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DOI:

[10.1037/dev0001468](https://doi.org/10.1037/dev0001468)

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Document Version

Peer reviewed version

Citation for published version (Harvard):

Foley, S, Devine, RT & Hughes, C 2023, 'Mind-mindedness in new mothers and fathers: stability and discontinuity from pregnancy to toddlerhood', *Developmental Psychology*, vol. 59, no. 1, pp. 128–140. <https://doi.org/10.1037/dev0001468>

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**Mind-Mindedness in New Mothers and Fathers: Stability and Discontinuity from
Pregnancy to Toddlerhood.**

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Accepted at *Developmental Psychology* on 12th August 2022.

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Data are available from the UK Data Service: Hughes, C., Devine, R.T., Mesman, J., & Blair, C. (2018). *The New Fathers and Mothers Study*. Colchester, Essex: UK Data Service. 10.5255/UKDA-SN-853278.

This study was not preregistered.

Abstract

This study examined the development of caregiver mind-mindedness – defined as the propensity to see one’s child as an agent with an independent mind – across the first 1000 days of life. At four time-points (i.e., third trimester of pregnancy, 4, 14 and 24 months postpartum), 384 first-time mothers ($M_{\text{age}} = 32.55$, $SD = 3.63$ years) and fathers ($M_{\text{age}} = 33.96$, $SD = 4.40$ years) gave five-minute speech samples about their infant that were coded for mind-mindedness (Meins & Fernyhough, 2015). Reflecting the local population, the 192 heterosexual couples were highly educated (84.6% of mothers, 77.1% of fathers had a degree) and ethnically homogenous (92.7% of mothers, 94.8% of fathers identified as White British). Results showed significant variability in mind mindedness within both expectant mothers and expectant fathers, with no mean group difference. Auto-regressive models demonstrated modest positive associations between prenatal and postnatal mind-mindedness. Latent change score models showed gains in mean mind-mindedness over time that, on average, were stronger for mothers than for fathers. For fathers, gains in mind-mindedness were positively associated with having an infant daughter and infant surgency. For mothers, higher socioeconomic status and more equal childcare were associated with greater gains in mind-mindedness across toddlerhood. Within-couple associations were evident for changes in mind-mindedness, but not for initial (prenatal) scores. We apply the relational account of mind-mindedness to frame our discussion of these findings that, by highlighting both developmental stability and change in mind-mindedness, suggest fruitful avenues for future research.

Key words: mind-mindedness; mothers; fathers; pregnancy; infancy; latent-change score models.

Public significance statement:

- Parental mind-mindedness – defined as the propensity to see one’s child as an agent with an independent mind – has established links with children’s social, emotional, cognitive, and behavioural outcomes. Understanding the developmental origins and changes in parental mind-mindedness is thus important for both theory and practice.
- In this study of 384 low-risk first-time mothers and fathers, 5-minute speech samples were used to code mind-mindedness at four time points (in the third trimester of pregnancy and at 4, 14 and 24 months postpartum). For both mothers and fathers, individual differences in mind-mindedness were: (i) measurable during pregnancy; and (ii) modestly stable across these four time-points.
- Across the transition to parenthood and the first two years of life, parents showed significant gains in mind-mindedness that were (i) similar within couples and associated with (ii) having an infant daughter and temperamentally emotionally reactive infant for fathers and (iii) equal childcare and higher socioeconomic status for mothers.

Charles Darwin's diary entries about his first-born son Doddy reveal an awareness – that emerged around the age of 4 months – of Doddy as an agent with his own thoughts, feelings and desires (Conrad, 1998). An awareness of children's inner lives has long been theorised to be central to parents' ability to notice, interpret, and respond in a timely and appropriate manner to children's signals (Zeegers et al., 2017). Mentalising capacities have been operationalised into distinct but related constructs, including reflective functioning (Fonagy et al., 1998), mind-mindedness (Meins, 1999) and insightfulness (Oppenheim et al., 2001). With similar foundations in attachment theory, parents' representational capacities are viewed as relational constructs and can be elicited via talk (Sharp & Fonagy, 2008).

Mind-mindedness refers to parents' tendency to think of their child as a mentalistic agent, while insightfulness refers to the extent which parents' consider the motives underlying children's behaviors and emotional experiences. Insightfulness and parental reflective functioning both refer to parents' capacity to understand their own *and* their child's behaviour as a function of mental states (Sharp & Fonagy, 2008). Equally, while mind-mindedness requires explicit acknowledgement of the child's mental states, insightfulness encompasses a range of representational capacities (e.g., the extent parents provide a complex and coherent description of their child). Reflecting these conceptual distinctions, these measures show modest concordance and distinct correlates (e.g., Krink & Ramsauer, 2021).

These different means of operationalising parent mentalising have been used to test a framework that posits that parental inability to 'meet the mind' of their child increases the risk of child developmental psychopathology (Sharp & Fonagy, 2008). Evidence from meta-analyses (Zeegers et al., 2017) and interventions (Menashe-Grinberg et al., 2022) supports the hypothesis that poor mentalising can disrupt the formation of a secure parent-infant attachment, children's own mentalising abilities and self-regulatory capacities. Research examining parents' mentalising skills in relation to parents' sensitivity and infant attachment

security has largely centred on parental mind-mindedness (Zeegers et al., 2017), which shows modest positive associations with later child executive functions, language abilities and social cognition (Aldrich et al., 2021). However, few studies have included both mothers and fathers, or assessed mind-mindedness at multiple time points. As a result, little is known about within-couple concordance, stability and change in mind-mindedness as children grow up. To address these twin challenges, the current longitudinal study used dynamic modeling to track mind-mindedness in a sample of first-time mothers and fathers interviewed in four waves of home visits, from late pregnancy and across the first 1000 days of development.

Examining Relationship Quality via Parental Talk to and about their Child.

Mind-mindedness sits at the interface between the interaction and representational components of the parent-child relationship (Meins, 1999) and is measured from parents' spontaneous speech, as elicited either during parent-child interactions or in parental descriptions of their children (Meins & Fernyhough, 2015); hereafter these are respectively referred to as interactional and representational measures of mind-mindedness. In both cases, parents' utterances related to their child are divided into mind-related comments (e.g., beliefs, thoughts, and desires) and non-mind related comments (e.g., behaviours, physical descriptions) to create an index of parents' tendency to treat the infant as a sentient being, rather than an individual with needs that must be satisfied. When observing parents, one can also examine the accuracy of mind-related comments; that is, parents are either 'appropriate' or 'non-attuned' in their interpretation. For example, upon observing an infant reaching for a ball a parent may appropriately comment "you want the ball" or, in a non-attuned manner, comment "you're not interested in that" whilst moving the ball out of reach.

Studies of parents with infants have typically applied the interactional method and examined relations between mind-mindedness and infant attachment security. These studies have demonstrated positive associations between parents' appropriate mind-related

comments and attachment security, while non-attuned mind-related comments are more strongly linked to attachment insecurity assessed in infancy (Zeegers et al., 2017), pre-school (Meins et al., 2018) and late childhood (Miller et al., 2019). The representational measure is more commonly used beyond toddlerhood.

