EFFECTS OF MATERNAL REGULATORY ATTEMPTS AND MIND-MINDEDNESS ON TODDLERS' SELF-REGULATION

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# ABSTRACT

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The toddler years are a watershed developmental period for emergence of emotional and behavioral regulation (i.e., self-regulation; SR), and the gradual transition from other-supported self-regulation to more autonomous forms of regulation. Negative emotional expression and delay of gratification are developmentally salient aspects of self-regulation, particularly since expectations for frustration tolerance and waiting increase during toddlerhood. As toddlers develop regulatory capacities, Maternal Regulatory Attempts (MRAs: the ways in which parents respond to toddlers' expressions and behaviors) are thought to play an important role in self-regulatory development. While MRAs have been linked to SR in toddlers, the role of maternal Mind-Mindedness (MM), the tendency to interpret behaviors in context of the child's mental life, has been neglected despite recent theoretical and empirical evidence for its regulatory effects. This study examined the role of MRAs, MM, and Toddlers' Regulatory Strategies (TRS) on toddlers' Expression of Negative Emotion (ENE: emotional regulation) and Delay of Gratification (DG: behavioral regulation) during a two-minute delay of gratification task. All study predictors (MRA, MM, and TRS) and study outcomes (ENE and DG) were observed and coded in twelve 10s intervals. A series of multilevel models with 10s-repeated measurement occasions nested within 134 mother-toddler dyads (67 girls; Mage = 25.77 months, SDage = 1.60) enrolled in the National Early Head Start Research and Evaluation Project, were used. Toddlers' current interval ENE and DG were predicted from lagged (e.g., previous 10s interval) MRAs, lagged MM, and lagged TRS in random coefficient models. Findings provide evidence for effects of MRAs, specifically more robust effects of lagged maternal positive emotional reactions (e.g., laughs with child) on toddlers' ENE, lagged maternal initiated distraction on DG, and lagged maternal negative emotional reactions (e.g., becomes upset herself) on both ENE and DG. Toddlers' lagged independent and dependent use of non-verbal distractions and lagged mother-directed verbalizations of self-control ("I wait") were related to lower ENE, while toddlers' lagged independent use of verbal distractions and lagged mother-dependent physical comfort were related to higher ability to wait. Study results did not provide evidence for effects of lagged MM on ENE or DG, but can be used to inform future directions. Study findings provide evidence for contributions of caregiving context and point to important temporal contingencies and interactional effects to be considered in future investigations of MRAs, MM, and SR.

This dissertation is dedicated to my parents for carrying me on their back.
And to my brother for his vision, courage, and paving the way.

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# CHAPTER 1: Introduction

The purpose of this introduction is to present the study focus, identify the theoretical contexts of the study, and articulate key study concepts. Study concepts as they are housed in the current literature are more thoroughly addressed in the literature review in Chapter 2. Formal research questions and hypotheses are presented in the current study description at the conclusion of Chapter 2.

## The Importance of Self-Regulation in Children's Outcomes

Self-regulation is a multidimensional system of cognitive, emotional, and behavioral control that undergoes rapid shifts during early periods of development, has profound implications for developmental psychopathology, and is significantly affected by early environmental factors including cumulative risk and quality of interactions with primary caregivers. A range of positive developmental outcomes has been associated with children's growing capacity for self-regulation. For example, self-regulation promotes social, emotional, and behavioral competence in toddlers (Spinrad et al., 2007b), school readiness in preschoolers (Blair, 2002), academic success in school aged children (McClelland & Cameron, 2012), and positive psychosocial adjustment in youth from low-income families (Buckner, Mezzacappa, & Beardslee, 2009). Moreover the acquisition of self-regulatory skills is a defining characteristic of resilient youth living in poverty (Buckner, Mezzacappa, & Beardslee, 2003). Self-regulation moderates the relationship between life stressors and social-emotional and behavioral outcomes (Lengua & Long, 2002; Lengua & Sandler, 1996), and, thus, functions as a protective factor in the context of cumulative risk (Lengua, 2002).

One explanation for the protective effects of self-regulation may lie in the relationship between self-regulation, coping, and children's subsequent resiliency (Lengua & Long, 2002).

For instance, children with greater ability to focus attention, inhibit automatic or dominant responses, and lower impulsivity are more likely to utilize positive internal coping strategies, including cognitive reappraisal and problem solving, to manage stressful life events; in turn, they demonstrate fewer internalizing and externalizing problem behaviors (Lengua & Long, 2002). Coping responses to stressful circumstances reflect behavioral mechanisms related to differences in regulation of attentional, emotional, and control systems (Eisenberg, Valiente, & Sulik, 2009), making the examination of contributing factors to these differences particularly relevant to the study of social-emotional development. On the other hand, disruptions in physiological and behavioral regulation place toddlers at risk for aggressive and destructive behavior problems (Calkins & Dedmon, 2000). Children with regulatory deficits are more prone to anger, impulsivity, anxiety, social withdrawal and depression (Eisenberg et al., 2001) Additionally, children from at risk populations (e.g., poverty, maternal psychosocial problems) are more likely to experience disruptions in normative regulatory development (Blair & Raver, 2012), and more likely to experience negative parenting practices that contribute to regulatory competence. Thus, identification of contributing mechanisms which promote or disrupt self-regulation has significant implications for long-term mental health.

**Origins of Individual Differences in Self-Regulation: The Caregiving Context**

Individual differences in self-regulation point to both intrinsic (e.g., temperament) and extrinsic mechanisms (e.g., parental support of emerging regulatory skills) that contribute to its developmental trajectory (Posner & Rothbart, 2000; Fox & Calkins, 2003). In support of this notion, recent biological perspectives in self-control, an early form of self-regulation, suggest psychophysiological and neural differences between internal mechanisms of intentional self-control and externally facilitated self-control (Schel, Scheres, & Crone, 2014). Similarly, Swingler, Perry, and Calkins (2015) highlight the joint role of intrinsic factors such as biological mechanisms, specifically neural plasticity, and extrinsic factors, specifically the caregiving environment, on the development of attention, attentional control, and emotion regulation systems in the first year of life and subsequent development. This study focuses on the caregiving environment, specifically maternal behaviors as they relate to toddlers' self-regulation in a low-income population.

This focus is informed by several theoretical frameworks including (1) developmental models of self-regulation as a relational construct and its continuous susceptibility to socialization (Cole, Martin, & Dennis, 2004; Cole, 2014; Eisenberg, Cumberland, & Spinrad, 1998; Morris, Silk, Steinberg, Myers, & Robinson, 2007), (2) attachment theory which designates the parent-child relationship as an organizing and regulating construct (Bowlby, 1969; Cassidy, 1994; Schore & Schore, 2008), and (3) developmental models which highlight the role of maternal social cognition (e.g. tendency to treat the young child as a psychological agent) in children's social and emotional development (Ainsworth, Blehar, Waters, & Wall, 1978; Fonagy, 2006; Gottman, Katz, & Hooven, 1996; Koren-Karie, Oppenheim, Dolev, Sher & Etzion-Carasso, 2002; Meins, Fernyhough, Fradley, & Tuckey, 2001; Sharp & Fonagy, 2008).

Understandings of self-regulation as a relational construct are informed by Eisenberg et al.'s (1998) emotion socialization model which highlights the role of emotion-related parenting practices, discussion of emotions, and emotional expressivity in children's acquisition of regulatory competence. Emotion-related parenting practices refer to a broad range of parenting behaviors (e.g., punitive reactions to negative emotions, cognitive reframing of a stressful situation) which contribute to children's expression and regulation of negative emotions (Brophy-Herb, Stansbury, Bockneck, & Horodynski, 2012; Morris, Silk, Morris, Steinberg, Aucoin, & Keyes, 2011; Morris et al., 2007). The socializing role of the family context, in particular, parental reactions to children's expressions of negative emotions, have been conceptualized as influential mechanisms in the development of self-regulation and its subcomponents (Eisenberg et al., 1998; Morris et al., 2007), and continue to be a point of emphasis for current investigations of self-regulation (Bridgett, Burt, Edwards, & Deater-Deckard, 2015).

Within an attachment framework, a central component of the caregiving environment is the parent-child relationship. The characteristics of the parent-child relationship continually influence children's opportunities to practice and build self-regulation skills. For example, the parent-child relationship provides an interactional context in which each person's cognitive and emotional states may be mutually communicated and regulated (Tronick, 1989). For infants and toddlers, who mostly depend on their external caregiving environment for regulation of internal states of arousal (Schore & Schore, 2008), interactions with primary caregivers serve a regulatory function in modulation and organization of activated emotional states (Cole et al., 2004; Schore & Schore, 2008).

Additionally, social-cognitive theories of parenting, suggest that parent-child relationships of optimal quality (e.g. secure attachments) are characterized by maternal tendencies to accurately represent and interpret their children's internal states and to be aware of and accepting of these states(Fonagy, Steele, Steele, Moran et al., 1991; Gottman et al., 1996; Oppenheim & Koren-Karie, 2002; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005). A dominant social-cognitive parenting construct is mentalization, a form of social cognition that refers to an individual's tendency to consider behaviors of self and others as evidence for underlying mental states including emotions, cognitions, beliefs, and intentions (Fonagy et al., 1991; Fonagy, 2006). Parental mentalization has been suggested as the mechanism through which the parent-child relationship contributes to children's attachment security, which, in turn, directs the organization and regulation of children's mental activity, specifically emotional and emotionally relevant states (Fonagy, Gergley, Jurist, & Target, 2002). The parent-child relationship contributes to differences in children's growing abilities for emotional and attentional regulation as well as the capacity to understand and interpret mental states in themselves and others (Fonagy & Target, 2002). Children's (and adults') developing capacities to understand themselves and others in terms of mental states facilitate self-regulation through organization of mental states specifically "(1) representation of mental states' (2) the attentional control of mental states; and (3) the capacity for reflection on mental states." (Fonagy, 2004, p.187). Within this framework, self-organization including affect regulation, impulse control, self-monitoring, and self-agency are promoted by a "mentalizing" caregiver in the context of a secure attachment relationship (Fonagy & Target, 1997; Fonagy et al., 2002).

**Defining Self-Regulation**

The construct of self-regulation has been described as multidimensional with differentiated subcomponents, which overlap and become an integrated process as development unfolds (Bell & Deater-Deckard, 2007; Bridgett et al., 2015; Cole et al., 2011; McClelland and Cameron, 2012). Despite current lack of consensus on the exact definition of self-regulation (Burman, Green, & Shanker, 2015), *emotion regulation* and *delay of gratification,* the foci of this study, are construed as two constructs that reflect the emotional and behavioral dimensions of self-regulation (Kopp, 1982). Both emotion regulation and delay of gratification are relevant processes in toddlers' everyday experiences and are subject to socialization and rapid developmental shifts in toddler years (Raikes, Robinson, Bradley, Raikes, & Ayoub, 2007).

Specifically, for toddlers from low-income families, self-regulation, including emotion regulation and delay of gratification, partly develop in the context of the parent-child relationship during daily interactions in a variety of routine and play contexts (Brophy-Herb et al., 2012).

Next, I turn to effortful control as an underlying construct for both emotion regulation and delay of gratification. Although effortful control is not a measured construct in this study, it is discussed here to conceptualize the overlapping concepts of emotion regulation and delay of gratification as jointly espoused by the underlying construct of effortful control. This provides theoretical and empirical support for the rationale that maternal behaviors contribute to differences in emotion regulation and delay of gratification by influencing underlying mechanisms (e.g., effortful control) shared by emotion regulation and delay of gratification. Both emotion regulation (Eisenberg & Spinrad, 2004; Eisenberg, Spinrad, & Eggum, 2010a) and delay of gratification (Spinrad, Eisenberg, & Gaertner, 2007a) involve effortful control. Effortful control represents a voluntary (vs. reactive) form of control, which involves the ability to shift and sustain attention, inhibit dominant responses, and activate subdominant responses (Rothbart & Bates, 2006). Individual differences in effortful control emerge toward the end of the first year of life while rapid developmental shifts occur in the second and third years (Eisenberg et al., 2010a; Spinrad et al., 2007a). In terms of emotion regulation, effortful control is suggested to facilitate production of strategies that help reduce negative affect or overarousal such as attention shifting (for review see Eisenberg et al., 2010a). Delay of gratification is one behavioral manifestation of effortful control (Spinrad et al., 2007a). Additionally, effortful control has been found to play a mediating role in the relationship between maternal emotion-related socialization behaviors and toddlers' social-emotional functioning (e.g., externalizing behaviors, separation distress, inhibition to novelty, and social competence) concurrently (18 months) and longitudinally (a year later; Spinrad et al., 2007b). Emotion regulation and delay of gratification are each discussed next.

**Emotion Regulation.** Emotion regulation refers to systematic changes in one's activated emotions using strategies to initiate, maintain, evaluate, and modify emotional intensity and expression in a goal-oriented and socially adaptive manner (Cole et al., 2004; Thompson, 1994). Cole et al. (2004) argued that "The term emotion regulation can denote two types of regulatory phenomena: emotion as regulating and emotion as regulated" (p. 320). "Emotion as regulated" implies that emotion is being regulated via the behavioral strategies an individual employs. For instance, a toddler's frustration (*emotion*) decreases (frustration *is regulated*) as a function of seeking comfort from a caregiver (*regulatory strategy*). Thus, emotion is regulated via the strategy for coping with the negative emotion. Within heuristic models for emotion regulation (Eisenberg & Morris, 2002; Eisenberg, Morris, & Spinrad, 2005; Eisenberg & Spinrad, 2004) emphasis has been placed on theoretical and methodological distinctions between regulation of internal processes (e.g., modulation of internal feeling states, attention shifting) and behavioral concomitants of emotion (e.g., voluntary inhibition or activation of behavior linked to emotion and overt expression of emotion). Additionally, emotion is increasingly understood as a process that is socially regulated with intensive (e.g., intensity of expression) and temporal features (e.g., relationship between strategy use and latency, duration, frequency, and intensity of expression) that reflect regulatory processes (Cole, 2014). To avoid making faulty inferences regarding emotion regulation (e.g., take low levels of emotion expression as evidence for emotion regulation; Eisenberg, Champion, & Ma, 2004), recent advancements in conceptualization of emotion regulation emphasize that emotion regulation strategies be measured independently from activated emotions (e.g., emotion expression) and emphasize analysis of temporal relations between such strategies and their corresponding activated emotions (Cole et al., 2004; 2011). Cole et al. (2004) suggest that emotion regulation should be measured in such a way that findings will provide strong evidence that "an emotional state was activated and that regulatory processes occurred independently" (p.320). In the current study, toddlers' emotion regulation is operationalized as a combination of toddler-initiated regulatory strategies (predictor variable) and toddlers' subsequent intensity of expression of negative emotion (outcome variable). Independent examination of the effect of maternal and toddlers' regulatory strategies on toddlers' intensity of expression of negative emotion provides methodological advancement over studies in which temporal distinction between regulatory strategies (maternal attempts or toddler strategies) and toddlers' negative emotion expression are not made. Thus, operationalization of emotion regulation as the relationship between maternal and toddlers' use of regulatory strategies and toddlers' intensity of emotion expression over time presents a methodological strength in the study of emotion regulation (Thompson, 1996; Cole, 2014; Cole et al., 2004; Cole et al., 2011).

**Delay of Gratification.** In addition to emotion regulation, the focus of this study is to examine behavioral self-regulation operationalized as toddlers' ability to wait upon request and will hereafter be referred to as delay of gratification. The ability to wait is a behavioral manifestation of self-regulation as it reflects the integration of emotional, attentional, and behavioral control (Cole et al., 2011, Bell & Deater-Deckard, 2007). Behavioral self-regulation involves interrelated processes including self-control, effortful control, and executive functioning (Bridgett et al., 2015). Behavioral manifestations of self-control, emerge in the second year of life, and involve the ability to monitor behavior, comply with demands of caregiver, and delay gratification upon request (Kopp, 1982), which represent developmentally salient, albeit challenging, regulatory skills. In the current study, toddlers' delay of gratification is measured as toddlers' ability to wait to touch an attractive object upon maternal request.

**Self-Regulation during Toddler Years**

Toddlerhood represents a key period for the examination of individual differences in early self-regulation. Toddlers are often expected to delay gratification and tolerate frustration in the course of daily family life. As language abilities increase in the second and third years of life, toddlers gain more regulatory competence (Cole, Armstrong, & Pemberton, 2010; Roben, Cole, & Armstrong, 2013; Vallotton & Ayoub, 2011) and learn to shift from external sources of regulation to internal sources (Kopp, 1982; Raikes et al., 2007). As toddlers' bids for autonomy emerge, new motor and language skills begin to develop, and parents' expectations for behavioral competencies increase, maternal socialization and scaffolding of toddlers' self-regulation skills become salient to the everyday experiences of toddlers. Perhaps accordingly, mothers' use of explanations of emotional distress during frustrating tasks increase between 18 and 30 months, while their use of distraction and soothing decrease between 18 and 30 months (Spinrad, Stifter, Donelan-McCall, & Turner, 2004).

Typically, toddlers use a range of strategies that rely on the self (independent strategies) or the caregiver (dependent strategies) to regulate negative emotions and delay gratification (Calkins & Johnson, 1998; Feldman, Dollberg, & Nadam, 2011; Grolnick, Bridges, & Connell, 1996; Gilliom et al., 2002; Spinrad et al., 2004). Independent strategies typically include distraction and self-comforting behaviors, whereas, dependent strategies include physical and verbal bids to caregivers (Calkins & Johnson, 1998; Gilliom et al., 2002). Distraction involves toddlers' behaviors that shift their attention to objects other than the frustrating task or delay object such as looking away or exploring other objects in the room. Self-comforting includes verbal self-soothing behaviors ("I'm a big girl") or physical self-soothing behaviors such as thumb sucking or other forms of self-touch (e.g., self-hug) (Feldman et al., 2011; Grolnick et al., 1996). Bids to caregivers refer to toddler initiated behaviors that attempt to involve the mother in regulation such as physical comfort seeking or verbalizations directed toward or in response to caregiver (e.g., "mommy"). Other behaviors may be observed including focus on delay object/task (Ekas, Braungart-Rieker, Lickenbrock, Zentall, & Maxwell, 2011; Gilliom et al., 2002).

**Maternal Behaviors and Toddlers' Self-Regulation**

Toddlerhood marks an early period in which mothers' behaviors in response to toddlers' negative emotions may have important effects on toddlers' emerging emotion regulation and delay of gratification. Accordingly, differences in children's use of regulatory skills have often been studied in the context of maternal availability by manipulating levels of maternal involvement during frustrating tasks (Diener & Mangelsdorf, 1999). Generally, mothers tend to use more regulation strategies to help toddlers' manage negative affect compared to positive affect (Spinrad et al., 2004). Thus, frustrating tasks which induce toddlers' negative emotions provide a rich context for the examination of effects of maternal regulatory strategies on toddlers' emotion regulation and delay of gratification. Literature on the development of emotion regulation and delay of gratification in childhood highlights the role of parenting behaviors in facilitating young children's regulatory strategies (Eisenberg et al., 1998; Kopp, 1989). Specifically, mothers' attempts to help toddlers' regulate their negative emotions (Friedlmeier, Corapci, & Benga, 2015a), hereafter called Maternal Regulatory Attempts (MRAs), and, maternal tendency to consider their toddlers' mental states (e.g. emotions, cognitions, preferences) as motivations for their toddlers' observable behavior , hereafter called Mind-

Mindedness (MM; Meins et al., 2001) have recently emerged as two parenting constructs gaining attention for their links to early social-emotional development. As will be described next, MRAs refer to specific strategies parents use with the intention to promote young children's regulatory behaviors during emotion eliciting experiences, such as during a frustrating task. Mind-mindedness refers to the parent's tendency to view the child as a separate individual with his/her own internal mental states, which concurrently contribute to a child's behaviors (Meins et al., 2001; Meins & Fernyhough, 2015). Given the prevailing focus on mothers in the literature and the current study's exclusive sample of mothers, the term maternal is used throughout this study. Although I recognize that fathers are important socializing agents, the socializing role of fathers is beyond the scope of this study and is being pursued elsewhere.

**Purpose and Rationale**

The general aim of this study is to examine how the relationship shared by toddlers and their mothers may contribute to children's developing self-regulation using a multilevel modeling approach. In particular, the purpose of this study is to examine maternal and toddlers' contributions to two components of toddlers' self-regulation. Specifically, maternal contributions as defined by the effects of Maternal Regulatory Attempts, maternal mind-mindedness, and toddlers' regulatory strategies to toddlers' (1) expression of negative emotion (measured as overall intensity and predominance) , and (2) ability to wait upon request or delay of gratification (measured as sum of touch and attempted touch of the attractive keys), during a 2-minute frustrating task. As stated earlier, emotion regulation refers to changes in intensity, duration, and frequency of emotional expression as a function of a temporally contingent strategy (Cole et al., 2004, Cole, 2014; Thompson, 1994). In the current study, emotion regulation was operationalized as within-individual differences[1] in intensity and predominance in expression of negative emotion as a function of a previous-interval strategy. Behavioral regulation was defined as self-control manifested in toddlers' ability to delay gratification or wait upon request (Kopp, 1982). In the current study, behavioral regulation was operationalized as within-individual differences in total number of times toddlers refrained from touching or attempting to touch a desirable object as a function of a previous-interval strategy.

A very limited number of studies have used multilevel modeling to examine self-regulation using longitudinal data. Cole et al. (2011) investigated age-related progress (18-48 months) in ability to wait as operationalized by latency and duration of anger expression and children's regulatory strategies (e.g., attention focus and bids to caregiver) during an 8-min gift delay task. However, Cole et al., (2011) did not examine temporal contingency between regulatory strategies and emotional expression (e.g., anger expression), maternal regulatory strategies or maternal mind-mindedness. In another study, Morris et al. (2011) examined influence of maternal regulatory strategies on children's expression of anger and sadness in older children (preschool-2nd grade) in an observational task while nesting repeated measurement occasions (a form of longitudinal data structure) within mother-child dyads. Similarly, the current study nested repeated measurement occasions (12 units of 10s intervals) within mother-child dyads, and examined effects of maternal mind-mindedness, and toddlers' regulatory strategies in addition to effects of Maternal Regulatory Attempts as level-one predictors. Additionally, the current study's analyses considered the temporal contingency between regulation strategy and emotional expression (e.g., effects of strategy from previous interval on outcome in current interval), in 24-month old toddlers from low-income families, a population

[1] measured over 10s repeated measurement occasions

that was not examined in previous studies but is a sensitive developmental period for emergence of self-regulation.

