depression is the experience of depression or anxiety during pregnancy (Friedman & Resnick, 2009). Further, given the onset of postpartum depression typically occurs within 6 months after birth (Friedman & Resnick, 2009), maternal mind-mindedness assessed at 5-months postpartum could have captured mothers who were currently experiencing postpartum depression, leading to a lower level of mind-minded comments. Future work with at-risk caregivers may consider obtaining measures of postpartum caregiver depression, particularly if the mind-mindedness assessment occurs within 6 months after birth, in order to examine or account for the potential effect of mood dysregulation on caregiver mind-mindedness and children's developmental outcomes.

Limitations

While limitations related to each specific aim such as the measurement of prenatal mind-mindedness and children's ToM, have been addressed throughout the discussion, some broader limitations of the current study should also be considered. First, while the analysis utilizes structural equation path analysis to assess the direct and indirect effect of early mind-mindedness on children's developmental outcomes, the relatively small sample size (Time 1 n = 104 to Time 4 n = 76) in the current study should be considered in the interpretation and applicability of the results. In the structural equation literature, Kline (2016) recommends 10 to 20 observations per

free parameter following the N:q rule where *q* is the number of free parameters. Following the N:q rule and using 10 observations per free parameter, my largest model – the mediation model with maternal education and depression as covariates with 20 free parameters (see Figure 16 for reference) – should have at least 200 participants. The aforementioned sample size requirement is applicable to the most complex model specified in my dissertation, thus a model with fewer free parameters in my study should be less constrained by the sample size. For example, my smallest model (see Figure 6 for reference) with 9 free parameters should have at least 90 participants as recommended by Kline (2016), slightly more comparable to the current sample size.

Second, while the measures of maternal mind-mindedness were longitudinal across three time points, all child outcome variables were cross-sectional and collected at one time point. Thus, while direct and indirect effects were observed, it is not possible to determine whether the contribution of maternal mind-mindedness to children's later EF may be through children's early language, early EF, both, or other unexamined variables (discussed next). Further, even if a serial mediation model were employed through earlier measures of children's language and EF, causality cannot be fully determined given the nonexperimental nature of the study design. That said, a rigorous serial mediation with multiple time points of measurement that controls maternal characteristics and tests a theoretically relevant causal pathway would still be beneficial in furthering our understanding of potential mechanisms in which mind-mindedness operates on children's self-control and language. For now, the current investigation provides initial support for the indirect role of children's language in the association between early mind-mindedness and children's later self-control.

Last, while the selection of the maternal and child study variables in the dissertation was informed by theory and past empirical findings, there may be other unexamined variables that could explain the influence of caregiver mind-mindedness on children's developmental outcomes. For example, given the shared theoretical origin between mind-mindedness and maternal sensitivity – Meins (1997) proposed that mind-mindedness is cognitive component of maternal sensitivity – the findings from my dissertation would be strengthened if early mind-mindedness contributes to children's later EF and language beyond mothers' general parenting competency (e.g., sensitivity). Additionally, while some maternal characteristics such as education and depression and child characteristics such as vocabulary were controlled in the analysis, no measure of early infant characteristics such as infants' general cognition or temperament were included. Thus, it cannot be ruled out that a reciprocal association may exist between mothers' proclivity to comment on their infants' internal states and the infant's expressiveness or responsiveness to outside engagement. In sum, opportunities remain to integrate additional caregiver and child variables to thoroughly examine the potential unique contribution of caregiver mind-mindedness and children's developmental outcome.

Future Directions

Based on the findings of the current dissertation and the limitations addressed in the previous section, there are several promising future directions that may further advance what is known about caregiver mind-mindedness. First, given the mixed findings in group level continuity and discontinuity in caregiver mind-mindedness across the first two years of life and the distinct methods (interactional vs. representational) used to measure mind-mindedness at each time point, a more thorough comparison and evaluation of the interactional (free play) and the representational (interview) measure of mind-mindedness across early childhood is

warranted. Utilizing the new interactional mind-minded coding scheme for older children developed by Fishburn and colleagues (2022), future research could examine how interactional mind-mindedness unfolds beyond the second year of life as children begin to advance in their cognitive, linguistic, and social understanding. This endeavor may also further determine whether caregiver mind-mindedness expresses its influence early on in infancy or if mind-minded discourse during the preschool years (e.g., when children are actively acquiring social understanding) is particularly crucial in advancing children's social understanding at a later age. Although laborious, an assessment that includes both interactional and representational methods across infancy through early childhood will allow for examination of the interchangeability of the two assessment methods and better characterize the longitudinal individual stability and group level continuity of the construct.

Second, as most studies generally focus on caregivers' mind-mindedness towards one target (e.g., the child), the consistency of mind-mindedness across different targets is typically not investigated such that the trait-like or relational quality of mind-mindedness cannot be fully characterized. In one study, Meins et al. (2014) extended mind-mindedness research into adult relationships and found that maternal mind-mindedness (n = 37 mothers) towards children is correlated with mind-mindedness when describing a spouse/romantic partner (r = .42), demonstrating stability across close relationships. The study also found that when adults (college students) were asked to describe a close friend/romantic partner, celebrity/politician, or still paintings, the adults showed greater mind-mindedness towards a romantic partner and best friend compared to the famous figures and still paintings. Adults' mind-minded descriptions of their best friend and romantic partner was significantly correlated (r = .42) while no correlation was found between the close friend and famous figures/paintings. While Meins et al. (2014) provided

initial support for some individual differences and stability in adult mind-mindedness, the argument for the relational rather than trait-like quality of mind-mindedness cannot be established solely based on adults' lack of mind-like descriptions toward famous figures and inanimate objects.

To further characterize the trait-like or relational quality of mind-mindedness, the representational interview can be assessed in the caregiver across a range of relationships that vary in relationship closeness, for example, a spouse or partner, another child, a sibling within the same family, an acquaintance, a distant family member, or a disliked person. Along this line of research, Gluck et al. (2021) found in a sample of 264 college students, a significant association between mind-minded comments about a close target (best friend or significant other) and an acquaintance ($r = .28$). Further, the association between a close target and a *disliked* target was also significant, albeit with a smaller effect ($r = .18$), suggesting a degree of stability in people's propensity to describe others' internal states beyond relationship closeness. Lastly, established explicit measures of relationship quality or closeness (e.g., time known, relationship closeness scale) can be employed to compare whether level of mind-mindedness differs based on self-report of relationship closeness.

Third, given the positive developmental outcomes such as children's language and self-control being associated with caregiver mind-mindedness, determining whether prenatal mind-mindedness is a meaningful construct is important because of the potential for early intervention aimed at improving future caregiver-infant relationship quality. The prenatal period continues to be an understudied area in the mind-mindedness literature although at the time of writing the discussion, two additional papers that focused on mind-mindedness in expectant parents were

published (Foley et al., 2022; Foley et al., in press) recognizing the importance of this understudied period.

Foley et al. (2022) administered a five-minute describe your child interview prenatally and 4 months post birth in 93 highly educated parents (>75% with undergraduate or higher degree) and found that prenatal (but not 4 months) mind-minded comments in mothers and fathers were associated with greater frequency of infant-initiated conversations at 7 months as assessed through a day long naturalistic recording. Further, only maternal (not paternal) parental mind-mindedness was associated with greater caregiver-initiated conversations at 7 months. Of note, mothers' representational mind-mindedness was correlated (r = .29) across the two time points while fathers were not and the authors did not specify whether any expectant parents were unable to provide a mentalistic description, although caregivers were asked to describe the child for a relatively long period of time (5 min). In another study that also utilized the five minute interview, Foley et al. (in press) found individual stability (rs between .19 to .34) and increase over time in group level mind-mindedness across four time points between pregnancy and 24 months in 192 highly educated couples (>77% with undergraduate or higher degree). The authors indicated that around 20% of expectant parents did not provide a mentalistic comment about their child, lower than the 50% found in the current study and Arnott and Meins (2008). These recent studies that include the prenatal period provide further insight into the use of the interview method to assess mind-mindedness across the transition to parenthood, and found evidence of individual stability across time and association with caregiver-infant conversation turn taking. Future research should compare whether the interactional and representational assessment during infancy are interchangeable and examine whether the representational measure of mind-

mindedness assessed prenatally and at infancy is associated with children's later developmental outcome.

Fourth, the positive association with children's EF and language found in the current study further elucidate the potential developmental benefits afforded by caregivers attuned to the internal state of their young children. However, the developmental pathways through which caregiver mind-mindedness towards their infants may directly or indirectly influence their later self-regulation is understudied and warrants further investigation. While the influence of caregiver mind-mindedness on children's language has been discussed extensively throughout the paper, there may be additional linguistic and behavioral variables associated with a caregiver attuned to the internal states of their infants that should be considered in future research. For example, future studies could examine whether caregivers who make more mind-minded comments may provide a generally language rich environment for their children (Zauche et al., 2016), engage in behavior that promotes children's autonomy (Lundy & Fyfe, 2016), and provide age-appropriate behavioral and verbal scaffolding during challenging situations (Meins et al., 2001).