Studies with diverse samples have shown that maternal mind-mindedness is related to reduced adjustment difficulties in the pre-school years and in pre-adolescence (e.g., Hughes, Aldercotte, et al., 2017). Studies adopting both measures provide evidence for their concordance (McMahon et al., 2016), while meta-analytic findings indicate that interactional and representational measures of mind-mindedness show positive associations of similar (modest) magnitude with pre-schoolers' false-belief understanding (Devine & Hughes, 2018). For associations between measures of mind-mindedness and of social, cognitive and language development at different child ages, studies using frequency scores typically show stronger associations than studies that adopt proportional scores to control for verbosity (Aldrich et al., 2021). While the representational method cannot easily be used to assess the appropriateness of the mental attributes, it provides meaningful data on parents' mentalizing and offers two practical advantages: efficiency (in both data collection and coding) and developmental scope (e.g., enabling mind-mindedness to be assessed during pregnancy).

Both measures of mind-mindedness have been used to test the relational account of mind-mindedness (Meins et al., 2011), which holds that mind-mindedness reflects the quality of the relationship rather than an individual trait. Evidence to support this view includes findings that: (a) adults are more mind-minded when describing someone they know, such as a romantic partner, a best friend or child, than when they describe a celebrity and a famous piece of art (Meins et al., 2014); (b) caregiver mind-mindedness is reduced in the context of parent neglect or abuse (Fishburn et al., 2017); and (c) interventions targeting maternal mind-mindedness have improved the mother-infant relationship (Schacht et al., 2017). By

following new parents across a key transition and a period of rapid infant development, the current study examines rank-order stability and within-person change in mind-mindedness.

Mind-Mindedness in Expectant Parents

The transition to parenthood is a major life event that is salient to the attachment system: expectant parents' representations of their own caregivers and imagined relationships with their infants are both considered to be important for later parent-child relationship quality (e.g., Foley & Hughes, 2018). Two exploratory studies have examined mind-mindedness in expectant parents. In the first, 25 British expectant couples were asked to describe their future infant at six months and then observed parent-infant interactions at six months (Arnott & Meins, 2008). Mothers and fathers both struggled to describe their unborn infants, such that a simple present/absent code was used for mentalistic descriptions. Results did not distinguish between mothers who made either appropriate or non-attuned mind-related comments during observed interactions at 6 months. However, the extent to which pregnant women were able to say anything at all about their unborn infant was related to the frequency of appropriate mind-related comments at 6 months. Moreover, expectant fathers who made a mentalistic comment were more likely to use appropriate mind-related comments during later interactions. In a study of 43 Australian expectant mothers in which prompts were used to encourage elaboration, prenatal mind-mindedness showed a positive association with maternal-fetal attachment (McNamara et al., 2021). Though promising, small sample sizes limited the detection of individual differences in mind-mindedness and so precluded examination of stability and continuity of mind-mindedness across the first years of life. The first aim of the current longitudinal study was to examine whether expectant mothers and fathers showed a similar or contrasting proclivity to describe their unborn infant using mind-minded attributes. Despite increases in fathers' involvement in childcare, asymmetry in access to parental leave and anticipated caregiving accentuates the lack of

physical connection between father and fetus during pregnancy (Ives, 2014). Thus, a maternal advantage in mind-mindedness was expected, both in pregnancy and beyond.

Stability and Change in Parental Mind-Mindedness

Adopting a representational measure of mind-mindedness permits examination of both *stability* (i.e., individual rank order within a group through time) and *continuity* (i.e., mean level of the group) in mind-mindedness across the transition to parenthood. While the mean level of mind-mindedness might increase over the transition, an individual's position relative to others may stay the same. Examining both developmental stability and change using longitudinal methods informs theoretical understanding of a phenomenon and has implications for measurement and intervention (Bornstein et al., 2017).

Longitudinal work (see McMahon & Bernier, 2017 for review) has documented links between (maternal) mind-mindedness in infancy and a diverse range of child outcomes. Studies assessing parents across two time points indicate modest stability of interactional mind-mindedness in the first year of life; this stability appears somewhat stronger for mothers, $r = .33$, than fathers, $r = .24$ (Zeegers et al., 2018). Parents' use of appropriate mind-related comments also appears stable across different observational *contexts*, for example between snack and play time at 7 months (mothers $r = .43$, and fathers $r = .30$; Goffin et al., 2020). Results from auto-regressive models using data from three time points illustrated consecutive links between mothers' appropriate mind-related comments from 4 to 12 months and 12 to 30 months, but non-significant links between 4 and 30 months (Colonnesi et al., 2019). Parallel analyses for fathers showed stability in appropriate mind-related comments across the first year of life.

Estimates of continuity and discontinuity in parental mind-mindedness have rested on comparing average levels for interaction measures. Across the first year of life, different studies have reported both limited change (Giovanelli et al., 2020; Cohen's $d = 0.07$) and

large increases (Meins et al., 2011; Cohen's $d = 0.83$) in mothers' appropriate mind-related comments. Studies with a longer developmental reach have reported the frequency of appropriate mind-related comments peaks in early infancy and reduces in toddlerhood (Colonnesi et al., 2019; Cohen's $d = 0.50$, and 1.24). Interestingly, this pattern was similar for mothers and fathers (Colonnesi et al., 2019), though others have reported a maternal advantage over fathers during infancy (Miller et al., 2019). These studies suggest that, on average, infancy is a period of discontinuity in interactional measures of mind-mindedness, which may reflect children become more adept at making their own feelings explicit.

Few studies have tested the stability and continuity of representational mind-mindedness. In one study of 32 families focused on middle childhood, mothers' representational and interactional mind-mindedness for their younger and older children showed moderate stability across a nine-month window (representational: younger $r = .47$ and older $r = .36$, interactional: younger $r = .71$ and older $r = .46$; Illingworth et al., 2016). Two cross-sectional studies have examined mothers' representational mind-mindedness during infancy (at 6 months; Farrow & Blissett, 2014 and 12 months; Ontai & Virmani, 2010) and found mothers produced a similar proportion of mind-related comments as parents of pre-schoolers (e.g., Lundy, 2013). By adopting the representational measure across four time points in infancy, the current study sought to examine the stability and continuity of mothers' *and* fathers' representational mind-mindedness.

Novel longitudinal models are needed to examine factors associated with stability and change in the developmental unfolding of mentalising (Luyten et al., 2020). Latent change score models (LCS; McArdle, 2009) offer a powerful and error-free way to examine inter-individual differences in intra-individual change over time. Unlike simple difference scores, latent true scores are modelled from observed scores without measurement error. These latent true scores are used to create latent difference scores and reflect the change between

consecutive time points without measurement error. LCS models estimate the mean of the first time point and the mean of the differences between adjacent time-points. Unlike static latent growth curve models, LCS models are dynamic (i.e., scores are a function of previous scores) and do not impose linear trajectories (Serang et al., 2019). LCS models therefore enable examination of (i) continuity and discontinuity across a group; (ii) individual differences in these patterns, and (iii) correlates of change.

The second aim of this study was to assess stability and continuity in mothers' and fathers' representational mind-mindedness from the last trimester of pregnancy to the children's second birthdays. To this end, we use auto-regressive models to examine stability in mind-mindedness across four time points straddling the transition to parenthood, infancy, and toddlerhood. We hypothesised that individual differences in parents' representational mind-mindedness would be modestly stable over time, though stronger in magnitude for mothers compared with fathers. We used LCS models to examine gains in mind-mindedness across each of these windows. Overall, we predicted that mind-mindedness would increase from pregnancy to 4 months, as the infant shifts from being an abstract concept to the focus of family relationships. We anticipated that the prenatal maternal advantage in mind-mindedness would extend into the early post-partum period. We anticipated that, after an initial steep increase for both parents from pregnancy to early infancy, mean levels of mind-mindedness would plateau across the first two years of life. Finally, for both mothers and fathers, we expected significant variation in the magnitude of gains over time.