Examining the occurrence of Maternal Regulatory Attempts, Appropriate and non-attuned mind-related comments, toddlers' regulatory strategies, toddlers' overall expression of negative emotion (average intensity and predominance) and toddlers' frequency of overall touch (delay of gratification/ability to wait), separately and over repeated measurement occasions (i.e., intervals in this study), allowed me to (1) demonstrate within-individual differences (changes) in toddlers' overall expression of negative emotion over time (2) demonstrate within individual-differences (changes) in toddlers' frequency of overall Touch over time (3) explain such differences in toddlers via temporally contingent maternal regulatory attempted, maternal mind-mindedness, and toddlers' regulatory strategies. Examination of the relationship between maternal and toddlers' regulatory strategies and Overall Expression of Negative Emotion, considering temporal associations can provide evidence for effectiveness of a regulatory strategy on overall expression of negative emotion, and, thus partly explain change in intensity and predominance of expressed emotion as a function of a regulatory strategy. Examination of the relationship between maternal and toddlers' regulatory strategies and overall touch, considering temporal associations can provide evidence for effectiveness of regulatory strategy on delay of gratification, and, thus partly explain change in ability to wait as a function of a regulatory strategy.

# CHAPTER 2: Literature Review

The following sections in this chapter clarify (a) definitions of maternal regulatory attempts; (b) unique contributions of maternal regulatory attempts to toddlers' emotion regulation and delay of gratification; (c) definitions of mind-mindedness; (d) unique contributions of mind-mindedness to toddlers' emotion regulation and delay of gratification, (e) contributions of maternal regulatory attempts and mind-mindedness (f) unique contributions of toddler-initiated regulatory strategies to toddlers' emotion regulation and delay of gratification. The chapter concludes with study research questions and hypotheses.

## Maternal Regulatory Attempts (MRAs)

Mothers provide scaffolding for emotional development in multiple contexts of daily life including playtime, daily routines, and social interactions (Brophy-Herb et al., 2012). MRAs refer to parental behaviors, or parent-initiated regulatory strategies, that attempt to regulate children's behaviors and emotional expressions in response to stressors (Friedlmeier, Corapci, & Benga, 2013; Calkins & Johnson, 1998; Spinrad et al., 2004; Putnam, Spritz, Stifter, 2002). MRAs are strategies for facilitating regulation of child distress induced, for example, by request to wait for an attractive toy, and may include distraction (e.g. 'look at the cars outside the window'), soothing (e.g. 'it's alright, you are ok'), granting wishes (e.g. 'you can have the toy'), verbal explanations of emotion or situation (e.g. 'we will be done in a bit'), punitive reactions (e.g. threatening), and minimizing reactions (e.g. 'it is nothing to get upset about') (Spinrad et al., 2004, Spinrad et al., 2007b). While these maternal behaviors are traditionally assessed in observational paradigms (Calkins & Johnson, 1998), others have examined MRAs by investigating self-reported maternal reactions to children's negative emotions, specifically, sadness, fear and anger (Eisenberg et al., 2010b; Davidov & Grusec, 2006, Spinrad et al., 2007b). These studies suggest that maternal responses to young children's expressions of negative emotions include differences in the use of supportive strategies such as encouragement of emotional expression and problem solving and non-supportive strategies including minimizing, ignoring, or punishment of children's negative emotions (Spinrad et al., 2007b; Eisenberg et al., 2010b). MRAs have commonly been examined in response to children's negative affect or in the context of frustrating tasks including toy removal, still-face paradigm, and delay of gratification tasks (Feldman et al., 2011; Putnam et al., 2002).

**Unique Contributions of MRA to Toddler Emotion Regulation and Delay of Gratification**

A number of studies have established the link between specific MRAs and differences in regulatory capacities in toddlers. Generally, physically and verbally warm and comforting strategies are related to positive development of self-regulation. For instance, Spinrad et al. (2004) found that maternal supportive strategies, specifically soothing and acceptance of their 18-month-old's negative affect, were associated with children's greater use of self-initiated or independent regulation strategies at age 5, and, in particular, soothing and acceptance was associated with higher use of children's self-distraction as an emotion regulatory strategy in response to disappointment. Additionally, higher maternal warmth is associated with higher behavioral regulation in 3 year olds in at risk families (Eiden, Edwards, & Leonard, 2007), and predicts greater growth in sustained attention from 2 to 4.5 years (Graziano, Calkins, and Keane, 2011).When mothers use positive feedback and guidance (e.g., physical affection, warmth when reminding child not to touch delay object in gentle voice) during delay of gratification tasks, their toddlers tend to use self-distraction as a regulatory strategy in delay of gratification tasks (Calkins & Johnson, 1998; Feldman et al., 2011).

Findings with regard to maternal use of distraction as an effective strategy in regulating distress during frustration have been mixed (Spinrad et al., 2004). While some studies have found no relations between maternal use of distraction and toddlers' negative emotional expression (Spinrad et al., 2004), others have found positive relationship between maternal use of distraction and toddlers' negative emotional expression (Grolnick, Kurowski, McMenamy, Rivkin, & Bridges, 1998). Grolnick et al., (1998) found that when mothers use distraction while actively engaging with their toddlers, their toddlers display higher levels of distress when they are required to regulate independently (e.g. parent-passive paradigms) which can suggest a temporary effectiveness of distraction  on toddlers' emotion expression. In support of this Feldman et al., (2011) argue that although distraction may serve a regulatory function in context of distress, it is not "inherently regulatory in nature" (Feldman et al., 2011, p. 311). However, maternal use of distraction may be effective for anger regulation in older children (Morris et al., 2011) or delay of gratification in toddlers (Putnam et al., 2002). Morris et al., (2011) found that maternal use of distraction was effective in reducing intensity of anger expression in a cross-sectional sample (6-9 year olds).  Putnam et al., (2002) found that higher maternal use of distraction was associated with higher ability to delay gratification in 30 month olds and a greater ability to allocate attention on others instead of a desirable toy. The bidirectional nature of maternal use of distraction and toddlers' tendency to express negative emotion (Calkins & Johnson, 1998) may play a role in these inconsistent findings. It may also be the case that maternal use of distraction is more of an adaptive strategy with older children compared to younger children due to toddlers' growing integration of emotional, cognitive and behavioral systems of control (Cole et al., 2011). For instance, Cole et al., found that compared to 2 year-olds, 3-year olds' ability to sustain self-initiated distractions for longer periods of time was related to shorter duration of anger expression. Together, these findings suggest mixed effects for maternal use of distraction on toddlers' emotion regulation and a positive relationship between maternal use of distraction and delay of gratification.

Unsupportive maternal reactions to toddlers' negative emotions, specifically minimizing and punishment of negative emotions, have been associated with emotional dysregulation, including externalizing problem behaviors concurrently and longitudinally at 18, 30, and 42 months (Eisenberg et al., 2010b). Toddlers' experience of unsupportive maternal reactions' to their negative emotions may lead to over arousal of negative emotion and therefore compromise their ability to develop and employ effective regulatory strategies (Spinrad et al., 2007b). The use of minimizing emotional expressions in toddlerhood may have negative implications for developing self-regulatory skills as development continues. For instance, children who do not use (or do not have access to) behavioral strategies to regulate disappointment at age 5 tend to have mothers who questioned their negative affect at 18 months, suggesting that the minimization of emotional distress induced by "why are you crying?" is a responsible mechanism for development of poor regulatory capacities (Spinrad et al., 2004). Maternal harsh control (e.g., use of harsh and angry discipline, scolding, insulting or hitting) is related to higher anger expression in toddlers (Feldman et al., 2011). Additionally, Eisenberg and colleagues (2010b) found that greater maternal unsupportive responses (i.e., minimization and punishment of negative emotions) at 18 months significantly predicted lower toddler's effortful control (i.e., attention shifting, attention focusing, inhibitory control, and observed ability to delay gratification) at 30 months of age.

In sum, MRAs refer to maternal behaviors directed towards the child that contribute to emotion regulation and delay of gratification. Although maternal verbal support such as explanation (e.g., we will be done soon) or verbal comfort (e.g. “It is alright”), have been included under Maternal Regulatory Attempts (Spinrad et al., 2004), they do not necessarily reflect toddlers’ internal states and how such states may be interpreted as motives underlying toddlers’ external behaviors. Another type of maternal support for toddlers’ emotion regulation and delay of gratification, however, is focused on toddlers’ internal states—mind-mindedness.

**Mind-Mindedness (MM)**

Mind-Mindedness is one manifestation of the parent’s mentalization capacity, the tendency to consider emotions, cognitions, and intentions as mental states that motivate behaviors in self and others (Meins, Fernyhough, & Harris-Waller, 2014). In order to accurately perceive mental states in others as underlying motives of behaviors, one must first recognize others as separate psychological agents with intentionality. In parents, this tendency is indicative of a range of mentalization capacities including mind-mindedness (Sharp & Fonagy, 2008). Mind-mindedness refers to a parent’s tendency to consider and treat her young child as an individual with mental states, which directly motivate his behaviors (Meins et al., 2001; Meins & Fernyhough, 2015). MM has been operationalized as parents’ (1) tendency to make appropriate mind-related comments (e.g. “You’re angry because you can’t have the toy; You want it now” after child has displayed frustration with waiting) regarding their infants’ (Meins et al., 2001) and toddlers’ (Demers, Bernier, Tarabulsy, & Provost, 2010a) presumed internal states; (2) tendency to consistently attribute intentionality and meaning to preverbal toddlers’ vocalizations of non-standard words (e.g. vocalization “micmic” interpreted as music) (Meins, 1998; Meins and Fernyhough, 1999), and (3) tendency to describe one’s toddler (Demers, Bernier, Tarabulsy, & Provost, 2010b) and preschooler (Meins, Fernyhough, Russell, & Clark-Carter, 1998) using mental attributes (e.g., curious, nervous) when asked to describe one’s child.

The current study, utilizes the interactional operationalization of MM. Interactional measures of MM operationalize the construct of MM as the maternal tendency to make appropriate or non-attuned mind-related comments that reflect the child's putative mental state. Appropriate comments refer to comments which seem to be an accurate interpretation of the toddler's internal states which are governing his current overt behavior. For instance, "you're angry because you can't have the toy; you want it now" said after child has displayed frustration with waiting. Non-attuned comments refer to inaccurate interpretations of toddlers' internal states and do not necessarily accurately explain the child's observable behavior in terms of his mental states (e.g. "you are bored" while the child is actively engaged with a toy). Additionally, appropriate mind-related comments connect the child's current activity to his/her past and future (e.g., "remember you saw a giraffe at the zoo" said while child plays with giraffe; Meins & Fernyhough, 2015). To date, MM has been studied primarily relative to parental sensitivity and child-centered responses (Meins et al., 2001; Meins, Fernyhough, Arnott, Turner & Leekman, 2011) during parent-child interactions (Laranjo, Bernier, Meins, & Carlson, 2014; Meins et al., 2001). It is important to clarify that appropriate mind-related comments have been studied most often as predictors of early manifestations of theory of mind understanding in 2-year-olds (Laranjo, Bernier, Meins, & Carlson, 2010), theory of mind performance in 4-year-olds (Meins, Fernyhough, Wainwright, Gupta, Fradley, & Tuckey 2002), and 6- and 10-year-olds' (Ensor, Devine, Marks, & Hughes, 2014). However, MM has recently been associated with fewer behavioral problems including tendency to experience negative emotions, and hyperactivity in children (44 and 61 months; Meins, Centifanti, Fernyhough, Fishburn, 2013) and toddlers (18-36 months) from low-income families (Brophy-Herb et al., 2015) and is the focus of a few studies examining maternal behaviors that may support toddlers' early self-regulatory skills (Bernier, Carlson, & Whipple 2010).

MM is marked by use of mental states language that can be manifested as "emotion talk" or "mental state discourse" in parent-child conversational contexts. Mental state language refers to a specific form of communication that utilizes references to internal states, including cognition (e.g. think/know), emotions (e.g., sad/excited), and desires/goals (e.g. like, want) in order to facilitate social-emotional understanding, identify internal states, and facilitate meaning-making (Taumoepeau & Ruffman 2006, 2008; Fivush & Baker-Ward, 2005). Maternal mind-mindedness and engagement in mental state language (e.g., "emotion talk" or "mental state discourse") share reflection, labeling, and explanation of mental states. Mental state language reflects the ability to identify internal states in child or others (e.g., 'you are sad', 'she wants to play'), describe connections between internal states and behaviors in child or others (e.g., 'he is crying because he feels sad'), and to facilitate meaning making related to child's internal states as children interact with their environment (e.g. remember how you were crying and felt sad after grandmother went back home?). However, not all mental state language is manifested as mind-mindedness.

MM is distinct from mental state language in that its focus is on the caregivers' "appropriate" [2] utilization of mental state terms to reflect putative, present, and ongoing mental activity of the *child* that are "*accurately*" assumed to govern observable behaviors. A mind-minded caregiver often utilizes mental state language as a tool in order to verbalize her representations of her child's internal states. An essential distinction between MM and merely the use of mental state language is MM's additional assessment of "appropriateness" or "non-

[2] The term "appropriate" is conceptualized by Meins et al., (2001) to indicate mind-related comments that align child's behavior with assumed underlying mental states.

attunement" of comments, which reflect a caregiver's level of attunement and psychological orientation to one's child (Meins, Fernyhough, Arnott, Turner & Leekam, 2011). Appropriate vs. non-attuned mind-related comments represent distinct dimensions of mind-mindedness as not all mind-minded comments accurately reflect children's mental states (Meins et al., 2012). Appropriate mind-related comments have been linked to infant's security of attachment and maternal sensitivity (Meins et al., 2001) whereas non-attuned mind-related comments have been found to be unrelated to maternal sensitivity (Arnott & Meins, 2007) and independently predict attachment disorganization in infants (Meins et al., 2012). The majority of research on MM has focused on the contribution of maternal MM to children's competence in social cognition, such as theory of mind (Laranjo et al., 2010; Meins et al, 2002; Ensor et al. 2014), while less focus has been placed on elucidation of the effects of maternal MM on regulatory competence in young children. Thus, the study of MM as it relates to toddlers' regulatory competencies offers both empirical value in its potential contributions to the extant literature and applied significance via its possible implications for parenting/caregiver educational programs.

**Unique Contributions of Maternal Mind-Mindedness to Children's Emotion Regulation and Delay of Gratification**

**Attuned Mind-Related Comments.** To our knowledge, the direct effects of mind-mindedness, operationalized as appropriate-attuned, and non-attuned mind-related comments, on toddler expression of negative emotion or delay of gratification have not been examined in toddlers with the exception of one study which examined the effects of mind-mindedness (appropriate mind-related comments only) on toddlers' self-regulation (Bernier et al., 2010). I will discuss this study shortly. There are only a handful of studies which have examined associations between maternal mind-related comments and children's behavioral outcomes. For instance, exposure to appropriate mind-related comments in infancy is negatively related to dysregulatory behaviors, specifically, internalizing and externalizing problem behaviors at 44 and 61 months (Meins et al., 2013) and conduct problems at age 10 (Centifanti, Meins, & Fernyhough, 2016). Furthermore, appropriate mind-related comments directed toward infants mitigate the negative impact of low-socioeconomic status on behavior problems in childhood after controlling for maternal sensitivity, depressive symptoms, perceived social support, child language abilities and child gender (Meins et al., 2013). Although these prior studies make important contributions to the field, Bernier et al. (2010) were the first to study potential mechanisms through which mind-related comments are related to regulatory outcomes. In the only study of mind-related comments and toddlers' self-regulation, they investigated the effects of maternal sensitivity, autonomy support, and mind-mindedness (operationalized as number of appropriate mind-related comments during a 10-minute free play session) at 12 and 15 months on dimensions of executive function including working memory and impulse control at 18 and 26 months (N=80). Compared to toddlers exposed to fewer appropriate mind-related comments, those exposed to more appropriate mind-related comments had better working memory at 18 months and better impulse control at 26 months. Additionally, Bernier and colleagues (2017) have provided evidence for the longitudinal indirect effects of appropriate mind-related comments (infancy) on children's school readiness (kindergarten) as mediated by toddlers' language (2 year olds) and effortful control (3 and 4 year olds). Furthermore, fathers' appropriate mind-related comments at 18 months predict better inhibitory control in delay tasks for 3 year olds (Gagne, Bernier, & McMahon, 2017). These findings provide emerging evidence that exposure to appropriate mind-related comments are associated with processes underlying emotional and behavioral regulation such as effortful control.

Similarly, despite the dearth of research on the effects of maternal mind-mindedness on toddlers' emotion regulation and delay of gratification, maternal behaviors that are indicators of mind-mindedness, particularly maternal differences in use of and references to mental states language have been linked to toddlers' regulatory behaviors, including emotion regulation and delay or gratification. For instance, maternal mental state language, specifically the number of emotion, cognition, and desire words mothers use with toddlers during a book sharing task, has been associated with toddlers' concurrent abilities to delay gratification in low-income samples (Brophy-Herb et al., 2012). Maternal emotion bridging, a type of emotion talk which aims to interpret behaviors of others in terms of their underlying mental states (e.g., she is sad because her pet is lost), and to make meaningful connections between internal states of toddlers and others (e.g., do you remember you were sad when grandma left?) has been found to moderate the effect of demographic risk on toddlers' behavior problems especially for children from higher risk families and with greater earlier behavioral problems (Brophy-Herb et al., 2015). Broadly, these findings suggest that maternal appropriate mind-related comments may facilitate toddlers' delay of gratification by facilitative use of processes underlying behavioral regulation including working memory and impulse control. Additionally, maternal mentalization-related parenting behaviors indicated by use of mental state words, emotion bridging, and representational mind-mindedness is related to toddlers' coping behaviors and effortful control (Senehi, Brophy-Herb, & Vallotton, 2018). Although, maternal sensitivity and maternal representations of the parent-child relationship, two constructs closely related to maternal mind-mindedness (Arnott & Meins, 2007; Meins et al., 2011) are related to toddlers' anger expression during frustrating tasks (Feldman et al., 2011), the exact nature of the contribution of maternal mind-mindedness to intensity of emotion expression is not known in the existing literature.

To date, most explanatory mechanisms relative to the links between these maternal behaviors and young children's outcomes have focused on emotion understanding, an attribute related to emotion regulation. For example, toddlers' exposure to mental state references, promotes children's emotion understanding (Centifanti et al., 2016; Laible, 2004; Taumoepeau & Ruffman 2008), including understanding of mental states in self and others (Symons, Fossum, & Collins, 2006), and advance capacity for toddlers' own use of mental state language (Taumoepeau and Ruffman 2008), which serves regulatory functions by allowing the child to express and identify emotions and other internal states. Thus, maternal references to mental states, an indicator associated with mind-mindedness, may promote the development of self-regulation through its effects on very young children's emerging knowledge and skills about emotions in themselves and others (Eisenberg, Sadovsky, & Spinrad, 2005). Research with preschool aged children provides similar evidence of such mechanisms. For example, understanding of emotion regulation strategies (which requires emotion understanding) in preschoolers has been associated with preschooler-initiated regulatory strategies (e.g. distraction and support seeking), and behavioral regulation (e.g. persistence) during a frustrating task (Cole, Dennis, Smith-Simon, & Cohen, 2009). Additionally, emotion understanding at 51 months is negatively related to problem behaviors reflective of regulatory deficits in 10 year olds including externalizing problem behaviors, conduct problems, and impulsivity (Centifanti et al., 2016).

However, other possible mechanisms may be the skills that are modeled and promoted by mothers via mind-mindedness. For example, toddlers' exposure to maternal mind-mindedness as characterized by attuned mind-related comments, which models maternal awareness of another's internal states, including behavioral and verbal scripts about emotions, may promote toddlers' self-regulation capacity by providing them with social, emotional, and cognitive tools for cognitive reappraisal of emotional arousal which can serve a regulatory function (Cole et al, 2004). For instance, Morris et al., (2011) found that cognitive reappraisal of a frustrating event was related to lower intensity of anger expressions in school-aged children. Theoretically, accurate interpretation of toddlers' internal states as motives of behavior and subsequent narration of these motives may be an essential mechanism of influence on children's awareness and understanding of emotional, cognitive, and intentional states (Meins et al., 2001). Therefore, exposure to appropriate mind-related comments during frustrating situations may facilitate early development of toddlers' awareness and understanding of internal states, which may help toddlers to gain attentional control over internal states during this developmental period when they are transitioning from external-regulation towards self-regulation. The proposed study is the first to examine another potential mechanism: temporal relationships between mothers' regulatory strategies, mind-mindedness, toddlers' regulatory strategies and toddlers' intensity of emotion expression and delay of gratification. Following a brief discussion of non-attuned mind-related comments, I turn toward further explanation of how both Maternal Regulatory Attempts and mind-mindedness may be jointly related to toddlers' regulatory outcomes.

**Non-Attuned Mind-Related Comments.** Contrary to the promotion of skills associated with attuned mind-related comments, non-attuned mind-related comments may be negatively related to children's outcomes. Maternal tendency to misinterpret children's internal states are reflected in mothers' non-attuned mind-related comments and indicate an "imposition of the caregivers' own agenda" (Meins et al., 2012, p. 395). Although no study has investigated the effects of non-attuned mind-related comments on toddlers' emotion regulation or delay of gratification, it stands to reason that such tendency to impose one's own agenda would interfere with children's' growing capacity to develop self-regulation. Imposition of the mother's own agenda on toddlers' internal states, may also manifest as maternal behavioral imposition which is problematic. In fact, maternal preemptive actions (e.g. interference with child's actions rather than allowing child to do activity on his own) leads to higher intensity of negative emotion expression in toddlers in response to a frustration task (Calkins & Johnson, 1998). However, the exact nature of this relationship remains to be empirically validated.