Overall Discussion

The research aims of the current study have focused on the temporal characterization of maternal mind-mindedness across the transition to motherhood, examined its longitudinal association with children's theory of mind and executive functioning, and investigated potential mechanisms of influence in a sample of socioeconomically diverse first-time mothers. Three overarching findings emerged from the dissertation.

First, given the lack of individual stability in maternal mind-mindedness across pregnancy and early infancy, in addition to the fact that half of the expectant mothers did not

provide any mentalistic descriptions about their child, it can be posited that caregiver-child mind-mindedness may be particularly sensitive to change and fluctuation during the transition to motherhood and early infancy, suggesting some relational quality of the construct. On the other hand, parental representation of an unborn child's internal states may not be equivalent to their mind-minded representation after birth. That said, as the caregiver-child relationship lengthened and evolved post-birth, individual, and possibly, trait-like stability in mothers' mind-mindedness was seen between 5 and 17 months. While further research is needed across a longer period of time utilizing both representational and interactional measure, the current findings suggest that mind-mindedness is dynamic during the transition from pregnancy to early motherhood.

Second, mothers' mind-minded comments at 17 months significantly predicted children's executive functioning at age 5 as measured through a multi-method and multi-informant approach, and the effect persisted beyond controlling for maternal education and children's concurrent language ability. The current findings further extend the age beyond toddlerhood and early preschool years (Cheng et al., 2018; Regueiro et al., 2022; Senehi et al., 2018) at which caregivers' attunement to the internal states of their infants predicts children's self-regulatory behaviors. In addition, the inclusion of multiple child behavioral assessments and mothers' report of children's self-control captured greater variability in children's EF under different contexts, strengthening the current findings. Examination of potential mechanisms of influence revealed that, while children's concurrent language had an indirect effect on the association between mind-mindedness and children's EF, mothers' mind-mindedness continued to exert a direct effect on children's later EF. An additional analysis also revealed that the total number of comments mothers made towards their infants was not associated with children's language and did not predict children's EF outcome. Taken together, these findings suggest that mothers'

internal state comments that appropriately reflect the infants' current state of mind may provide linguistic and behavioral scaffolds to facilitate children's own later cognitive development, namely language and self-regulatory behaviors.

Third, in contrast to what has more commonly been found in other studies (e.g., Aldrich et al., 2021), mind-mindedness did not predict children's ToM in the present sample, although ceiling effect in one of my ToM tasks used may have limited the variability in children's performance such that meaningful individual differences could not be detected. An *a priori* and theory-informed investigation for potential indirect effects revealed that maternal mind-mindedness had an indirect effect on children's ToM via children's concurrent language ability (but not EF). The indirect effect via children's language partially replicates past findings (Meins et al., 2003; 2013), although in Meins et al. (2003; 2013) mind-mindedness had a direct effect on children's ToM beyond the indirect effect via children's concurrent language. The current finding suggests that a mind-minded caregiver may be particularly attuned to their child's vocal utterances, attempting to label, decode, and respond accordingly to the child, which may in turn promote children's language understanding and development. Supporting this finding, past research has found that mind-mindedness during infancy (Laranjo & Bernier, 2013; Meins et al., 2013) predicted children's expressive vocabulary at 2 years of age and children's language has been positively associated with later EF (Romeo et al., 2022) and ToM understanding (Shahaeian et al., 2022).

Overall Evaluation

A continued challenge that faces mind-mindedness researchers is how to characterize the nature of the mind-mindedness construct, such as its trait or relational quality, individual stability (vs. instability) and group level consistency (vs. inconsistency). Evidence from the current study

suggests, at least as measured through caregiver-child interaction, that there may be a degree of individual, possibly trait-like stability in how mothers attribute internal states towards their infants, yet the relational aspects of mind-mindedness cannot be ruled out based on the current study as no additional relationships were examined. It is possible that mind-mindedness may be applied towards specific relationships, such as the relationship between caregivers and their child(ren), akin to early attachment relationships. For example, in a small study with 32 mothers and their children (siblings from the same family), mothers who were mind-minded in their interaction with one sibling tended to be mind-minded in their interaction with their other child (Illingworth et al., 2016) and this association persisted across a 9 months period. While future research should expand on whether mind-mindedness is also applied towards individual with whom one has a personal relationship (e.g., spouse, close friend, parents or extended family members), the interchangeability between the representational (interview) and interactional (free play) method and/or an extension of the interactional assessment in older children and adults would be needed to allow for a more accurate comparison of mind-mindedness across differing relationships (the interchangeability between the two measures is discussed further below). Towards this aim, Fishburn and colleagues (2022) have developed a coding scheme to assess interactional mind-mindedness in older parent-child dyads that aimed to characterize mind-mindedness in terms of how parents approach interacting with their older children, rather than merely labeling their mental states.

The characterization of mind-mindedness is also further complicated by the different methods of assessment based on the age of the child – theoretically argued to be interchangeable (Meins et al., 2011; Meins et al., 2014), but have not been thoroughly tested empirically except for a few small sampled studies (Meins et al., 2003, Illingworth et al., 2016) – such that a

consistent longitudinal assessment of mind-mindedness from infancy to early childhood is not methodologically possible. Further, it is not clear whether an open-ended interview that asks caregivers "*Can you describe [child's name] for me*?" can be informative on the subtleties of caregivers' attunement of their child in a mental manner compared to the behavioral manifestation of attuned versus unattuned reference towards the oftentimes preverbal infants' internal states. Thus, caregivers do not necessarily need to take on the perspective of their child in the representational (interview) measure in contrast to the interactional (free play) measure where an attuned mind-minded interaction relies on accurate perception and response of the infant's perspective. While Meins (2013) would argue that caregivers' mind-minded behavioral manifestation is only possible through caregivers' representation of their infants as an intentional agent, it could also be proposed that a caregiver may be mind-minded in their offline representations of their child but at the same time may not be mind-minded during an online interaction with the child. Thus, the validity of the representational measure and its interchangeability with the interactional measure remains understudied and further research may determine whether representational mind-mindedness may be a distinct construct separate from attuned interactional mind-mindedness.

Despite the methodological limitation of the representational measure, the interactional (free play) assessment of mind-mindedness used in infancy, along with the potential to examine accuracy in caregivers' attunement to the infants' internal state, appears to be a promising measure that captures individual differences in caregivers' representation of and interaction towards their infant as an intentional agent early on in development. While it can be argued that the criterion for accuracy rests solely on the researcher coding the interaction with very little opportunity for validation beyond interrater reliability, the occurrence of non-attuned mental

comments have consistently been low across studies, including in the current study that oversampled for at risk mothers (mean frequency of non-attuned comments = 1.21 and 1.45 at 5- and 17-months respectively; Table 1), and does not appear to be consistent within individuals over time (r = .13, p = .28), unlike attuned mental comments which has shown a certain degree of individual stability. This is not to dismiss the importance of unattuned comments as an unusually high number of unattuned comments would be detrimental to the infants if they continually encounter a caregiver who is misattributing their internal states, however this occurrence appears to be infrequent in typically developing low-risk samples. In conclusion, the interactional assessment appears to be a promising indicator of early caregiver mind-mindedness and has demonstrated significant longitudinal association with children's developmental outcomes, namely social understanding (Devine & Hughes, 2016), self-regulation (Bernier et al., 2010; Cheng et al., 2018; current study), and language (current study; Laranjo & Bernier, 2013).

The ability to interview expectant parents about their thoughts on their unborn child may provide an opportunity to examine the emergence of mind-mindedness and the development of prenatal intervention. However, more research is needed to better characterize prenatal mind-mindedness, in particular considering the fact that 50% of expectant caregivers in the current study did not provide any mentalistic comments when describing their unborn child. Moreover, the current study and also Arnott and Meins (2008) did not find a significant association between mental comments made during the prenatal interview and caregivers' interactional mind-mindedness with their infants postpartum. While more recent studies have indicated stability in caregivers prenatal and postnatal representational mind-mindedness (Foley et al., in press) along with some evidence of association between prenatal mind-mindedness and infants' conversation turn-taking behavior (Foley et al., 2022), these studies were all from highly educated parents

(over 75% with undergraduate or higher degree) and utilized a lengthy 5 min describe your child interview prenatally and after birth as its measure of representational mind-mindedness. Thus, it remains unanswered whether prenatal representational mind-mindedness is equivalent to postnatal mind-mindedness, in particular postnatal interactional mind-mindedness.

Conclusion

In closing, mothers' propensity to represent and treat their young children with reference to their internal states, in particular as assessed by their attuned mental comments during free play interaction, appeared stable within individuals across infancy and toddlerhood. Individual differences in mothers' appropriate mind-minded comments during toddlerhood was also associated with children's later self-control (but not social understanding) in a socioeconomically diverse sample. Children's concurrent language ability emerged as a potential indirect pathway of influence in the association between mind-mindedness and children's developmental outcomes (self-control and social understanding). On the other hand, questions remain about whether expectant mothers' mentalistic descriptions of their infants during a prenatal interview may be akin to their mind-minded interaction towards their infants post birth, or whether the two methods of mind-mindedness assessments (interview vs. free play) are interchangeable. The current study extends our understanding of the mind-mindedness construct, generalizes mind-mindedness' developmental influence to a more socioeconomically diverse sample, and raises fruitful paths for future research and potential intervention.