Correlates of Initial Levels of and Changes in Mind-Mindedness

While numerous studies have examined the correlates of parental mind-mindedness, evidence on the relative salience of parent, child and contextual influences is mixed (McMahon & Bernier, 2017). Some studies (e.g., Meins et al., 2011) report no links between mind-mindedness and parental education, wellbeing, or infant temperament. In contrast,

others report associations between reduced mind-mindedness and lower levels of education (Hughes, Aldercotte, et al., 2017), clinical depression, and temperamental difficulty (Bigelow et al., 2018). However, few studies have examined whether parent, child and contextual factors influence *changes* in mind-mindedness. The transition to parenthood is associated with an elevated risk for poor parental mental health (Hughes et al., 2020), which may attenuate gains in mind-mindedness in this period. Evidence that poor parental mental health is associated with a reduced ability to focus on the infant (Foley et al., 2020), indicates that postpartum symptoms of depression may constrain parents' mind-mindedness. In addition, behavioural manifestations of temperamental difficulties may prompt reflection on situations that elicit infant distress and foster parents' mind-minded representations. Alternatively, parents may struggle with their developing relationship and form a less mentalistic representation of a 'difficult' infant. Building on evidence that parents adopt different language with daughters and sons (Fivush et al., 2000), the present study tests whether child gender effects are also apparent in parents' talk *about* their child.

Finally, the development of the parent-child relationship takes place within an existing network of family relationships. Studies of within-couple concordance in parents' mind-mindedness have produced mixed findings (Colonnesi et al., 2019; Lundy, 2013). Arguably, when new roles and boundaries are evolving across the transition to parenthood, there may be within-couple similarity in mind-mindedness. Expectant couples are likely to share ideas about their future family and so may offer similar descriptions of their infants during pregnancy. Parents also consolidate their thoughts and feelings about their child over time, with conversations with partners and shared experiences contributing to an alignment between parents. Supporting this, within-couple concordance in parents' appropriate mind-mindedness becomes stronger from 4 to 12 months (Zeegers et al., 2018). Thus, the third aim of this study was to examine whether parent or infant characteristics previously identified in

the literature relate to variability in changes in parental mind-mindedness over time and within-couple concordance in these scores. Given the mixed nature of evidence, we adopted an exploratory approach to these questions.

The Current Study

Our study aimed to examine maternal and paternal mind-mindedness across the first 1000 days of development. Three questions guided our study. First, do expectant mothers and fathers show a similar or contrasting proclivity to describe their unborn infant using mind-minded attributes? Here we hypothesised a maternal advantage over fathers in mind-mindedness in pregnancy and beyond. Second, is the development of mind-mindedness in mothers and fathers from the third trimester of pregnancy to 24 months postnatal characterised by stability (i.e., rank order) and discontinuity (i.e., group mean)? Here we hypothesised modest levels of stability across the four time points. We anticipated descriptions would become more mind-minded over time, but expected individual differences for both parents in the magnitude of gains made between each time point. Third, do mothers and fathers show similar or contrasting patterns of correlates with variability in changes in parental mind-mindedness over time? We adopted an exploratory approach to this question.

Method

Participants

We recruited 213 expectant couples attending antenatal clinics, ultrasound scans and parenting fairs in the East of England. To be eligible participants had to: (1) be first-time parents, (2) expecting delivery of a healthy singleton baby, (3) planning to speak English as a primary language with their child and (4) have no history of severe mental illness (e.g., psychosis) or substance misuse. Of the 205 families eligible for follow-up when the infants were 4 months old ($M_{Age} = 4.12$ months, $SD = 0.40$ months, range: 2.97 – 5.63 months), 196 (95.6%) agreed to a home visit. At 14 months ($M_{Age} = 14.42$ months, $SD = 0.59$ months,

range: 13.10 – 18.40 months) two families declined to take part but a family that did not participate at 4 months returned (i.e., 95% of families eligible postpartum). At 24 months, 3 families declined to take part and 192 (93.6%) agreed to a home visit ($M_{Age} = 24.29$ months, $SD = 0.85$ months, range: 20.34 – 26.97 months). Of these families, at the birth of their baby mothers were, on average, 32.55 years old, $SD = 3.63$ years, range: 25.10 – 43.15 years, and fathers were, on average, 33.96 years old, $SD = 4.40$ years, range: 23.76 – 49.63 years. Most of the sample were highly educated (84.6% of mothers and 77.1% of fathers had an undergraduate or higher degree) and a minority of parents were from ethnic minority backgrounds (92.7% of mothers and 94.8% of fathers identified as White British).

Procedure

The National Health Service (NHS UK) Research Ethics Committee (London Bloomsbury, REC reference: 14/LO/1113) approved the ‘New Fathers and Mothers Study’ protocol (ref: A093314). Parents provided informed consent to be interviewed at home in the third trimester of pregnancy and at 4-, 14- and 24-months post-birth and completed online questionnaires about their wellbeing, infant characteristics and family background.

Measures

Mind-Mindedness

At each time point parents provided a five-minute speech sample describing their (future) infant and their (future) relationship with their child (Magana et al., 1986). Specifically, they were instructed: *“I’d like to hear your thoughts and feelings about [CHILD], in your own words and without my interrupting with any questions or comments. When I ask you to begin, I’d like you to speak for 5 minutes, telling me what kind of a person [CHILD] is and how the two of you get along together.”* These speech samples were audio-recorded, transcribed verbatim, anonymised and coded for mind-mindedness (Meins & Fernyhough, 2015). The study team each had prior experience coding representational

measures of parental mind-mindedness. Coding the representational mind-mindedness from the transcripts first required identification of attributes that referred to the child. The coding manual (Meins & Fernyhough, 2015) required several adaptations for use with expectant parents. For example, after initial reading of the speech samples, it was evident that parents described the infant using different tenses (e.g., “you agree, it’s kicking me” or “she’ll enjoy being in my company”). These adaptations were discussed via personal correspondence with the manual developers. All attributes were coded as mental (e.g., including cognitions, emotions, desires, such as “He’s an inquisitive little chap” or “She’s very joyful”) or non-mental (e.g., including general descriptors or physical and behavioral attributes such as ‘He’s very tall for his age’ or ‘She’s a bundle of energy’). Exact repetitions only counted once. The frequencies of mental or non-mental child attributes were used to construct proportional scores, to control for variation in parental fluency or verbosity. The proportion scores in this study are similar to those reported by others using the describe your child interview (e.g., McMahon & Meins, 2012). We double coded 20% of the speech samples; 50% of the reliability set was also double coded to check for coder drift. Inter-rater reliability based on 20% of the speech samples was excellent for mental (prenatal ICC = .81, 4 months ICC = .75, 14 months ICC = .92, 24 months ICC = .76) and non-mental attributes (prenatal ICC = .91, 4 months ICC = .84, 14 months ICC = .83, 24 months ICC = .81).

