

# Long-Term Sequelae of Mothers' and Fathers' Mind-Mindedness in Infancy: A Developmental Path to Children's Attachment at Age 10

Jane E. Miller  
University of Iowa

Sanghag Kim  
Hanyang University

Lea J. Boldt, Kathryn C. Goffin, and Grazyna Kochanska  
University of Iowa

Rapidly growing research on parental mind-mindedness, a tendency to treat one's young child as a psychological agent and an individual with a mind, internal mental states, and emotions, has demonstrated significant links among parents' mind-mindedness, their parenting, and multiple aspects of children's development. This prospective longitudinal study of 102 community mothers, fathers, and infants, followed from 7 months to 10 years, contributes to research on mind-mindedness by addressing several existing gaps and limitations. We examine mechanisms that account for associations between parents' early mind-mindedness and children's future attachment security, using robust behavioral measures. Teams of trained observers coded parents' mind-minded comments to their infants at 7 months during naturalistic interactions, parents' responsiveness in naturalistic interactions and in elicited imitation tasks at 15 months, and children's security, using Attachment Q-Set at 2 years and Iowa Attachment Behavioral Coding at 10 years. Sequential mediation analyses supported a model of a developmental path from parents' appropriate mind-minded comments in infancy to children's security at age 10. For mothers and children, the path was mediated first through responsiveness at 15 months and then security at 2 years. For fathers and children, the path was mediated through attachment security at 2 years. Parents' nonattuned mind-minded comments had no effects on responsiveness or security.

*Keywords:* mind-mindedness, parenting, attachment, longitudinal studies

Over the last two decades, parental mind-mindedness has increasingly become a target of research interest, sweeping across areas of developmental psychology and psychopathology, as well as personality, social, and clinical psychology, and psychiatry. Research on mind-mindedness has matured to the point of generating several comprehensive narrative and meta-analytic reviews that have summarized the work to date and proposed a forward-

looking agenda (e.g., Luyten, Nijssens, Fonagy, & Mayes, 2017; McMahon & Bernier, 2017; Meins, 2013; Sharp & Fonagy, 2008; Zeegers, Colnonesi, Stams, & Meins, 2017). The extant research encompasses several rich, dovetailing literatures that are grounded in diverse conceptual traditions, including psychoanalytic theories, attachment theory, and social cognition. Those literatures focus on a set of related constructs, including mentalization and reflective functioning (Fonagy & Luyten, 2009; Fonagy & Target, 1997; Luyten, Mayes, Nijssens, & Fonagy, 2017; Luyten, Nijssens, et al., 2017; Slade, 2005; Suchman et al., 2017), social representations and internal working models (Crittenden, 1990), theory of mind (Ensor, Devine, Marks, & Hughes, 2014), relational schemata (Baldwin, 1992), and mind-mindedness (McMahon & Bernier, 2017; Meins et al., 2003). Despite diverse labels and conceptual foundations, the key constructs of interest share many core features and converge on a similar latent concept. They all refer to individuals' capacity and willingness to perceive others as psychological agents with their own minds and repertoires of internal states, motivated by emotions, thoughts, desires, and intentions, as well as an accurate ability to adopt others' perspectives and interpret their behavior in terms of underlying motives and mental states.

That latent concept has been particularly heuristically fruitful when applied to parents' representations of their child, using various methodologies (e.g., analyzing parents' speech to the child, or examining their descriptions of the child produced in

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Jane E. Miller, Department of Psychological and Brain Sciences, University of Iowa; Sanghag Kim, Department of Sociology, Hanyang University; Lea J. Boldt, Kathryn C. Goffin, and Grazyna Kochanska, Department of Psychological and Brain Sciences, University of Iowa.

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Correspondence concerning this article should be addressed to Jane E. Miller, Department of Psychological and Brain Sciences, University of Iowa, Iowa City, IA 52242-1407. E-mail: [jane-miller@uiowa.edu](mailto:jane-miller@uiowa.edu)

interviews or questionnaires). It has substantially informed the research at the intersection of caregiving and parenting, parent-child attachment, and children's future developmental trajectories. There is a general consensus that caregivers' capacity for mentalizing, mind-mindedness, and reflective functioning, and, perhaps even more importantly, their willingness to deploy and engage spontaneously in mind-mindedness when interacting with their young children, are key characteristics required for sensitive and responsive parenting (Meins, 2013; see also Zeegers et al., 2017, for review).

Parental responsiveness is a broad concept that encompasses sensitivity, support, synchrony, emotional availability, and prompt and effective comforting when the child is distressed; enthusiastic, connected, warm response to the child's positive social cues; and helpful, supportive engagement in play and teaching contexts. Indeed, multiple studies have demonstrated positive associations between parents' mind-mindedness (and related constructs, such as reflective functioning) and their responsiveness, sensitivity, emotional availability, affectively positive caregiving, and other adaptive parenting qualities (see Zeegers et al., 2017, for a recent meta-analytic review). Parents who are able and willing to treat their infants as psychological agents and who appreciate their inner mental states, emotions, cognitions, and motivations are, therefore, well "tuned into" their young children's psychological cues and are likely to interpret them accurately. Consequently, this mind-reading ability should serve parents well, and it should promote appropriate behavioral responsiveness during their interactions with their children.

Parental responsiveness, in turn, has been very broadly associated with children's security of attachment, as first proposed by Bowlby (1969/1982) and Ainsworth, Bell, and Stayton (1971). The association between responsiveness and attachment security has been examined in countless studies, which overall have supported reliable, albeit sometimes modest links (see De Wolff & van IJzendoorn, 1997; Goldsmith & Alansky, 1987; Lucassen et al., 2011; Pasco Fearon & Belsky, 2016; Thompson, 2006; van IJzendoorn & De Wolff, 1997; Verhage et al., 2016, for narrative and meta-analytic reviews).

Researchers seem to agree that a model of parental mind-mindedness as a precursor to parental responsiveness, and responsiveness, in turn, as a mediator of the link between mind-mindedness and the child's attachment security, has conceptual merit. Recently, a large meta-analytic study supported that model by extrapolating from extant separate data sets (Zeegers et al., 2017). Surprisingly, however, to our knowledge, only two empirical studies have explicitly tested such a mediational model. Lundy (2003) found evidence of the association among parents' mind-minded comments to their infants, synchrony (both assessed at 6 months), and attachment security at 13 months, such that synchrony mediated the link between mind-minded comments and security, notably for both mother- and father-child relationships. That study, however, had limitations. The sample was small (24 families at 6 months and 16 families at 13 months), data on mind-mindedness and synchrony were concurrent and based on a very short observed interaction (6 min), and finally, attachment security was assessed through the parent-rated Attachment Q-Set (AQS; Waters, 1987). Observer-rated AQS is strongly preferred to parent-rated AQS (Cadman, Diamond, & Fearon, 2018; van IJzen-

doorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004).