APPENDIX A

CHILDREN'S BEHAVIOR QUESTIONNAIRE SHORT FORM - EFFORTFUL CONTROL DIMENSION

Instructions: Please read carefully before starting:

On the next pages you will see a set of statements that describe children's reactions to a number of situations. We would like you to tell us what your child's reaction is likely to be in those situations. There are of course no "correct" ways of reacting; children differ widely in their reactions, and it is these differences we are trying to learn about. Please read each statement and decide whether it is a "true" or "untrue" description of your child's reaction within the past six months. Use the following scale to indicate how well a statement describes your child:

Circle #	If the statement is:
l	extremely untrue of your child
2	quite untrue of your child
3	slightly untrue of your child
4	neither true nor false of your child
5	slightly true of your child
6	quite true of your child
7	extremely true of your child

If you cannot answer one of the items because you have never seen the child in that situation, for example, if the statement is about the child's reaction to your singing and you have never sung to your child, then circle NA (not applicable).

Please be sure to circle a number or NA for every item.

Attentional Focusing

16R. When practicing an activity, has a hard time keeping her/his mind on it.
21R. Will move from one task to another without completing any of them.
62. When drawing or coloring in a book, shows strong concentration
71. When building or putting something together, becomes very involved in what s/he is doing, and works for long periods.
84R. Is easily distracted when listening to a story.
89. Sometimes becomes absorbed in a picture book and looks at it for a long time.

Inhibitory Control

38. Can wait before entering into new activities if s/he is asked to.

45. Prepares for trips and outings by planning things s/he will need.
53R. Has trouble sitting still when s/he is told to (at movies, church, etc.).
67. Is good at following instructions.
73. Approaches places s/he has been told are dangerous slowly and cautiously.
81. Can easily stop an activity when s/he is told "no."

Low Intensity Pleasure
26. Enjoys taking warm baths.
39. Enjoys "snuggling up" next to a parent.
57. Enjoys just being talked to.
65. Enjoys looking at picture books.
72. Likes being sung to.
76. Likes the sound of words, as in nursery rhymes.
86. Enjoys sitting on parent's lap.
94. Enjoys gentle rhythmic activities, such as rocking or swaying.

Perceptual Sensitivity
5. Notices the smoothness or roughness of objects s/he touches.
13. Notices it when parents are wearing new clothing.
24. Seems to listen to even quiet sounds.
32. Comments when a parent has changed his/her appearance.
47. Is quickly aware of some new item in the living room.
83R. Doesn't usually notice odors, such as perfume, smoke, cooking, etc.

APPENDIX B

ASSESSMENT OF CHILDREN'S LANGUAGE - NEPSY LANGUAGE SUBSCALE

Body Part Naming

Discontinue Rule
4 consecutive scores of 0

	Item Point to... (DO NOT SAY)	Response	Item Repeated Using Child's Body	Score
3–4	1. ear		Y N	0 1 2
	2. nose		Y N	0 1 2
	3. chin		Y N	0 1 2
	4. elbow		Y N	0 1 2
	5. eyebrow		Y N	0 1 2
	6. knee		Y N	0 1 2
	7. shoulder		Y N	0 1 2
	8. cheek		Y N	0 1 2
	9. forehead		Y N	0 1 2
	10. ankle		Y N	0 1 2
	11. heel		Y N	0 1 2

Qualitative Observations

○ Poor Articulation

Total Score
(Maximum = 22)

Phonological Processing

Core

Discontinue Rule
5 consecutive scores of 0

	Item (Say)	Correct Response	Response	Score
3–4	1. bi—ke	c		0 1
	2. tele-	a		0 1
	3. -indow	b		0 1
	4. ki—tchen	a		0 1
	5. -oar	c		0 1
	6. -lip	c		0 1
	7. -ake	a		0 1

Item (Say)	Correct Response	Response	Score
8. -og	a		0 1
9. -able	b		0 1
10. -ask-	c		0 1
11. -oast-	b		0 1
12. -ar-	b		0 1
13. -ap-	b		0 1
14. -ick-	c		0 1

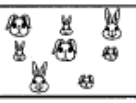
Qualitative Observations

Asks for Repetition (tally)

Total Score
(Maximum = 14)

Comprehension of Instructions

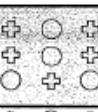
Discontinue Rule
4 consecutive scores of 0

	Item	Child's Response	Score
3–4	1. Show me...a big bunny		0 1
	2. ...a little bunny		0 1
	3. ...a blue bunny		0 1
	4. ...a happy bunny		0 1
	5. ...a sad bunny		0 1
	6. ...a yellow bunny		0 1
	7. ...a bunny that is big and blue		0 1
	8. ...a bunny that is big and yellow		0 1
	9. ...a little sad bunny		0 1
	10. ...a little happy bunny		0 1
	11. ...a bunny that is little and blue		0 1
	12. ...a bunny that is big and blue and happy		0 1
	13. ...a bunny that is little and yellow and sad		0 1

Subtotal
(Items 1–13)

Qualitative Observations

Asks for Repetition
(tally)

Item	Child's Response	Score
Prerequisite Items Point to...a circle. Point to...a cross.		
14. Point to...the blue cross and the yellow cross		0 1
15. ...the white one and a circle		0 1
16. ...one that is not a cross and not blue or yellow		0 1
17. ...a shape that is not a circle, but is yellow or black		0 1
18. ...a blue circle last and a black cross first		0 1
19. ...all the crosses and then to a red circle		0 1
20. ...two red ones, but first to a yellow cross		0 1
21. ...a white cross after you have pointed to a red shape under a blue one		0 1
22. ...the black circle and the third shape in the second row		0 1
23. ...the circle below the white cross and the shape above the black circle		0 1
24. ...a shape that is above one cross and beside another cross		0 1
25. ...a shape that is between two crosses and above a circle		0 1
26. ...a cross that is to the left of a circle and underneath a cross		0 1
27. ...the second cross in the first row, but first to a blue circle		0 1
28. ...a cross, the black circle, and the red cross		0 1

Qualitative Observations

Items 1–13 (from previous page)	+	Items 14–28 (tally)	=	Total

Asks for Repetition

Total Score (Maximum = 28)

Note: Include points for items on previous page.

APPENDIX C

ASSESSMENT OF CHILDREN'S EXECUTIVE FUNCTION

NEPSY Statue

Say,

"***Let's see if you can stand like a statue holding a flag".***

Model the position and position the child if necessary. The child should stand with feet slightly apart, **the left arm on the table or chair** to aid balance, and the right arm bent at the elbow so it is perpendicular to the body. The hand is in a fist as if holding a flag.

Say,

"***When I tell you to begin, I want you to stand completely still like a statue holding a flag with your eyes closed. Don't even move your fingers. Don't move at all, don't open your eyes, and don't say anything- no matter what- until I say "Times Up!" Ready? Close your eyes. Keep them closed. Begin."***

Administration

If the child moves, open his or her eyes, or vocalizes, remind the child gently and briefly, saying,

"Eyes closed" or ***"Stay still"***

Involuntary coughing, silent smiling, and small movements of the fingers are not considered errors.

Statue

Time Limit
75 seconds

Discontinue Rule
Administer the entire subtest.

Distractor	Interval	Child's Actions (Errors) None	Body Movement	Eye Opening	Vocalization	Number of Actions Errors → Score	Interval Score
	1"–5"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
Drop pencil →	6"–10"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	11"–15"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
Cough once →	16"–20"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	21"–25"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
Knock on table twice →	26"–30"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	31"–35"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	36"–40"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	41"–45"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
Say "Ho Hum!" →	46"–50"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	51"–55"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	56"–60"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	61"–65"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
	66"–70"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2
Say "Time's up!" →	71"–75"	N	Y	Y	Y	3→0, 2→0, 1→1, 0→2	0 1 2

Total Score
(Maximum = 30)

Tower of Hanoi

Warm-up with 2 circles
(Set up the 2 circle Tower of Hanoi, **horizontally in front of the child**, with C's tower on the **left peg**.)

"O.K. Now we're going to play a game where we pretend that these wooden circles are monkeys. This small circle is a boy monkey (point to small circle) ***and this large circle is a daddy monkey*** (point to large circle). ***See the boy monkey is sitting on the daddy's back. And we're going to pretend that these pegs*** (point to pegs) ***are trees. Now you know that monkeys like to jump from tree to tree, right? Well, these monkeys love to jump from tree to tree. But only one monkey can jump at a time and the daddy monkey can never go on the back of the boy monkey, because you know what would happen? The daddy is much heavier than the boy and the daddy monkey would smush the boy monkey and we don't want that to happen, do we? But the boy monkey can go on the back of the daddy monkey just like he is now*** (point to circles), ***because the boy is much smaller than the daddy. Now there is water all around these trees, so the monkeys always have to stay in the trees and can only jump from one tree to another and never into the water."***

Rule #1-- Identification

"So would you like to play the monkey jumping game? O.K. Can you point to the boy monkey?"

____CORRECT
"That's right"!

____INCORRECT
"Whoops! That monkey is the daddy monkey. Can you point to the boy monkey?"
# of tries until correct_____

"Can you point to the daddy monkey?"