### Contributions of Maternal Regulatory Attempts and Mind-Mindedness

Although there is emerging evidence of the moderating role of social context (e.g., book sharing, mealtimes, conversation about past events) on individual differences in child and maternal use of mental state language in preschoolers (Howe, Rinaldi, Recchia, 2010), maternal mind-mindedness has not been examined during frustrating tasks with toddlers, leaving a gap in understanding of the effects of maternal reflection of mental states (i.e., mind-mindedness) on toddlers' regulation of internal states above and beyond traditionally examined Maternal Regulatory Attempts. It has been suggested that maternal mind-mindedness may facilitate toddlers' self-regulation (specifically executive function) by promoting cognitive skills (e.g., linguistic tools), and effortful control (Bernier et al., 2017) necessary to shift from reliance on external-regulation to self-regulation (Bernier et al., 2010; Carlson, 2003). However, empirical evidence for the contribution of mind-mindedness on toddlers' emotional expression and delay of gratification is lacking. Additionally, the degree to which mind-mindedness, in tandem with other maternal regulatory strategies, facilitates or hinders emotional and behavioral regulation, remains to be understood. Examining the effectiveness of maternal mind-mindedness and maternal regulatory strategies in the same study, will inform our current understanding of the nature of the relationship among maternal regulatory strategies and maternal mind-mindedness as well as the nature of temporal effects each of these approaches on toddlers' emotion regulation and delay of gratification.

Maternal Regulatory Attempts and mind-mindedness reflect aspects of parenting that may support young children's regulatory skills. Yet, each approach is quite different in the mechanisms through which they may promote emotion regulation and delay of gratification. Maternal Regulatory Attempts have been examined in tasks that elicit distress in toddlers and preschoolers. Mind-mindedness, on the other hand, has traditionally been examined in tasks that induce positive or neutral affect in infants. To date, no study has examined the contributions of each approach simultaneously in at risk populations in the context of a frustrating task. Although each form of responsiveness has unique effects on toddlers' growing capacities for self-regulation, immediacy of effects and predictive strengths of each (MRA or MM) are not known. The examination of each approach in separate multilevel models will provide evidence for immediacy of effects and predictive strengths of each as a regulatory strategy.

**Unique Contributions of Toddlers' Regulatory Strategies to Children's Emotion Regulation and Delay of Gratification**

Developmental changes in anger expression and attention focus underlie the ability to wait and partly occur as a function of maturational processes (Cole et al., 2011). However, differences in toddler-initiated use of regulatory strategies may explain some variation in toddlers' emerging regulatory behaviors. Across the toddler and preschool years, toddlers' ability to quickly distract themselves for long periods of time predicts shorter duration of anger expression in waiting tasks (Cole et al., 2011). In a longitudinal study, Gilliom et al., (2002) found that toddlers' (all boys sample) use of distraction and information gathering were related to decreased anger (emotion regulation) while having to wait to eat a cookie (delay of gratification). Additionally, toddlers' use of help seeking as an emotion regulation strategy is related to greater sustained attention (Graziano et al., 2011). In a sample of 20-month old toddlers (N=116), Ekas et al., (2011) found that toddlers who made more bids to their inattentive mothers (while their mothers were instructed to ignore the toddlers' bids) expressed more negative affect compared to toddlers who did not use parent-focused strategies. These findings suggest that toddlers' use of dependent regulatory strategies (e.g. bids to caregiver) are more distress inducing while exposed to unsupportive maternal regulatory attempts such as being ignored. However, Diener and Mangelsdorf (1999) found that toddlers' fussing to mothers was effective in reducing fear and anger across four laboratory episodes designed to elicit fear and anger, while distraction only served to maintain levels of anger intensity and was thus deemed as a less effective strategy. Broadly, these findings suggest that toddler-initiated distraction and bids to caregiver may be effective in reducing negative emotion and helping toddlers wait but are influenced by levels of maternal involvement.

**Current Study**

The current study aimed to examine the effects of Maternal Regulatory Attempts (MRAs), maternal Mind-Mindedness (MM), and Toddlers' Regulatory Strategies (TSR) on toddlers' (1) overall expression of negative emotion (ENE-O), and (2) ability to wait upon request or delay of gratification (Overall Touch), during a 2-minute delay of gratification task. Conceptual and operational definitions are presented in Table 1 (maternal variables of interest) and Table 2 (toddler variables of interest). The frustrating task used in the current study (i.e. Delay of Gratification Task) was designed to elicit toddlers' frustration while having to wait to touch an attractive set of toy keys upon maternal request. All study variables were coded observationally using the delay of gratification task. The duration of the delay of gratification task was 120 seconds. Coding of independent and dependent study variables were conducted along 12 intervals. Each interval was defined as a 10s unit of time. Twelve 10s-repeated measurement occasions were nested within 134 mother-toddler dyads. This was the first study to simultaneously examine MRAs, MM, and TSR (predictors) as they were related to toddlers' ENE-O and Overall Touch (outcomes). Thus, hypotheses were only proposed for the relationship of each predictor to each outcome variable and analyzed in separate two-level models with random intercepts. The overarching goal of the study was to identify temporal associations between predictors in previous intervals (lagged 10s) to toddlers' ENE-O and Overall Touch in the current interval. Thus, my focus was not on which maternal behavior or toddler behavior was the most effective predictor of ENE-O or Overall Touch, in presence or interaction of other predictors, but whether each maternal behavior and toddler behavior predicted ENE-O or Overall Touch. Therefore, hypotheses about the effectiveness of strategies in comparison to each other or as they interacted with each other were not made in this initial study. I do expect to examine such questions in subsequent studies.

Table 1
*Conceptual and Operational Definitions of Maternal Variables*

| Overarching Theoretical/Conceptual or Developmental Framework | Conceptual Definitions | Operational Definitions → | Independent Variables |
|---|---|---|---|
| | | <u>Maternal Regulatory Attempts</u> | |
| Emotion-Related Socialization Behaviors (Eisenberg et al., 1998, Morris et al., 2007) | Specific strategies parents (mothers in the current study) demonstrate to promote young children's regulatory behaviors during emotion-eliciting experiences, such as during a frustrating task.<br><br>These strategies include verbal and physical comfort of the child, distraction, orientation to delay, commands, punitive reactions in response to the child, minimizing the child's emotions, physical restraint of the child, and parents' own emotional reactions to the child. | 1. Sum of verbal comfort<br>2. Sum of physical comfort<br>3. Sum of initiated distraction<br>4. Sum of joined distraction<br>5. Sum of verbal orientation to delay<br>6. Sum of positive commands<br>7. Sum of negative commands<br>8. Sum of punitive reactions<br>9. Sum of minimizing<br>10. High/low physical restraint<br>11. Presence/absence of positive emotional reactions<br>12. Presence/absence of negative emotional reactions | 1. Verbal Comfort<br>2. Physical Comfort<br>3. Initiated Distraction<br>4. Joined Distraction<br>5. Verbal Orientation to Delay<br>6. Positive Commands<br>7. Negative Commands<br>8. Punitive Reactions<br>9. Minimizing<br>10. Physical Restraint<br>11. Positive Emotional Reactions<br>12. Negative Emotional Reactions |
| | | <u>Mind-Mindedness</u> | |
| Attachment Theory (Meins, et al., 2001); Mentalization, Affect Regulation, & Self-Organization (Fonagy et al., 2002) | Tendency to treat child as a separate individual with psychological states that govern his behavior. Mind-minded comments may be appropriate (e.g., accurate and aligned with the child's internal states) or non-attuned (inaccurate and not aligned with the child's internal states). | 1. Sum of appropriate mind-related comments<br>2. Sum of non-attuned mind-related comments | 1. Appropriate Mind-Related Comments (1)<br>2. Non-Attuned Mind-Related Comments (2) |

*Note.* "Sum" indicates total frequency of instances behavior was observed during each 10s interval; detailed definitions and examples for each variable is given in Tables 3 and 4.

Table 2

*Conceptual and Operational Definitions of Toddler Variables*

| Overarching Theoretical/Conceptual or Developmental Framework | Conceptual Definition | Operational Definitions → | Independent Variables | Dependent Variables |
|---|---|---|---|---|
| | | <u>Emotion Regulation</u> | | |
| Developmental frameworks for operationalization of emotion-regulation (Cole, Martin, & Dennis, 2004; Eisenberg and Spinrad, 2004; Thompson, 1994) | Emotion regulation refers to systematic changes in one's activated emotions using strategies to initiate, maintain, evaluate and modify emotional intensity and expression in a goal-oriented and socially adaptive manner. Emotion regulation includes verbal and nonverbal behaviors. Some strategies may not involve the parent (independent of the parent) and some strategies involve the parent (termed dependent). | Sum of toddler initiated:<br>1. verbal distraction<br>2. non-verbal distraction<br>3. verbal-keys<br>4. verbal-self-control<br>5. verbal-desire<br>6. self-comfort<br>Sum of toddler joined:<br>7. verbal distraction-bids<br>8. verbal distraction-joined<br>9. non-verbal distraction joined<br>10. verbal-keys-bids<br>11. verbal-self-control-bids<br>12. verbal-desire-bids<br>13. comfort seeking | 1. Toddler IRS (sum of 1-6)<br>2. Toddler DRS (sum of 7-13) | Intensity of Expression of Negative Emotion<br>0 = no cue for emotion<br>1 = slight<br>2 = moderate<br>3 = strong intensity |
| | | <u>Delay of Gratification</u> | | |
| Developmental frameworks for operationalization of behavioral self-regulation (Kopp, 1982) | Ability to wait to touch the keys upon request. | 1. sum of discreet events of touching the keys<br>2. sum of discreet attempts to touch the keys | - | Overall Touch (sum of Touch and Attempted Touch) |

*Note.* "Sum" indicates total frequency of instances behavior was observed during each 10s interval; detailed definitions and examples for each variable is given in Tables 5 and 6. IRS = Independent Regulatory Strategies, DRS = Dependent Regulatory Strategies.

**Covariates.** Findings related to gender differences in toddlers' use of regulation strategies, emotion regulation, and delay of gratification is limited. However, a few studies point to gender differences related to toddler-initiated regulatory strategies. Two-year-old girls display more caregiver-focused regulation strategies, self-soothing, and higher distress when observed in low-threat novelty episode (e.g., interaction with a female clown or puppet show) (Premo and Kiel, 2014). In one study by Premo and Kiel (2014), child gender moderated the association between toddler initiated regulation strategy and maternal regulatory attempts such that 2-year old boys who sought more caregiver focused regulations strategies (e.g., seeking caregiver contact) during mildly frustrating laboratory experiments (e.g., interacting with a clown), received less non-supportive regulatory attempts (e.g. minimization, punitive reactions) at age 3. Smith, Calkins, and Keane (2006) found that maternal controlling behaviors including threats and criticisms of their 2-year olds was negatively associated with girls' negative emotion but this relationship was not significant for boys. These findings point to gender differences in maternal emotion socialization practices which broadly suggest supportive responses for girls' sadness and fear, and boys' anger (Chaplin, Casey, Sinha, & Mayes, 2010)

Toddlers' expressive language undergoes rapid developmental shifts in the second and third years of life and facilitate emergence of self-regulatory faculties (Cole et al., 2010) including effortful control (Bernier et al., 2017). Additionally, gender differences in expressive language skills promote girls' development of self-regulation (Vallotton & Ayoub, 2011). Thus, toddlers' gender and expressive language were treated as explanatory variables on overall intercepts in the current study and will be pursued as moderators for slope differences (e.g., effects of MRAs on outcomes) in future analyses.

**Overview of Research Questions.**[3] An overview of research questions and accompanying hypotheses is provided below. Questions are operationalized within multilevel modeling framework under Plan of Analyses in Chapter3: Method. Questions are presented in order of maternal and toddler predictor variables and toddlers' Overall Expression of Negative Emotion, followed by maternal and toddler predictor variables and toddlers' Overall Touch.

***Question 1A and 1B.*** Do Maternal Regulatory Attempts from the previous interval (lagged) predict toddlers' Overall Expression of Negative Emotion in the current interval?

***Hypothesis 1A.*** Maternal Regulatory Attempts from previous interval including lagged Verbal Comfort, lagged Physical Comfort, lagged Initiated Distraction, lagged Joined Distraction, lagged Verbal Orientation to Delay, lagged Positive Commands, lagged Positive Emotional Reactions, and lagged Appropriate Mind-Related Comments will each be related to low Overall Expression of Negative Emotion in current interval.

***Hypothesis 1B.*** Maternal Regulatory Attempts from previous interval including lagged Negative Commands, lagged Punitive Reactions, lagged Minimizing, lagged Physical Restraint, lagged Negative Emotional Reaction, and lagged Non-Attuned Mind-Related Comments will each be related to high Overall Expression of Negative Emotion in current interval.

***Question2A.*** Do toddlers' independent regulatory strategies from the previous interval (lagged) predict toddlers' Overall Expression of Negative Emotion in the current interval?

***Hypothesis 2A.*** Toddlers' independent regulatory strategies from previous interval including lagged Initiated Verbal Distraction, lagged Initiated Non-Verbal Distraction, lagged Initiated Verbal Keys, lagged Initiated Verbal Self-Control, lagged Initiated Verbal Desire, and

[3] See Supplementary Summaries A and Table 20 on page 80. Table 20 is also provided on page 2 of Supplemental Materials. All supplementary materials are included in a supplemental file in the electronic ProQuest account.

lagged Self-Comfort will each be related to low Overall Expression of Negative Emotion in current interval.

***Question 2B.*** Do toddlers' dependent regulatory strategies from the previous interval (lagged) predict toddlers' Overall Expression of Negative Emotion in the current interval?

***Hypothesis 2B.*** Toddlers' dependent regulatory strategies from previous interval including lagged Verbal Distraction-Bids to Mom, lagged Joined Verbal Distraction, Toddler Joined Non-Verbal Distraction, lagged Verbal Keys – Bids to Mom, lagged Verbal Self-Control-Bids to Mom, lagged Verbal Desire – Bids to Mom, and lagged Physical Comfort Seeking will each be related to low Overall Expression of Negative Emotion in current interval.

***Question 3A and 3B.*** Do Maternal Regulatory Attempts from the previous interval (lagged) predict toddlers' Overall Touch in the current interval?

***Hypotheses 3A.*** Maternal Regulatory Attempts from previous interval including lagged Verbal Comfort, lagged Physical Comfort, lagged Initiated Distraction, lagged Joined Distraction, lagged Verbal Orientation to Delay, lagged Positive Commands, lagged Positive Emotional Reactions, and lagged Appropriate Mind-Related Comments will each be related to low Overall Touch in current interval.

***Hypothesis 3B.*** Maternal Regulatory Attempts from previous interval including lagged Negative Commands, lagged Punitive Reactions, lagged Minimizing, lagged Physical Restraint, lagged Negative Emotional Reaction, and lagged Non-Attuned Mind-Related Comments will each be related to high Overall Touch in current interval.

***Question 4A.*** Do toddlers' independent regulatory strategies from the previous interval (lagged) predict toddlers' Overall Touch in current interval?

***Hypothesis 4A.*** Toddlers' independent regulatory strategies from previous interval including lagged Initiated Verbal Distraction, lagged Initiated Non-Verbal Distraction, lagged Initiated Verbal Keys, lagged Initiated Verbal Self-Control, lagged Initiated Verbal Desire, and lagged Self-Comfort will each be related to low Overall Touch in current interval.

***Question 4B.*** Do toddlers' dependent regulatory strategies from the previous interval (lagged) predict toddlers' Overall Touch in the current interval?

***Hypothesis 4B.*** Toddlers' dependent regulatory strategies from previous interval including lagged Verbal Distraction-Bids to Mom, lagged Joined Verbal Distraction, Toddler Joined Non-Verbal Distraction, lagged Verbal Keys – Bids to Mom, lagged Verbal Self-Control-Bids to Mom, lagged Verbal Desire – Bids to Mom, and lagged Physical Comfort Seeking will each be related to low Overall Touch in current interval.

# CHAPTER 3: Method

## Participants

The data used in the current study were collected as part of the Early Head Start Research and Evaluation Project (Love et al., 2005). A total of 3,001 low-income families were recruited nationally across 17 research sites. The current sample is comprised of 134 toddlers (67 girls; $M_{age}$ = 25.77 months, $SD_{age}$ = 1.60) with available video data from one Midwestern site. There were 2 cases with fathers that were not included in the current sample. Thus, all parental [4] variables are maternal variables. Families were randomly assigned to receive Early Head Start (EHS) services (N=69) or to a comparison group (N = 65). Families in the comparison group were free to access non-EHS programs. Data were collected in the home at study enrollment, at children's 14-months, 24 months, 36 months, 60 months birth-related assessments, and when children were 10 years old. The current study utilizes the data collected for Michigan research site with available videotaped interviews at the 24-months assessment. About 68.7% (n= 92) of the sample was Caucasian, 14.9 % (n=20) African-American, 3.0% (n=4) Hispanic, and 3.7% (n=5) endorsed "other" race. On average, mothers were 22.97 (SD = 4.92) years old at enrollment. About 42.9 % (n=51) mothers had less than high school education, 33.6 % (n= 40) mothers had a high school diploma, and 23.5 % (n=28) mothers had a college education. Cumulative risk was calculated as a sum score (Love et al., 2002) indicated by the presence or absence of five risk factors (single parenting, welfare receipt, teen pregnancy, high-school dropout, and unemployment) and ranged from 0.00-5.00, with mean of 2.81 (*SD* = 1.20).

[4] The term "maternal" refers to the current study's sample and findings, while "parental" extends to other caregivers.

## Procedure

**Delay of Gratification Task.** MRAs, MM, TRS, ENE-O and Overall Touch were observed during the Delay of Gratification Task assessed during the 24-month parent-child interview at the participants' home. Before the start of the task, the camera was placed 4 feet in front of the parent-child dyad with both faces visible on the tape. The interviewer said to the parent "For this activity, I am going to bring out a set of keys attached to a cartoon character or toy animal (e.g., Pooh Bear, turtle). I would like you to keep (child) from touching it for 2 minutes. We are doing this because we are interested in learning about a situation that happens to toddlers a lot, which is that they have to wait for something they want right away. For this part, you can do whatever you want, but please do not move the keys. Do you have any questions?" The interviewer asked the parent to sit on mat with child. Once the parent and child were sitting on mat, the interviewer shook the keys several times until they perceived the child to be fully attentive to keys. The set of keys had a small toy (e.g., Pooh bear, turtle, tiger) attached to them to make them more attractive. The interviewer placed the keys only 2 feet from the child and said, "You can begin now." After two minutes the interviewer said "That is the end of this activity, (child) can play with the keys now". The interviewer was instructed to refrain from making any eye contact with the child or interact with the parent at any time point during the task. Study protocol indicated that the task be stopped if the child cried hard for more than 30 seconds or if the parent restrained the child for more than 1 minute. Restraining was defined as the mother holding back the child as the child was actively trying to move toward the keys. In the current study we also coded maternal physical restraint as a regulatory attempt.

## Measures[5]

**Maternal Regulatory Attempts.** Maternal Regulatory Attempts were coded using the Coding System for Delay of Gratification Task-Mother's Regulatory Attempts (Friedlmeier, Corapci, & Benga, 2015a). Friedlmeier et al.'s coding system includes 18 regulatory attempts. The coding system was adapted for the current study and included 12 types of attempts described below (Table 3). This adaptation is based on previous findings that have found most variation in use of these attempts and the effects they exert on children's emotion regulation and delay of gratification (Calkins & Johnson, 1998; Morris, et al. 2011, Putnam et al., 2002; Spinrad et al., 2004).

Maternal behaviors coded in the current study included: (1) *Verbal Comfort (V-Comf)*, statements that praise, encourage, and acknowledge child's efforts to wait(e.g., "Good job waiting for the keys"), statements that reassure the child that he/she will soon get the keys (e.g., "Only a few seconds left"), and statements that encourage the expression of internal states (e.g., "What happened?"), (2) *Physical Comfort (Phy-Comf)*, behaviors that provide physical comfort for the child (e.g., hugging), (3) *Maternal Initiated Distraction (M-INI-Dis),* mother shifts attention (distracts) child by holding a conversation about a non-task related topic or by pointing out objects in the room, making suggestions for activities (e.g., "Show me your nose!"), (4) *Maternal Joined Distraction (M-JNT-Dis),* mother joins child in distracting conversation or activity that child has initiated, (5) *Maternal Verbal Orientation to Delay (VO2D),* statements that direct the child's attention toward the delay task (e.g., "keys" "What color are they?"), (6) *Positive Commands (Pos-Comd),* statements that indicate rules of the task without reasons (e.g., "Now we wait"), sometimes said in a suggestive tone (e.g., "Can you wait a minute?), and may

[5] For list of variable names and abbreviations as they appear throughout the Method and Results sections please refer to Supplementary Summaries A and B and Table 11.

provide explanations for compliance based on norms, values, or consequences (e.g., "You have to be a big girl and wait for the keys, okay?"), (7) *Negative Commands (Neg-Comd),* explicit rule statements or requests that specify the child's desired action in negative terms (e.g., "Don't touch that"), (8) *Punitive Reactions (Pun),* mother scolds child or threatens child about consequences if she/he is not obedient (e.g., "You want a spanking?"), (9) *Minimizing (Min),* statements that minimize child's emotional response/expression, make fun of, or tease child (e.g., "Don't be upset", "Boys don't cry"). Verbal Comfort, Physical Comfort, Initiated Distraction, Joined Distraction, Verbal Orientation to Delay, Positive Commands, Negative Commands, Punitive Reactions, and Minimizing were counted as frequency sum scores for each 10s interval. Additionally, codes include (10) *Physical Restraint (Phy-RST),* using physically restrictive behavior to stop child from touching keys, (e.g., holding child's arms when child reaches for keys, holding child firmly or forcefully in lap). Physical restraint was coded for each 10s interval with 2 = high restraint indicating forceful and continuous holding of child (e.g., pulling child back forcefully, holding child firmly in lap), 1 = low restraint indicating gentle, non-continuous restraint (e.g., gently holding child's hand back), and 0 = no restraint indicating absence of either low or high physical restraint, (11) *Positive Emotional Reactions (Pos-Aff),* mother shows overt positive affect to the child (e.g., smiling, laughing), and (12) *Negative Emotional Reactions (Neg-Aff),* mother becomes distressed by child's emotional response (e.g., she is upset, heavy sighs, harsh tone) or displays positive affect when child is crying (e.g. laughs at child in mocking way). Maternal affect was coded as an ordinal variable (-1 = negative, 0 = neutral, 1= positive) and dichotomized to create two categorical variables (1) Positive Emotional Reactions (1 = Positive affect, 0 = Neutral or Negative affect), and (2) Negative Emotional Reactions (1 = Negative affect, 0 = Neutral or Positive affect). The coders were instructed to code for the most predominant affect during each 10s interval thus each interval was coded with mutual exclusivity of either positive, neutral, or negative affect. In cases during which mothers displayed positive affect for majority of the interval with *any* instance of observed negative affect, the interval was coded as negative. Descriptions are presented in Table 3.[6]

**Maternal Mind-Mindedness.** Maternal mind-mindedness was coded using Mind-Mindedness Coding Manual, version 2.1 (Meins & Fernyhough, 2015)[7]. The coding system for maternal mind-mindedness yields two dichotomous and mutually exclusive codes including (1) Appropriate Mind-Related Comments (AMM) (2) Non-Attuned Mind-related Comments (NMM). Because Appropriate Mind-Related Comments and Non-Attuned Mind-related Comments have not been found to share significant association and have distinctly explained variance in attachment organization, Meins and colleagues suggest that each tendency represents separate indices or dimensions of mind-mindedness (2012). Therefore, both Appropriate and Non-Attuned Mind-Related Comments were coded to examine the unique effects of each tendency on toddlers' emotion regulation and delay of gratification.