Laranjo, Bernier, and Meins (2008) also supported a model in which mothers' sensitivity, observed during lengthy sessions at 12–13 months, mediated the link between their mind-minded comments to their children, assessed during a 10-min interaction at the same time, and children's security of attachment, assessed by observers who rated AQS at 15–16 months. That sample also was relatively modest in size ( $N = 50$ ) and the data on mind-mindedness and responsiveness were concurrent.

One other study examined mothers' reflective functioning, a construct closely related to mind-mindedness, by testing the links among reflective functioning, sensitive parenting, and children's security among 83 mothers with childhood maltreatment histories (Stacks et al., 2014). Reflective functioning was assessed using a short form of Parent Development Interview (Slade, Aber, Berger, Bresgi, & Kaplan, 2003), administered to the mothers. Mothers' sensitivity was observed during 10-min interactions with their children, and security of attachment was assessed in the Strange Situation Paradigm (SSP). The authors reported the presence of an indirect effect from reflective functioning to sensitive parenting to attachment security. All measures, however, were concurrent, and obtained when children were 16 months.

It should be noted that other conceptual models of the relations among parents' mind-mindedness, their sensitivity, and children's attachment—ones not proposing the mediated link—are certainly viable, and have been supported. Mind-mindedness and sensitivity can function as independent precursors of security. For example, Meins, Fernyhough, Fradley, and Tuckey (2001) demonstrated that parents' appropriate mind-minded comments and their sensitivity served as independent predictors of children's attachment security, with the former accounting for more variance.

Further, not all mind-minded comments are equally helpful in development. An important distinction between appropriate and nonattuned parental comments reflects whether or not the parent appears to represent the infant's mental state accurately. In several studies, Meins and colleagues have demonstrated that the former have positive developmental implications, whereas the latter, although typically quite rare, have been associated with poorer outcomes (Meins, 2013; Meins, Bureau, & Fernyhough, 2018; Meins & Fernyhough, 2015; Meins et al., 2012). In another sample, Meins et al. (2012) found that sensitivity did not predict attachment classifications, whereas parents' mind-minded appropriate and nonattuned comments, examined along with sensitivity, predicted secure and insecure classifications, respectively.

Although the previously described findings are very important, we should note that mind-mindedness and sensitivity were measured concurrently, in infancy, and attachment—at 15 months, in the SSP. Consequently, the design was not optimal for the testing of mediation, which typically requires that the predictor (mind-mindedness), the mediator (sensitivity), and the outcome (attachment) be assessed at consecutive times (McMahon & Bernier, 2017).

In summary, the extant work that has examined the path from the parent's mind-mindedness to her or his responsiveness to the child's security, although certainly valuable, has been subject to various limitations. We addressed those limitations in the present study. We examined parental mind-mindedness as an early starting point for a developmental path leading toward security of attach-

ment in middle childhood, at age 10. We posit that the association between appropriate mind-mindedness in infancy and security at age 10 is sequentially mediated first, by parental responsiveness at 15 months and second, by security at age 2. Given that evidence on effects of nonattuned comments is mixed (McMahon & Bernier, 2017), those comments were included, but their examination was secondary and exploratory.

We were able to extend the sequence examined in this study—from parental mind-mindedness in infancy to responsiveness at 15 months to security at age 2—to age 10 years because of the availability of a new attachment measure, developed in our laboratory. In our past work with the current sample, we have shown that children's attachment security, assessed at age 2 by observers who performed AQS based on lengthy observations of the parent-child dyad, predicted security at age 10 in that new measure, based also on observations of those parent-child dyads at age 10 (Iowa Attachment Behavioral Coding, IABC; Boldt, Kochanska, Grekin, & Brock, 2016). Although the issue of stability of attachment (or lack of it) across development is a perennial and central one in attachment theory and research, evidence remains inconsistent (Groh et al., 2014; L. A. Sroufe, Egeland, Carlson, & Collins, 2005; see also meta-analysis by Piquart, Feussner, & Ahnert, 2013). Whether or not the child's organization of attachment is stable depends on multiple factors, including stability of care, life events, or changes in the environment. Pertinent research is further complicated by the fact that different attachment measures are appropriate at different ages; consequently, the availability of observer-based measures that both capitalize on lengthy parent-child interactions in comparable contexts is highly advantageous. An examination of the developmental cascade initiated by parental mind-mindedness in infancy to responsiveness at 15 months to attachment at toddler age to attachment in middle childhood may inform our understanding of early origins of future attachment trajectory. To our knowledge, ours is the most longitudinally extensive examination of the developmental implications of mind-mindedness in attachment research.

Our study sought to accomplish several goals and pursue several directions that McMahon and Bernier (2017) explicitly articulated as key for the future research agenda in their comprehensive review. One, we deployed a research design that uses multiple time points and contemporary techniques of longitudinal data analysis necessary to shed light on the developmental pathways that might link early parental mind-mindedness to children's socioemotional outcomes in subsequent years. Two, our design was prospective, with mind-mindedness measured at an earlier age than responsiveness, and responsiveness assessed earlier than security, to allow for a truly developmental test of mediation (that we test using appropriate analytic tools). Three, although we collected data on parents' mind-mindedness in a play context, most commonly used, we supplemented those data by observations of a typical daily routine (parent-child snack, followed by a brief cleanup). This likely increases the robustness of our measures. Four, we collected parallel data from mother-child and father-child dyads, addressing the dearth of research on paternal mind-mindedness, a problem stubbornly present in the field, despite promising findings that indicated importance of fathers' mind-mindedness in children's development (Gagné, Bernier, & McMahon, 2018).

Further, as stated above, a new measure of security at age 10 allowed us to considerably extend the age range typically studied

in research on mind-mindedness, responsiveness, and attachment security (generally, from infancy to toddler or preschool age). To our knowledge, ours is the first study to examine a 9-year attachment trajectory (infancy to 10 years). We relied on robust observational data to assess all constructs, and we used analytic techniques developed specifically to assess sequential mediation, particularly appropriate for developmental longitudinal designs.