____CORRECT
"That's right!"

____INCORRECT
"Whoops! That monkey is the boy monkey. Can you point to the daddy monkey?"
# of tries until correct_____

Rule #2 – Jumping Rules

"Now watch, the boy monkey is going to jump to this tree, like this. (move small circle to second peg) ***Remember, the boy monkey can go on the daddy's back, but daddy monkey can never go on the boy's back. Now, where should the daddy jump?"***

____CORRECT

"That's right, cause if he moved here (point to second peg)***, then he would smush the boy monkey and we don't want that to happen do we? No way!"***

____INCORRECT

"Whoops! Oh no, the boy monkey is being smushed. (remove large circle and keep in hand) ***Remember that the boy can go on the daddy's back, but the daddy can never go on the boy's back.*** (Replace large circle on left peg) ***Now where should the daddy jump?"***

# of tries until correct_____

LEVEL 1— 2 disks, ONE MOVE

(Bring out **E's tower with circles stacked on right peg**. Place parallel to C's board.)

"Now look, I've got some just like yours. (point to E's) ***Did you know that monkeys like to copy each other? Well, your monkeys are copycat monkeys*** (point to C's***) and they always want to look just like my monkeys*** (point to E's)***. Remember to only move your monkeys after I finished talking. So, can you make your monkeys look just like my monkeys, so that your monkeys are sitting in this tree (***point to C's right peg***), just like my monkeys are sitting in this tree*** (point to E's right peg)***."***

Indicate Trial #

____ ____CORRECT # of moves (1)

"That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!"

____ ____COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)

"***Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again."***

INCORRECT (remind of rule broken and circle)

____ ____ ***"Remember, only one monkey can jump at a time."***

____ ____ ***"Remember, the monkeys need to be in the trees, they can't swim in the water."***

____ ____ ***"Whoops! Now the boy monkey is being smushed by the daddy monkey. Remember, the boy monkey can be on the back of the daddy monkey, but the daddy monkey can never be on the back of the boy monkey."***

____ ____ ***"Whoops! Your monkeys don't look exactly the same as mine. See,*** (state why)."

"This one is a hard one. Let's try again."

TRIAL 1: PASS (go to next level) FAIL (repeat)

TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 2 – 2 disk, TWO MOVE

(Take off C's circles one at a time and place in hands.) "O.K., now I'm going to move your monkeys back over to this tree. (place one at a time from hand, with large disk on bottom on C's left peg). ***Let's say that the boy monkey jumps to this tree*** (move small circle to middle peg). ***Now remember, your monkeys*** (point to C's board) ***like to copy my monkeys*** (point to E's board) ***Can you make your monkey's look exactly like my monkeys?"***

Indicate Trial #

____ ____CORRECT # of moves (2)

"That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!"

____ ____COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)

"Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again."

INCORRECT (remind of rule broken and circle)

____ ____ "***Remember, only one monkey can jump at a time.***

____ ____ ***Remember, the monkeys need to be in the trees, they can't swim in the water.***

____ ____ ***Whoops! Now the boy monkey is being smushed by the daddy monkey. Remember, the boy monkey can be on the back of the daddy monkey, but the daddy monkey can never be on the back of the boy monkey.***

____ ____ ***Whoops! Your monkeys don't look exactly the same as mine. See,*** (state why)."

"This one is a hard one. Let's try again."

TRIAL 1: PASS (go to next level) FAIL (repeat)
TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 3 – 2 disk, THREE MOVE

(Take off C's circles one at a time and place in hands.) ***"O.K., now I'm going to move your monkeys back over to this tree.*** (place one at a time from hand, with large disk on bottom on C's left peg). ***O.K., now can you make your monkeys look exactly like my monkeys?"***

Indicate Trial #

____ ____CORRECT # of moves (3)

"That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!"

____ ____COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)

"Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again."

INCORRECT (remind of rule broken and circle)

____ ____ ***"Remember, only one monkey can jump at a time.***

____ ____ ***Remember, the monkeys need to be in the trees, they can't swim in the water.***

____ ____ ***Whoops! Now the boy monkey is being smushed by the daddy monkey. Remember, the boy monkey can be on the back of the daddy monkey, but the daddy monkey can never be on the back of the boy monkey.***

____ ____ ***Whoops! Your monkeys don't look exactly the same as mine. See,*** (state why)."

"This one is a hard one. Let's try again."

TRIAL 1: PASS (go to next level) FAIL (repeat)
TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 4 – 3 disk, TWO MOVE

(Take off C's circles one at a time and place in hands.) ***"Now look who wants to play. This is the new little baby sister monkey.*** (Take out tiny circle and place on top of E's other two circles). ***Isn't she tiny? Since she's so tiny, the boy monkey can't jump on her back, cause he would smush her, and the daddy monkey can't jump on her back, cause then he would really smush her. But the baby sister monkey can jump on the daddy's back and on the brother's back. Look, you have a baby sister monkey too. Now let's pretend that the daddy monkey is sitting in this tree*** (place large circle on right peg) ***and the boy monkey is sitting in this tree*** (place small circle on middle peg) ***and the baby monkey is sitting in this tree*** (place tiny circle on left peg). ***Now remember, your monkeys are copycat monkeys and they like to copy my monkeys. Can you make your monkeys look exactly like my monkeys?"***

Indicate Trial #

____ ____CORRECT # of moves (2)

"That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!"

____ ____COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)

"Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again."

INCORRECT (remind of rule broken and circle)

____ ____ ***"Remember, only one monkey can jump at a time."***

____ ____ ***"Remember, the monkeys need to be in the trees, they can't swim in the water."***

____ ____ ***"Whoops! Now the boy monkey is being smushed by the daddy monkey. Remember, the boy monkey can be on the back of the daddy monkey, but the daddy monkey can never be on the back of the boy monkey."***

____ ____ ***"Whoops! Now the baby monkey is being smushed by the boy monkey. Remember, the baby monkey can be on the back of the boy monkey, but the boy monkey can never be on the back of the baby monkey."***

____ ____ ***"Whoops! Your monkeys don't look exactly the same as mine. See***, (state why)."

"This one is a hard one. Let's try again."

TRIAL 1: PASS (go to next level) FAIL (repeat)
TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 5 – 3 disk, THREE MOVE

(Take off C's circles one at a time and place in hands.) ***" O.K., let's do another one. Let's pretend that the daddy monkey is sitting in this tree*** (place large circle on right peg) ***and the boy monkey is sitting in this tree*** (place small circle on middle peg) ***and the baby sister monkey is sitting on the back of the boy monkey*** (place tiny circle on top of small circle). ***Now, can you make your monkeys look exactly like my monkeys?"***

Indicate Trial #
____ ____CORRECT # of moves (3)
"That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!"

____ ____COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)
"Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again."

INCORRECT (remind of rule broken and circle)
____ ____ "***Remember, only one monkey can jump at a time."***
____ ____ ***"Remember, the monkeys need to be in the trees, they can't swim in the water."***
____ ____ ***"Whoops! Now the boy monkey is being smushed by the daddy monkey. Remember, the boy monkey can be on the back of the daddy monkey, but the daddy monkey can never be on the back of the boy monkey."***
____ ____ ***"Whoops! Now the baby monkey is being smushed by the boy monkey. Remember, the baby monkey can be on the back of the boy monkey, but the boy monkey can never be on the back of the baby monkey."***
____ ____ ***"Whoops! Your monkeys don't look exactly the same as mine. See,*** (state why)."

"This one is a hard one. Let's try again."

TRIAL 1: PASS (go to next level) FAIL (repeat)
TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 6 – 3 disk, FOUR MOVE

(Take off C's circles one at a time and place in hands.) ***"All right, let's do another one. Let's pretend that the daddy monkey is sitting in this tree*** (place large circle on left peg) ***and the boy monkey is sitting in this tree*** (place small circle on middle peg) ***and the baby sister monkey is sitting on the back of the boy monkey*** (place tiny circle on top of small circle)***. Now can you make your monkeys look exactly like my monkeys?"***

Indicate Trial #
____ ____CORRECT # of moves (4)
"That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!"

____ ____COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)
"Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again."

INCORRECT (remind of rule broken and circle)
____ ____ "***Remember, only one monkey can jump at a time."***
____ ____ ***"Remember, the monkeys need to be in the trees, they can't swim in the water."***
____ ____ ***" Whoops! Now the boy monkey is being smushed by the daddy monkey. Remember, the boy monkey can be on the back of the daddy monkey, but the daddy monkey can never be on the back of the boy monkey."***
____ ____ ***"Whoops! Now the baby monkey is being smushed by the boy monkey. Remember, the baby monkey can be on the back of the boy monkey, but the boy monkey can never be on the back of the baby monkey."***
____ ____ ***"Whoops! Your monkeys don't look exactly the same as mine. See,*** (state why)."