Mind-related comments were coded based on the following criteria outlined by Meins & Fernyhough (2015). Any comment that (a) uses an explicit internal state term to comment on what the toddler may be thinking, experiencing, or feeling. Mind-related comments include internal state terms that reflect *emotions* (e.g., happy, sad), *cognitions* (e.g., think, obsessed), *desires and preferences* (e.g., like, want), *epistemic states* (e.g., teasing) or (b) comments that reflect 'putting words into the toddlers' mouth with the caregiver talking on the toddler's behalf.

[6] Friedlmeier et al., (2015a) does not include *Ignoring* in their coding manual, however, Spinrad et al., (2007a) consider *Ignoring* as an unsupportive strategy, and therefore, *Ignoring* (e.g., mother does not respond to child's bid's verbally or non-verbally) was coded. However, due to the low number of observed instances of *ignoring*, (M = .00, SD = .06, Skewness = 14.9, 0.004 % of intervals*)*, it was not included in final analyses. Additionally, due to the low number of observed instances of *Removing Keys* (e.g., mother removes keys out of child's sight or reach), (M = .06, SD = .23, Skewness = 3.81, 5.7 % of intervals) it was not included in final analyses

[7] For descriptions on exploratory overlap of MRAs and MM see Appendix A.

Statements that indicate *talking on the toddler's behalf* include any utterance that is meant to be said or though by the toddler, and may not always contain internal state terms (e.g., "That's a teddy bear Mommy"; Meins & Fernyhough, 2015, p. 5) said on behalf of the toddler.

After identification of all mind-related comments, they were dichotomously categorized as appropriate or non-attuned based on the following criteria. Mind-related comments were coded as appropriate if (a) the coder agreed with the mother's interpretation of toddler's internal state (e.g., "You are such a happy boy" – said while the toddler is smiling or laughing (Meins & Fernyhough, p. 9), "You really want those keys" – said while the toddler is fussing and reaching for keys, or (b) the comment linked current activity with similar events in the past or future (e.g., "Remember we read Pooh Bear?" – said after toddler says "Pooh Bear" or was looking at the keys with Pooh Bear attached to it), or (c) the comment served to clarify how to proceed after a lull in the interaction (e.g., "Do you want to sing a song?" – said after toddler has been gazing around the room not focused on any object or activity for 2-3 seconds). Per Meins' (2015) manual, mind-related comments were coded as Non-Attuned if (a) the coder disagreed with the mother's interpretation of the toddler's current internal state (e.g., "Are you tired? – after the toddler has shown no overt signs of tiredness), or (b) the comment refers to a past or future event that is unrelated to the toddler's current activity (e.g., would you like Grandma to come and see you tomorrow – having not previously mentioned Grandma), or (c) the caregiver asks what the toddler wants to do or suggests that the toddler wants to be involved in a new activity when the toddler is actively engaged in playing with or attending to something else ("Do you want to count? – when the toddler is attending to keys) or (d) the mother seems to be attributing internal states that are not implied by the toddler's behaviors and which appear to be projections of the adult's own internal states onto the child (e.g., "Are you thinking about Daddy who you love so much?"), or (e) the referent of the mother's comment is not clear (e.g., "You like that" – when the toddler is not playing with or attending to any particular object or event). To ensure accuracy in coding, all mind-related comments were identified by the first author before they were coded as appropriate or non-attuned by trained undergraduate research assistants. Descriptions are presented in Table 4.

Table 3
*Description of Maternal Regulatory Attempts*

| Variable Name | Description | Example |
|---|---|---|
| 1. Verbal Comfort (V-Comf) | · Statements that praise, encourage, and acknowledge child's efforts to wait. | "Good job waiting for the keys", "You are a good boy", "I know you can wait!" |
| | · Statements that reassure the child that he/she will soon get the keys. | "It's alright" "Only a few seconds left" |
| | · Statements that encourage the expression of internal states. | "What happened?" |
| 2. Physical Comfort (Phy-Comf) | · Behaviors that provide physical comfort for the child. | Giving hugs, kissing, holding child's hand |
| 3. Maternal Initiated Distraction (M-INI-Dis) | · Mother shifts attention (distracts) child by holding a conversation about a non-task related topic or by pointing out objects in the room, making suggestions for activities. | "Show me your nose!" Playing. |
| 4. Maternal Joined Distraction (M-JNT-Dis) | · Mother joins child in distracting conversation or activity that child has initiated. | Child plays with toes and mom says "Let's count your toes" |
| 5. Maternal Verbal Orientation to Delay (M-VO2D) | · Statements that direct the child's attention toward the delay task. | "Keys" "What color are they?" "Turtle is sleeping, don't wake him up" "What are the keys for?" |
| | · Statements that indicate rules of the task without reasons. | "Now we wait", "You need to sit down." |
| 6. Positive Commands (Pos-Comd) | · Suggestive statements | "Can you wait a minute? |
| | · May provide explanations for compliance based on norms, values, or consequences | "You have to be a big girl and wait" |
| 7. Negative Commands (Neg-Comd) | · Explicit rule statements or requests that specify the child's desired action in negative terms | "Don't touch that", "No, you shouldn't play with the keys." |

Note. The attractive set of keys was attached to different toys. Terms such as "Pooh Bear" "Turtle" "Tiger" "Keys" are all related to the Key Task.

Table 3 (cont'd)

| | | |
|---|---|---|
| 8. Punitive Reactions (Pun) | · Mother scolds child or threatens child about consequences if she/he is not obedient | "You want a spanking?" "Bad boy/girl"; Slapping child's hand when he reaches for keys |
| 9. Minimizing (Min) | · Statements that minimize child's emotional response/expression, make fun of, or tease child | "Don't be upset", "Boys don't cry", "Stop!" said while child is crying |
| 10. Physical Restraint (Phy-RST) | · Using physically restrictive behavior to stop child from touching keys (0 = no physical restraint, 1 = low physical restraint (gentle, non-continuous), 2 = high physical restraint (forceful, continuous) | Low – mother may gently tap child's arm or pull back arm High – firmly holding child in lap |
| 11. Positive Emotional Reactions (Pos-Aff) | . Mother shows overt positive affect to the child | - Smiling at child, Laughing with child, expressing joy |
| 12.Negative Emotional Reactions (Neg-Aff) | . Mother becomes distressed by child's emotional response or displays positive affect when child is crying | - Heavy sighs, harsh tone, laughs to mock child, yells at child |

Table 4
*Description of Maternal Mind-mindedness*

| Variable Name | Description | Example |
|---|---|---|
| Appropriate Mind-Related Comments (AMM) | Mind-related comments which:<br>. Accurately identify/interpret the internal states of the toddler including emotional, cognitive, desires, goals, preferences based on observable behaviors<br>. Link current activity with similar events in the past or future, the comment.<br>. Serve to clarify how to proceed after a lull in the interaction. | "You really want those keys" – said while child is looking at keys or saying keys<br>"You are frustrated" " You want to touch it" – said while child is frustrated after she is told she can't touch keys<br>"Remember we use keys to start the car?" |
| Non-Attuned Mind-Related Comments (NMM) | Mind-related comments which:<br>. Non-accurately identify/interpret the internal states of the toddler based on observable behaviors<br>. Refer to past or future events, unrelated to toddler's current activity.<br>. Ask what the toddler wants to do or suggest that the toddler wants to be involved in a new activity when the toddler is actively engaged in playing with or attending to something else.<br>. Attribute internal states that are not implied by the toddler's behaviors and which appear to be projections of the adult's own internal states onto the child | " You are so tired" – said while toddler shows no overt signs of fatigue<br>"Do you want to count?" – said when toddler is attending to keys |

**Toddler Regulatory Strategies.** Toddler regulatory strategies were coded based on Coding System for Delay of Gratification Task – Child Behavior and Regulatory Attempts (Friedlmeier, Corapci, & Benga, 2015b) as a frequency sum score for each 10s interval. Friedlmeier et al.'s coding system includes 8 regulatory attempts classified into two mutually exclusive categories (1) independent regulatory strategies and (2) dependent regulatory strategies. The coding system was adapted for the current study and identified 13 strategies that were classified into two mutually exclusive categories (1) independent regulatory strategies (1-6), and (2) dependent regulatory strategies (7-13) described below (Tables 5 and 6). Strategies were based on established coding schemes from previous studies (Grolnick et al., 1996; Gilliom et al., 2002). Strategies were coded in 10s intervals and were calculated as the sum of total strategies for each strategy per 10s interval.

Independent regulatory strategies refer to a toddler's *initiated* attempts to regulate by him/herself that do not involve the mother and include 6 mutually exclusive strategies. Strategies include (1) *Toddler Initiated Verbal Distraction (T-INI-Vdis),* verbal behaviors that shift attention away from keys/task by describing or talking about other things in the room or other activities (e.g., "chair", singing), (2) *Toddler Initiated Non-Verbal Distraction (T-INI-nonVDis),* toddler shifts focus away from keys for more than 3 seconds (e.g., looks away, walks out of the room, engages in play). Independent strategies also included any "word like" verbalizations directed towards the delay task, in the form of (3) *Toddler Initiated Verbal Keys(T-INI-Vkeys),* any "word like" verbalizations that describe the keys (e.g., "keys"), (4) *Toddler Initiated Verbal Self-Control(T-INI-Vctrl)*, any "word like" verbalizations in the form of self direction (e.g., "I wait") or in reference to rules of the task (e.g., "No touch"), (5) *Toddler-Initiated-Verbal Desire (T-INI-Vdes),* any self-talk expressing desire for the keys (e.g., "I want it"), and (6) *Toddler Self-Comfort (T-SComf),* child physically comforts self (e.g., thumb sucking). Descriptions are presented in Table 5.

Dependent regulatory strategies refer to toddlers' attempts to regulate by joining or involving the mother and include 7 mutually exclusive strategies. Strategies include (7) *Toddler Verbal Distraction-Bids to Mom (T-VDis-2M),* toddler- initiated verbal behaviors that shift attention away from keys/task by describing or talking about other things in the room or other activities that were *also* directed towards mother (e.g., "I want bottle" or initiated singing while looking at mom), these behaviors are the same as *Toddler-Initiated Verbal Distraction (T-INI-VDis)* except that they are also directed towards or engage mother and are thus categorized under dependent regulatory strategies, (8) *Toddler Joined Verbal Distraction (T-JNT-VDis),* toddler joins in alternative verbal activity that mother has initiated (e.g., mom starts counting and child joins in), (9) *Toddler Joined Non-Verbal Distraction (T-JNT-nonVDis),* child joins in alternative non-verbal activity that mother has initiated (e.g., mom initiates play and child joins in, mom points to a direction away from keys and child looks where mom is pointing). Dependent strategies also include any "word like" verbalizations directed towards the delay task, that were *also* directed towards mother (looking at mother or in response to mother), in the form of (10) *Toddler Verbal Keys- Bids to Mom (T-Vkeys-2M),* any "word like" verbalizations that describe the keys (e.g., "keys", "Pooh Bear") or reframed the task, "The turtle is sleeping, wake up turtle" said while looking at or in response to mother), (11) *Toddler Verbal Self-Control- Bids to Mom (T-Vctrl-2M)*, any "word like" verbalizations in the form of self direction (e.g., "I wait" said while looking at or in response to mother) or in reference to rules of the task (e.g., "No touch" said while looking at or in response to mother) and (12) *Toddler Verbal Desire- Bids to Mom (T-Vdes-2M)*, any self-talk expressing desire for the keys (e.g., "I want it" said while looking at or in response to mother), and (13) *Toddler Physical Comfort Seeking (T-ComfSk)*, child seeking physical closeness to mother (e.g., reaching arms up to mother, hugging mother, leaning on mother's body). Descriptions are presented in Table 6.

Table 5

*Description of Toddler Independent Regulatory Strategies*

| Variable Name | Description | Example |
|---|---|---|
| 1. Toddler Initiated Verbal Distraction (T-INI-VDis) | Toddler- initiated verbal behaviors that shift attention away from keys/task by describing or talking about other things in the room or other activities | Toddler says “chair”, or sings |
| 2. Toddler Initiated Non-Verbal Distraction (T-INI-nonV-Dis) | Toddler shifts focus away from keys for more than 3 seconds | looks away, walks out of the room, engages in play |
| 3. Toddler Initiated Verbal Keys (T-INI-Vkeys) | Any “word like” verbalizations that describe the keys or reframed the task | “Keys”, “Pooh Bear”, “The turtle is sleeping, wake up turtle” |
| 4. Toddler Initiated Verbal Self-Control (T-INI-Vctrl) | Any “word like” verbalizations in the form of self direction or in reference to rules of the task | “I wait”, “No touch” |
| 5. Toddler Initiated Verbal Desire (T-INI-Vdes) | Any self-talk expressing desire for the keys | “I want it”, “I need it” “I like it” “Mine”. |
| 6. Toddler Self-Comfort (T-SComf) | Child physically comforts self | Thumb sucking, rocking back and forth |

Note. The attractive set of keys was attached to different toys. Terms such as “Pooh Bear” “Turtle” “Tiger” “Keys” are all related to the Key Task.

Table 6

*Description of Toddler Dependent Regulatory Strategies*

| Variable Name | Description | Example |
|---|---|---|
| 7. Toddler Verbal Distraction-Bids to Mom (T-Vdis-2M) | Toddler- initiated verbal behaviors that shift attention away from keys/task by describing or talking about other things in the room or other activities that were *also* directed towards mother | "I want bottle" said to mom or initiated singing while looking at mom. |
| 8. Toddler Joined Verbal Distraction (T-JNT-VDis) | Toddler joins in alternative verbal activity that mother has initiated | Mother starts counting and child joins in. |
| 9. Toddler Joined Non-Verbal Distraction (T-JNT-nonV-Dis) | Toddler joins in alternative non-verbal activity that mother has initiated | Mother initiates play and child joins in, Mother points to a direction away from keys and child looks where she is pointing. |
| 10. Toddler Verbal Keys-Bids to Mom (T-Vkeys-2M) | Any "word like" verbalizations that describe the keys or reframed the task said while looking at or in response to mother | "Keys", "Pooh Bear", "The turtle is sleeping, wake up turtle" |
| 11. Toddler Verbal Self-Control- Bids to Mom (T-Vctrl-2M) | Any "word like" verbalizations in the form of self direction or in reference to rules of the task said while looking at or in response to mother | "I wait", "No touch" |
| 12. Toddler Verbal Desire- Bids to Mom (T-Vdes-2M) | Any self-talk expressing desire for the keys said while looking at or in response to mother | "I want it", "I need it" "I like it" "Mine". |
| 13. Toddler Physical Comfort Seeking (T-ComfSk) | Toddler seeking physical closeness to mother | e.g., reaching arms up to mother, hugging mother, leaning on mother's body |

Note. The attractive set of keys was attached to different toys. Terms such as "Pooh Bear" "Turtle" "Tiger" "Keys" are all related to the Key Task.

**Toddlers' Overall Expression of Negative Emotion.** Toddlers' intensity of expression of negative emotion was coded based on the Coding System for Delay of Gratification Task-Intensity of Emotion Expression (Friedlmeier, Corapci, & Benga 2015c). The coding system was designed to distinguish valence (Happy, Sad, and Angry) and intensity (0-3) of emotions, from low to high intensity. For the purpose of this study, "happy" was not coded. The delay task has been primarily designed to elicit anger and used to assess anger expression, thus criteria for "sad" and "angry" expressions were treated and coded as "negative" emotions. Valence was coded using vocal cues, facial cues, and posture/gesture cues. "Sad" was coded when vocal cues reflected lowering of voice from previous volume without intention to whisper or dropped off at the end of utterance, and if child was whining. Facial cues for "sad" included lip corners beginning to pull down, bottom lip appearing loose, droopy eyes, oblique shaped (^) brows. Posture/gesture cues for "sad" included toddlers' head dropping down to the side, shoulders/body were slumping or slacking, eye rubbing to catch or hide tears. "Anger" was coded when vocal cues reflected harsh voice, protest, irritation, and pitch of voice was loud and deep. Facial cues reflected furrowed brows, narrowed eyes in a "hard stare", clenched jaw, mouth squared off if open, and lips pressed or tightened if mouth was closed. Posture/gesture cues for anger reflected arms akimbo (fists placed on each hip), finger wagging or jabbing. Aggressive behaviors (e.g. punching) were not codable without additional anger cues. Emotion intensity was coded on a four point scale (0-3) with 0 indicating 'no sign of any cue for this emotion', 1 indicating 'slight intensity' (e.g., whimpers, frowns), 2 indicating 'clear but moderate intensity (e.g., crying, nagging), and 3 indicating 'strong intensity' (e.g., screaming, kicking feet to the ground).

In order to capture maximum variation in expression of negative emotions, considering both intensity and temporal features (e.g. duration) of emotional expression, the final coding was done as the following to yield an *intensity* of expression of negative emotion (ENE-I), and a *predominance* of expression of negative emotion (ENE-P) score for each interval. Using the four point scale, we coded the highest observed intensity during the $1^{st}$ 5s and the highest observed intensity during the $2^{nd}$ 5s for each 10s interval. Then, an average *intensity* score was calculated for the entire 10s interval using the highest observed intensity scores for the $1^{st}$ 5s, and the $2^{nd}$ 5s for each interval. Using the four point scale, we additionally coded the most predominant intensity level (i.e., the intensity level with longest duration in seconds) observed during the $1^{st}$ 5s and most predominant intensity level (i.e., the intensity level with longest duration in seconds) during the $2^{nd}$ 5s for each interval. Then, an average *predominance* score was calculated for the entire 10s interval using the predominance scores (longest observed intensity level) for the $1^{st}$ 5s, and the $2^{nd}$ 5s for each interval. This coding scheme was done to distinguish highest intensity (ENE-I) expressed from most enduring level of intensity (ENE-P). For instance, during a 5s interval, a toddler who screamed (level-3 intensity) for 1 second and whimpered (level-1 intensity) for 4 seconds would receive a score of 3 for *intensity* and a score of 1 for *predominance*. Finally, an average *overall* expression score reflective of both intensity and predominance was calculated using total ENE-I and ENE-P for each interval. Overall Expression of Negative Emotion (ENE-O) was calculated as the average of intensity scores for the $1^{st}$ 5s, the $2^{nd}$ 5s, predominance score (longest observed intensity level) for the $1^{st}$ 5s, and the predominance score for the $2^{nd}$ 5s for each interval (Table 7). Descriptive, correlational, and multilevel analyses are reported on ENE-O.

**Toddler' Delay of Gratification.** Toddlers' delay of gratification was coded as count variable and reflected a frequency score comprised of touching and attempting to touch the keys as follows. *Touch* was scored as having occurred each time the toddler touched the keys and *Attempted Touch* was scored as having occurred each time the toddler attempted to touch the keys but was physically restrained by mother for each 10s interval. Behaviorally, both *Touch* and *Attempted Touch* reflect lower capacity to wait. Therefore, *Touch* and *Attempted Touch* were summed to create an *Overall Touch* score for each interval with higher scores indicating lower delay of gratification (Table 7). Descriptive, correlational, and multilevel analyses are reported on Overall Touch.

Table 7

*Description of Toddler Expression of Negative Emotion and Delay of Gratification*

| Variable Name | Description | Scale ICC |
|---|---|---|
| ENE-O | Average of ENE-I 1$^{st}$ 5s, ENE-I 2$^{nd}$ 5s, ENE-P 1$^{st}$ 5s, and ENE-P 2$^{nd}$ 5s | .96 |
| ENE-I - 1st 5s | Expression of Negative Emotion Intensity | - |
| ENE-I - 2nd 5s | Expression of Negative Emotion Intensity | - |
| ENE-I | Average of ENE-I 1$^{st}$ 5s and 2$^{nd}$ 5s | .91 |
| ENE-P - 1st 5s | Expression of Negative Emotion Predominance | - |
| ENE-P - 2nd 5s | Expression of Negative Emotion Predominance | - |
| ENE-P | Average of ENE-P 1$^{st}$ 5s and 2$^{nd}$ 5s | .92 |
| Touch | Sum of times child touched the keys | - |
| Attempted Touch | Sum of times child tried (reached) to touch the keys but was restrained by mother | - |
| Overall Touch | Sum of Touch and Attempted Touch | - |

*Note.* ENE-O = Overall Expression of Negative Emotion, ENE-I = Intensity of Expression of Negative Emotion, ENE-P = Predominance of Expression of Negative Emotion, s = seconds.