Parent Mental Health

At each time point parents completed the 12-item General Health Questionnaire (GHQ12; Goldberg et al., 1997), the 20-item Centre for Epidemiological Studies Depression Scale (CESD; Radloff, 1977), and the six-item State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983). A latent factor score, invariant across parent and time, (Hughes et

al., 2020) reflecting parents' symptoms of anxiety and depression was created and used in analyses, whereby a high score was indicative of poorer mental health.

Involvement in Childcare

Parental involvement in childcare at 4 and 14 months was assessed using the 11-item Who Does What Questionnaire (Cowan & Cowan, 1990). Both parents reported on how day-to-day childcare tasks (e.g., feeding the baby, playing with the baby) were shared between the respondent and their partner using a 9-point scale ranging from 1 (*'I do it all'*) to 9 (*'My partner does it all'*). We reverse coded the items for fathers so that a 9 indicated that the father had sole responsibility for a given childcare task. Maternal and paternal ratings of involvement in childcare activities were strongly correlated at each time point, $r = .47$ and $r = .57$, and items were averaged across parents, with high scores indicating greater paternal involvement in childcare ($\alpha = 0.77$; $\alpha = 0.74$). On average parents reported that mothers were more involved in child-care activities than fathers at 4 months, $M = 3.63$, $SD = .64$ (range 1.55 – 6.27), and 14 months, $M = 3.82$, $SD = .91$ (range 1.67 – 6.13).

Child Temperament

At 4 months, mothers and fathers completed the Distress to Limitations subscale of the Brief Infant Behavior Questionnaire (Putnam et al., 2013). Parents used a 7-point scale to rate how often they observed specific infant behaviours in the last week (e.g., How often during the last week did the baby protest being placed in a confining place (e.g., infant seat, etc.)?). Mothers' and fathers' ratings of infant's Distress to Limitations were correlated, $r = .53$, and averaged to create a single score with higher scores indicating greater levels of negative affect in response to limitations ($\alpha = .83$). At 14 months, mothers completed the 36-item Early Childhood Behavior Questionnaire (ECBQ; Putnam et al., 2006) and used a 7-point scale to rate three dimensions of temperament: Negative Affect (e.g., When s/he was upset, how often did your child cry for more than 3 minutes, even when being comforted?),

Surgency (e.g., When playing outdoors with other children, how often did your child seem to be one of the most active children?) and Effortful Control (e.g., When asked to wait for a desirable item (e.g., ice cream), how often did your child wait patiently?). Surgency and Effortful Control showed moderate internal consistency ($\alpha = .66$ and $.63$). Negative Affect scores showed low internal consistency ($\alpha = .26$) and were dropped from further analyses.

Analytic Strategy

We used an autoregressive model to examine stability in maternal and paternal mind-mindedness over time, specifically whether prior levels of mind-mindedness were associated with consecutive measures (Geiser, 2013). Following this we used a LCS model, including both maternal and paternal data, to examine intra-individual change over time (McArdle, 2009), for example this can be expressed as:

$$\text{Time 2 MM} = 1 \text{ Prenatal MM} + 1 (\text{Postnatal MM} - \text{Prenatal MM})$$

This first involved fixing the regression weight of the score at time two as a function of time one to 1. Then a latent factor score (ΔMM) was defined by subtracting the time 1 score from time 2 with a factor loading fixed to 1 (see Figure 1 for a conceptual path diagram). Latent change scores were then regressed onto predictors of parental mind-mindedness, specifically parent socio-economic status (SES) and mental health and, for the change model, parents' prior mental health, involvement in childcare, child gender, and child temperament were also included. All models were tested using *Mplus* version 8 (Muthén & Muthén, 1998-2017). Model fit was evaluated using the recommended criteria (Geiser, 2013): non-significant χ^2 , Root Mean Square Error of Approximation (RMSEA) $< .08$, Comparative Fit Index (CFI) $> .90$ and Tucker Lewis Index (TLI) $> .90$. Five-minute speech samples were completed by 192 mothers (94%) and 187 fathers (92%) during pregnancy, by 183 mothers (94%) and 187 fathers (95%) at 4 months, by 189 mothers (97%) and 187 fathers (96%) at 14 months and 179 mothers and fathers (93%) at 24 months. Parents who did

not provide a speech sample at a postnatal time point did not differ from those who did provide a speech sample in terms of SES or in the proportion of mind-minded attributes described during pregnancy. We used a full information approach to data analysis so that all eligible families ($N = 192$) were included in the model. This approach used the covariance matrix for all available data on the independent variables to estimate parameters and standard errors for all cases and provides more accurate estimates than listwise deletion or mean replacement. The study (not preregistered) began in 2014. Data is available from the UK Data Service (Hughes, Devine, et al., 2018).

Results

Prenatal Mind-Mindedness: Expectant Mothers versus Fathers

Most expectant parents (86.5% mothers and 80.7% fathers) used at least one mental attribute to describe their unborn infant. As shown in Table S1 (see Online Supplementary Materials) there were no mean differences in SES or prenatal mental health between expectant parents who did or did not offer at least one mental attribute when describing their unborn infant. During pregnancy 56% of parents in the study did not know the sex of the fetus ($n = 108$), 26% had been told they were expecting a boy ($n = 50$) and 18% had been told they were expecting a girl ($n = 34$). There was a modest difference in the likelihood of mentalistic attributes according to knowledge of fetal sex, $\chi(2) = 6.65, p = .036$. Mothers who knew they were expecting a boy were less likely to offer a mentalistic attribute ($n = 22\%$ did not describe a mentalistic attribute) than mothers who knew they were expecting a girl ($n = 3\%$ did not describe a mentalistic attribute) or who did not know the infant's sex (12% did not describe a mentalistic attribute) (see Table S2 in Online Supplementary Materials).

Table 1 presents descriptive statistics for frequencies of mental and non-mental attributes and for mental attributes as a proportion of total attributes. There were similar levels of mind-mindedness in expectant mothers and fathers, both in terms of the proportion,

Cohen's $d = 0.11$, and frequency of mind-minded descriptions, Cohen's $d = 0.09$. For expectant mothers, knowledge of infant female sex was not associated with either the proportion, $F(2) = 2.62, p = .076$, or frequency of mind-minded descriptions, $F(2) = 1.80, p = .168$. There were no differences in either the proportion or frequency of expectant fathers' mind-minded descriptors based on knowledge of infant sex, $F(2) = .21, p = .811$ and $F(2) = .17, p = .846$, respectively (see FigS1 in Online Supplementary Materials).

Stability and Continuity in Mind-Mindedness: Pregnancy to 24 months Postnatal

Stability versus instability. An auto-regressive model, where mothers' and fathers' later proportion scores for mind-mindedness were regressed onto earlier maternal and paternal measures, showed a good fit to the data, $\chi^2(14) = 15.22, p = .363$, RMSEA = .022, 90%CI [.00, .08], CFI = 0.983, TLI = 0.967. There was modest temporal stability for mothers' mind-mindedness, with previous levels of mind-mindedness positively associated with subsequent measures (see Figure 2). For fathers, prenatal mind-mindedness was associated with 14 months, which in turn was associated with mind-mindedness at 24 months. Model comparisons using Wald χ^2 tests revealed that stability estimates were stronger for mothers than for fathers from the third trimester of pregnancy to 4 months post-partum, $w(1) = 5.36, p = .021$, and from 14 months to 24 months, $w(1) = 3.63, p = .057$. However, there were no significant contrasts from the third trimester of pregnancy to 14 months or 24 post-partum, $w(1) = .47, p = .493$ and $w(1) = 1.11, p = .292$, nor between 4 to 14 months or 4 to 24 months, $w(1) = 1.03, p = .310$ and $w(1) = .01, p = .912$, respectively.