"This one is a hard one. Let's try again."
TRIAL 1: PASS (stop) FAIL (repeat)
TRIAL 2: PASS (stop) FAIL (stop)

"OK! We're all done with this game. You're doing really well!"
TOTAL NUMBER OF TRIALS: ____ HIGHEST LEVEL ACHIEVED: ____

Working Memory

Ceiling Rule: If the examinee receives ***2 or fewer points*** on a testlet, discontinue testing for that subtest. Continue to administer testlets for the remaining subtests until each subtest meets the ceiling rule.

Working Memory Level 1

Directions
Place the Item book in the upright easel position
Sample
Say, **Listen, and say what I say. Ready?**
Say, **Good dog.**

If the examinee responds correctly, circle P (pass) for this item.

If the examinee does not respond or responds incorrectly, say, **I said, "Good dog." You should say, "Good dog."** Circle F (fail) for this item.

Sample: **F P**

Say**, Let's try another one**. Read each item clearly and at a steady rate, dropping your voice at the end of each sentence. Do not repeat items.

1. **Drink milk.**
2. **Trees are big.**
3. **Lee has two dogs.**

Raw Score WM 1**: _____**

Score
Score 2 points if the examinee repeats the sentence perfectly.
Score 1 point if the examinee makes a single error.
Score 0 points if the examinee makes two or more errors.

Errors include word changes, omissions, or additional words. Also count changes in tense, person, or singular/plural as errors. Do not count contractions (such as *isn't* for *is not*) or poor articulations (such as *stwing* for *string*) as errors.

Working Memory Level 2

Directions
Place the Item Book in the upright easel position.

Sample
Say, **Listen and say what I say. Ready?**
Say, **Cars go fast.**

If the examinee responds correctly, circle P (pass) for this item.

Sample: **F P**

If the examinee does not respond or responds incorrectly, say, **I said, "Cars go fast." You should say, "Cars go fast."** Circle F (fail) for this item.

Say, **Let's try another one**. Read each item clearly and at a steady rate, dropping your voice at the end of each sentence. Do not repeat items.

1. **The circus came to town.**
2. **The little child would not stop crying.**
3. **Kim did not want to leave before the movie was over.**

Raw Score WM 2: **_____**

Score
Score 2 points if the examinee repeats the sentence perfectly.
Score 1 point if the examinee makes a single error.

Score 0 points if the examinee makes two or more errors.

Errors include word changes, omissions, or additional words. Also count changes in tense, person, or singular/plural as errors. Do not count contractions (such as *isn't* for *is not*) or poor articulations (such as *stwing* for *string*) as errors.

Working Memory Level 3

Directions

Say, **I will ask you two questions. I want you to remember the last word in each question in order. Let's practice**.

Sample

Accept either a Yes or No answer because the responses to the questions are not scored.

1. Say, **Do children drink milk?**
2. Say, **Do you like cookies?**
3. Say, **In order, tell me the last word in each question.**

If the examinee responds correctly, circle P (pass) for this item.

If the examinee does not respond, responds incorrectly to the last-word part of the sample, or does not seem to understand, say, **Remember I asked "Do children drink milk?" and "Do you like cookies?" The last word in the first question was milk, and the last word in the second question was cookies. So you would say "milk" and "cookies," in that order**. Circle F (fail) for this item.

Sample: **F** **P**

Correct Response: milk, cookies.

Say, **Let's try another one.**

Directions

Accept any answer to each of the questions. Only the responses to **1c, 2c,** and **3c** are scored.

1a. Say, **Do birds fly?**
1b. Say, **Do babies cry?**
1c. Say, **In order, tell me the last word in each question.**

2a. Say, **Do cars go fast?**
2b. Say, **Do dogs bark?**
2c. Say, **In order, tell me the last word in each question.**

3a. Say, **Do horses talk?**
3b. Say, **Do rocks float?**
3c. Say, **In order, tell me the last word in each question.**

Raw Score WM 3:_____

Score

For 1c, 2c, and 3c, score 2 points if the examinee recalls the exact words correctly and in the correct sequence.
Score 1 point if the examinee recalls the exact words in the incorrect sequence or makes one mistake (omission or wrong word).
Score 0 points for a response that has 2 or more mistakes.

Grass/Snow Receptive Stroop Task

Use hand template centered below white and green cards (page with hand shapes, instruct child to place his/her hands on top of the hand template).

"When it's summer time, there is grass. What color is grass? _____. Right! Grass is green like this card." Point to green card.

"When it's winter time, there is snow. What color is snow? _____. Right! Snow is white like this card." Point to white card.

"This is another silly game. When I say GRASS you point to the white card *(point)* ***and when I say SNOW you point to the green card*** (point)."

"Let's practice. Put your hands on the Hands Page. After you point, put your hands back on the Hands".

"SNOW" + green / - white

"GRASS" + white/ - green

"Okay, let's do the rest of these silly cards:" *START stopwatch*

What you say	Correct Answer	Score
G	S	
S	G	
S	G	
G	S	
S	G	
G	S	
S	G	
G	S	
G	S	
S	G	
G	S	
S	G	
S	G	
G	S	

S	G	
G	S	

Total Correct: _____/16

Score **first** responses, even if they change their mind!

Day/Night Expressive Stroop Task

Mini conversation before showing cards. Say,
"***During the day, the sun is out. It is bright and sunny during the day. Night is different. When it is night, the moon is out. There are stars at night and it is dark. During the day there is a sun in the sky and at night there is a moon in the sky".***

***"We will use these cards for a silly game*.** Show sun and moon cards.

When I show you this card (moon) ***you have to say "DAY."***

When I show you this card (sun) ***you have to say "NIGHT.""***

"Let's practice."

Show moon + Day/ - Night

Show sun + Night/ - Day

"Okay, let's do the rest of these silly cards." Random shuffle per child, START stopwatch, show 1st card

Total correct: ____/16 Time:_____
Score **first** responses, even if they change their mind!

Dimensional Change Card Sort

* Ensure that the card is placed *face down* in the appropriate tray, turning the card over if necessary.
* Respond to children in a neutral, non-evaluative, non-corrective fashion (e.g., do not say, "Okay").
* Ensure that the same type of test card, e.g., a red rabbit, is not selected on more than 2 consecutive trials

Part 1. Demonstration Phase: Place the two sorting trays within reaching distance of the child. Move your chair so you are both viewing the display panels. Affix target cards to the display panels behind the sorting trays (blue rabbit, red boat). Say while pointing appropriately, ***"Here's a blue rabbit and here's a red boat."***

"Now, we're going to play a card game. This is the color game. In the color game, all the blue ones go here (point to blue rabbit tray) ***and all the red ones go there*** (point to red boat tray)*."*

- Sort one type of test card (e.g., a blue boat) by color, saying, ***"See, here's a blue one. So it goes here."*** Place it face down in the blue boat tray.

"If it's blue it goes here, but if it's red it goes there." Point appropriately.

- Show children the other type of test card (e.g., a red rabbit),
"Now here's a red one. Where does this one go?"
- If children sort it correctly**:** ***"Very good. You know how to play the color game."***
- If they point: ***"Can you help me put this red one down?"***
- If children sort incorrectly: ***"No, this one's red, so it has to go over here in the color game. Can you help me put this red one down?"***

*Make sure cards are put face down, turn them if necessary.

Part 2: Pre-switch Phase (6 trials):

- On the first pre-switch trial say,
"Now it's your turn. So remember, if it's blue it goes here, but if it's red it goes there."
- On each trial randomly select a test card, (show it to children, and label it by the relevant dimension only. ***"Here's a red/blue one. Where does it go?"***
- respond in neutral way, do not say "Okay," make sure the same type of test card is not selected on more than two consecutive trials
- Whether or not children sort correctly say,
"Let's do another one" or "Let's do it again," *or* ***"How about another one?"*** then say,***"If it's blue it goes here, but if it's red it goes there."***
Show the card to children, label it by the relevant dimension only, and ask children where it goes:

Pre-switch	Color/Shape
1	correct/incorrect
2	correct/incorrect
3	correct/incorrect
4	correct/incorrect
5	correct/incorrect
6	correct/incorrect

Part 3: Post-switch Phase (6 trials):

"Now we're going to play a new game. We're not going to play the color game anymore. We're going to play the shape game. In the shape game, all the rabbits go here and all the boats go there. Remember, if it's a rabbit, put it here, but if it's a boat put it there. Okay?"

* Do not remove the target cards or the cards that were sorted during the pre-switch phase, and do not pause between pre- and post-switch phases. Select a test card, show the card to children, label it by the relevant dimension only, and ask, **"Where does this one go?"**
* Whether or not children sort correctly, simply say, **"Let's do another one"**

Post-switch	Color/Shape
1	correct/incorrect
2	correct/incorrect
3	correct/incorrect
4	correct/incorrect
5	correct/incorrect
6	correct/incorrect

* Children need to sort 5 or more out of 6 post-switch trials correctly in order to pass. Analyses of post-switch performance are usually based only on children who sort 5 or more out of 6 pre-switch trials correctly.

Part 4: Border version (12 trials)

Remove the cards Keep 4 red rabbits and 3 blue boats, and combine them with the border cards.