## Method

### Participants and Overview

Two-parent families of 102 typically developing infants (almost all born in 2001) volunteered for the longitudinal study. The study was advertised broadly in community venues (a college town, a small city, and surrounding rural communities in a Midwestern state in the United States). To be accepted, the biological parents had to be living together, both wishing to participate in the planned assessments, able to speak English during sessions, and not planning to move in the next 5 years. Among the families, there was a range of education: 25% of mothers and 30% of fathers had no more than high school education, and 21% of mothers and 20% of father had postgraduate education. There was also a range of annual income: 25% of families made less than \$40,000, and 49% made over \$60,000. In terms of race, 90% of mothers and 84% of fathers were White, 3% and 8% Hispanic, 2% and 3% African American, 1% and 3% Asian, 1% of mothers Pacific Islanders, and 3% and 2% "other" non-White. In 20% of families, one or both parents were non-White. The University of Iowa Institutional Review Board approved the study under approval number 200107049 and project title "Developmental Pathways to Antisocial Behavior: A Translational Research Program." Parents completed informed consent, and children (at age 8) completed assent.

This article reports data from the following assessments (all measures were parallel for mother-child and father-child relationships). Parents' mind-mindedness was measured at the first assessment, when children were 7 months ( $N = 101$ , 50 girls; one family failed to speak English during the sessions and could not be coded). Parents' responsiveness to the child was assessed at 15 months ( $N = 101$ , 51 girls); children's attachment security was assessed twice, at 25 months, or 2 years ( $N = 100$ , 50 girls), and at 123 months, or 10 years ( $N = 82$ , 37 girls). The participants who returned at 10 years did not differ from those who did not return with regard to any of the constructs examined in this report (all  $t$ s < 1).

All measures were observational, collected during multiple paradigms in lengthy (2–4 h) sessions, conducted with each parent at each age. The sessions at 7 months were in the families' homes, and all subsequent sessions were in a university laboratory. At 7 months, the mother-child session was first; at the other times, the order was counterbalanced. The sessions for one family were generally conducted within 1–3 weeks.

The laboratory includes a naturalistically furnished living room and a sparsely furnished play room. All data were coded from video recordings, with different coders coding the child with the mother and with the father. Reliability was typically established on approximately 15–20% of cases, followed by frequent realignments, and, depending on the type of coded constructs, relied on  $\alpha$ s, intraclass correlations (ICCs), or  $\kappa$ s. When legitimate, we



aggregated data at multiple levels to produce robust final constructs (Rushton, Brainerd, & Pressley, 1983).

### Parental Mind-Mindedness Measures, 7 Months

**Observed contexts, transcribing, coding, and data aggregation.** Mind-mindedness was assessed during two contexts, parallel for the mother–child session and father–child session. During snack (7 min), in the kitchen, the parent was asked to feed the child food of their choice and wash the child’s face and hands at the beginning and end. During play (6 min), the parent was asked to engage the baby with a standard toy, a small plastic Pooh Bear.

**Transcribing and coding.** Members of a trained team transcribed, verbatim, each parental comment made to the child. A new comment was defined as an utterance separated from the previous one by a 1-s pause or reflecting new semantic content. Reliability for parsing the parents’ speech into separate units, ICCs, ranged from .74 to .99.

Then, a team of trained coders coded the transcripts while watching the video. The coders additionally evaluated the accuracy of the transcription, and edited if needed. They then coded each utterance as mind-minded or not mind-minded, according to the manual by Meins and Fernyhough (2015). Mind-minded comments typically included references to the infant’s desires, cognitions, emotions, and talking on the infant’s behalf. All other comments were coded as not mind-minded. Reliability,  $\kappa$ s, ranged from .96 to .99.

Finally, each mind-minded comment was coded either as appropriate or nonattuned (Meins & Fernyhough, 2015). The criteria for an appropriate mind-minded comment were as follows: The observer agreed with the parent’s reading of the infant’s internal state; the comment linked the infant’s current activity with similar events in the past or future; or the comment served to clarify how to proceed after a lull in the interaction. The remaining mind-minded comments (that did not meet those criteria) were coded as nonattuned. Reliability,  $\kappa$ s, ranged from .69 to .95.

**Data aggregation.** For each parent, we computed sums, for snack and for play, of all *mind-minded appropriate comments* and *nonattuned comments*. Three parents were missing a single context; for them, we imputed the averages for that context. We computed the composite scores for each parent by summing the tallies across snack and play. The appropriate comments correlated across snack and play for mothers,  $r(101) = .43, p < .001$  and fathers,  $r(101) = .30, p < .01$ . Because the nonattuned comments were very rare, not surprisingly, they did not correlate across the contexts (the respective  $r$ s were  $-.04$  and  $.07$ ). There were no significant differences between girls and boys in the numbers of received appropriate comments, from mothers, girls,  $M = 13.70, SD = 10.25$ , boys,  $M = 14.76, SD = 7.50$ , or from fathers, girls,  $M = 10.42, SD = 9.13$ , boys,  $M = 11.33, SD = 8.07$ , or nonattuned comments, from mothers, girls,  $M = 1.48, SD = 1.53$ , boys,  $M = 1.73, SD = 2.15$ , or from fathers, girls,  $M = 1.18, SD = 1.37$ , boys,  $M = 1.37, SD = 1.92$ , all  $t$ s  $< 1$ .

### Parental Responsiveness, 15 Months

**Global ratings of naturalistic interactions.** Responsiveness was assessed during 42 min of mother–child and 42 min of

father–child naturalistic interactions that encompassed a variety of typical, carefully scripted, but naturalistic daily routines, leisurely and playful contexts, chore-oriented contexts, and caregiving activities. Coders assigned one overall rating to each context (e.g., toy cleanup, free time, parent busy, snack, and play), on a scale from 1 (*very unresponsive*) to 7 (*very responsive*). The rating incorporated the classic dimensions (Ainsworth et al., 1971): sensitivity–insensitivity, cooperation–interference, and acceptance–rejection. Coding reliabilities,  $\alpha$ s, ranged from .90 to .96. Codes across all contexts were then averaged into an overall global responsiveness score for each parent;  $\alpha$ s were .75 for mothers and .81 for fathers.

**Microscopic coding of naturalistic interactions.** Different teams coded the same 42 min of naturalistic contexts for each mother- and father–child dyad. For each 1-min segment, coders recorded each child signal calling for parental response, as one of three categories (negative/distress bid, e.g., crying; neutral or positive bid, e.g., vocalizing, smiling; or a physiological signal, e.g., coughing). Reliability,  $\kappa$ , was .77. In the next pass, different coders, using detailed descriptions of the anchor points, rated the parent’s responsiveness to each signal as 1 = *poor (annoyed, dismissive response)*, 2 = *fair (perfunctory, somewhat distracted, and minimal response)*, 3 = *good (appropriate, concerned, and positive response)*, or 4 = *exceptional (warm, empathic, skillful, and enthusiastic response)*. Reliability,  $\kappa$ s, were .79–.80.