**Covariates[8].** Toddlers' gender was coded as a binary variable at baseline (1=male), (0=female). Toddler's expressive language was assessed using the 24-month MacArthur Communicative Development Inventories – Vocabulary Short Form (Fenson et al., 1993).

[8] **Note to committee:** For list of covariate names and abbreviations as they appear throughout the Method and Results sections please refer to Table H1 in Appendix H (also provided on page 2 of Supplemental Materials).
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Mothers were asked to respond with a yes (1) or no (0) indicating if they had heard their child use the word. All 100 items were summed to yield a Vocabulary Production score.

Additionally, in order to examine effects of verbal MRAs and MM beyond effects of maternal talkativeness, maternal verbosity was used as a level-1 covariate in models with verbal maternal predictors including Verbal Comfort, Verbal Orientation to Delay, Positive Commands, Negative Commands, Minimizing, as well as Appropriate Mind-Related Comments, and Non-Attuned Mind-related Comments (Questions 1 & 3). Before coding, all comments made by mothers and toddlers were transcribed verbatim from the videotaped interactions during the delay of gratification task by a trained coder. Maternal verbosity was computed as sum of all maternal comments. A comment was defined as any utterance of one-word (e.g., “Stop”, “No”) or multiple-word statements (e.g., “Stop that”, “Sit down”) mothers made during the 2-mintue delay of gratification task ($M$ = 3.01, $SD$ = 2.30, Range = 0-15 comments/interval).

To control for linear and quadratic dependency of outcomes on time, when all predictors were zero (e.g., expected fatigue), Elapsed Time-Linear (ET) and Elapsed Time – Quadratic ($ET^2$) were calculated as time varying predictors in seconds per interval and used as level-1 covariates in all random coefficient models.[9]

**Coding[10]**

All variables were coded using event-based coding conducted along 10s intervals, which yielded a sum of 12 intervals for the entire task. Coding occurred during three phases including (1) initial training phase, (2) baseline training phase, and (3) independent coding phase. Coders

[9] See Appendix D for results of descriptive statistics and ANOVA conducted to describe direction of change in study variables including Overall Expression of Negative Emotion and Overall Touch (Table D1), Maternal Regulatory Attempts, Appropriate, and Non-Attuned Mind-Related Comments (Table D2), and Toddlers’ Regulatory Strategies (Table D3). Curve Estimations examining the relationship between time and outcome variables are presented in Figure D1.

[10] For detailed description for Coder Training and Inter-Coder Reliability procedures refer to Appendix B.

reached inter-coder reliability of 0.80 or greater for all variables before they could be considered reliable to code independently in phase 3. During phase 3, 35% of cases were randomly double coded for all variables to ensure consistent and accurate coding. Inter-coder reliability estimates for all study variables ranged between acceptable to very good (0.66 -1.00). For all reliability estimates refer to Tables 8-10.

Based on standards by Altman (1991), MedCalc for Windows, version 16.2.0 (MedCalc Software, Ostend, Belgium) was used to calculate the inter-rater agreement statistics (weighted kappa and intraclass correlation estimates) with 95% confidence interval for nominal and ordinal variables. Kalpha (Krippendorff, 1997; 2004) was used to estimate inter-coder reliability for all variables with Reliability Calculator for Ordinal, Interval, and Ratio Data (ReCal OIR; Freelon, 2013). Kalpha allows for the estimation of inter-coder reliability with specificity of the measurement scale (Krippendorff, 2004). Thus, Kalpha is reported for all variables according to each variable's specific scale of measurement. All count variables are reported as Kalpha-Ratio, Expression of Negative Emotion is reported as Kalpha-Interval, Maternal Emotional Reactions and Physical Restrained are reported as Kalpha-Ordinal. Additionally, Cohen's Kappa (Cohen, 1960) is reported for nominal data.

Table 8

*Interobserver Reliability Estimates for Maternal Regulatory Attempts, Appropriate Mind-Related, and Non-Attuned Mind-Related Comments*

| Variable Name | ICC | Kappa | Weighted Kappa | Kalpha |
|---|---|---|---|---|
| | Mean (Range) | Mean (Range) | Mean (Range) | Mean (Range) |
| V-Comf | 1.00(1.00 - 1.00) | .76 (.74 - .77) | .85 (.83 - .83) | .76 (.74 - .76) |
| Phy-Comf | .95 (.82 - 90) | .86 (.70 - .96) | .88 (.70 - .91) | .87 (.70 - .90) |
| M-INI-Dis | .94 (.92 - .98) | .82 (.62 - .95) | .84 (.71 - .96) | .85 (.67 - .96) |
| M-JNT-Dis | .91 (.80 - .95) | .84 (.66 - .90) | .84 (.66 - .90) | .84 (.66 - .90) |
| M-VO2D | 1.00 (.99 - 1.0) | .86 (.81 - .88) | .91 (.90 - .92) | .89 (.88 - .89) |
| Pos-Comd | .99 (.90 - .99) | .78 (.75 - .78) | .84 (.80 - .84) | .86 (.80 - .91) |
| Neg-Comd | 1.00 (1.00 - .97) | .84 (.83 - .84) | .94 (.89 - .96) | .93 (.92 - .95) |
| Pun | 1.00 | 0.76 | 0.87 | 0.82 |
| Min | 1.00 | 0.82 | 0.90 | 0.82 |
| Phy-RST | .94 (.93 - .93) | .83 (.81 - .86) | .86 (.84 - .87) | .88 (.87 - .88) |
| Affect | .89 (.88 - .92) | .82 (.77 - .89) | .81 (.77 - .87) | .81 (.77 - .82) |
| AMM | .91 (.87 - .97) | .80 (.73 - .94) | .81 (.74 - .94) | .80 (.72 - .94) |
| NMM | .96 (.96 - .97) | .85 (.82 - .91) | .89 (.87 - .92) | .87 (.85 - .91) |

*Note.* ICC = Intraclass Correlation, V-Comf = Verbal Comfort, Phy-Comf = Physical Comfort, M-INI-Dis = Maternal Initiated Distraction, M-JNT-Dis = Maternal Joined Distraction, M-VO2D = Maternal Verbal Orientation to Delay, Pos-Comd = Positive Commands, Neg-Comd = Negative Commands, Pun = Punitive Reactions, Min = Minimizing, Phy-RST = Physical Restraint, AMM = Appropriate Mind Related Comments, NMM = Non-Attuned Mind Related Comments. Affect was coded as an ordinal variable and later dichotomized to create presence/absence of positive and negative affect; (Weighted Kappa 0.61-0.80 = Good, 0.81- 1.00 = Very Good, Altman, 1991; Kalpha ≥.80 = Very Good, ≥ 0.67 = Acceptable)

Table 9

*Interobserver Reliability Estimates for Toddlers' Regulatory Strategies*

| Variable Name | ICC | Kappa | Weighted Kappa | Kalpha |
|---|---|---|---|---|
| | Mean (Range) | Mean (Range) | Mean (Range) | Mean (Range) |
| | Independent Regulatory Strategies | | | |
| T-INI-VDis | 1.0 (1.0 -1.0) | .70 (.67 - .80) | .80 (.76 - .81) | .73 (.69 - .79) |
| T-INI-nonVDis | 1.0 (1.0 -1.0) | .67 (.63 - .72) | .74 (.69 - .77) | .74 (.71 - .76) |
| T-INI-Vkeys | 1.0 (1.0 -1.0) | .96 (.91 - .98) | .98 (.95 - .98) | .96 (.91 - .98) |
| T-INI-Vctrl | 1.0 (1.0 -1.0) | .95 (.90 - 1.0) | .98 (.96 - 1.0) | .95 (.90 - 1.0) |
| T-INI-Vdes | 1.0 (1.0 -1.0) | 1.0 (1.0 - 1.0) | 1.0 (1.0 - 1.0) | 1.0 (1.0 - 1.0) |
| T-SComf | 1.0 (.99 - 1.0) | .75 (.71 - .78) | .82 (.75 - .87) | .82 (.78 - .85) |
| | Dependent Regulatory Strategies | | | |
| T-VDis-2M | 1.0 (1.0 - 1.0) | .68 (.66 - .68) | .80 (.75 - .81) | .71 (.66 - .75) |
| T-JNT-VDis | 1.0 (1.0 - 1.0) | .73 (.67 - .81) | .84 (.69 - .89) | .77 (.72 - .84) |
| T-JNT-nonVDis | 1.0 (1.0 - 1.0) | .74 (.67 - .81) | .86 (.72 - .87) | .77 (.70 - .82) |
| T-Vkeys-2M | 1.0 (1.0 - 1.0) | .98 (.97 - 1.0) | .99 (.98- 1.0) | .98 (.97 - 1.0) |
| T-Vctrl-2M | 1.0 (1.0 - 1.0) | .95 (.90 - 1.0) | .98 (.96- 1.0) | .95 (.90 - 1.0) |
| T-Vdes-2M | 1.0 (1.0 - 1.0) | 1.0 (1.0 - 1.0) | 1.0 (1.0 - 1.0) | 1.0 (1.0 - 1.0) |
| T-ComfSk | 1.0 (.99 - 1.0) | .70 (.62 - .77) | .79 (.66- .84) | .74 (.69 - .78) |

*Note.* ICC = Intraclass Correlation, T-INI-VDis = Toddler Initiated Verbal Distraction, T-INI-nonVDis = Toddler Initiated Non-Verbal Distraction, T-INI-Vkeys = Toddler Initiated Verbal Keys, T-INI-Vctrl = Toddler Initiated Verbal Self-Control, T-INI-Vdes = Toddler Initiated Verbal Desire, T-SComf = Toddler Self-Comfort; T-VDis-2M, = Toddler Verbal Distraction-Bids to Mom, T-JNT-VDis = Toddler Joined Verbal Distraction, T-JNT-nonVDis = Toddler Joined Non-Verbal Distraction, T-Vkeys-2M = Toddler Verbal Keys - Bids to Mom, T-Vctrl-2M = Toddler Verbal Self-Control- Bids to Mom, T-Vdes-2M = Toddler Verbal Desire- Bids to Mom, T-ComfSk = Toddler Physical Comfort Seeking. (Weighted Kappa 0.61-0.80 = Good, 0.81- 1.00 = Very Good, Altman, 1991; Kalpha ≥.80 = Very Good, ≥ 0.67 = Acceptable)

Table 10

*Interobserver Reliability Estimates for Toddler Expression of Negative Emotion and Delay of Gratification*

| Variable Name | ICC | Kappa | Weighted Kappa | Kalpha |
|---|---|---|---|---|
| | Mean (Range) | Mean (Range) | Mean (Range) | Mean (Range) |
| ENE-I - 1st 5s | 1.0 (.98 - 1.0) | .82 (.63 - .86) | .89 (.78 - .92) | .92 (.79 - .95) |
| ENE-I - 2nd 5s | 1.0 (1.0 - 1.0) | .86 (.68 - .90) | .92( .81- .95) | .95 (.83 - .97) |
| ENE-P - 1st 5s | 1.0 (.97 - 1.0) | .85 (.78 - .89) | .91 (.86- .93) | .93 (.87 - .94) |
| ENE-P - 2nd 5s | 1.0 (1.0 - 1.0) | .86 (.69 - .91) | .82 (.82 - .94) | .94 (.83 - .96) |
| Touch | 1.0 (1.0 - 1.0) | .90 (.86 - .95) | .92 (.89 - .96) | .93 (.89 - .97) |
| Attempted Touch | 1.0 (1.0 - 1.0) | .70 (.69 - .71) | .79 (.76 - .80) | .78 (.77 - .78) |

Note. ENE-I = Expression of Negative Emotion – Intensity, ENE-P = Expression of Negative Emotion – Predominance, s = seconds. (Weighted Kappa 0.61-0.80 = Good, 0.81- 1.00 = Very Good, Altman, 1991; Kalpha ≥.80 = Very Good, ≥ 0.67 = Acceptable)

**Plan of Analyses**

A multilevel modeling (Byrk & Raudenbush, 1992) approach was used to examine the effects of maternal regulatory attempts, mind-mindedness, and toddlers' regulatory strategies on toddlers' overall expression of negative emotion and toddlers' delay of gratification. Multilevel modeling allows for the distinction between individual- and group-level sources of variance to explain a single individual outcome and can be used to analyze data that has been collected over repeated measures (Snijders & Bosker, 2012). This study utilized two-level multilevel models with random intercepts with 12 repeated measurement occasions nested within 134 mother-child dyads. Heterogeneity of within-person variance (e.g., significant differences in Overall Expression of Negative Emotion and Overall Touch) was examined using intraclass correlations of the intercept-only models (no predictors). Multilevel analyses are well suited to analyze nested data in which error terms may be dependent, which violate assumptions of independence of errors underlying ordinary least square (OLS) estimation. Thus, in multilevel analyses, concerns related to power and effect sizes are adequately handled as long as there are large numbers of level-2 units (134 dyads in this study) (Snijders, 2005).

Each outcome variable was predicted in a separate model. Models were specified with level-1 and level-2 predictors, random intercepts (intercepts were allowed to vary among toddlers), and fixed (Model 1) or random slopes (Model 2). This structure allowed for the examination of specific Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments, and Toddlers' Regulatory Strategies, on toddlers' Overall Expression of Negative Emotion and Overall Touch. This structure also allowed for examination of toddlers' gender and expressive language as control variables meaning gender differences or expressive language differences were allowed to partly explain amount of variation in random intercepts over groups. Toddler gender was specified as a level-2 covariate in all models for Questions 1- 3 but not Question 4. Toddlers' expressive language was specified as a level-2 covariate for models in Question 4 but not Questions 1-3. No hypotheses regarding cross-level interactions were made and were not included in analyses.

**Outcome 1: Toddlers' Overall Expression of Negative Emotion (ENE-O).** Research Questions 1 and 2 examine the effects of maternal predictors (Question 1) and toddler predictors (Question 2) on toddlers' Overall Expression of Negative Emotion (ENE-O). First, a base model was used to test whether there was significant within-toddler variance (across all intervals) before we could test what maternal and toddler regulatory strategies predict toddlers' ENE-O. Therefore, the first analysis concerns the amount of variance in intensity of expression of negative emotion when all predictors are zero (i.e., does toddlers' ENE-O differ across the two-minute task). Operationalized in multilevel modeling framework to test whether there were intraindividual differences in means of ENE-O *within* toddlers across 12 intervals, the following equation was employed,

Level-1 Equation: The Intercept-Only Model

$$\text{ENE-O}_{ij} = \beta_{0j} + e_{ij}$$

where $I$ indicates the time interval within a dyad and j indicates a mother-child dyad, $\beta_{0j}$ indicates the intercept (mean) for ENE-O in dyad j (varies over j dyads), $e_{ij}$ indicates random errors of prediction for level-1 equation (deviation for interval $I$ from its dyad $j$).

Level-2 Equation: The Intercept-Only Model

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

where $\beta_{0j,}$ an intercept (mean) for group j is the sum of the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0, $\gamma_{00}$, and the random error associated with the group intercept, $u_{0j}$ (deviation for group j from overall intercept)[11]

Next, the base models were tested to determine whether Maternal Regulatory Attempts and maternal Mind-Mindedness (Research Question 1) and Toddlers' Regulatory Strategies (Research Question 2) from a previous interval predicted toddlers' Overall Expression of Negative Emotion in a current interval. See Table 11 below for the specific list of maternal and toddler behaviors tested as predictors of toddlers' ENE-O.

Table 11

*Maternal and Toddler Predictors of Expression of Negative Emotional Expression and Overall Touch*

| Observed Predictor Label | Predictor Name |
|---|---|
| **Maternal Regulatory Attempts (MRA)** | |
| Verbal Comfort | V-Comf |
| Physical Comfort | Phy-Comf |
| Maternal Initiated Distraction | M-INI-Dis |
| Maternal Joined Distraction | M-JNT-Dis |
| Maternal Verbal Orientation to Delay | M-VO2D |
| Positive Commands | Pos-Comd |
| Negative Commands | Neg-Comd |
| Punitive Reactions | Pun |
| Minimizing | Min |
| Physical Restraint | Phy-RST |
| Positive Emotional Reactions | Pos-Aff |
| Negative Emotional Reactions | Neg-Aff |
| **Maternal Mind-Mindedness (MM)** | |
| Appropriate Mind-Related Comments | AMM |

[11] In addition to intraclass correlations (between group variance/within + between variance; i.e., $u_{0j/}$ $e_{ij+}$, $u_{0j}$), descriptive statistics were used to describe direction of change in levels of ENE-O across 12 intervals (e.g., over time) in Appendix D (Table D1).

Table 11 (cont'd)

| | |
|---|---|
| Non-Attuned Mind-Related Comments | NMM |
| **Toddlers' Regulatory Strategies (TRS)** | |
| *Independent Regulatory Strategies (IRS)* | |
| Toddler Initiated Verbal Distraction | T-INI-VDis |
| Toddler Initiated Non-Verbal Distraction | T-INI-nonVDis |
| Toddler Initiated Verbal Keys | T-INI-Vkeys |
| Toddler Initiated Verbal Self-Control | T-INI-Vctrl |
| Toddler Initiated Verbal Desire | T-INI-Vdes |
| Toddler Self-Comfort | T-SComf |
| *Dependent Regulatory Strategies (DRS)* | |
| Toddler Verbal Distraction-Bids to Mom | T-VDis-2M |
| Toddler Joined Verbal Distraction | T-JNT-VDis |
| Toddler Joined Non-Verbal Distraction | T-JNT-nonVDis |
| Toddler Verbal Keys- Bids to Mom | T-Vkeys-2M |
| Toddler Verbal Self-Control- Bids to Mom | T-Vctrl-2M |
| Toddler Verbal Desire- Bids to Mom | T-Vdes-2M |
| Toddler Physical Comfort Seeking | T-ComfSk |

As operationalized in multilevel modeling framework, the following equation was employed to determine what level-one variables predict ENE-O,

Level-1 Equation: The Random Coefficients Model with Predictors at Both Levels

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{1j}(X_{i\text{-}1j}) + e_{ij}$$

where *i* indicates the time interval within a dyad (current interval), i-1 indicates the current time interval minus one time lag within a dyad (previous interval or lagged) and j indicates a mother-child dyad, $\beta_{0j}$ indicates the intercept (mean) for ENE-O that varies over dyads j, $\beta_{1j}$ indicates the slope for the relationship in dyad j between ENE-O and level-1 predictors (e.g., ElapsedTime, lagged maternal Verbal Comfort, lagged toddler Self-Comfort), and $e_{ij}$ indicates the random errors of prediction for the level 1 equation (deviation for interval *i* from its dyad *j*).

Similarly, we employed the following equation to test what level-two variables predict ENE-O,

Level-2 Equation: The Random Intercept Model with Predictors at Both levels

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{01}W_{1j} + u_{0j}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$W_{1j}$ indicates level-2 predictor (Gender)
$\gamma_{01}$ indicates the overall regression coefficient for the relationship (slope) between Gender and ENE-O

$u_{0j}$ indicates the random error associated with group intercept (deviation for group j from overall intercept)

$$\text{Slope: } \beta_{1j} = \gamma_{10} + u_{1j}$$

$\gamma_{10}$ indicates the overall regression coefficient between the level one predictor and the ENE-O
$u_{1j}$ indicates the random error associated with group slope (deviation for group j from overall slope.)[12]

Separate models were specified for all predictors as the following example.

<u>Example: Level-1 Predictor X, Outcome Y, Level-1 Covariate W, Level-2 Covariate Z</u>

Level-1 Equation:

$$Y_{ij} = \beta_{0j} + \beta_{X,j}(X_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + \beta_{W,j}(W_{i-1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_Z(Z_j) + u_{0j}$$
$$\text{Slopes: } \beta_{X,j} = \gamma_X + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$
$$\beta_{W,j} = \gamma_W$$

Mixed Model:

$$Y_{ij} = \gamma_{00} + \gamma_Z(Z_j) + \gamma_X(X_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + \gamma_W(W_{i-1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Y scores across all dyads when all predictors = 0
$\gamma_Z(Z_j)$ = the average slope between Y and Z times score of Z in dyad j
$\gamma_X(X_{i-1j})$ = the average slope between Y and lagged X times score of lagged X in dyad j
$\gamma_{ETL}(ET_{ij})$ = the average slope between Y and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}(ET^2_{ij})$ = the average slope between Y and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_W(W_{i-1j})$ = the average slope between Y and W times score of W in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

[12] Random slope variance components were estimated and included if they varied between dyads and if model fit was improved; however, no hypotheses were made regarding differences in IV-DV slopes among dyads. Also, no level-2 explanatory variables were hypothesized to interact with level-1IVs to explain differences in random slopes between toddlers. For all equations of model specification refer to Appendix C.

In summary, for Research Question 1: The Random Intercept Model Predicting Expression of Negative Emotion from lagged Maternal Regulatory Attempts and lagged Mind-Mindedness, a total of 14 two-level hierarchical models examined the effects of lagged Maternal Regulatory Attempts, lagged Appropriate and Non-Attuned Mind Related Comments on toddlers' ENE-O while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender.

For Research Question 2: The Random Intercept Model Predicting Expression of Negative Emotion from lagged toddlers' regulatory strategies, a total of 13 two-level hierarchical models examined the effects of lagged toddlers' independent regulatory strategies (6 models), and dependent regulatory strategies (7 models) on toddlers' ENE-O while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' gender.

**Outcome 2: Toddlers' Delay of Gratification (Overall Touch).** As previously mentioned, we used *Overall Touch* (sum of Touch and Attempted Touch) to reflect delay of gratification such that higher *Overall Touch* scores indicate lower ability for delay of gratification. Research Questions 3 and 4 examine the effects of maternal predictors (Question 3) and toddler predictors (Question 4) on toddlers' Overall Touch. First, a base model was used to test whether there was significant within-toddler variance (across all intervals) before we could test what maternal and toddler regulatory strategies predict toddlers' Overall Touch. Therefore, the first analysis concerns the amount of variance in intensity of expression of negative emotion when all predictors are zero (i.e. does toddlers' Overall Touch differ across the two-minute task).