"Ok, you played really well. Now I have a more difficult game for you to play. In this game, you sometimes get cards that have a black border around it like this one (*show a red rabbit with a border).* ***If you see cards with a black border, you have to play the color game. In the color game, red ones go here and blue ones go there (****point to appropriate trays).* ***This card's red, so I'm going to put it right there (****place it face down in appropriate tray).* ***But if the cards have no black border, like this one (****show them a red rabbit without a border),* ***you have to play the shape game. In the shape game, if it's a rabbit, we put it here, but if it's a boat, we put it there (****point to appropriate trays).* ***This one's a rabbit, so I'm going to put it right here*** *(put it face down in the appropriate tray).* ***Ok? Now it's your turn.***

On each trial, repeat the rules. "If there's a border, play the color game. If there's no border, play the shape game.* Say, "*here's a (border/no border), where does this go?"

When child has sorted, say, ***"Let's do another".***

Border Trial	Border/no border
1	correct/incorrect
2	correct/incorrect
3	correct/incorrect
4	correct/incorrect
5	correct/incorrect
6	correct/incorrect
7	correct/incorrect
8	correct/incorrect
9	correct/incorrect
10	correct/incorrect
11	correct/incorrect
12	correct/incorrect

APPENDIX D

CHILDREN'S THEORY OF MIND TASKS

Diverse Desires

Materials: Toy figure of an adult, sheet of paper with pictures of a carrot and a cookie.

"Here's Mr. Jones. It's snack time, so Mr. Jones wants a snack to eat. Here are two different snacks: a carrot and a cookie. Which snack would you like best? Would you like a carrot or a cookie best?"

(a) Carrots _____ Cookie _____

IF child chooses the **cookie**: "***Well, that's a good choice, but Mr. Jones really likes carrots. He doesn't like cookies. What he likes best are carrots."***
IF child chooses the **carrot**: "***Well, that's a good choice, but Mr. Jones really likes cookies. He doesn't like carrots. What he likes best are cookies."***

Target Question*:* ***"So now, it's time to eat. Mr. Jones can only choose one snack, just one. Which snack will Mr. Jones choose? A carrot or a cookie?"***

(b) Carrots ---_____ Cookie _____

Correct (answer for (b) opposite from answer to (a)): Y/N

Contents False Belief

Materials: Band-Aid box with plastic toy pig inside.

"Here's a Band-Aid box. What do you think is inside the Band-Aid box?"
Open Band-Aid box.
"Let's see…it's really a pig inside!"
Close Band-Aid box.
"Okay, what is in the Band-Aid box?"

Answer: _____

Take out toy boy.
"***Peter has never seen inside this Band-Aid box. Now here comes Peter. So, what does Peter think is in the box? Band-Aids or a pig?"***

Band-Aids _____ Pig _____

"Did Peter see inside the box?" Y/**N**
Correct (Band-Aids, No): Y/N

REFERENCES CITED

Ainsworth, M. D., Bell, S. M., & Stayton, D. J. (1974). Infant-mother attachment and social development: Socialization as a product of reciprocal responsiveness to signals. *The integration of a child into a social world*, *1*, 9-135.

Ainsworth, M. D. S., Bell, S. M., & Stayton, D. J. (1972). Individual differences in the development of some attachment behaviors. *Merrill-Palmer Quarterly of Behavior and Development*, *18*(2), 123-143.

Aldrich, N. J., Chen, J., & Alfieri, L. (2021). Evaluating associations between parental mind-mindedness and children's developmental capacities through meta-analysis. *Developmental Review*, *60*, 100946. https://doi.org/10.1016/j.dr.2021.100946

Arnott, B., & Meins, E. (2008). Continuity in mind-mindedness from pregnancy to the first year of life. *Infant Behavior & Development*, *31*(4), 647–654. https://doi.org/10.1016/j.infbeh.2008.07.001

Astington, J. W., & Jenkins, J. M. (1999). A longitudinal study of the relation between language and theory-of-mind development. *Developmental Psychology*, *35*(5), 1311–1320. https://doi.org/10.1037/0012-1649.35.5.1311

Avison, W. R., Turner, R. J., & Noh, S. (1986). Screening for problem parenting: Preliminary evidence on a promising instrument. *Child Abuse & Neglect*, *10*(2), 157–170. https://doi.org/10.1016/0145-2134(86)90077-3

Barreto, A. L., Fearon, R. M. P., Osorio, A., Meins, E., & Martins, C. (2016). Are adult mentalizing abilities associated with mind-mindedness? *International Journal of Behavioral Development*, *40*(4), 296–301. https://doi.org/10.1177/0165025415616200

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development*, *81*(1), 326–339. https://doi.org/10.1111/j.1467-8624.2009.01397.x

Bernier, A., McMahon, C. A., & Perrier, R. (2017). Maternal mind-mindedness and children's school readiness: A longitudinal study of developmental processes. *Developmental Psychology*, *53*(2), 210–221. https://doi.org/10.1037/dev0000225

Bornstein, M. H., Putnick, D. L., & Esposito, G. (2017). Continuity and stability in development. *Child Development Perspectives*, *11*(2), 113-119. https://doi.org/10.1111/cdep.12221

Bowlby, J. (1985). The nature of the child's tie to his mother 1. In A. C. Furman & S. T. Levy (Eds.), *Influential Papers from the 1950s* (1st ed., pp. 222–273). Routledge. https://doi.org/10.4324/9780429475931-15

Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology*, *53*(1), 371–399. https://doi.org/10.1146/annurev.psych.53.100901.135233

Brophy-Herb, H. E., Choi, H. H., Senehi, N., Martoccio, T. L., Bocknek, E. L., Babinski, M., Krafchak, S., Accorsi, C., Azmoudeh, R., & Schiffman, R. (2022). Stressed mothers receiving infant mental health-based early head start increase in mind-mindedness. *Frontiers in Psychology*, *13*, 897881. https://doi.org/10.3389/fpsyg.2022.897881

Carlson, S. M. (2009). Social origins of executive function development. *New Directions for Child and Adolescent Development*, *2009*(123), 87–98. https://doi.org/10.1002/cd.237

Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development*, *72*(4), 1032–1053. https://doi.org/10.1111/1467-8624.00333

Centifanti, L. C. M., Meins, E., & Fernyhough, C. (2016). Callous-unemotional traits and impulsivity: Distinct longitudinal relations with mind-mindedness and understanding of others. *Journal of Child Psychology and Psychiatry*, *57*(1), 84–92. https://doi.org/10.1111/jcpp.12445

Cheng, N., Lu, S., Archer, M., & Wang, Z. (2018). Quality of maternal parenting of 9-month-old infants predicts executive function performance at 2 and 3 years of age. *Frontiers in Psychology*, *8*, 2293. https://doi.org/10.3389/fpsyg.2017.02293

Colonnesi, C., Zeegers, M. A. J., Majdandžić, M., van Steensel, F. J. A., & Bögels, S. M. (2019). Fathers' and mothers' early mind-mindedness predicts social competence and behavior problems in childhood. *Journal of Abnormal Child Psychology*, *47*(9), 1421–1435. https://doi.org/10.1007/s10802-019-00537-2

Demers, I., Bernier, A., Tarabulsy, G. M., & Provost, M. A. (2010). Maternal and child characteristics as antecedents of maternal mind-mindedness. *Infant Mental Health Journal*, *31*(1), 94–112. https://doi.org/10.1002/imhj.20244

Demers, I., Bernier, A., Tarabulsy, G. M., & Provost, M. A. (2010). Mind-mindedness in adult and adolescent mothers: Relations to maternal sensitivity and infant attachment. *International Journal of Behavioral Development*, *34*(6), 529–537. https://doi.org/10.1177/0165025410365802

Demir-Vegter, S., Aarts, R., & Kurvers, J. (2014). Lexical richness in maternal input and vocabulary development of Turkish preschoolers in the Netherlands. *Journal of Psycholinguistic Research*, *43*(2), 149–165. https://doi.org/10.1007/s10936-013-9245-7

Devine, R. T., & Hughes, C. (2016). Family correlates of false belief understanding in early childhood: A meta-analysis. *Child Development*. https://doi.org/10.1111/cdev.12682

DeWolff, M. S., & van Ijzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on parental antecedents of infant attachment. *Child Development*, *68*(4), 571–591. https://doi.org/10.2307/1132107

Dunn, L. M., & Dunn, L. M. (1997). *Peabody picture vocabulary test—3rd ed. (PPVT-III).* Circle Pines, MN: American Guidance Service.

Farrow, C., & Blissett, J. (2014). Maternal mind-mindedness during infancy, general parenting sensitivity and observed child feeding behavior: A longitudinal study. *Attachment & Human Development*, *16*(3), 230–241. https://doi.org/10.1080/14616734.2014.898158

Federal Reserve of St. Louis. (2022). *Estimate of Median Household Income for Lane County, OR*. https://fred.stlouisfed.org/series/MHIOR41039A052NCEN

Fenson, L., Dale, P., Reznick, J., Thal, D., Bates, E., Hartung, J., Pethick, S., & Reilly, J. (1993). *MacArthur Communicative Development Inventories: User's guide and technical manual*. Baltimore, MD: Paul H. Brookes.