We tallied all instances when the parent responded poorly, fairly, well, or exceptionally to the signals in each category, and divided each sum by the total number of signals in that category (e.g., the proportions of all child distress signals to which the parent responded poorly, fairly, well, or exceptionally). Next, we computed four composite scores representing poor, fair, good, and exceptional response (respectively, the averages of poor, fair, good, and exceptional response across all child signals). Finally, we weighed the composite of poor responses by  $-2$ , fair responses by  $-1$ , good responses by 1, and exceptional responses by 2, and summed them into an overall microscopic responsiveness score for each parent (for details, see Kochanska & Aksan, 2004).

**Ratings of responsiveness in elicited imitation tasks.** Each parent–child dyad was observed in an elicited imitation paradigm (Forman, Aksan, & Kochanska, 2004). The parent demonstrated three simple play sequences (“Make a rattle,” “Pour and drink tea,” and “Clean the table”) and encouraged the child to imitate. For each sequence, parental responsiveness was coded in terms of sensitivity to the child’s needs and degree of helpfulness. The ratings ranged from 0 = *low (too little or minimal assistance or encouragement, or else intrusive assistance, poorly timed)*, to 1 = *medium (some appropriate and some inappropriate assistance)*, to 2 = *high (helpful, appropriate, sensitive guidance, encouragement, and assistance)*. Coding reliability,  $\kappa$ , was .77. For each parent, the scores were averaged across the three play sequences into an overall sensitivity score in the elicited imitation tasks (the correlations across the sequences ranged .60–.63 for mothers and .41–.59 for fathers).

**Overall responsiveness score.** The three scores (overall global score, overall microscopic score, and overall score for sensitivity in elicited imitation) correlated; for mothers, the correlations ranged from .16,  $p = .10$  to .48,  $p < .001$  (all  $d$ fs = 101), and for fathers, .21,  $p = .05$  to .51,  $p < .001$  (all  $d$ fs = 101). Cronbach’s  $\alpha$ s were each .60, indicating moderate coherence.

Consequently, they were standardized and averaged into an *overall composite responsiveness score* for each parent. There were no differences between girls and boys in terms of experienced responsiveness, either maternal, girls,  $M = -0.03$ ,  $SD = 0.78$ , boys,  $M = 0.03$ ,  $SD = 0.71$ , or paternal, girls,  $M = 0.03$ ,  $SD = 0.74$ , boys,  $M = -0.03$ ,  $SD = 0.76$ , both  $t_s < 1$ .

### Child Attachment Security Measure, 2 Years: Observer-Reported AQS

Trained coders completed the AQS (Version 3; Waters, 1987), having observed each mother- and father-child dyad during the entire 2- to 2.5-h laboratory session in multiple, psychologically diverse contexts (see Boldt, Kochanska, Yoon, & Koenig Nordling, 2014, for details). Those contexts encompassed various parent-child interactions, both leisurely or neutral (e.g., play, free time, snack, and opening gift) and mildly stressful (e.g., toy cleanup, prohibition, and parent busy), and laboratory paradigms that involved interactions between the child and a friendly adult (the visit coordinator) and the child in the context of games and tasks of varying difficulty. The latter paradigms targeted various temperament dimensions and aspects of rule-compatible conduct that were also assessed in the overall study. The coders sorted the 90 cards into nine 10-card piles ranging from 1 = *most uncharacteristic*, to 9 = *most characteristic* of the child. Each coder's sort was correlated with the criterion sort representing the "ideal secure child" and the *final AQS security scores* were created according to the standard instructions. Reliability, ICC, was .85.

There were gender differences. Girls' security scores were higher than boys', with mothers, girls,  $M = .34$ ,  $SD = .25$ , boys,  $M = .24$ ,  $SD = .22$ ,  $t(98) = 2.19$ ,  $p < .05$ , and with fathers, girls,  $M = .34$ ,  $SD = .22$ , boys,  $M = .23$ ,  $SD = .20$ ,  $t(98) = 2.62$ ,  $p < .05$ .

### Child Attachment Security Measure, 10 Years: IABC

**Observed contexts.** IABC is a new system, developed in our laboratory to assess parent-child attachment in middle childhood, based on lengthy observations of the parent-child dyad, interacting across diverse contexts. Highly trained coders viewed each mother- and father-child dyad interacting in 11 contexts, for approximately 67 min, as well as the transitions between the contexts (cumulatively approximately 80 min per dyad). A coder did not code the same child with both parents. The contexts, many of which were affectively charged, were adapted from attachment-informed research programs that have targeted the period of middle childhood and early adolescence, such as Allen's research (Allen et al., 2003; Hare, Marston, & Allen, 2011) and Minnesota Longitudinal Study (L. A. Sroufe et al., 2005; J. Sroufe, 1991). Those contexts were as follows.

"Campaigns": The dyad devises campaigns (a physical fitness and a cell phone campaign for one dyad; a good nutrition and a fights/conflicts campaign for the other dyad). "Puzzles": Interactive puzzle solving, with each person blindfolded in turn. "Hot topics": Dyad chooses and discusses two family "hot topics," followed by one "Fun topic": Discussion of an activity the dyad enjoys doing as a family. "Plan an outing": Dyad plans an all-expenses-paid outing (a trip or a visit to the Mall of America). "Difficult scenario": Dyad discusses a hypothetical difficult deci-

sion scenario (e.g., choosing whom to save after a plane crash). "Seeking advice": Child seeks advice from the parent on a troubling issue. The dyad also was observed in "Snack/Free time." After viewing the entire 80-min interaction, coders first considered a set of attachment-informed behavioral codes, not described here (e.g., the child's level of confidence with the parent, how engaged the child was with the parent, whether the conversation tended to be personal or impersonal, the child's level and appropriateness of negative and positive emotional arousal and expression, and the level of comfort and support sought and accepted from the parent).

**Coding.** Coders gave each child one *overall security rating* that reflected a conceptual, clinical (not a simple mean) integration of the previous codes. Those final codes ranged from 1 = *not at all descriptive of child*, to 5 = *very descriptive of child*. The rating reflected the degree to which the child showed well-regulated emotions, sought and readily accepted the parent's comfort when distressed or aroused, and comfort appeared effective. Coders also considered the child's confidence in his or her own abilities and performance, enjoyment of the interactions, responsiveness to the parent, and being comfortable sharing personal references and his or her point of view with ease. Overall, the coders evaluated whether the child seemed to have a "special," tension-free, trusting, and comfortable connection with the parent.