Operationalized in multilevel modeling framework to test whether there were intraindividual differences in means of Overall Touch *within* toddlers across 12 intervals, the following equation was employed, Level-1 Equation: The Intercept-Only Model

$$\text{Overall Touch}_{ij} = \beta_{0j} + e_{ij}$$

where *i* indicates the time interval within a dyad and j indicates a mother-child dyad, $\beta_{0j}$ indicates the intercept (mean) for Overall Touch in dyad j (varies over j dyads), $e_{ij}$ indicates random errors of prediction for level-1 equation (deviation for interval *i* from its dyad *j*).

Level-2 Equation: The Intercept-Only Model

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

where $\beta_{0j,}$ an intercept (mean) for group j is the sum of the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0, $\gamma_{00}$, and the random error associated with the group intercept, $u_{0j}$ (deviation for group j from overall intercept)[13]

Next, the base models were tested to determine whether Maternal Regulatory Attempts and maternal mind-mindedness (Research Question 3) and toddlers' regulatory strategies (Question 4) from a previous interval predicted toddlers' Overall Touch in a current interval. Please refer to Table 11 on pages 59-60 for the specific list of maternal and toddler behaviors tested as predictors of toddlers' Overall Touch.

As operationalized in multilevel modeling framework, the following equation was employed to determine what level-one variables predict Overall Touch,

Level-1 Equation: The Random Coefficients Model with Predictors at Both Levels

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{1j}\,(X_{i-1j}) + e_{ij}$$

where *i* indicates the time interval within a dyad (current interval), i-1 indicates the current time interval minus one time lag within a dyad (previous interval or lagged) and j indicates a mother-child dyad, $\beta_{0j}$ indicates the intercept (mean) for Overall Touch that varies over dyads j, $\beta_{1j}$ indicates the slope for the relationship in dyad j between Overall Touch and level-1 predictors (e.g., ElapsedTime, lagged AMM, lagged NMM), and $e_{ij}$ indicates the random errors of prediction for the level 1 equation (deviation for interval *i* from its dyad *j*).

[13] In addition to intraclass correlations (between group variance/within + between variance; i.e., $u_{0j/}\ e_{ij+},\ u_{0j}$), descriptive statistics were used to describe direction of change in levels of Overall Touch across 12 intervals (e.g., over time) in Appendix D (Table D1).

Similarly, we employed the following equation to test what level-two variables predict Overall Touch,

Level-2 Equation: The Random Intercept Model with Predictors at Both levels

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{01}W_{1j} + u_{0j}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$W_{1j}$ indicates level-2 predictor (Gender)
$\gamma_{01}$ indicates the overall regression coefficient for the relationship (slope) between Gender and Overall Touch
$u_{0j}$ indicates the random error associated with group intercept (deviation for group j from overall intercept)

$$\text{Slope: } \beta_{1j} = \gamma_{10} + u_{1j}$$

$\gamma_{10}$ indicates the overall regression coefficient between the level one predictor and the Overall Touch
$u_{1j}$ indicates the random error associated with group slope (deviation for group j from overall slope). [14]

In summary, for Research Question 3: The Random Intercept Model Predicting Overall Touch from lagged Maternal Regulatory Attempts and lagged Mind-Mindedness, a total of 14 two-level hierarchical models examined the effects of lagged Maternal Regulatory Attempts, lagged Appropriate and Non-attuned Mind Related Comments on toddlers' Overall Touch, while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddlers' gender.

For Research Question 4: The Random Intercept Model Predicting Overall Touch from lagged toddlers' regulatory strategies, a total of 13 two-level hierarchical models examined the effects of lagged toddlers' independent regulatory strategies (6 models), and dependent

[14] Random slope variance components were estimated and included if they varied between dyads and if model fit was improved; however, no hypotheses were made regarding differences in IV-DV slopes among dyads. Also, no level-2 explanatory variables were hypothesized to interact with level-1IVs to explain differences in random slopes between toddlers. For all equations of model specification refer to Appendix C

regulatory strategies (7 models) on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, toddlers' gender[15] and expressive language.

[15] Toddlers' gender was not a significant predictor of Overall Touch in Q4 and was removed from analyses.

# CHAPTER 4: Results

Descriptive and correlational statistics were conducted prior to multilevel analyses. Data were analyzed using *SPSS* (version 24) and *HLM* software (version 7.1). In order to examine the effects of independent variables from previous intervals on study outcomes in current interval, lagged predictors were created (lagged = previous 10s interval). Descriptive statistics for outcome variables are presented on pages 68-69, for maternal predictor variables on pages 69-71, for toddler predictor variables on pages 73-74. Results specific to Question 1 are presented on pages 76-77 (Correlational) and on pages 85-100 (Multilevel); Question 2 are presented on pages 78-79 (Correlational) and on pages 102-116 (Multilevel); Question 3 are presented on pages 79-81 (Correlational) and on pages 118-131 (Multilevel); and, Question 4 are presented on pages 81-82 (Correlational) and on pages 133-144 (Multilevel). Summaries of the results for each research question are included after each set of results is presented (Q1A on page 93; Q1B on page 100, Q2A on page 108, Q2B on page 116, Q3A on page 118, Q3B on pages 131, Q4A on page 139, and Q4B on page 144).

## Missing Data

All cases were coded for all study variables. During intervals in which the toddler stepped out of camera frame or walked out of the room and could not be observed (20 out of 1571 intervals or 1.2 % of intervals), toddlers' strategy was coded as Toddler Initiated Non-Verbal Distraction for walking out of the room, expression of negative emotion was coded using vocal cues and zero touch was counted. The Delay of Gratification task lasted 120 seconds or 12 intervals for all cases (n=134), except for cases in which the toddler had been in severe distress for more than 30 seconds (3.73 %, n = 5), or the experimenter ended the task before the end of the 2 minutes for no apparent reason (2.23 %, n = 3). In dyads for which the experimenter did not end task after 12 intervals (17.16%, n = 23), the remaining intervals were not included in the final analyses. Additionally, specification of multilevel models with previous interval (lagged 10s) predictors resulted in missing data for 134 intervals (first interval data deleted in each dyad). Level-1 missing data was handled using *HLM*'s default method of listwise deletion of level-1 units for 134 intervals. Moreover, for models specified with toddlers' expressive vocabulary as a level-2 explanatory variable for overall mean in Overall Touch (Question 4), 3 cases were missing scores for expressive vocabulary and were handled via listwise deletion prior to running models reducing sample size to 131 in Question 4.

**Assumptions**

Maternal Regulatory Attempts (except for maternal Physical Restraint, maternal Positive Emotional Reactions and Negative Emotional Reactions), Appropriate and Non-Attuned Mind-Related Comments, Toddlers' Regulatory Strategies (predictors), and Touch, Attempted Touch, and Overall Touch (outcomes) were count variables, where scores reflected the number of times the behaviors were observed in each 10s interval. While, ENE-O was slightly positively skewed (1.03, SE = .06), positive skewness was observed in Overall Touch (2.94, SE = .06). Tests of normality were conducted to assess violations of assumptions of normality for outcome variables. All *p* values associated with Shapiro-Wilk and Kolmogorov-Smirnov tests were less than .001 indicating violations of assumptions for distributional normality for both outcome variables. Boxplots were obtained and indicated 15 intervals with extreme outliers (data values that were 3 times the interquartile range) for Overall Touch, but no outliers were identified for ENE-O. Given the moment to moment measurement approach of the current study design, the large number of zeros for all count variables was expected as behaviors were not realistically occurring repeatedly in a short amount of time. As noted by Raudenbush, Bryk, Cheong, Congdon, and du Toit (2011) assumptions of normality for count and binary data are not realistic and transformations may not help linearize the data specially when there are many zeros as is the case with the current data. However, to ensure results accuracy, I compared model results between untransformed Overall Touch and transformed (square root transformation) and found that model results did not did not change significantly for transformed variables. Additionally, I compared model results between untransformed Overall Touch and Overall Touch after removing extreme outliers. Marginal *p*-values for previous lagged maternal Negative Commands and lagged Physical Restraint fell under .05 in models without outliers. However, significant *p*-values for lagged maternal Initiated Distraction and lagged Positive Emotional Reactions were no longer significant in models without outliers while all other results remained the same. Therefore, untransformed scores were retained in final analyses. No tests concerning collinearity were conducted as we did not model any interactions.

**Descriptive Statistics**

Descriptive statistics were conducted for outcome variables per 10s interval (Tables 12-14)[16].

**Toddler Expression of Negative Emotion and Delay of Gratification – Per 10s Interval and Overall Task.** Descriptive statistics for ENE-O and Overall Touch are reported (Table 12). Per 10s interval, on average, toddlers expressed a mild level of intensity (*M* = 0.76, *SD* = 0.99) on a scale of 0-3 (0 indicating no cues for negative emotion, 1 = mild, 2 = moderate, 3 = severe level of intensity of negative emotion). Scores for average ENE-O fell between 0-1

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[16] For descriptive statistics for study variables in overall scores across the entire 2-minute delay of gratification task (all 120 seconds) for each parent-child dyad (sums and averages for all 12 intervals) see APPENDIX E (Tables E1-E4). The only difference between descriptive statistics that are presented in Tables E1-E4 and Tables 12-14 is in how variables were calculated across units of time. Tables E1-E4 variables were calculated and described across the entire 120 second task (wide format), while Tables 12-14 variables were calculated and described per 10s interval (long format). Differences in means of observed toddler independent regulatory strategies and dependent regulatory strategies were analyzed across task (Table E4) and per interval (Table E5) using paired sample t-tests.

(mild) intensity level for majority of intervals (71.8 %, n = 1128), greater than 1 or equal to 2 (moderate) intensity level for 15.3% of the intervals (n = 241), and greater than 2 or equal to 3 (severe) intensity level for 12.9 % of the intervals (n = 202). For the delay of gratification task as a whole, scores for average ENE-O was zero for 9.7% of toddlers (n = 13), fell between 0-1 (mild) intensity level for slightly more than half of all toddlers (59 %, n = 79), greater than 1 or equal to 2 (moderate) intensity level for 22.3% of all toddlers (n = 31), and greater than 2 or equal to 3 (severe) intensity level for 9 % of the toddlers (n = 11).

Overall Touch scores revealed that on average toddlers either touched or attempted to touch the keys 0-6 times per interval (*M* = 0.27, *SD* = 0.61). Out of all 10s intervals for all toddlers (n = 1571), most toddlers either touched or attempted to touch the keys (Overall Touch) 0 times per interval for majority of the intervals (79.4%, n = 1247), 1 time for 15.8% of intervals (n = 249), 2 times per interval for 3.5 % of intervals (n = 55), and 3 – 6 times for 1.4 % of intervals (n = 20). For the delay of gratification task as a whole, 23.1 % (n = 31) of toddlers did not touch or attempt to touch the keys at all, while 22.4% (n = 30) of toddlers touched or attempted to touch the keys 1 time, and 54.5% (n = 73) of toddlers touched or attempted to touch the keys 2 or more times.

Table 12
*Descriptive Statistics for Toddler Expression of Negative Emotion and Overall Touch*

| Per 10s Interval | Min | Max | Mean | SD | Skewness (SE) |
|---|---|---|---|---|---|
| ENE-O | 0.00 | 3.00 | 0.76 | 0.99 | 1.03 (.06) |
| Overall Touch | 0.00 | 6.00 | 0.27 | 0.61 | 2.94 (.06) |

*Note*. ENE-O = Overall Expression of Negative Emotion (average of ENE-I and ENE-P); Overall Touch = sum of Touch and Attempted Touch

**Maternal Regulatory Attempts and Mind-Mindedness – Per 10s Interval and Overall Task.** Descriptive statistics are reported in Table 13. Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments were used infrequently and on average occurred less than 1 time per internal. Maximum variation in frequency of strategies used was observed for Negative and Positive Commands, while minimum variation in frequency of strategies used was observed for maternal Joined Distraction, Appropriate and Non-Attuned Mind-Related Comments. These results were similar to those found in previous studies (Meins et al., 2001; Spinrad et al., 2004). The most frequently used regulatory attempts were Negative Commands (e.g., "No!, "Don't touch!") and Positive Commands (e.g., "Wait" "Hold on"). The least frequently used regulatory attempts were Negative Emotional Reactions (e.g., yells at child), Minimizing (e.g., "Stop crying") and Punitive Reactions (e.g., "Bad boy/girl", "You want a spanking?"), per interval. On average, mothers used more Physical Comfort than Verbal Comfort. Mothers initiated distractions more often than joined in to their toddler's initiated distractions. Punitive reactions were more frequently used than Minimizing statements. Mothers did not use any form of Physical Restraint majority of the time (59.4% of all intervals, n= 933), however, when mothers did use Physical Restraint as a form of regulatory strategy (40.6 % of all intervals, n = 638), majority of time high restraint was used (23.8% of all intervals, n = 374) compared to low restraint (16.8 % of all intervals, n = 264). For majority of the time, mothers did not display either positive or negative emotional reactions (58.1 % of all intervals, n = 913). Negative emotional reactions were expressed in 2% of all intervals (n =32) while positive emotional reactions were expressed in 39.8 % of all intervals (n = 626). Overall means for maternal mind related comments per interval suggest that on average mothers made more Appropriate Mind-Related than Non-Attuned Mind-related Comments (Table 13). Additionally, the percent and number of mothers who did not use any strategies and those who used each strategy at least one or more times during the task as a whole (as opposed to the per interval results presented previously) is summarized in Table 13. As noted in the table, more than half of mothers used the following strategies at least once during the 2-minute task: verbal and physical comfort, initiated distraction, verbal orientation to delay, positive and negative commands, physical restraint, and positive emotional reactions. About one third of mothers used mind-minded comments at least once during the delay task.

Table 13
*Descriptive Statistics of for Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments*

| | Per 10s Interval | | | | | Overall Task Frequency % (n) | |
|---|---|---|---|---|---|---|---|
| Variable Name | Min | Max | Mean | SD | Skewness (SE) | 0 | > or = 1 |
| Verbal Comfort | 0 | 6 | 0.14 | 0.5 | 4.94 (.06) | 48.5 (65) | 51.5 (69) |
| Physical Comfort | 0 | 4 | 0.18 | 0.48 | 3.06 (.06) | 45.5 (61) | 54.5 (73) |
| Initiated Distraction | 0 | 5 | 0.3 | 0.53 | 2.04 (.06) | 32.1 (43) | 67.9 (91) |
| Joined Distraction | 0 | 2 | 0.07 | 0.26 | 3.83 (.06) | 66.4 (89) | 33.6 (45) |
| Verbal Orientation to Delay | 0 | 7 | 0.36 | 0.98 | 3.13 (.06) | 46.3 (62) | 53.7 (72) |
| Positive Commands | 0 | 10 | 0.42 | 0.94 | 3.09 (.06) | 26.1 (35) | 73.9 (99) |
| Negative Commands | 0 | 11 | 0.59 | 1.26 | 3.12 (.06) | 15.7 (21) | 84.3 (113) |
| Punitive Reactions | 0 | 3 | 0.05 | 0.27 | 6.55 (.06) | 77.6 (104) | 22.4 (30) |
| Minimizing | 0 | 4 | 0.03 | 0.22 | 10.32 (.06) | 84.3 (113) | 15.7(21) |
| Physical Restraint | 0 | 2 | 0.64 | 0.84 | 0.75 (.06) | 15.7 (21) | 84.3 (113) |
| Positive Emotional Reactions | 0 | 1 | 0.4 | 0.49 | 0.42 (.06) | 14.2 (19) | 85.8 (115) |
| Negative Emotional Reactions | 0 | 1 | 0.02 | 0.14 | 6.8 (.06) | 89.6 (120) | 10.4 (14) |
| Appropriate Mind Related Comments | 0 | 3 | 0.08 | 0.31 | 4.61 (.06) | 60.4 (81) | 39.6 (53) |
| Non-Attuned Mind Related Comments | 0 | 3 | 0.07 | 0.31 | 5.44 (.06) | 68.7 (92) | 31.3 (42) |

*Note.* Frequency for each variable in Overall Task indicates percentage and number of mothers out of n = 134 who did not use strategy at all (0) or used it at least once (> or =1), for Physical Restraint 0 indicates NO restraint, 1 or 2 indicate low or high restraint, for Positive or Negative Emotional Reaction 0 indicates Emotional Reaction was not observed at all, > or = 1indicates Emotional Reaction was observed at some point during the overall task.

**Toddlers' Regulatory Strategies – Per 10s Interval and Overall Task.** Means for the frequency of toddler regulatory strategies are reported (Table 14). Additionally, the percent and the number of toddlers who did not display any strategies and those who displayed each strategy at least one or more times during the task as a whole (as opposed to per interval) is presented in Table 14.

***Independent Regulatory Strategies – Per 10s Interval and Overall Task.*** In general, Independent Regulatory Strategies were used infrequently and on average occurred less than 1 time per interval. Maximum variation in frequency of strategies used was observed for toddler initiated verbalizations about keys (e.g., "Pooh", "Wake up Turtle"), initiated verbalizations expressive of desire states (e.g., "I want it", "I need it"), and physically self-comforting behaviors (e.g., thumb sucking, rocking back and forth). Minimum variation in frequency of strategies used was observed for toddler initiated verbal distractions (e.g., "chair" or singing). The most frequently displayed independent strategy by toddlers was Self-Comfort (e.g., thumb sucking, rocking back and forth), while the least frequently displayed independent strategy was Initiated Verbal Distractions (e.g., "Chair" or singing).

On average, toddlers initiated fewer Verbal Distraction (e.g., "Chair" or singing) than Non-Verbal Distraction (e.g. looks away for more than 3 seconds) per 10s interval. Toddlers vocalized more words or phrases describing the keys or reframing the task (e.g., "Keys") than they vocalized words expressing desire for the keys (e.g. "I want it") (while all verbalizations in the form of self-direction or in reference to the rules of the task (e.g., "No touch") were directed towards or involved mother (described below).

More than 75% of toddlers used nonverbal distraction independently and self-comforting one or more times during the entire 2 minute task. Other strategies occurred less frequently.

***Dependent Regulatory Strategies – Per 10s Interval and Overall Task.*** In general, Dependent Regulatory Strategies were used infrequently and on average occurred less than 1 time per interval. Maximum variation in frequency of strategies used was observed for toddler Joint Non-Verbal Distraction (e.g., looks to where mother points, joins in mothers' initiated distracting activity). Minimum variation in frequency of strategies used was observed for toddler verbalizations about keys (e.g., "Pooh") in response to mother, verbalizations in the form of self-direction or in reference to the rules of the task (e.g., "No touch") in response to mother, and Comfort-Seeking (e.g., leaning on mothers' body, turning body toward mother). The most frequently displayed strategy directed toward or in response to mother was Physical Comfort Seeking (e.g., leaning on mothers' body, turning body toward mother), while the least frequently displayed strategy directed toward or in response to mother were verbalizations in the form of self-direction or in reference to the rules of the task (e.g., "No touch").

On average, toddlers displayed more Joined Non-Verbal Distraction than Joined Verbal Distraction. On average, toddlers vocalized more words or phrases describing the keys or reframing the task (e.g., "Keys", "Wake up Turtle") than then vocalized words expressing desire for the keys (e.g. "I want it", "I need it") or verbalizations in the form of self-direction or in reference to the rules of the task (e.g. "I wait", "No touch"). Less than 10%-20% of all intervals were scored with maximum number of frequencies for all dependent regulatory strategies.

In terms of independent strategies, more than 60% of toddlers sought physical comfort and more than 40% utilized non-verbal distraction directed at or in response to the mother. Other strategies occurred less frequently.

Table 14

*Descriptive Statistics for Toddlers' Regulatory Strategies*

| | Per 10s Interval | | | | | Overall Task Frequency % (n) | |
|---|---|---|---|---|---|---|---|
| Variable Name | Min | Max | Mean | SD | Skewness (SE) | 0 | > or = 1 |
| Independent Regulatory Strategies (IRS) | | | | | | | |
| Initiated Verbal Distraction | 0 | 2 | 0.01 | 0.11 | 12.30 (.06) | 93.3 (125) | 6.7 (9) |
| Initiated Non-Verbal Distraction | 0 | 4 | 0.45 | 0.59 | 1.12 (.06) | 23.1 (31) | 76.9(103) |
| Initiated Verbal Keys | 0 | 5 | 0.04 | 0.25 | 9.96 (.06) | 82.8 (111) | 17.2 (23) |
| Initiated Verbal Self-Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Initiated Verbal Desire | 0 | 5 | 0.02 | 0.18 | 17.93 (.06) | 93.3 (125) | 6.7 (9) |
| Self-Comfort | 0 | 5 | 0.5 | 0.68 | 1.26 (.06) | 11.9 (16) | 88.1 (118) |
| Dependent Regulatory Strategies (DRS) | | | | | | | |
| Verbal Distraction-Bids to Mom | 0 | 4 | 0.06 | 0.3 | 6.44 (.06) | 74.6 (100) | 25.4 (34) |
| Joined Verbal Distraction | 0 | 4 | 0.06 | 0.31 | 6.60 (.06) | 79.9 (107) | 20.1 (27) |
| Joined Non-Verbal Distraction | 0 | 5 | 0.14 | 0.41 | 4.32 (.06) | 59.7 (80) | 40.3 (54) |
| Verbal Keys-Bids to Mom | 0 | 3 | 0.08 | 0.38 | 5.24 (.06) | 70.1 (94) | 29.9 (40) |
| Verbal Self-Control-Bids to Mom | 0 | 3 | 0.01 | 0.13 | 16.03 (.06) | 96.3 (129) | 3.7 (5) |
| Verbal Desire- Bids to Mom | 0 | 4 | 0.03 | 0.21 | 8.95 (.06) | 81.3 (109) | 18.7 (25) |
| Physical Comfort Seeking | 0 | 3 | 0.24 | 0.48 | 1.91 (.06) | 37.3 (50) | 62.7 (84) |

*Note.* The relatively wide ranges of frequency for Initiated Non-Verbal Distraction and Self-Comfort per interval, but relatively low means, may be related to the different frequencies with which behaviors were observed. For majority of intervals (60%) toddlers did not display any Initiated Non-Verbal Distraction or any Self-Comfort and displayed the maximum number of Initiated Non-Verbal Distraction (4) and Self-Comfort (5) for only 10% of intervals. In fact, less than 10% of all intervals were scored with maximum number of frequencies for all independent regulatory strategies. Frequency for each variable in Overall Task indicates percentage and number of toddler out of n = 134 who did not use strategy at all (0) or used it at least once (> or =1) at some point during the task.