Fishburn, S., Meins, E., Fernyhough, C., Centifanti, L. C. M., & Larkin, F. (2022). Explaining the relation between early mind-mindedness and children's mentalizing abilities: The development of an observational preschool assessment. *Developmental Psychology*, *58*(1), 17–31. https://doi.org/10.1037/dev0001272

Fishburn, S., Meins, E., Greenhow, S., Jones, C., Hackett, S., Biehal, N., Baldwin, H., Cusworth, L., & Wade, J. (2017). Mind-mindedness in parents of looked-after children. *Developmental Psychology*, *53*(10), 1954–1965. https://doi.org/10.1037/dev0000304

Foley, S., & Hughes, C. (2018). Great expectations? Do mothers' and fathers' prenatal thoughts and feelings about the infant predict parent-infant interaction quality? A meta-analytic review. *Developmental Review*, *48*, 40–54. https://doi.org/10.1016/j.dr.2018.03.007

Foley, S., Hughes, C., & Fink, E. (2022). Expectant mothers' not fathers' mind-mindedness predicts infant, mother, and father conversational turns at 7 months. *Infancy*.

Fonagy, P., & Target, M. (2002). Early intervention and the development of self-regulation. *Psychoanalytic Inquiry*, *22*(3), 307–335. https://doi.org/10.1080/07351692209348990

Friedman, S. H., & Resnick, P. J. (2009). Postpartum depression: An update. *Women's Health*, *5*(3), 287–295. https://doi.org/10.2217/WHE.09.3

Fuhs, M. W., Nesbitt, K. T., Farran, D. C., & Dong, N. (2014). Longitudinal associations between executive functioning and academic skills across content areas. *Developmental Psychology*, *50*(6), 1698–1709. https://doi.org/10.1037/a0036633

Gagné, C., Bernier, A., & McMahon, C. A. (2018). The role of paternal mind-mindedness in preschoolers' self-regulated conduct. *Infant and Child Development*, *27*(3), e2081. https://doi.org/10.1002/icd.2081

Gerstadt, C. L., Hong, Y. J., & Diamond, A. (1994). The relationship between cognition and action: Performance of children 312–7 years old on a stroop- like day-night test. *Cognition*, *53*(2), 129–153. https://doi.org/10.1016/0010-0277(94)90068-X

Gluck, S. C., Hodges, S. D., & Moses, L. J. (2021). *Examining mind-mindedness: Associations with relationship closeness, theory of mind, empathy and anthropomorphism*. Unpublished manuscript. Department of Psychology, University of Oregon.

Hill, S., & McMahon, C. (2016). Maternal mind-mindedness: Stability across relationships and associations with attachment style and psychological mindedness. *Infant and Child Development, 25*(5), 391–405. https://doi.org/10.1002/icd.1947

Hresko, W. P., Reid, D. K., & Hammill, D. D. (1999). *Test of early language development: 3rd ed. (TELD-III).* Austin, TX: Pro-Ed.

Hughes, C., Aldercotte, A., & Foley, S. (2017). Maternal mind-mindedness provides a buffer for pre-adolescents at risk for disruptive behavior. *Journal of Abnormal Child Psychology, 45*(2), 225–235. https://doi.org/10.1007/s10802-016-0165-5

Hughes, C., Devine, R. T., & Wang, Z. (2018). Does parental mind-mindedness account for cross-cultural differences in preschoolers' theory of mind? *Child Development, 89*(4), 1296–1310. https://doi.org/10.1111/cdev.12746

Illingworth, G., MacLean, M., & Wiggs, L. (2016). Maternal mind-mindedness: Stability over time and consistency across relationships. *European Journal of Developmental Psychology, 13*(4), 488–503. https://doi.org/10.1080/17405629.2015.1115342

Kaushanskaya, M., Park, J. S., Gangopadhyay, I., Davidson, M. M., & Weismer, S. E. (2017). The relationship between executive functions and language abilities in children: a latent variables approach. *Journal of Speech, Language, and Hearing Research, 60*(4), 912–923. https://doi.org/10.1044/2016_JSLHR-L-15-0310

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (Fourth edition). The Guilford Press.

Korkman, M., Kirk, U., & Kemp, S. (1998). *NEPSY: A Developmental Neuropsychological Assessment Manual*. San Antonio, TX: The Psychological Corporation.

Kristen, S., Rossmann, F., & Sodian, B. (2014). Theory of own mind and autobiographical memory in adults with ASD. *Research in Autism Spectrum Disorders*, *8*(7), 827–837. https://doi.org/10.1016/j.rasd.2014.03.009

Laflamme, E., Matte-Gagné, C., & Baribeau-Lambert, A. (2022). Paternal mind-mindedness and infant-toddler social-emotional problems. *Infant Behavior and Development, 69*, 101767. https://doi.org/10.1016/j.infbeh.2022.101767

Laranjo, J., & Bernier, A. (2013). Children's expressive language in early toddlerhood: Links to prior maternal mind-mindedness. *Early Child Development and Care, 183*(7), 951–962. https://doi.org/10.1080/03004430.2012.699964

Laranjo, J., Bernier, A., & Meins, E. (2008). Associations between maternal mind-mindedness and infant attachment security: Investigating the mediating role of maternal sensitivity. *Infant Behavior & Development*, *31*(4), 688–695. https://doi.org/10.1016/j.infbeh.2008.04.008

Laranjo, J., Bernier, A., Meins, E., & Carlson, S. M. (2014). The roles of maternal mind-mindedness and infant security of attachment in predicting preschoolers' understanding of visual perspective taking and false belief. *Journal of Experimental Child Psychology*, *125*, 48–62. https://doi.org/10.1016/j.jecp.2014.02.005

Larkin, F., Oostenbroek, J., Lee, Y., Hayward, E., & Meins, E. (2019). Proof of concept of a smartphone app to support delivery of an intervention to facilitate mothers' mind-mindedness. *PLOS ONE*, *14*(8), e0220948. https://doi.org/10.1371/journal.pone.0220948

Larkin, F., Schacht, R., Oostenbroek, J., Hayward, E., Fernyhough, C., Muñoz Centifanti, L. C., & Meins, E. (2020). Mind-mindedness versus mentalistic interpretations of behavior: Is mind-mindedness a relational construct? *Infant Mental Health Journal*, imhj.21901. https://doi.org/10.1002/imhj.21901

Lawson, G. M., Hook, C. J., & Farah, M. J. (2018). A meta-analysis of the relationship between socioeconomic status and executive function performance among children. *Developmental Science*, *21*(2), e12529. https://doi.org/10.1111/desc.12529

Lok, S. M., & McMahon, C. A. (2006). Mothers' thoughts about their children: Links between mind-mindedness and emotional availability. *British Journal of Developmental Psychology*, *24*, 477–488. https://doi.org/10.1348/026151005X49854

Lundy, B. L. (2003). Father- and mother-infant face-to-face interactions: Differences in mind-related comments and infant attachment? *Infant Behavior & Development*, *26*(2), 200–212. https://doi.org/10.1016/S0163-6383(03)00017-1

Lundy, B. L. (2013). Paternal and maternal mind-mindedness and preschoolers' theory of mind: The mediating role of interactional attunement. *Social Development*, *22*(1), 58–74. https://doi.org/10.1111/sode.12009

Lundy, B. L., & Fyfe, G. (2016). Preschoolers' mind-related comments during collaborative problem-solving: Parental contributions and developmental outcomes: preschoolers' mind-related comments during collaborative problem-solving. *Social Development*, *25*(4), 722–741. https://doi.org/10.1111/sode.12176

Marcoux, A.-A., Bernier, A., Séguin, J. R., Boike Armerding, J., & Lyons-Ruth, K. (2017). How do mothers with borderline personality disorder mentalize when interacting with their infants?: Mothers with borderline personality disorders. *Personality and Mental Health*, *11*(1), 14–22. https://doi.org/10.1002/pmh.1362

McMahon, C. A., & Bernier, A. (2017). Twenty years of research on parental mind-mindedness: Empirical findings, theoretical and methodological challenges, and new directions. *Developmental Review*, *46*, 54–80. https://doi.org/10.1016/j.dr.2017.07.001

McMahon, C. A., & Meins, E. (2012a). Mind-mindedness, parenting stress, and emotional availability in mothers of preschoolers. *Early Childhood Research Quarterly*, *27*(2), 245–252. https://doi.org/10.1016/j.ecresq.2011.08.002

McMahon, C. A., & Meins, E. (2012b). Mind-mindedness, parenting stress, and emotional availability in mothers of preschoolers. *Early Childhood Research Quarterly*, *27*(2), 245–252. https://doi.org/10.1016/j.ecresq.2011.08.002

McMahon, C., Camberis, A.-L., Berry, S., & Gibson, F. (2016). Maternal mind-mindedness: Relations with maternal-fetal attachment and stability in the first two years of life: findings from an Australian prospective study. *Infant Mental Health Journal*, *37*(1), 17–28. https://doi.org/10.1002/imhj.21548

Meins, E. (1997). *Security of attachment and the social development of cognition*. Psychology Press/Erlbaum (UK) Taylor & Francis.