Reliability, weighted  $\kappa$ , was .84. Girls and boys did not differ on security with mothers, girls,  $M = 2.86$ ,  $SD = 1.06$ , boys,  $M = 2.88$ ,  $SD = 1.12$ ,  $t < 1$ , but girls had higher scores than boys on security with fathers, girls,  $M = 3.38$ ,  $SD = 0.74$ , boys,  $M = 2.70$ ,  $SD = 0.99$ ,  $t(72) = 3.30$ ,  $p < .005$ .

Of note, the coders also assigned to each child the ratings for avoidance, ambivalence, and disorganization, but those were not used in this article, because we wished to target a measure analogous to AQS. More extensive information about this assessment and its psychometric qualities, including validity, is in Boldt et al. (2016). Briefly, the attachment dimensions correlated in theoretically consistent and anticipated ways with the history of parental care, with observer-rated AQS at 25 months, and for mothers and children, with child-reported security at age 8, and with a range of measures of child adjustment at age 10 and 12 years (externalizing behavior problems, competence, and embracing parental values). All descriptive data are in Table 1.

## Results

### Preliminary Analyses

**Descriptive analyses: Effects of parent, context, and type of mind-minded comment.** Few, if any, studies deployed two different observational contexts for assessments of parental mind-mindedness. Typically, the observations have been conducted in the context of the parent-child play. Consequently, we present exploratory descriptive data for the mind-mindedness comments with regard to the effects of parent, context, type of comment, and their interactions.

We conducted a 2 (Parent: mother, father)  $\times$  2 (Context: snack, play)  $\times$  2 (Type: appropriate, nonattuned) repeated-measures analysis of variance (ANOVA; we used the number of comments per minute to adjust for the difference in length between snack and play, to avoid Context having an effect merely because of the length of observation). There were two significant main effects and

Table 1  
Descriptive Data for All Measures

Age and measure	Mother-child dyads				Father-child dyads				<i>t</i> test
	<i>M</i>	<i>SD</i>	Range	<i>N</i>	<i>M</i>	<i>SD</i>	Range	<i>N</i>	<i>p</i> level
Parental mind-mindedness at age 7 months									
MM appropriate comments									
Play	6.11	5.49	0–28	101	4.87	5.02	0–30	101	n.s.
Snack	8.13	5.09	0–22	101	6.01	5.61	0–38	101	<.005
Total	14.24	8.94	0–50	101	10.88	8.58	0–45	101	<.005
MM nonattuned comments									
Play	.63	1.19	0–9	101	.55	.97	0–4	101	n.s.
Snack	.97	1.48	0–7	101	.72	1.28	0–6	101	n.s.
Total	1.60	1.87	0–10	101	1.28	1.66	0–8	101	n.s.
Total MM comments	15.84	9.43	0–52	101	12.16	9.28	1–51	101	<.005
Parental responsiveness at age 15 months									
Global (interactions)	4.95	.78	3.00–6.33	101	4.51	.93	2.17–6.17	101	<.001
Microscopic (interactions)	.29	.39	–.83–1.24	101	.07	.48	–1.07–1.17	101	<.001
Sensitivity (elicited imitation)	1.13	.60	0–2	101	.93	.54	0–2	101	<.01
Overall composite	.00	.74	–1.87–1.88	101	.00	.74	–2.20–1.59	101	N/A <sup>a</sup>
Child attachment security at age 2 years									
AQS	.29	.24	–.46–.79	100	.28	.22	–.25–.77	100	n.s.
Child attachment security at age 10 years									
IABC	2.87	1.09	1–5	78	3.01	.94	1–5	74	n.s.
Covariate									
Education level	3.53	1.14	1–5	101	3.40	1.16	1–5	102	n.s.

Note. MM = mind-minded; AQS = Attachment Q-Set; IABC = Iowa Attachment Behavioral Coding; n.s. = not significant.

<sup>a</sup> Constructs for mother-child and father-child dyads are standardized; thus, each has a mean of 0.

one two-way interaction. Not surprisingly, the main effect of Type revealed that parents made more appropriate than nonattuned comments,  $F(1, 100) = 282.79, p < .001, \eta_p^2 = .739$ , 95% confidence interval (CI) of the difference [.752, .953]. The main effect of Parent revealed that mothers made more mind-minded comments than fathers,  $F(1, 100) = 9.652, p < .005, \eta_p^2 = .088$ , 95% CI of the difference [.050, .228]. This effect, however, was qualified by the significant interaction effect, Parent  $\times$  Type,  $F(1, 100) = 7.632, p < .01, \eta_p^2 = .071$ . Mothers made significantly more appropriate comments than fathers,  $p < .005$ , 95% CI [.086, .423], but parents did not differ with regard to nonattuned comments. The main effect of Context, and the remaining two- and three-way interactions were not significant.

**Correlations among the measures.** The intercorrelations are presented in Table 2. For both mother- and father-child dyads, parents' mind-minded appropriate comments to their 7-month-old infants positively related to responsiveness to the child at 15 months, which in turn positively related to child security assessed at 2 years and at 10 years (although the latter only marginally for mothers). As well, security scores at 2 years and at 10 years were positively related (note that the latter associations have been previously reported, Boldt et al., 2016). For father-child dyads only, fathers' mind-minded appropriate comments positively related to security at 2 years and at 10 years.

The appropriate and nonattuned comments were unrelated for mothers, but positively correlated for fathers. The nonattuned

Table 2  
Correlations Among All Measures

Age and measure	7 months		15 months	2 years	10 years
	MM appropriate comments	MM nonattuned comments	Parental responsiveness	Child security AQS	Child security IABC
7 Months					
MM appropriate comments	.22*	.17	.26**	–.02	.10
MM nonattuned comments	.34***	.14	.03	.07	.17
15 Months					
Parental responsiveness	.31**	.19	.29**	.29**	.22
2 Years					
Child security, AQS	.30**	.10	.28**	.72***	.49***
10 Years					
Child security, IABC	.25*	.20	.36**	.47***	.55***

Note. MM = mind-minded; AQS = Attachment Q-Set; IABC = Iowa Attachment Behavioral Coding. Correlations for mother-child dyads are above the diagonal, and correlations for father-child dyads are below the diagonal. Correlations across the dyads are on the diagonal.

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

comments were unrelated to responsiveness or security at age 2 or at age 10 years, for both mother- and father-child dyads.