Continuity versus discontinuity. As illustrated in Table 1, at 4 months post-partum, mothers described more mental and non-mental attributes than fathers, but there was no difference between parents in the proportional scores. At 14- and 24-months post-partum, there was a moderate advantage for mothers compared with fathers in terms of frequencies of mental descriptions of their children, Cohen's $d = 0.45$ and 0.55 at 14 and 24 months

respectively, with a more modest advantage in the proportion of mind-related attributes, Cohen's $d = 0.25$ and 0.37 at 14 and 24 months respectively. Figure 3 shows mean levels of maternal and paternal mind-mindedness at each time point.

Unstandardized results from the just-identified LCS model indicated that mind-mindedness increased across the transition to parenthood for both mothers, Mean $\Delta\text{MM} = .14$, 95%CI [.12, .16], $p < .0001$, and fathers, Mean $\Delta\text{MM} = .09$, 95%CI [.06, .12], $p < .0001$. The variance in the latent change scores differed significantly from 0 in both mothers, Estimate = 0.04, $p < .0001$, and fathers, Estimate = 0.06, $p < .0001$. The rate of gains in mind-mindedness across the transition to parenthood was stronger for those with lower initial levels of mind-mindedness in both mothers, $r = -.76$, $p < .0001$, and fathers, $r = -.85$, $p < .0001$. The mean rate of change was greater for mothers than fathers, $w(1) = 5.43$, $p = .020$.

Parental mind-mindedness increased from infancy to early toddlerhood (i.e., 4 to 14 months) for mothers, Mean $\Delta\text{MM} = .20$, 95%CI [.18, .23], $p < .0001$, and fathers, Mean $\Delta\text{MM} = .15$, 95%CI [.12, .18], $p < .0001$. The variance in the latent change scores (i.e., gains) in mind-mindedness differed significantly from 0 in both mothers, Estimate = 0.03 $p < .0001$, and fathers, Estimate = 0.04, $p < .0001$. Gains in mind-mindedness from 4 to 14 months were stronger for those with lower initial levels of mind-mindedness in both mothers, $r = -.79$, $p < .0001$, and fathers, $r = -.81$, $p < .0001$. The mean rate of change was greater for mothers than fathers, $w(1) = 7.04$, $p = .008$.

Similarly, both maternal and paternal mind-mindedness subsequently increased across the second year of life (i.e., 14 to 24 months), mothers Mean $\Delta\text{MM} = .22$, 95%CI [.19, .24], $p < .0001$, and fathers Mean $\Delta\text{MM} = .15$, 95%CI [.12, .18], $p < .0001$. The variance in the latent change scores (i.e., gains in mind-mindedness) differed significantly from 0 in both mothers, Estimate = 0.04, $p < .0001$, and fathers, Estimate = 0.06, $p < .0001$. Gains in mind-mindedness from 14 to 24 months were stronger for those with lower initial levels of mind-

mindfulness in both mothers, $r = -.73, p < .0001$, and fathers, $r = -.85, p < .0001$. The mean rate of change was greater for mothers than fathers, $w(1) = 8.16, p = .004$.

We examined whether the mean latent change scores for mind-mindedness varied between each window. Gains were greater postnatally (4 – 14 months and 14 – 24 months) than across the transition to parenthood, fathers: $w(1) = 21.42, p = .004$ and $w(1) = 22.51, p < .0001$ respectively; mothers: $w(1) = 32.87, p < .0001$ and $w(1) = 36.73, p < .0001$. There was no difference in the gradient of gains between the postnatal periods: 4 and 14 months versus 14 to 24 months for fathers, $w(1) = .03, p = .856$, or mothers, $w(1) = 1.69, p = .193$.

Correlates of Changes in Maternal and Paternal Mind-Mindedness

Latent mind-mindedness scores reflecting the initial level and the latent change scores (i.e., pregnancy to 4 months, 4 to 14 months, and 14 to 24 months) were regressed on to parent SES, concurrent mental health, and for the change model, parents' mental health at the previous time point, involvement in childcare, child gender and temperament. Correlations between mothers' and fathers' mind-mindedness proportion scores and parent and child characteristics at each time point are presented in Table S3. The model showed good fit, $\chi^2(95) = 98.46, p = .384, RMSEA = .014, 95\%CI [.00, .04], CFI = 0.967, TLI = 0.945$.

Neither parent SES or mental health were associated with initial levels of maternal or paternal mind-mindedness during pregnancy. These variables were not associated with gains in mind-mindedness across the transition to parenthood or from 4 to 14 months (see Table 2). Child gender and temperament were not associated with changes in maternal mind-mindedness. Gains in fathers' mind-mindedness across the transition to parenthood were stronger for fathers with daughters than for fathers with sons. Trends suggested greater gains from pregnancy to early infancy for fathers with infants rated as displaying high levels of negative affect and for fathers who were more involved in caring for their infant. Infant temperament was associated with gains in fathers' mind-mindedness from 4 to 14 months,

with infant surgency (but not effortful control) positively associated with changes in paternal mind-mindedness. SES and father involvement in childcare were positively associated with gains in maternal mind-mindedness from 14 to 24 months.

Expectant mothers' and fathers' scores for mind-mindedness were not correlated (see Figure 2). Modest within-couple concordance was evident at 4 months, but not at 14 or 24 months. Across the transition to parenthood, latent change scores showed a modest within-couple association, $r = .19, p = .01$. Within-couple associations in 4-to-14-month and 14-to-24-month latent change scores were non-significant, $r = .06, p = .429$, and $r = .04, p = .570$.

Discussion

Three key findings emerged from this longitudinal study of parents' developing mind-mindedness across the transition to parenthood. First, expectant mothers and fathers were, on average, equally mind-minded during pregnancy. Second, the development of mind-mindedness from the last trimester of pregnancy to 24 months postpartum was characterised by modest stability of individual differences combined with an increase over time in mean levels of mind-mindedness. This pattern was more prominent for mothers than for fathers and at each time point mothers were more mind-minded than fathers. Third, for fathers, gains in mind-mindedness were stronger in the context of infant surgency and for fathers with daughters than sons and for mothers, gains in mind-mindedness across the second year of life were stronger in the context of high levels of both SES and father involvement in childcare. Changes in mind-mindedness across the transition to parenthood showed within-couple concordance, unlike scores at each time-point and gains between other time points.

Pregnancy: An Early Window onto a Developing Relationship?

Our study is the first to include a sufficiently large sample of expectant parents to examine individual differences in mind-mindedness during pregnancy and compare mean levels in expectant mothers and fathers. In our demographically low-risk sample of first-time

parents, most expectant parents provided at least one mentalistic description of their unborn child (accounting for approximately a quarter of all infant attributes). These descriptions were unprompted and unlikely to reflect demand characteristics. Relatively infrequent parent dimensions can be important for child outcomes; for example, maternal use of mental state terms in conversations with toddlers has been shown to predict individual differences in children's theory of mind eight years later (Ensor et al., 2014). Parents' appropriate and non-attuned mind-related comments are rare yet salient for a host of child outcomes (e.g., Aldrich et al., 2021). Further research is needed to test whether variation in prenatal mind-mindedness is uniquely associated with later postpartum parent and child outcomes.