Meins, E. (1999). Sensitivity, security and internal working models: Bridging the transmission gap. *Attachment & Human Development*, *1*(3), 325–342. https://doi.org/10.1080/14616739900134181

Meins, E. (2013). Sensitive attunement to infants' internal states: Operationalizing the construct of mind-mindedness. *Attachment & Human Development*, *15*(5–6), 524–544. https://doi.org/10.1080/14616734.2013.830388

Meins, E., Centifanti, L. C. M., Fernyhough, C., & Fishburn, S. (2013). Maternal mind-mindedness and children's behavioral difficulties: Mitigating the impact of low socioeconomic status. *Journal of Abnormal Child Psychology*, *41*(4), 543–553. https://doi.org/10.1007/s10802-012-9699-3

Meins, E., & Fernyhough, C. (2015). *Mind-Mindedness coding manual*. Unpublished manuscript. Durham University, Durham, UK.

Meins, E., Fernyhough, C., Arnott, B., Leekam, S. R., & de Rosnay, M. (2013). Mind-mindedness and theory of mind: Mediating roles of language and perspectival symbolic play. *Child Development*, *84*(5), 1777–1790. https://doi.org/10.1111/cdev.12061

Meins, E., Fernyhough, C., Arnott, B., Turner, M., & Leekam, S. R. (2011). Mother- versus infant-centered correlates of maternal mind-mindedness in the first year of life. *Infancy*, *16*(2), 137–165. https://doi.org/10.1111/j.1532-7078.2010.00039.x

Meins, E., Fernyhough, C., & Centifanti, L. C. M. (2019). Mothers' early mind-mindedness predicts educational attainment in socially and economically disadvantaged british children. *Child Development*, *90*(4), e454–e467. https://doi.org/10.1111/cdev.13028

Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking maternal sensitivity: Mothers' comments on infants' mental processes predict security of attachment at 12 months. *Journal of Child Psychology and Psychiatry*, *42*(5), 637–648. https://doi.org/10.1017/S0021963001007302

Meins, E., Fernyhough, C., & Harris-Waller, J. (2014). Is mind-mindedness trait-like or a quality of close relationships? Evidence from descriptions of significant others, famous people, and works of art. *Cognition*, *130*(3), 417–427. https://doi.org/10.1016/j.cognition.2013.11.009

Meins, E., Fernyhough, C., Russell, J., & Clark-Carter, D. (2001). Security of attachment as a predictor of symbolic and mentalising abilities: A Longitudinal Study. *Social Development, 7*(1), 1–24. https://doi.org/10.1111/1467-9507.00047

Meins, E., Fernyhough, C., Wainwright, R., Clark-Carter, D., Das Gupta, M., Fradley, E., & Tuckey, M. (2003b). Pathways to understanding mind: Construct validity and predictive validity of maternal mind-mindedness. *Child Development, 74*(4), 1194–1211. https://doi.org/10.1111/1467-8624.00601

Miller, J. E., Kim, S., Boldt, L. J., Goffin, K. C., & Kochanska, G. (2019). Long-term sequelae of mothers' and fathers' mind-mindedness in infancy: A developmental path to children's attachment at age 10. *Developmental Psychology*, *55*(4), 675–686. https://doi.org/10.1037/dev0000660

Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: Meta-analysis of the relation between language ability and false-belief understanding. *Child Development, 78*(2), 622–646. https://doi.org/10.1111/j.1467-8624.2007.01018.x

Nikolić, M., Zeegers, M., Colonnesi, C., Majdandžić, M., de Vente, W., & Bögels, S. M. (2022). Mothers' and fathers' mind-mindedness in infancy and toddlerhood predict their children's self-regulation at preschool age. *Developmental Psychology*. https://doi.org/10.1037/dev0001428

Nyberg, S., Rudner, M., Mattila, P., & Heimann, M. (2021). No evidence of an association between parental mind-mindedness at 9 months and language development at either 9 or 25 months in Swedish infants. *First Language*, *41*(6), 760–778. https://doi.org/10.1177/01427237211035985

Pequet, A., & Warnell, K. R. (2020). Thinking of you: Relations between mind-mindedness, theory of mind, and social anxiety traits in middle childhood and adulthood. *Social Development*, sode.12468. https://doi.org/10.1111/sode.12468

Putnam, S. P., & Rothbart, M. K. (2006). Development of short and very short forms of the children's behavior questionnaire. *Journal of Personality Assessment, 87*(1), 102–112. https://doi.org/10.1207/s15327752jpa8701_09

Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385–401. https://doi.org/10.1177/014662167700100306

Regueiro, S., Matte-Gagné, C., & Bernier, A. (2022). Paternal mind-mindedness and child executive functioning in the kindergarten classroom. *Early Childhood Research Quarterly*, *58*, 27–34. https://doi.org/10.1016/j.ecresq.2021.07.007

Romeo, R. R., Flournoy, J. C., McLaughlin, K. A., & Lengua, L. J. (2022). Language development as a mechanism linking socioeconomic status to executive functioning development in preschool. *Developmental Science*, *25*(5). https://doi.org/10.1111/desc.13227

Rosenblum, K. L., McDonough, S. C., Sameroff, A. J., & Muzik, M. (2008). Reflection in thought and action: Maternal parenting reflectivity predicts mind-minded comments and interactive behavior. *Infant Mental Health Journal*, *29*(4), 362–376. https://doi.org/10.1002/imhj.20184

Rowe, M. L. (2012). A longitudinal investigation of the role of quantity and quality of child-directed speech in vocabulary development: Child-directed speech and vocabulary. *Child Development*, *83*(5), 1762–1774. https://doi.org/10.1111/j.1467-8624.2012.01805.x

Schacht, R., Hammond, L., Marks, M., Wood, B., & Conroy, S. (2013). The relation between mind-mindedness in mothers with borderline personality disorder and mental state understanding in their children. *Infant and Child Development*, *22*(1), 68–84. https://doi.org/10.1002/icd.1766

Schacht, R., Meins, E., Fernyhough, C., Centifanti, L. C. M., Bureau, J.-F., & Pawlby, S. (2017). Proof of concept of a mind-mindedness intervention for mothers hospitalized for severe mental illness. *Development and Psychopathology*, *29*(2), 555–564. https://doi.org/10.1017/S0954579417000177

Senehi, N., Brophy-Herb, H. E., & Vallotton, C. D. (2018). Effects of maternal mentalization-related parenting on toddlers' self-regulation. *Early Childhood Research Quarterly*, *44*, 1–14. https://doi.org/10.1016/j.ecresq.2018.02.001

Shahaeian, A., Haynes, M., & Frick, P. J. (2023). The role of language in the association between theory of mind and executive functioning in early childhood: New longitudinal evidence. *Early Childhood Research Quarterly*, *62*, 251–258. https://doi.org/10.1016/j.ecresq.2022.09.003

Silletti, F., Salvadori, E. A., Presaghi, F., Fasolo, M., Aureli, T., & Coppola, G. (2022). Maternal mind-mindedness during the first year of life: Developmental trajectories and moderators. *Developmental Psychology*, *58*(9), 1615–1628. https://doi.org/10.1037/dev0001389

Taumoepeau, M., Sadeghi, S., & Nobilo, A. (2019). Cross-cultural differences in children's theory of mind in Iran and New Zealand: The role of caregiver mental state talk. *Cognitive Development*, *51*, 32–45. https://doi.org/10.1016/j.cogdev.2019.05.004

Valcan, D. S., Davis, H., & Pino-Pasternak, D. (2018). Parental Behaviours predicting early childhood executive functions: A meta-analysis. *Educational Psychology Review*, *30*(3), 607–649. https://doi.org/10.1007/s10648-017-9411-9

Vygotsk, L. S., & Cole, M. (1981). *Mind in society: The development of higher psychological processes* (Nachdr.). Harvard University Press.

Walker, T. M., Wheatcroft, R., & Camic, P. M. (2012). Mind-mindedness in parents of pre-schoolers: A comparison between clinical and community samples. *Clinical Child Psychology and Psychiatry*, *17*(3), 318–335. https://doi.org/10.1177/1359104511409142

Wang, L., Zhu, L., & Wang, Z. (2017). Parental mind-mindedness but not false belief understanding predicts Hong Kong children's lie-telling behavior in a temptation resistance task. *Journal of Experimental Child Psychology*, *162*, 89–100. https://doi.org/10.1016/j.jecp.2017.04.023

Wellman, H. M., & Liu, D. (2004). Scaling of theory-of-mind tasks. *Child Development*, *75*(2), 523–541. https://doi.org/10.1111/j.1467-8624.2004.00691.x

Welsh, M. C., Pennington, B. F., & Groisser, D. B. (1991). A normative-developmental study of executive function: A window on prefrontal function in children. *Developmental Neuropsychology*, *7*(2), 131–149. https://doi.org/10.1080/87565649109540483

Zauche, L. H., Thul, T. A., Mahoney, A. E. D., & Stapel-Wax, J. L. (2016). Influence of language nutrition on children's language and cognitive development: An integrated review. *Early Childhood Research Quarterly*, *36*, 318–333. https://doi.org/10.1016/j.ecresq.2016.01.015

Zelazo, P. D. (2006). The Dimensional Change Card Sort (DCCS): A method of assessing executive function in children. *Nature Protocols*, *1*(1), 297–301. https://doi.org/10.1038/nprot.2006.46