### Main Analyses: A Developmental Path From Mind-Minded Appropriate Comments at 7 Months to Responsiveness at 15 Months to Security at 2 Years to Security at 10 Years

**Overview of the main analyses.** We performed multiple sequential mediation analyses separately for mother- and father-child dyads. The parent's mind-minded appropriate comments at 7 months were modeled as the independent variable; the parent's responsiveness to the child at 15 months as the first mediator, followed by the child security (AQS) at 2 years as the second mediator; finally, the child's security at 10 years (IABC) was the outcome variable. Child gender, the parents' education levels, and the parents' mind-minded nonattuned comments served as the covariates.<sup>1</sup>

To test the estimated indirect effects, we performed a nonparametric resampling method (bias-corrected bootstrap) with 10,000 resamples drawn to derive the 95% CIs for the indirect effects. This method is preferred, especially when the sample size is small or moderate, because (a) the sampling distribution is not assumed to be normal, (b) no particular formula for the *SE* is required, and (c) power is maximized while minimizing Type I error rate (MacKinnon, Lockwood, & Williams, 2004; Preacher, Rucker, & Hayes, 2007; Shrout & Bolger, 2002). To test the main mediational models, we deployed the Mplus code (Muthén & Muthén, 2012) provided by Stride, Gardner, Catley, and Thomas (2015). This adaptation of the original SPSS PROCESS macro (Hayes, 2013), by converting the syntax into Mplus code, allows for the full information maximum likelihood (FIML) missing data treatment. Figure 1 and Figure 2 represent the models for the mother- and father-child dyads, respectively.

**Mother-child dyads.** There was a significant path from the mother's mind-minded appropriate comments to her responsiveness to the child; mothers who made more such comments were more responsive. There were no significant direct paths from mind-minded appropriate comments to the child's security, either at 2 or at 10 years. There was a significant path from the mother's responsiveness to the child's security at 2, and from security at 2 to security at 10. Responsiveness, however, did not have a significant direct effect on the child's security at 10 years.

One anticipated indirect effect was present. The mother's mind-minded appropriate comments at 7 months predicted the child's security at 10 years, and this effect was sequentially mediated—first by maternal responsiveness at 15 months and next by the child's security at 2 years,  $B = 0.004$ ,  $SE = .002$ , bias-corrected 95% CI [0.001, 0.011], indicating the presence of an indirect effect. The other tested indirect effects were not present: From the mother's mind-minded appropriate comments to responsiveness to security at 10 years,  $B = 0.002$ ,  $SE = .003$ , bias-corrected 95% CI [-0.003, 0.011], and from mind-minded appropriate comments to security at 2 to security at 10,  $B = -0.010$ ,  $SE = .007$ , bias-corrected 95% CI [-0.025, 0.002].

As for the covariates, child gender and the mother's education level had significant effects on child security at 2 years (AQS), consistent with the univariate findings presented above. The non-

attuned comments had no significant effects on either the mediators or the outcome.

**Father-child dyads.** There were significant paths from the father's mind-minded appropriate comments in infancy to the child's security at 2 years. Fathers who made more such comments had children who were more secure. There was also a significant path from the father's responsiveness at 15 months to the child's security at 10 years, and another significant path from the child's security at 2 years to security at 10.

There was one indirect effect present. The father's mind-minded appropriate comments at 7 months predicted the child's security at 10 years, and this effect was mediated by the child's security at 2 years,  $B = 0.008$ ,  $SE = .005$ , bias-corrected 95% CI [0.001, 0.021], indicating the presence of an indirect effect. We also examined the other two indirect effects: From mind-minded appropriate comments to responsiveness to security at 2 to security at 10,  $B = 0.001$ ,  $SE = .001$ , bias-corrected 95% CI [0.000, 0.006], and from mind-minded appropriate comments to responsiveness to security at 10,  $B = 0.006$ ,  $SE = .005$ , bias-corrected 95% CI [0.000, 0.019]. Upon the inspection of the CIs, the evidence for the presence of these two indirect effects was deemed insufficient.

As for the covariates, child gender had a significant effect on child security at 2 (AQS). The father's education level and the nonattuned comments had no significant effects on either the mediators or the outcome.

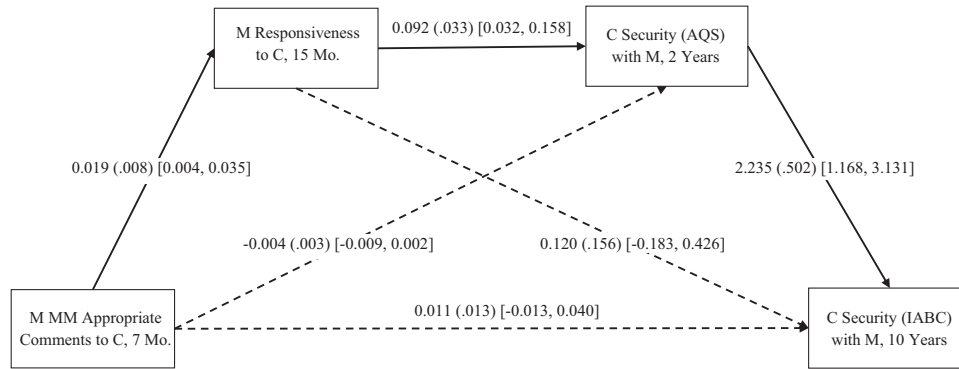
## Discussion

This study makes several contributions to the growing body of research on parental mind-mindedness. We tested the developmental path from mind-mindedness in infancy to responsiveness at 15 months to security of attachment at age 2 to security of attachment at age 10 in a longitudinal prospective design, using robust observational measures. We collected parallel data for mother-child and father-child relationships, addressing the dearth of research on long-term implications of paternal influences on development, relative to our knowledge of maternal influences. This study is unique in terms of the age span of a developmental cascade that begins with mind-mindedness in infancy and ends in middle childhood.

Of note, other researchers have studied long-term implications of maternal mind-mindedness. Meins et al. (2018) examined a path from mothers' mind-minded appropriate and nonattuned comments and sensitivity in infancy to attachment at 15 months to attachment at 44 months to attachment at 51 months. Bernier, McMahon, and Perrier (2017) reported a 6-year developmental cascade, triggered by maternal mind-mindedness at age 1; this study, however, focused on children's language ability and self-regulation as sequential mediators, and on children's school readiness as the outcome. To our knowledge, the present work is the longest-term study to date of implications of parental mind-mindedness with regard to the development of attachment security,

<sup>1</sup> We also conducted a series of additional regression analyses (not reported), covarying the measures of security in Strange Situation Paradigm at 15 months (unrelated to MM comments) and a parental responsiveness measure at 7 months, to reduce the possibility that continuity of constructs may have accounted for the findings. The findings were essentially unchanged.