Our results for expectant mothers and fathers were markedly similar, demonstrating that physical connection to the fetus is not necessary for expectant parents to think about their unborn child as a person with individual thoughts, feelings, and desires. Within this relatively homogeneous, low-risk sample, parent demographic characteristics did not distinguish between expectant parents who did or did not describe a mentalistic attribute. Testing whether the similarity in expectant mothers' and fathers' mind-mindedness extends to more diverse samples is important for two reasons. First, pregnancy is a valuable window of opportunity for intervention. Second, the relative efficiency of using speech samples to assess mind-mindedness makes this potentially valuable means for large-scale cohort studies.

Developmental Stability and Discontinuity in Mothers' and Fathers' Mind-Mindedness

Findings from our autoregressive model suggest that for the majority of expectant parents, the capacity to construct a mentalistic representation of their unborn child sets the stage for thinking of their child as an agent with thoughts and feelings. These associations were similar in magnitude to estimates from models testing the stability of mothers' and fathers' appropriate mind-related comments (Colonnesi et al., 2019). Thus, it appears parents' tendency to use mentalistic comments to talk about and to their infant is modestly stable

across the first years of life. However, such modest stability suggests a moderate proportion of unshared variance between the measurements over time.

Mind-mindedness was also characterised by discontinuity, with parents typically becoming more mind-minded across the transition to parenthood. In a novel application to mentalising research (Luyten et al., 2020), this was illustrated using LCS models that, unlike traditional difference scores, capture error-free changes in representational mind-mindedness over time (McArdle, 2009). The LCS model showed sharper increases in parents' mind-mindedness postnatally than across the transition to parenthood. Such changes perhaps reflect the growth in the parent-child relationship and greater experience with the infant as well as infants achieving social and linguistic milestones that prompt parents to update their representations of their child. Conversely, as toddlers make their feelings explicit, reducing the need for parents to reflect on their infants' mental states, other studies (Colonnesi et al., 2019; McMahon et al., 2016) have reported a drop in appropriate mind-related comments. Steep changes in representational mind-mindedness within the current sample culminated in average scores levelling out across toddlerhood (i.e., 14 to 24 months), such that average scores echoed those in studies of parents with older children (Lundy, 2013).

Consistency and change in parents' mind-minded representations of their infant and their relationship with that shed light on the relational nature of mind-mindedness. Theorists have argued that attachment classifications show predictive utility even if they are not stable over time, for example, representations are subject to instability when there are substantial changes to the environment (Booth-LaForce et al., 2014). Given that the transition to parenthood and infancy is a period of remarkable change, the discontinuity and modest stability in representational mind-mindedness is unsurprising. Following families further over time will reveal whether mind-minded representations become more stable when families experience stability in parent-child relationship quality. Tracking the arrival of a sibling will

provide an opportunity to examine within- and between-family differences, with the advantage of controlling for between-parent differences.

Our study raises possibilities for comparing the salience of initial levels *versus* gradients of change in mind-mindedness as predictors of child and parenting outcomes. Longitudinal assessments of parents' observational and representational mind-mindedness will enable comparisons of concordance and developmental unfolding, as well as testing direct and indirect pathways of influence on parenting and child outcomes. While observational mind-mindedness is expected to link directly with child outcomes (Zeegers et al., 2018), representational mind-mindedness is expected to link to child outcomes via parenting; for example, by promoting autonomy supporting behaviours. Future work will clarify whether observational and representational measure of mind-mindedness can be used interchangeably as well as providing necessary data prior to testing whether existing mind-mindedness interventions can be targeted at developmental windows characterised by change.

Future research will also enable replication of the parent gender differences in stability and discontinuity within the current study. Specifically, fathers' mind-mindedness demonstrated greater instability than mothers, for whom mind-mindedness appeared stable between the third trimester of pregnancy and 4 months and across toddlerhood. This may reflect a connection to the infant that develops during pregnancy and grows in the first years. For fathers, mind-mindedness assessed in pregnancy but not at 4 months was associated with mind-mindedness at 14 months. One possible explanation of this, formed whilst coding the speech samples, is that, when asked to consider their future infant, expectant fathers described attributes of an older infant rather than thinking about the first few months of life.

We also found a modest maternal advantage over fathers that appeared over time. This is in line with our findings that, in early toddlerhood, mothers in this sample were, on average, more likely than fathers to display autonomy supporting behaviours (Hughes,

Lindberg, et al., 2018). Future research breaking down the content and quality of parents' representations will help tease apart parenting versus mothering and fathering dimensions. For example, though it is not possible to examine the appropriateness of mind-related descriptions gathered from parents' interviews, it might be pertinent to examine the valence or type of mentalistic descriptors (e.g., Giovanelli et al., 2020).

Differences in the Correlates of Gains in Mothers' and Fathers' Mind-Mindedness

Mothers made greater gains in mind-mindedness over time than fathers, but this contrast did not reflect their greater involvement in childcare, as more equal arrangements were associated with greater gains in *maternal* but not paternal mind-mindedness in the second year of life. These findings are in line with the relational account and suggest that it is the quality rather than quantity of time that matters most for mind-mindedness.

Expectant parents' mind-mindedness was not associated with either SES or mental health. Similarly, parental mind-mindedness was unrelated to either parents' anxious and depressive symptoms or infant temperament (Meins et al., 2011). However, infant and contextual characteristics each differentially impacted gains in mind-mindedness for new fathers versus new mothers. On average, fathers with daughters showed greater gains over time in mind-mindedness than did fathers with sons. This findings echoes results showing that, compared with fathers of boys, fathers of infant girls use more analytical language and more language related to sadness and the body (Mascaro et al., 2017). Gains in paternal mind-mindedness from 4 to 14 months were also associated with infant surgency (a temperamental trait linked with later extraversion), which may stimulate parents to think about infants' developing social preferences. Non-significant links between parental mind-mindedness and infant temperament (e.g., Meins et al., 2011) have been based upon the interactional measure of mind-mindedness for mothers and so the absence of associations may reflect mothers responding to their infants 'in the moment', which may be more

influenced by situational rather than relational characteristics. Fathers' representations may be more susceptible to stable infant characteristics, as mothers have greater exposure to diverse infant behaviors. Further work is needed to establish whether the correlates of the gains in mind-mindedness reflect differences in parental involvement than an effect of parent gender *per se*. Promising avenues include studies of same-sex parents, fathers who are primary caregivers, or separated parents with equal physical custody of the children.

The current study breaks new ground in two ways: by examining the correlates of prenatal mind-mindedness and gains in mind-mindedness. Compared with alternative models, LCS has the distinct advantage of directly modelling change as a latent variable and hence enabling examination of this as an error-free variable of interest. The decision to examine the specific correlates of these dimensions stemmed from prior studies of mind-mindedness and was not exhaustive. As our results highlighted unexplained variation in these constructs, a key avenue for future research is to examine why mind-mindedness increases over time in some individuals but decreases in others. Here, including measures of individual and contextual shifts (e.g., negative life events) may prove illuminating (Booth-LaForce et al., 2014).