## Correlational Analyses

Correlational analyses were conducted to examine associations between predictor and outcome variables. A total of five correlation tables are reported (Tables 15-19). First, correlations for lagged Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments with Expression of Negative Emotion are presented Table 15 (Question 1). Next, correlations for lagged Toddler Regulatory Strategies with Expression of Negative Emotion are presented in Table 16 (Question 2). Next, correlations for lagged Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments with Delay of Gratification are presented Table 17 (Question 3). Finally, correlations for lagged Toddler Regulatory Strategies with Delay of Gratification are presented in Table 18 (Question 4). Additionally, Pearson correlations for Expression of Negative Emotion and Delay of Gratification (Table 19) with toddler gender and expressive language are reported.

**Lagged Maternal Variables and Overall Expression of Negative Emotion.** First, correlations for lagged Maternal Regulatory Attempts, lagged Appropriate and lagged Non-Attuned Mind-Related Comments with ENE-O are presented (Table 15)[17]. Similar to correlations for current interval Maternal Regulatory Attempts with ENE-O, all correlations for lagged Maternal Regulatory Attempts with ENE-O were small but significant ($r = -.32$ to $.06$), except for non-significant correlations for lagged Positive Commands, and for lagged Maternal Verbal Orientation to Delay. Unexpectedly, as lagged Verbal Comfort and lagged Physical Comfort increased, ENE-O increased. All other correlations were in expected directions.

Strongest negative associations for both current and previous interval predictors were between maternal Positive Emotional Reactions and toddlers' Expression of Negative Emotion,

[17] See Appendix F for current – interval correlations for Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments with Expression of Negative Emotion (Table F1).

while strongest positive associations were between lagged Negative Emotional Reactions and Toddlers' Expression of Negative Emotion. Toddlers expressed lower intensity negative emotions as mothers expressed or shared positive affect with their toddlers in previous interval. However, when mothers laughed at their toddlers' expression of negative affect in a mocking way or when they became angry themselves, toddlers tended to express higher intensity of negative emotions. Appropriate Mind-Related Comments were not associated with Expression of Negative Emotion while Non-Attuned Mind-Related Comments were positively related to Expression of Negative Emotion as expected; suggesting that higher use of lagged Non-Attuned Mind-Related Comments was associated with higher intensity of Expression of Negative Emotion as expected.

Table 15

*Correlations for Lagged Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments with Expression of Negative Emotion (n=1437)*

| Variable Name | ENE-O |
|---|---|
| Verbal Comfort | .14** |
| Physical Comfort | .06* |
| Initiated Distraction | -.19** |
| Joined Distraction | -.05* |
| Verbal Orientation to Delay | -0.04 |
| Positive Commands | 0.01 |
| Negative Commands | .15** |
| Punitive Reactions | .12** |
| Minimizing | .18** |
| Physical Restraint | .28** |
| Positive Emotional Reactions | -.32** |
| Negative Emotional Reactions | .20** |
| Appropriate Mind Related Comments | -0.02 |
| Non-Attuned Mind Related Comments | .07** |

*Note.* ENE-O = Overall Expression of Negative Emotion (average of ENE-I and ENE-P). $^{*}p < .05$, one-tailed. $^{**}p < .01$, one-tailed. $^{\dagger}p < .10$, one-tailed.

**Lagged Toddlers' Regulatory Strategies and Expression of Negative Emotion.** Correlations for lagged Independent Regulatory Strategies[18] and lagged Dependent Regulatory Strategies with ENE-O are presented (Table 16) [19]. Similar to correlations for current-interval Independent Regulatory Strategies, correlations for lagged Independent Regulatory Strategies with ENE-O were small but significant (r = -.31 to .10). Lagged Toddler Initiated Verbal Keys (e.g., "Keys", "Turtle is sleeping, wake up turtle") was not significantly related to ENE-O. Unexpectedly, lagged Toddler Initiated Verbal Desire (e.g., "I want it", "I need it") was positively associated with ENE-O suggesting that as toddlers vocalized desire states, they tended to express more intense levels of negative emotion 10 seconds later. These associations suggest that verbalization of desire words that are not directed toward mother may facilitate expression of negative emotion. All other correlations were in expected negative directions. Strongest associations were observed for lagged Toddler Initiated Non-Verbal Distraction and ENE-O. As toddlers initiated engagement in non-verbal distracting behaviors such as play or looking away from the keys, they tended to express milder levels of negative emotion 10 seconds later.

Similar to correlations for current-interval dependent regulatory strategies, correlations for lagged Dependent Regulatory Strategies with ENE-O were small but significant (r= -.07 to -.19). Lagged Toddler Verbal Distraction-Bids to Mom (e.g. toddler said "I want bottle" or initiated singing while looking at mom), lagged Toddler Verbal Desire-Bids to Mom (e.g., toddler said "I want it, I need it" directed towards or in response to mom), lagged Toddler Verbal Self-Control (e.g., "I wait"), and lagged Toddler Physical Comfort Seeking (e.g., reaching arms

[18] No correlations were calculated for Toddler Initiated Verbal Self-Control. All observed Toddler Verbal Self-Control was coded under *Dependent* Regulatory Strategies (i.e., Toddler Verbal Self-Control- Bids to Mom) indicating that any time toddlers initiated verbal self-control (e.g., "I wait") it was while looking at mother or in response to mother.

[19] See Appendix F for current – interval correlations for Toddlers Regulatory Strategies with Expression of Negative Emotion (Table F2).

up to mother, hugging mother, leaning on mother's body) were not significantly related to ENE-O. All significant associations were in expected negative direction. Strongest associations were observed for lagged Toddler Joined Non-Verbal Distraction and ENE-O. As toddlers joined their mothers' initiated non-verbal distractions (e.g., Mother points to a direction away from keys and child looks where she is pointing), they expressed lower levels of ENE-O 10 seconds later.

Table 16

*Correlations for Lagged Toddler Regulatory Strategies with Expression of Negative Emotion (n = 1437)*

| Variable Name | ENE-O |
|---|---|
| Independent Regulatory Strategies (IRS) | |
| Initiated Verbal Distraction | -.04* |
| Initiated Non-Verbal Distraction | -.31** |
| Initiated Verbal Keys | -.03 |
| Initiated Verbal Self-Control | - |
| Initiated Verbal Desire | .10** |
| Self-Comfort | -.11** |
| Dependent Regulatory Strategies (DRS) | |
| Verbal Distraction-Bids to Mom | -.02 |
| Joined Verbal Distraction | -.12** |
| Joined Non-Verbal Distraction | -.19** |
| Verbal Keys-Bids to Mom | -.07** |
| Verbal Self-Control-Bids to Mom | -.03 |
| Verbal Desire- Bids to Mom | .02 |
| Physical Comfort Seeking | .00 |

*Note.* ENE-O = Overall Expression of Negative Emotion (average of ENE-I and ENE-P). *$p < .05$, one-tailed. **$p < .01$, one-tailed. †$p < .10$, one-tailed.

**Lagged Maternal Variables and Delay of Gratification.** Next, correlations for lagged Maternal Regulatory Attempts, lagged Appropriate, and lagged Non-Attuned Mind-Related Comments with Delay of Gratification operationalized as amount of Overall Touch are presented (Table 17)[20]. Similar to correlations for current-interval Maternal Regulatory Attempts with Overall Touch, correlations for lagged Maternal Regulatory Attempts with Overall Touch were small but significant (r = -.06 to .14). Lagged Verbal Comfort, lagged Maternal Joined

[20] See Appendix F for current – interval correlations for Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments with Overall Touch (Table F3).

Distraction, lagged Verbal Orientation to Delay, lagged Positive Commands, lagged Punitive Reactions, and lagged Minimizing statements were not significantly related to Overall Touch. Unexpectedly, lagged Positive Emotional Reactions was positively associated with Overall Touch. As mothers displayed or shared more positive affect (e.g., smiling), toddlers' tendency to touch or attempt to touch the keys increased. All other correlations were in the expected direction.

The strongest negative associations for both current and previous interval predictors were between lagged Initiated Distraction and Overall Touch, while the strongest positive associations were between lagged Physical Restraint and lagged Negative Emotional Reactions with Overall Touch. As mothers initiated distractions, toddlers' tendency to touch or attempt to touch the keys decreased. However as mothers' use of highly forceful and continuous physically restrictive behavior increased or when mothers laughed at their toddlers' expression of negative affect in a mocking way or when they became angry themselves, toddlers' tendency to touch or attempt to touch the keys increased as expected. Lagged Appropriate and Lagged Non-Attuned Mind-Related Comments were not correlated with Overall Touch.

Table 17
*Correlations for Lagged Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments with Overall Touch (n=1437)*

| Variable Name | Overall Touch |
|---|---|
| Verbal Comfort | -0.02 |
| Physical Comfort | -.06** |
| Initiated Distraction | -.09** |
| Joined Distraction | -0.03 |
| Verbal Orientation to Delay | 0.04 |
| Positive Commands | 0.01 |
| Negative Commands | .11** |
| Punitive Reactions | 0.01 |
| Minimizing | 0 |
| Physical Restraint | .14** |
| Positive Emotional Reactions | .06** |
| Negative Emotional Reactions | .13** |

Table 17 (cont'd)

| | |
|---|---|
| Appropriate Mind Related Comments | -0.03 |
| Non-Attuned Mind Related Comments | -0.03 |

*Note*. Overall Touch = sum of Touch and Attempted Touch. $^{*}p < .05$, one-tailed. $^{**}p < .01$, one-tailed. $^{\dagger}p < .10$, one-tailed.

**Lagged Toddlers' Regulatory Strategies and Delay of Gratification.** Correlations for lagged Independent Regulatory Strategies and lagged Dependent Regulatory Strategies with Delay of Gratification operationalized as amount of Overall Touch are presented (Table 16)[21]. Similar to correlations for current-interval Independent Regulatory Strategies, correlations for lagged independent regulatory strategies with Overall Touch were small but significant (r = -.11 to .05). Lagged Toddler Initiated Verbal Keys (e.g., "Keys") was not significantly related to Overall Touch. Unexpectedly, lagged Toddler Initiated Verbal Desire (e.g., "I want it") was positively associated with Overall Touch suggesting that as toddlers vocalized desire states, they tended to touch or attempted to touch the keys 10 seconds later. These associations suggest that verbalization of desire words that are not directed toward mother may impede ability to wait. All other correlations were in expected negative directions. Strongest associations were observed for lagged Toddler Self-Comfort and Overall Touch. As expected, as toddlers displayed more lagged Self-Comfort (e.g., thumb sucking), they tended to display less Overall Touch.

Correlations for lagged dependent regulatory strategies with Overall Touch were also small but significant (r= -.06 to -.04). Lagged Toddler Joined Verbal Distraction, lagged Verbal Keys-Bids to Mom, and lagged Verbal Self-Control-Bids to Mom were not significantly correlated with Overall Touch. Unexpectedly, lagged Toddler Verbal Desire (e.g., "I want it", I need it") when directed toward mother or in response to mother was positively and marginally associated with Overall Touch. All other correlations were in expected negative directions.

[21] See Appendix F for current – interval correlations for Toddlers Regulatory Strategies with Overall Touch (Table F4).

Strongest associations were observed for lagged Toddler Physical Comfort Seeking. As expected, as toddlers displayed more lagged Physical Comfort Seeking (e.g. leaning in to mom, reaching up for hug), they tended to display less Overall Touch.

Table 18

*Correlations for Lagged Toddler Regulatory Strategies with Overall Touch (n = 1437)*

| Variable Name | Overall Touch |
|---|---|
| Independent Regulatory Strategies (IRS) | |
| Initiated Verbal Distraction | -.03 |
| Initiated Non-Verbal Distraction | -.10$^{**}$ |
| Initiated Verbal Keys | .00 |
| Initiated Verbal Self-Control | - |
| Initiated Verbal Desire | .05$^{*}$ |
| Self-Comfort | -.11$^{**}$ |
| Dependent Regulatory Strategies (DRS) | |
| Verbal Distraction-Bids to Mom | -.05$^{*}$ |
| Joined Verbal Distraction | -.03 |
| Joined Non-Verbal Distraction | -.05$^{*}$ |
| Verbal Keys-Bids to Mom | .00 |
| Verbal Self-Control-Bids to Mom | -.01 |
| Verbal Desire- Bids to Mom | .04$^{\dagger}$ |
| Physical Comfort Seeking | -.06$^{**}$ |

*Note.* Overall Touch = sum of Touch and Attempted Touch. $^{*}p < .05$, one-tailed. $^{**}p < .01$, one-tailed. $^{\dagger}p < .10$, one-tailed.

**Expression of Negative Emotion, Delay of Gratification, Child Gender, and Expressive Language.** Toddlers' ENE-O and Overall Touch were not significantly correlated[22]. While toddlers' gender was positively correlated with ENE-O, it was not correlated with Overall Touch. On average, boys displayed higher levels of ENE-O. On the other hand, while toddlers' expressive language was not correlated with ENE-O, it was correlated with Overall Touch. On average, toddlers with reportedly higher scores on productive vocabulary displayed lower amounts of Overall Touch.

[22] On average as toddlers displayed more Touch (e.g., touching the keys), ENE-O ($r = -.07$, $p < .01$). However, as toddlers displayed more Attempted Touch (e.g., reach for keys but were restrained), they tended to express higher ENE-O ($r = .06$, $p < .01$). These results suggest that touching the keys is associated with less intense and shorter durations of expressed negative emotion, while attempting to touch the keys but being restrained is associated with more intense and longer duration of expressed negative emotion. These results point to interrelations between indicators of self-regulation not examined in the current study.

Table 19

*Intercorrelations for Expression of Negative Emotion with Overall Touch, Toddler Gender, and Vocabulary Production*

| Variable Names | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Overall Expression of Negative Emotion | - | | | |
| 2. Overall Touch | .03 | - | | |
| 3. Gender | $.14^{**}$ | -.01 | - | |
| 4. Vocabulary Production | .01 | $-.09^{**}$ | $-.12^{**}$ | - |

*Note.* Overall Expression of Negative Emotion = average of ENE-I and ENE-P; Overall Touch = sum of Touch and Attempted Touch. 1 = male. $^{*}p < .05$, one-tailed. $^{**}p < .01$, one-tailed. $^{\dagger}p < .10$, one-tailed.

**Multilevel Analyses**

This section describes results of all multilevel models utilized to answer study questions. First, Intraclass Correlations (ICCs) [23] were calculated for ENE-O and Overall Touch in the Intercept-Only Models. About 66% of variability in ENE-O, and 20% of variability in Overall Touch, was associated with differences between mother-child dyads. Higher ICC's indicate correlations in error terms and violations of assumptions of independence of error underlying hierarchical linear modeling, thus, analyses required grouping variables at more than 1 level (Tabachnick & Fidell, 2007).

Using restricted maximum likelihood (REML), separate two-level hierarchical models were estimated for a total of 12 models examining the effects of level-1 lagged Maternal Regulatory Attempts, a total of 2 models examining the effects of level-1 lagged Mind-Related Comments (Appropriate and Non-Attuned), and a total of 13 models examining the effects of level-1 lagged Toddlers' Regulatory Strategies on ENE-O and Overall Touch. Models for both outcomes were estimated separately. As previously mentioned, multilevel analyses are well suited to address violations to independence of errors that undermine accuracy and power, especially when there is large number of level-2 units (Snijders, 2005). To ensure model accuracy, models without random slope variance components (IV-DV slopes don't vary among

[23] See Appendix G for how independence of errors was determined for each outcome.

dyads) were tested against models with random slope variance components ($U_{1j}$: deviation of IV-DV slope in dyad j from average slope) for all predictors. Deviance ($\chi 2$ likelihood ratio) tests were used to compare models with fixed slopes against models in which slopes for significant Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments, and Toddlers' Regulatory Strategies were allowed to vary among dyads. The deviance test can be used when both models have the same fixed effects and only differ in estimation of random components (Snijders & Bosker, 2012). *P*-values less than .05 suggest that the full models (allowing slopes to vary) predicted models better than fixing slopes to be the same across all dyads (Tabachnick & Fidell, 2007). Thus, each predictor was specified and estimated in two separate models for each outcome. Model 1 was specified random intercepts (outcomes varied over dyads when all predictors were zero), and fixed slopes (association between level 1 IVs and DV is fixed for all dyads). Model 2 was specified with random intercepts and random slopes in which variance components for slopes were not constrained. Results of the more parsimonious models (Model 1) are reported for all predictors unless the random-intercept random slope model specification (Model 2) improved model fit as indicated by significant *p*-values associated with chi-squared difference tests ($X_D^2 < .05$). In other words, in cases where freeing the slopes resulted in better model fit results of less parsimonious model (Model 2) were reported. In cases where freeing the slopes did not add significant misfit ($X_D^2 > .05$), *but* freeing the slopes resulted in significant main effects (Model 2) where there were not main effects before (Model 1), the results of Model 2 were reported.[24]

[24] For decision tree refer to Supplementary Summary C.

Covariates included lagged maternal verbosity (i.e., total comments), linear and quadratic elapsed time, toddler gender, and toddlers' expressive language.[25] No interactions were hypothesized either within or between dyads to explain variations in slopes for predictors and outcomes. Therefore, no level-2 explanatory variables were modeled to explain differences in slopes between IV and DV (e.g., interactions between child gender and maternal verbal comfort to explain differences in slopes between verbal comfort and outcomes). Results of all analyses are reported using final estimation of fixed effects with robust standard errors [26], which are more appropriate for data with large level-2 units (Raudenbush et al., 2011), 134 units in the current study. Results are presented in order of research questions (Table 20).

Table 20

*Overview of Research Questions: Predictors X Outcomes*

| | Outcome 1 | | Outcome 2 | |
|---|---|---|---|---|
| | ENE-O | | Overall Touch | |
| Predictors | Positive associations hypothesized | Negative associations hypothesized | Positive associations hypothesized | Negative associations hypothesized |
| MRA/MM | Question 1A | Question 1B | Question 3A | Question 3B |
| TRS - Independent | - | Question 2A | - | Question 4A |
| TRS - Dependent | - | Question 2B | - | Question 4B |

Note. MRA = Maternal Regulatory Attempts, MM=Mind-Mindedness, TRS = Toddlers' Regulatory Strategies. ENE-O = Overall Expression of Negative Emotion calculated as mean Intensity and Predominance in 10s, Delay of Gratification is indicated by Overall Touch (Sum of Touch and Attempted Touch in 10s). Higher Overall Touch scores indicate lower delay of gratification or ability to wait.

**Research Question 1A: The Random Intercept Model Predicting Expression of Negative Emotion from Lagged [27]Maternal Regulatory Attempts and Mind-Mindedness.**

Effects of maternal variables in Question 1A were examined and are presented below. A summary of all model results is provided in Table 21[28]. Model results for each significant

[25] For details on model specification with covariates see Appendix H.

[26] Coefficients are the same for both robust and non-robust estimates. Robust standard errors are less biased in presence of violations of assumptions related to distributional normality of error terms.

[27] Throughout the paper "lagged" is used to refer to variables observed in the previous interval.

[28] Also provided in on page 4 of Supplemental Materials

predictor are then presented in the following pages (Tables 22-25). Model results for non-significant predictors (Phy-Comf, M-JNT-Dis, M-VO2D, and AMM) are presented in Appendix I (Tables I1-I4).

Table 21

*Question 1A. Do Lagged Maternal Regulatory Attempts and Lagged Mind-Mindedness predict toddlers' Overall Expression of Negative Emotion (Continuous: 0-3)*

| | | Model 1 - Random Intercept Fixed Slope | | Model 2 - Random Intercept Random Slope | | | |
|---|---|---|---|---|---|---|---|
| Lagged Maternal Variables in Question 1A | Variable Label | Does X significantly predict Y? | Is directionality as hypothesized? | Does X predict Y? | Does X-Y slope vary over dyads? | Does freeing slope significantly reduce misfit? | Is directionality as hypothesized? |
| Verbal Comfort | V-Comf | Yes | No (Pos) | Yes | No | No | No (Pos) |
| Physical Comfort | Phy-Comf | No | No (Pos) | No | No | No | No (Pos) |
| Initiated Distraction | M-INI-Dis | Yes† | Yes (Neg) | Yes | Yes | Yes | Yes (Neg) |
| Joined Distraction | M-JNT-Dis | No | Yes (Neg) | No | No | No | Yes (Neg) |
| Verbal Orientation to Delay | M-VO2D | No | Yes (Neg) | No | Yes | Yes | Yes (Neg) |
| *Positive Commands* | *Pos-Comd* | *No* | *No (Pos)* | *Yes†* | *No* | *Yes* | *No (Pos)* |
| **Positive Emotional Reactions** | **Pos-Aff** | **Yes** | **Yes (Neg)** | **Yes** | **Yes** | **Yes** | **Yes (Neg)** |
| Appropriate MRC | AMM | No | Yes (Neg) | No | No | No | Yes (Neg) |

*Note*. MRC = Mind-Related Comments; 1A predictors were hypothesized to be negatively associated with outcome; **Bold** font indicates largest slope coefficient. *Italics* font indicates X became significant predictor in model 2. * = *p*-value for slope coefficients with Non-Robust standard errors were < .05. All results report *p*-values for models estimated with robust standard errors. † = $p < .10$. Non-significant estimates and unexpected directionality are in red.