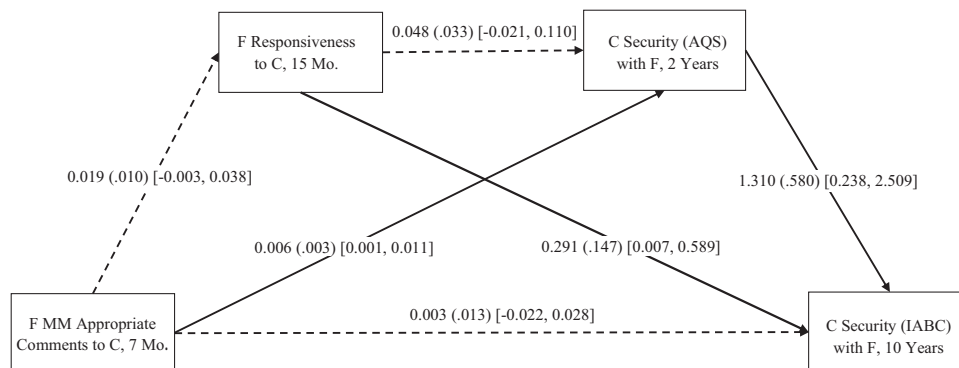
*Figure 1.* Mediation path from the mother's mind-minded appropriate comments to the child at 7 months to the mother's responsiveness to the child at 15 months to the child's attachment security (AQS) with the mother at age 2 to the child's attachment security (IABC) with the mother at age 10. Solid lines represent significant effects; dashed lines represent nonsignificant effects. Reported are unstandardized coefficients and *SEs* (in parentheses), and 95% confidence intervals (CIs). Although not depicted, the child's gender, the mother's highest level of education, and the mother's mind-minded nonattuned comments are included as covariates for both mediators and the outcome variable. The child's gender and the mother's education had significant effects on attachment security (AQS):  $B = -0.116$ ,  $SE = .044$ , 95% CI  $[-0.206, -0.031]$ , and  $B = 0.064$ ,  $SE = .025$ , 95% CI  $[0.016, 0.112]$ , respectively. MM = mind-minded; M = mother; C = child; Mo. = months; AQS = Attachment Q-Set; IABC = Iowa Attachment Behavioral Coding.

and likely the only one with parallel data for mother- and father-child relationships. The results add to and bolster our growing appreciation of the remarkable—although subtle and indirect—importance of parents' mind-mindedness in the first months of life, coded from their interactions with preverbal infants.

The fact that we studied mothers' and fathers' mind-minded comments in two contexts—play and snack—allowed us to conduct descriptive analyses that compared the effects of parent and context. This was an ancillary goal; however, given that this work was the first to examine mind-mindedness in both parents and two contexts, we believe the findings, although not surprising, are

useful to the field. Mothers produced more mind-minded comments than fathers, and the difference was because of the appropriate, but not nonattuned comments. Play and snack were equally conducive to both parents' mind-mindedness, indicating that either can be successfully deployed in future studies.

Our key goal was to test an anticipated sequential mediation model, informed by the extant empirical and meta-analytic literatures (McMahon & Bernier, 2017; Zeegers et al., 2017). Can parental comments about the child's emotions, thoughts, and desires, appropriately reflecting the child's internal state, made during naturalistic interactions with still preverbal infants, inaugurate



*Figure 2.* Mediation path from the father's mind-minded appropriate comments to the child at 7 months to the father's responsiveness to the child at 15 months to the child's attachment security (AQS) with the father at age 2 to the child's attachment security (IABC) with the father at age 10. Solid lines represent significant effects; dashed lines represent nonsignificant effects. Reported are unstandardized coefficients and *SEs* (in parentheses), and 95% confidence intervals (CIs). Although not depicted, the child's gender, the father's highest level of education, and the father's mind-minded nonattuned comments are included as covariates for both mediators and the outcome variable. The child's gender had a significant effect on attachment security (AQS):  $B = -0.115$ ,  $SE = .039$ , 95% CI  $[-0.191, -0.039]$ . MM = mind-minded; F = father; C = child; Mo. = months; AQS = Attachment Q-Set; IABC = Iowa Attachment Behavioral Coding.



a developmental path to security of attachment in middle childhood? We believe we can answer in the affirmative. The data essentially supported such model, in that parents' early willingness to engage in mind-minded appropriate speech to their infants indeed launched the parent-child dyad on a developmental trajectory leading to the child's security at age 10.

Of note, parents' nonattuned comments were unrelated to responsiveness or to future attachment security. This is not consistent with other research in the field that has shown that appropriate and nonattuned comments independently predicted security and insecurity, respectively, and further, that nonattuned comments differentially predicted forms of insecurity (Meins et al., 2001, 2012, 2018). The discrepancy is likely because of the difference in attachment paradigms and the type of scores. Meins and colleagues have routinely relied on SSP, and its categorical scores. In the current project, we used AQS, and its continuous score at 25 months and IABC, also a continuous measure, at age 10.

Although appropriate mind-minded speech to infants triggered a trajectory to security at age 10 for both mother- and father-child dyads, the specific paths in the two relationships were distinct. In other words, whereas appropriate mind-minded speech inaugurates a long-term cascade to security in middle childhood in both mother- and father-child dyads, the developmental mechanisms of its impact may not be the same. For mothers, the path from appropriate mind-minded comments to their infants to security at age 10 was sequentially mediated first, by the mother's responsiveness to the child at 15 months, and then by child security at age 2 (that in turn, predicted security at age 10). For fathers, the path from appropriate mind-minded comments was mediated by security at age 2 (that in turn, predicted security at age 10, as it did for mothers and children). Further complicating the process, whereas maternal responsiveness at 15 months was directly associated with security at age 2, paternal responsiveness was unrelated to security at 2, but directly associated with security at age 10. How can we explain those differences?

At this point, any interpretation must be tentative. Only a handful of studies have addressed fathers' mind-mindedness assessed from their comments to their infants in naturalistic interactions, and the need for more studies is dire (Zeegers et al., 2017). Lundy (2003) reported support for the mediational model, in which synchrony mediated the link between appropriate mind-minded comments and security for both mothers and fathers. Arnott and Meins (2007) reported links between such comments at 6 months and children's security at 1 year, also for mothers and fathers. In both studies, however, the numbers of fathers were small, 24 and 17, respectively. Gagné and colleagues (2018) examined 92 fathers' mind-minded comments to their 18-month-old children, and found that higher frequency of such comments predicted children's better inhibitory control at age 3. Consequently, our findings, suggesting support for the long-term path from the father's early mind-mindedness to the child's future attachment to the father, contribute meaningfully to the literature.