Finally, we found limited evidence of within-couple concordance in mind-mindedness and a positive within-couple association in gains in mind-mindedness across the transition to parenthood. Given the relational nature of mind-mindedness and the lack of within-couple association in mind-mindedness during pregnancy, such similarity is unlikely to reflect assortative mating. A simple explanation is that both members of the couple are exposed to the same infant characteristics, which in turn are expected to have a similar impact on both members of the couple. Another possibility is that parents turn to each other to facilitate understanding of caregiving, especially during periods of transition (Bugental & Johnston, 2000), where family-related cognitions appear subject to both interpersonal (i.e., partner

effect) or mutual influence (i.e., co-constructed, negotiation). Divergence between couples over time supports the relational account of mind-mindedness by showing that parents develop their own relationship with their infant.

Caveats and Conclusions

Our study sample brought both strengths and limitations. Including a large sample of first-time parents across the transition to parenthood enabled us to test the generalisability of findings across mothers and fathers. However, the relatively homogeneous and low-risk nature of the sample limits the generalisability of our study findings. It is important for researchers to continue to examine mind-mindedness in non-Western cultures. Two lines of research speak to the notion of universality without uniformity in parental mind-mindedness (Bornstein, 2012). First, despite contrasting mean levels of mind-mindedness in parents from the UK and Hong Kong, parental mind-mindedness has a similar association with children's theory of mind in each site (Hughes, Devine, et al., 2017). Second, recent research highlights the cross-cultural value of observational measures of the related construct of caregiver sensitivity across diverse settings (Mesman, 2021). That said, cross-cultural work is needed to test this explicitly, especially during infancy which is a time for some when the boundary between the self and other is blurred (Keller & Otto, 2009). Another limit concerns the correlates of mind-mindedness we examined. Note, at 14 months our measure of infant negative affect showed low internal consistency and so it was not possible to test whether negative emotionality was associated with changes in parent mind-mindedness across the second year of life.

In sum, the current study of new mothers and fathers contributes towards our understanding of parental mind-mindedness by highlighting the prenatal antecedents of this propensity as well as demonstrating developmental consistency and change across the first 1000 days of development.

Table 1.

Descriptive Statistics for Mothers' and Fathers' Representational Mind-Mindedness Scores Over Time.

		T1 Prenatal			T2 4 months			T3 14 months			T4 24 months		
		MM %	MM F	NM F	MM %	MM F	NM F	MM %	MM F	NM F	MM %	MM F	NM F
Mother	<i>M</i>	.25	3.50	9.13	.39	13.38	20.14	.45	16.50	20.05	.47	16.11	18.23
	(SD)	(.17)	(3.18)	(4.84)	(.13)	(6.87)	(7.12)	(.11)	(6.42)	(6.98)	(.14)	(6.22)	(6.31)
	Range	.00 – .75	0 – 18	1 – 25	.08 – .69	2 – 39	4 – 50	.14 – .78	3 – 36	6 – 50	.15 – .80	2 – 37	7 – 34
Father	<i>M</i>	.27	3.21	7.63	.37	9.78	16.66	.42	13.66	18.49	.42	12.84	17.35
	(SD)	(.20)	(3.34)	(4.75)	(.13)	(5.40)	(7.24)	(.13)	(6.31)	(7.13)	(.13)	(5.74)	(6.38)
	Range	.00 – .79	0 – 20	0 – 29	.00 – .67	0 – 37	2 – 37	.00 – .79	0 – 38	7 – 42	.03 – .76	1 – 32	4 – 34
Mother ν	<i>t</i>	-1.38	.97	3.08	1.44	5.53	5.55	2.38	4.14	1.84	3.35	4.70	2.17
Father	<i>d</i>	0.11	0.09	0.31	0.15	0.58	0.49	0.25	0.45	0.22	0.37	0.55	0.14

Note. T1 = 36-weeks gestation; T2 = 4-months postpartum; T3 = 14-months postpartum; T4 = 24-months postpartum. MM % = proportional mind-mindedness score; MM F = frequency of mentalistic descriptors; NM F = frequency of non-mental descriptors.

Table 2.
Unstandardised and Standardised Estimates for Correlates of Changes in Parental Mind-Mindedness.

Correlates	Mother									Father								
	ΔMM Prenatal – 4 months			ΔMM 4 – 14 months			ΔMM 14 – 24 months			ΔMM Prenatal – 4 months			ΔMM 4 – 14 months			ΔMM 14 – 24 months		
	Est.	S.E.	β	Est.	S.E.	β	Est.	S.E.	β	Est.	S. E.	β	Est.	S.E.	β	Est.	S.E.	β
Parent																		
SES	-.00	.01	-.02	-.00	.01	-.03	.02	.01	.15**	-.00	.01	-.01	-.01	.01	-.04	-.01	.01	-.06
Concurrent Mental Health	-.00	.01	-.04	.00	.01	.01	.00	.00	.09	.00	.00	.05	-.00	.00	-.02	-.00	.00	-.05
Prior Mental Health	.00	.01	.06	.00	.01	.02	.00	.00	.02	.00	.00	.01	-.00	.01	-.02	.00	.00	.05
Involvement in Childcare	.01	.02	.03	.00	.02	.00	.03	.01	.15**	-.03	.01	-.07 ⁺	-.01	.01	-.02	.01	.01	.07
Child																		
Sex	.00	.02	.00	-.01	.02	-.02	.01	.02	.02	.04	.02	.09*	.02	.02	.06	-.00	.02	-.01
Distress to Limitations ^a	.01	.01	.02	-.00	.01	-.01	-.01	.01	-.03	.02	.01	.07 ⁺	.01	.01	.03	.00	.01	.01
Surgency ^b	-	-	-	-.01	.02	-.03	-.00	.02	-.01	-	-	-	-.04	.02	-.12*	-.01	.02	-.02
Effortful Control ^b	-	-	-	-.01	.02	-.00	.02	.02	.05	-	-	-	.01	.02	.03	-.02	.02	-.06

Notes. ΔMM = changes in representational mind-mindedness; SES = socioeconomic status; ^a = 4-month temperament measure; ^b = 14-month temperament measure.

⁺ $p < .10$

* $p < .01$

** $p < .01$

Figure 1.
Conceptual Diagram of a Latent Change Score Model to Examine Intraindividual Change in Mind-Mindedness (MM) Over Time.