We note that the part of the studied cascade from security at age 2 to security at age 10 appeared comparable: For all dyads, security at age 2 robustly predicted security at age 10 (reported in Boldt et al., 2016). However, differences emerged in the earlier part of the cascade—the paths leading from mothers' and fathers' mind-mindedness to security at age 2. For mothers, their appropriate comments promoted responsiveness at 15 months, and responsive-

ness promoted security at age 2. For fathers, however, although their appropriate comments were related to responsiveness in univariate analyses, that path was not supported in the multivariate analyses. Rather, paternal mind-minded appropriate comments were directly associated with child security at age 2. Notably, the pattern for fathers fits the model reported by Meins et al. (2001, 2012), in which mind-mindedness rather than sensitivity in infancy predicted security. Arnott and Meins (2007) found that for fathers, the links between appropriate mind-minded comments and child security were stronger than for mothers. It is possible that paternal appropriate mind-mindedness promotes children's security with fathers at age 2 through a different mediator than for mothers, one unmeasured in our study (e.g., shared, highly positive affect; Feldman, 2003).

The issue of potentially different predictors of security with mothers versus fathers remains unsettled in attachment research (Thompson, 2006). Whereas there is a consensus that links between maternal sensitivity or responsiveness and child security with mothers are reliable, albeit modest (De Wolff & van IJzendoorn, 1997; Nieuvar & Becker, 2008), much less is known about antecedents of security with fathers (Lickenbrock & Braungart-Rieker, 2015; van IJzendoorn & De Wolff, 1997; van IJzendoorn et al., 2004). A meta-analysis (Lucassen et al., 2011) found similar, although smaller, links for fathers and children, but that analysis was limited to security assessed in SSP. Van IJzendoorn et al. (2004) noted that no significant meta-analytic results were found for paternal sensitivity and security in AQS; however, only four studies were included. Meta-analyses that involved older children (5 to 18 years) and multiple attachment assessments found that mothers' and fathers' responsiveness predicted security, with the former links being stronger (Koehn & Kerns, 2018).

In our study, although maternal responsiveness at 15 months predicted the child's security at age 2, paternal responsiveness did not. However, paternal responsiveness directly predicted security at age 10. Perhaps the construct of responsiveness is not parallel for mothers and fathers; it has been long suggested that proportions of its various constituent components, such as warmth, synchrony, nurturance, provision of comfort, stimulating and challenging play, support for exploration, regulation of arousal and affective dynamics, among others, may differ for mothers and fathers (Lucassen et al., 2011). It is also possible that a maternal responsive pattern, perhaps focused on warm comforting, effectively promotes early security, whereas a paternal responsive pattern, perhaps focused on challenging play and shared activities, is more pertinent to security in middle childhood (Grossmann et al., 2002). Our measures may have not sufficiently discerned those aspects of responsiveness.

Future research on potentially different implications of maternal and paternal mind-minded comments holds exciting possibilities. Are the implications similar or different for other aspects of parenting, such as play, discipline, or discourse styles, and on children's outcomes, such as theory of mind, behavior problems, language development, or school readiness? Are the differences moderated by the child's gender (Feldman, 2003)? Given fathers' increasing engagement in parenting, those are timely research questions (Cabrera, Volling, & Barr, 2018).

This study has limitations. One important issue is methodological. There is a controversy in the literature with regard to the need for controlling for parents' verbosity by using proportions of appropriate and nonattuned comments in the parent's overall com-

ments. The coding manual (Meins & Fernyhough, 2015) recommends such approach. Many studies, however, successfully employed simple frequency measures of mind-minded appropriate comments (e.g., Bernier et al., 2017; Demers, Bernier, Tarabulsy, & Provost, 2010; Laranjo et al., 2008; Laranjo, Bernier, Meins, & Carlson, 2010, 2014). Some studies showed that both approaches yield similar findings (Ereky-Stevens, 2008; Meins et al., 2003, 2012). The controversy has been explicitly acknowledged (Laranjo, Bernier, Meins, & Carlson, 2014, pp. 52–53; McMahon & Bernier, 2017, p. 75; Meins et al., 2003, p. 1199).

We created the proportion scores for mothers' and fathers' appropriate and nonattuned comments in addition to the frequency scores. Unfortunately, those proportion scores were unrelated to any of the other variables, for either mother–child or father–child dyads. Consequently, we acknowledge that the overall richness of the child's verbal environment may indeed be an important factor in the studied processes, and our findings must be treated with caution, with the caveat that they pertain to the absolute, or frequency scores.

Although our sample was relatively diverse in terms of education, the ethnic diversity was limited (although note that 20% of families had at least one non-White parent). This limitation is quite common in research on parental mind-mindedness (McMahon & Bernier, 2017). There are exceptions: Hughes, Devine, and Wang (2017) recruited and compared samples that were more diverse ethnically and culturally, Meins et al. (2012) studied a large group of predominantly low socioeconomic status (SES) mothers, and Meins, Centifanti, Fernyhough, and Fishburn (2013) studied a sample with broadly ranging SES level. As well, our sample included two-parent community families with their typically developing biological children, whose interactions were generally positive and responsive. Future research should include more diverse family configurations, and more at-risk families, as evidence has revealed differences in mind-mindedness, assessed in interviews, between biological and adoptive or foster parents, and between community families that were and were not involved with child protective services (Fishburn et al., 2017). Of note, SES appears to moderate the impact of appropriate mind-mindedness comments on children's development (Meins et al., 2013; Meins, Fernyhough, & Centifanti, 2018). Moreover, growing research has indicated significant relations between parental psychopathology and mind-mindedness (McMahon & Bernier, 2017; Schacht et al., 2017); consequently, studying samples enriched for higher levels of risk in parental adjustment and mental health would be an important aim.

The sample size was another limitation of this study, because it prevented us from examining the processes in mother–child and father–child dyads in one model. Ideally, in larger samples, mother- and father–child processes would be analyzed over time in one model, in a full auto-regressive design, to discern and account for complex interrelated dynamics within the family system (Cox & Paley, 2003). There is little consensus on the required sample size for structural equation modeling (MacCallum, Widaman, Zhang, & Hong, 1999); the decision may depend on various considerations, such as normality of data, estimation method, and missing data treatment. The current sample size, however, is not large enough to handle many parameters of the comprehensive model, even judging from the general guideline of 10 observations

per estimated parameter (Schreiber, Nora, Stage, Barlow, & King, 2006).

Research on mind-mindedness has clearly become one of the most rapidly developing scientific enterprises, richly integrating a range of theoretical frameworks and deploying multiple methodologies in a heuristically productive fashion. Significant translational implications of the basic research have also been evident in emerging promising applications to parental psychopathology and parenting intervention (Luyten, Mayes, et al., 2017; Luyten, Nijssens, et al., 2017; Schacht et al., 2017; Suchman et al., 2017). The future of this research appears intriguing, exciting, and bright.

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