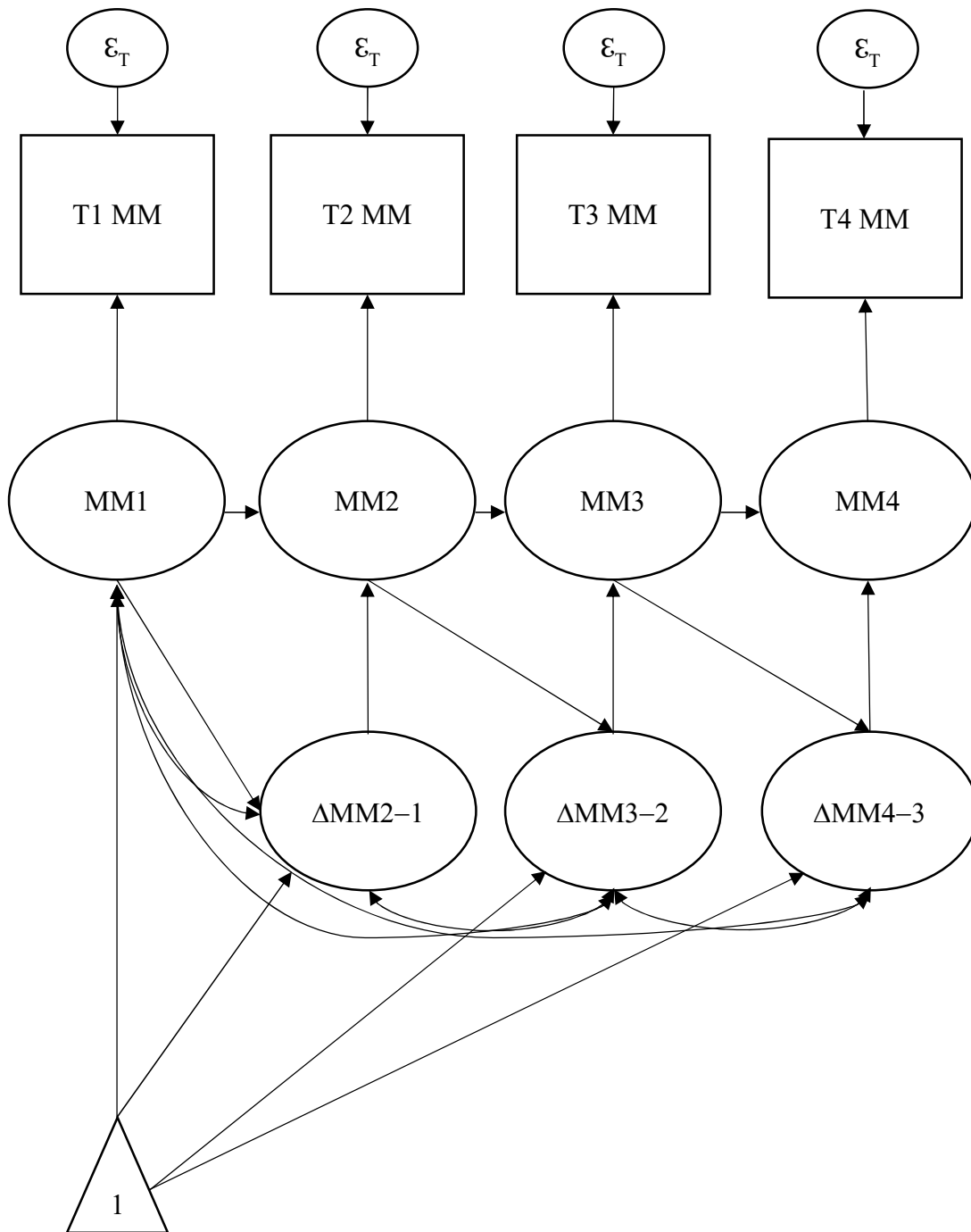
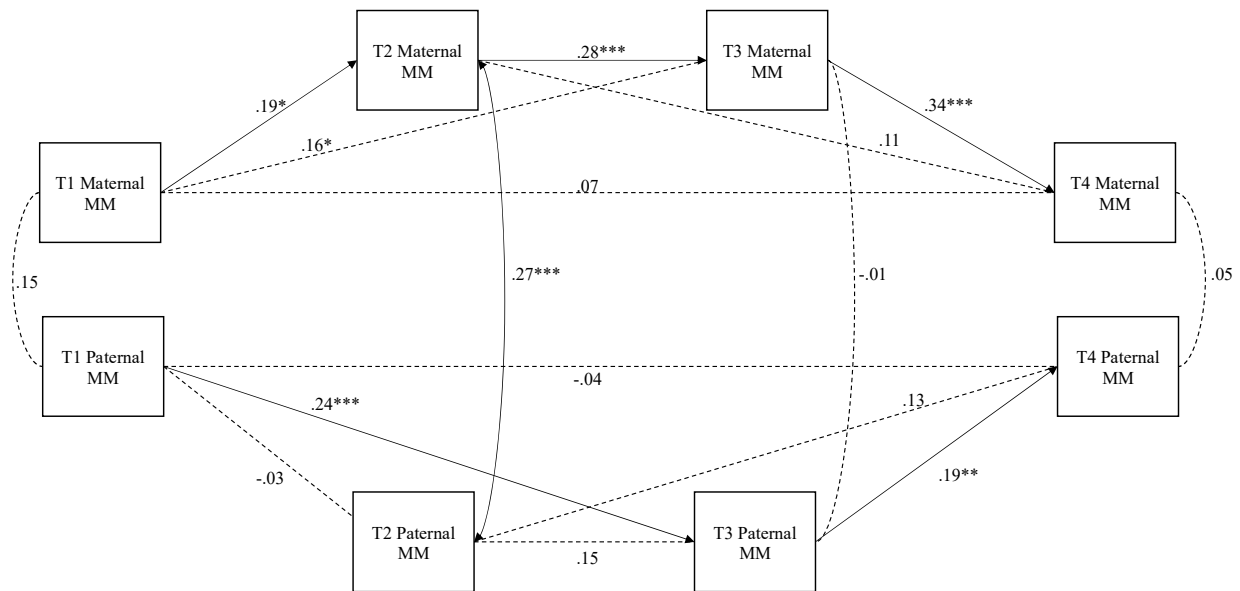
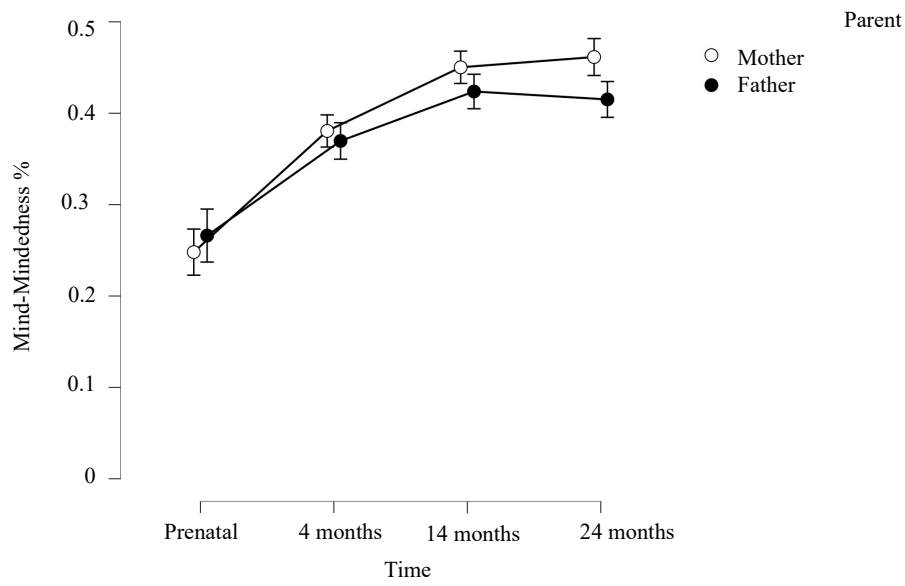


Figure 2.
Standardised Estimates for Auto-Regressive Model Examining Stability of Mothers' and Fathers' Mind-Mindedness (MM) from the Third Trimester of Pregnancy Across the First 24 months of Infant Development.



Notes. T1 = 36-weeks gestation; T2 = 4-months postpartum; T3 = 14-months postpartum; T4 = 24-months postpartum. Solid lines reflect significant associations and black dashed lines represent non-significant associations. * $p < .05$, ** $p < .01$, *** $p < .001$

Figure 3.
Maternal and Paternal Mind-Mindedness Estimated Means and 95% Confidence Intervals from the Third Trimester of Pregnancy to 24 months Postpartum.



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