***Lagged Maternal Verbal Comfort.*** A two-level hierarchical model examined the effects of lagged maternal Verbal Comfort on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{V\text{-}Comf}(\text{V-Comf}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was significantly associated with lagged maternal Verbal Comfort as hypothesized but were in unexpected direction (Table 22). For every unit increase in lagged maternal Verbal Comfort (e.g., "It is hard to wait", "What happened?"), toddlers' overall expression of negative emotion increased by 0.09 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.31 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Verbal Comfort and ENE-O were allowed to vary between dyads. However results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Verbal Comfort and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = .26, df = 2, $p$ > 0.05). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged maternal Verbal Comfort and ENE-O does not vary between dyads. In the random-intercept random-slope model (Model 2), the slope coefficient for lagged maternal Verbal Comfort was 0.08 ($p$ = 0.02). The results of more parsimonious model are presented in Table 22.

Table 22

*Effects of Lagged Maternal Verbal Comfort on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.51^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 |
| Verbal Comfort | $0.09^{**}$ | 0.03 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| Verbosity | $0.04^{***}$ | 0.01 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | $0.72^{***}$ | 0.85 |
| $e_{ij}$ | 0.32 | 0.56 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Initiated Distraction***. A two-level hierarchical model examined the effects of lagged maternal Initiated Distraction on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{M-INI-Dis}}(\text{M-INI-Dis}_{-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O were marginally associated with lagged maternal Initiated Distraction as hypothesized (Table 23). For every unit increase in lagged maternal Initiated Distraction (e.g., "Show me your nose, playing), toddlers' overall expression of negative emotion tended to decrease by 0.07 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors.

Additionally, the current model was compared against a model (model 2) in which slopes between lagged maternal Initiated Distraction and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Initiated Distraction and ENE-O to vary among dyads would significantly improve model fit $X_D^2$ = 15.98, df = 2, $p < 0.001$. Indeed, when the association between lagged maternal Initiated Distraction and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p <.05$), suggesting that dyads varied in the association between lagged maternal Initiated Distraction and ENE-O. In the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Initiated Distraction, toddlers' overall expression of negative emotion decreased by 0.09 on a scale of 0-3.

Table 23
*Effects of Lagged Maternal Initiated Distraction on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.63^{***}$ | 0.15 | $0.63^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.30^{*}$ | 0.15 |
| Initiated Distraction | $-0.07^{\dagger}$ | 0.04 | $-0.09^{*}$ | |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.71^{***}$ | 0.84 | $0.73^{***}$ | 0.86 |
| $u_{M\text{-}INI\text{-}Dis,\,j}$ | - | - | $0.12^{***}$ | 0.35 |
| $e_{ij}$ | 0.32 | 0.57 | 0.3 | 0.55 |
| *Deviance* | 2914.88 | | 2898.91 | |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Positive Commands.*** A two-level hierarchical model examined the effects of lagged maternal Positive Commands on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Pos\text{-}Comd}(\text{Pos-Comd}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Positive Commands (e.g., "you have to wait" "you need to sit down") was not associated with ENE-O (Table 24). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Positive Commands and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Positive Commands and ENE-O to vary among dyads would significantly improve model fit $X_D^2$ = 12.07, df = 2, $p < 0.01$. However, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Positive Commands and ENE-O does not vary between dyads. Additionally, in the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Positive Commands, toddlers' overall expression of negative emotion marginally increased by 0.04 on a scale of 0-3 ($p = 0.08$), but not in the expected direction.

Table 24

*Effects of Lagged Maternal Positive Commands on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.51^{***}$ | 0.15 | 0.53 | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.26^{\dagger}$ | 0.15 |
| Positive Commands | 0.03 | 0.03 | $0.03^{\dagger}$ | 0.02 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Verbosity | $0.04^{***}$ | 0.01 | $0.04^{***}$ | 0.01 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.73^{***}$ | 0.85 | $0.70^{***}$ | 0.84 |
| $u_{\text{Pos-Comd, j}}$ | - | - | 0.01 | 0.09 |
| $e_{ij}$ | 0.32 | 0.56 | 0.31 | 0.56 |
| *Deviance* | 2900.18 | | 2888.11 | |

*Note. Elapsed Time (ET) is in 10s intervals. *p < .05, **p < .01, *** p < .001, †p < .10*

***Lagged Maternal Positive Emotional Reactions.*** A two-level hierarchical model examined the effects of lagged maternal Positive Emotional Reactions on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{\text{Pos-Aff}}\,(\text{Pos-Aff}_{i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was significantly associated with lagged maternal Positive Emotional Reactions as hypothesized in the expected direction (Table 25). For every unit increase in lagged maternal Positive Emotional Reactions (e.g., smiling, laughing with child) toddlers' overall expression of negative emotion decreased by 0.19 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.31 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Positive Emotional Reactions and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Positive Emotional Reactions and ENE-O to vary among dyads would significantly improve model fit ($X_D^2$ = 20.30, df = 2, $p < 0.001$). Indeed, when the association between lagged maternal Positive Emotional Reactions and ENE-O was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant ($p < 0.001$), suggesting that dyads varied in the association between lagged maternal Positive Emotional Reactions and ENE-O. In the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Positive Emotional Reactions, toddlers' overall expression of negative emotion decreased by 0.25 on a scale of 0-3.

Table 25
*Effects of Lagged Maternal Positive Emotional Reactions on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | 0.74*** | 0.15 | 0.80*** | 0.15 |
| Gender | 0.30* | 0.15 | 0.21† | 0.13 |
| Positive Emotional Reactions | -0.19*** | 0.05 | -0.25*** | 0.05 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |

Table 25 (cont'd)

| | | | | |
|---|---|---|---|---|
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.67^{***}$ | 0.82 | $0.75^{***}$ | 0.87 |
| $u_{Pos\text{-}Aff,\,j}$ | - | - | $0.08^{***}$ | 0.29 |
| $e_{ij}$ | 0.32 | 0.56 | 0.31 | 0.56 |
| *Deviance* | 2893.13 | | | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 1A Summary of Results.** In summary, on average, toddler boys expressed higher overall levels of intensity and predominance of negative emotion (i.e., ENE-O) across the two-minute task, after each maternal regulatory attempt (Question1A) from a previous 10s interval was accounted for in separate multilevel models. Toddlers' overall expression of negative emotion significantly differed between 10s intervals (within dyad variance) based on the amount of verbal comfort, positive commands (marginal), initiated distractions, and positive emotional reactions their mothers displayed in a previous interval.

While, contrary to my hypotheses, higher lagged verbal comfort and lagged positive commands were associated with higher levels of overall expression of negative emotion, toddlers expressed lower levels of overall negative emotion as mothers initiated distractions and displayed positive emotional reactions in a previous interval as expected. Unexpectedly, the amount of lagged physical comfort (unexpected positive direction), and lagged verbal orientation to delay, lagged joint distraction, and lagged appropriate mind-related comments (expected negative directionality) in previous interval were not associated with overall expression of negative emotion in a current interval.

Among all significant predictors in Question 1A, lagged maternal positive emotional reactions were most strongly associated with lower levels of overall expression of negative emotion (random-intercept random-slope), while lagged maternal Initiated Distraction was least strongly associated with lower levels of overall expression of negative emotion.

**Research Question 1B: The Random Intercept Model Predicting Expression of Negative Emotion from Lagged Maternal Regulatory Attempts and Mind-Mindedness.** Effects of maternal variables in Question 1B were examined and are presented below. A summary of all model results in provided in Table 26[29]. Model results for each predictor are then presented in the following pages (Tables 27-30). Model results for non-significant predictors (Neg-Comd and NMM) are presented in Appendix I (Tables I5-I6).

Table 26

*Question 1B. Do Lagged Maternal Regulatory Attempts and Lagged Mind-Mindedness predict toddlers' Overall Expression of Negative Emotion (Continuous: 0-3)*

| | | Model 1 - Random Intercept Fixed Slope | | Model 2 - Random Intercept Random Slope | | | |
|---|---|---|---|---|---|---|---|
| Lagged Maternal Variables in Question 1B | Variable Label | Does X significantly predict Y? | Is directionality as hypothesized? | Does X predict Y? | Does X-Y slope vary over dyads? | Does freeing slope significantly reduce misfit? | Is directionality as hypothesized? |
| Negative Commands | Neg-Comd | No | Yes (Pos) | No | Yes | No | No (Neg) |
| Punitive Reactions | Pun | Yes | Yes (Pos) | Yes† | No | No | Yes (Pos) |
| *Minimizing* | *Min* | *No* | *Yes (Pos)* | *Yes* | *Yes* | *No* | *Yes (Pos)* |
| Physical Restraint | Phy-RST | Yes | Yes (Pos) | Yes | Yes | Yes | Yes (Pos) |
| **Negative Emotional Reactions** | **Neg-Aff** | **Yes†** | **Yes (Pos)** | **Yes** | **Yes** | **No** | **Yes (Pos)** |
| Non-Attuned MRC | NMM | No | Yes (Pos) | No | Yes | No | Yes (Pos) |

*Note*. MRC = Mind-Related Comments; 1B predictors were hypothesized to be positively associated with outcome; **Bold** font indicates largest slope coefficient. *Italics* font indicates X became significant predictor in model 2. * = *p*-value for slope coefficients with Non-Robust standard errors were < .05. All results report *p*-values for models estimated with robust standard errors. † = $p < .10$. Non-significant estimates and unexpected directionality are in red.

[29] Also provided in on page 5 of Supplemental Materials

***Lagged Maternal Punitive Reactions.***[30] A two-level hierarchical model examined the effects of lagged maternal Punitive Reactions on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{M-Pun}}(\text{M-Pun}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was significantly associated with lagged maternal Punitive Reactions as hypothesized but were in unexpected direction (Table 27). For every unit increase in lagged maternal Punitive Reactions (e.g., "Bad boy/girl", "You want a spanking?"), toddlers' overall expression of negative emotion increased by 0.12 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.31 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Punitive Reactions and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Punitive Reactions and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 0.76, df = 2, $p > 0.05$). Additionally, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Punitive Reactions and ENE-O does not vary between dyads. In the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Punitive Reactions, toddlers' overall expression of negative emotion

[30] Although Punitive Reactions contained mostly punitive verbal statements, they also included non-verbal punitive reactions such as slapping child's hand or spanking the child, thus we did not control for verbosity with Punitive Reactions as predictor.

marginally increased by 0.09 on a scale of 0-3 ($p$ = 0.05). The results of more parsimonious model are presented in presented in Table 27.

Table 27

*Effects of Lagged Punitive Reactions on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.63^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 |
| Punitive Reactions | $0.12^{*}$ | 0.05 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | $0.72^{***}$ | 0.85 |
| $e_{ij}$ | 0.32 | 0.57 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Minimizing.*** A two-level hierarchical model examined the effects of lagged maternal Minimizing on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Min}(\text{Min}_{i-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i-1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Minimizing (e.g., "Stop crying", "Don't be upset") was not associated with ENE-O (Table 28). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors associations.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Minimizing and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Minimizing and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 2.31, df = 2, $p$ >

0.05). However, when the association between lagged maternal Minimizing and ENE-O was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant ($p < .05$), suggesting that dyads tended to vary in the association between lagged maternal Minimizing and ENE-O. Additionally, in the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Minimizing, toddlers' overall expression of negative emotion increased by 0.33 on a scale of 0-3, as hypothesized in the expected direction.

Table 28

*Effects of Lagged Minimizing on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.51^{***}$ | 0.15 | $.52^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.27^{\dagger}$ | 0.15 |
| Minimizing | 0.10 | 0.09 | $0.33^{***}$ | 0.09 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Verbosity | $0.04^{***}$ | 0.01 | $0.04^{***}$ | 0.01 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.72^{***}$ | 0.85 | $0.72^{***}$ | 0.85 |
| $u_{\text{Min},j}$ | - | - | $0.05^{*}$ | 0.23 |
| $e_{ij}$ | 0.32 | 0.56 | 0.31 | 0.56 |
| *Deviance* | 2898.40 | | 2896.09 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Physical Restraint.*** A two-level hierarchical model examined the effects of lagged maternal Physical Restraint on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{Phy-RST}}(\text{Phy-RST}_{i-1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was significantly associated with lagged maternal Physical Restraint as hypothesized in the expected direction (Table 29). For every unit increase in lagged maternal Physical Restraint (e.g., 2 =

High-firmly holding child in lap, 1 = Low- gently pulls arm back, 0 = absence of any restraining behaviors) toddlers' overall expression of negative emotion increased by 0.18 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.28 units higher for boys after accounting for effects for all predictors, although this was a marginal association.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Physical Restraint and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Physical Restraint and ENE-O to vary among dyads would significantly improve model fit $X_D^2$ = 55.30, df = 2, $p < 0.001$. Indeed, when the association between lagged maternal Physical Restraint and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p$ <0.001), suggesting that dyads varied in the association between lagged maternal Physical Restraint and ENE-O. In the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Physical Restraint, toddlers' overall expression of negative emotion increased by 0.18 on a scale of 0-3.

Table 29

*Effects of Lagged Maternal Physical Restraint on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.45^{**}$ | 0.15 | $0.49^{**}$ | 0.15 |
| Gender | $0.28^{\dagger}$ | 0.14 | $0.26^{\dagger}$ | 0.14 |
| Physical Restraint | $0.18^{***}$ | 0.04 | $0.16^{***}$ | 0.04 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | 0.66 | 0.81 | $0.65^{***}$ | 0.81 |
| $u_{\text{Phy-RST, j}}$ | - | - | 0.09 | 0.30 |
| $e_{ij}$ | 0.31 | 0.60 | 0.28 | 0.53 |
| *Deviance* | 2871.39 | | 2816.08 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Negative Emotional Reactions.*** A two-level hierarchical model examined the effects of lagged maternal Negative Emotional Reactions on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{\text{Neg-Aff}}\,(\text{Neg-Aff}_{\,i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2{}_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O were marginally associated with lagged maternal Negative Emotional Reactions as hypothesized in the expected direction (Table 30). For every unit increase in lagged maternal Negative Emotional Reactions (e.g., harsh tone, laughs to mock child) toddlers' overall expression of negative emotion tended to increase by 0.22 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.31 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Negative Emotional Reactions and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Negative Emotional Reactions and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 3.57, df = 2, $p > 0.05$). However, when the association between lagged maternal Negative Emotional Reactions and ENE-O was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant ($p < .01$), suggesting that dyads varied in the association between lagged maternal Negative Emotional Reactions and ENE-O. In the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Negative Emotional Reactions, toddlers' overall expression of negative emotion increased by

0.69 on a scale of 0-3 ($p < .001$). The results of more parsimonious model are presented in Table 36.

Table 30

*Effects of Lagged Negative Emotional Reactions on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.63^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 |
| Negative Emotional Reactions | $0.22^{\dagger}$ | 0.14 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.71^{***}$ | 0.84 |
| $e_{ij}$ | 0.32 | 0.57 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 1B Summary of Results.** In summary, on average, toddler boys expressed higher overall levels of intensity and predominance of negative emotion (i.e., ENE-O) across the two-minute task, after each maternal regulatory attempt (Question 1B) from a previous 10s interval was accounted for in separate multilevel models.

Toddlers' overall expression of negative emotion significantly differed between 10s intervals (within dyad variance) based on the amount of punitive reactions, minimizing statements, physical restraint, and negative emotional reactions their mothers displayed in a previous interval. All associations were in expected directions (positive). As mothers displayed more punitive reactions, more minimizing statements, higher levels of physical restraint, and negative emotional reactions in a previous interval, toddlers' expressed greater intensity of negative emotions for longer duration. Unexpectedly, the amount of negative commands and non-attuned mind-related comments in previous interval was not associated with overall expression of negative emotion in a current interval but was in the expected direction.

Among all significant predictors in Question 1B, lagged maternal negative emotional reactions were most strongly associated with higher levels of overall expression of negative emotion (random-intercept random-slope), while lagged maternal punitive reactions were least strongly associated with higher levels of overall expression of negative emotion. In fact, lagged maternal negative emotional reactions were more strongly related to higher overall expression of negative emotion ($\beta = 0.69$, $p <.001$) than positive emotional reactions (Question 1A) were related to lower overall expression of negative emotions ($\beta = - 0.25$, $p <.001$), especially after accounting for the significant amount of variation in each of these IV-DV associations between dyads.

Interestingly, lagged maternal minimizing statements were moderately associated with higher overall expression of negative emotion only if this association was allowed to vary between dyads (random-intercept random-slope) model. Furthermore, exploratory interactional analyses (not hypothesized) revealed that toddler gender played a moderating role in the association between lagged minimizing statements and overall expression of negative emotion such that the main effect of minimizing on overall expression of negative emotion ($\beta = .52$, $p < 0.001$) was 0.39 units (scale of 0-3) lower for toddler boys compared to toddler girls.

No statistically significant associations were found for linear or quadratic elapsed time but they were retained in the models (both Questions 1A and 1B) since excluding them did not change significant coefficients and the results of the curve estimations revealed significant linear and quadratic trajectories of change for ENE-O across the task. As evident by the statistically significant residuals ($u_{oj}$), indicating significant remaining unexplained variance in average ENE-O between toddlers when all predictors were taken into account, there is room to improve each of the above models.

**Research Question 2A: The Random Intercept Model Predicting Expression of Negative Emotion from Lagged Independent Toddlers' Regulatory Strategies.** Effects of toddler variables in Question 2A were examined and are presented below. A summary of all model results in provided in Table 31[31]. Model results for each predictor are then presented in the following pages (Tables 32-35). Model results for non-significant predictor (T-INI-VDis) are presented in Appendix I (Table I7).

Table 31

*Question 2A. Do Lagged Toddlers' Regulatory Strategies predict toddlers' Overall Expression of Negative Emotion (Continuous: 0-3)*

| | | Model 1 - Random Intercept Fixed Slope | | Model 2 - Random Intercept Random Slope | | | |
|---|---|---|---|---|---|---|---|
| Lagged Toddler Variables in Question 2A | Variable Label | Does X significantly predict Y? | Is directionality as hypothesized? | Does X predict Y? | Does X-Y slope vary over dyads? | Does freeing slope significantly reduce misfit? | Is directionality as hypothesized? |
| Independent Regulatory Strategies | | | | | | | |
| Initiated Verbal Distraction | T-INI-VDis | No | Yes (Neg) | No | Yes† | No | Yes (Neg) |
| **Initiated Non-Verbal Distraction** | **T-INI-nonVDis** | **Yes** | **Yes (Neg)** | **Yes** | **Yes†** | **Yes** | **Yes (Neg)** |
| *Initiated Verbal Keys* | *T-INI-Vkeys* | *No* | *No (Pos)* | *Yes†* | *Yes* | *Yes* | *No (Pos)* |
| Initiated Verbal Self-Control | T-INI-Vctrl | - | - | - | - | - | - |
| Initiated Verbal Desire | T-INI-Vdes | Yes† | No (Pos) | Yes | No | No | No (Pos) |
| Self-Comfort | T-SComf | Yes | Yes (Neg) | Yes | Yes | Yes | Yes (Neg) |

*Note*. All Toddlers' Regulatory Strategies were predicted to be positively associated with outcome. 2A strategies are toddler initiated and don't involve mother, 2B strategies involve mother or are in response to mother. **Bold** font indicates largest slope coefficient. *Italics* font indicates X became significant predictor in model 2. * = *p*-value for slope coefficients with Non-Robust standard errors were < .05. All results report p-values for models estimated with robust standard errors. † = $p < .10$. Non-significant estimates and unexpected directionality are in red.

[31] Also provided in on page 6 of Supplemental Materials

***Lagged Toddler Initiated Non-Verbal Distraction.*** A two-level hierarchical model examined the effects of lagged Toddler Initiated Non-Verbal Distraction on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{T-INI-nonVdis}}(\text{T-INI-nonVDis}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was significantly associated with lagged Toddler Initiated Non-Verbal Distraction as hypothesized in expected negative direction (Table 32). For every unit increase in lagged Toddler Initiated Non-Verbal Distraction (e.g., looks away, walks out of the room, engages in play) toddlers' overall expression of negative emotion significantly decreased by 0.18 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.30 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Initiated Non-Verbal Distraction and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Initiated Non-Verbal Distraction and ENE-O to vary among dyads would significantly improve model fit $X_D^2$ = 45.21, df = 2, $p < 0.001$. Indeed, when the association between lagged Toddler Initiated Non-Verbal Distraction and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p < .05$), suggesting that dyads varied in the association between lagged Toddler Initiated Non-Verbal Distraction and ENE-O. In the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Initiated Non-Verbal Distraction, toddlers' overall expression of negative emotion significantly decreased by 0.25 on a scale of 0-3.

Table 32

*Effects of Lagged Toddler Initiated Non-Verbal Distraction on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.67^{***}$ | 0.15 | $0.72^{***}$ | 0.15 |
| Gender | $0.30^{*}$ | 0.15 | $0.21^{\dagger}$ | 0.12 |
| Initiated Non-Verbal Distraction | $-0.18^{***}$ | 0.04 | $-0.25^{***}$ | 0.04 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.67^{***}$ | 0.82 | $0.78^{***}$ | 0.88 |
| $u_{\text{T-INI-nonVdis, j}}$ | - | - | $0.11^{***}$ | 0.34 |
| $e_{ij}$ | 0.32 | 0.56 | 0.30 | 0.55 |
| *Deviance* | 2886.89 | | 2841.68 | |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Initiated Verbal Keys*** A two-level hierarchical model examined the effects of lagged Toddler Initiated Verbal Keys on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{T-INI-Vkeys}}(\text{T-INI-Vkeys}_{i-1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Initiated Verbal Keys (e.g., says "keys" "turtle is sleeping") was not associated with ENE-O (Table 33). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Initiated Verbal Keys and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Initiated Verbal Keys and ENE-O to vary among dyads would significantly improve model fit ($X_D^2$ = 8.98, df = 2, $p < 0.05$). Indeed, when the association between lagged Toddler Initiated Verbal Keys and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p < .05$), suggesting that dyads varied in the association between lagged Toddler Initiated Verbal Keys and ENE-O. Additionally, in the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Initiated Verbal Keys, toddlers' overall expression of negative emotion marginally increased by 0.24 ($p < .10$) on a scale of 0-3, but in unexpected direction.

Table 33
*Effects of Lagged Toddler Initiated Verbal Keys on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.61^{***}$ | 0.15 | $0.60^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.30^{*}$ | 0.15 |
| Initiated Verbal Keys | 0.12 | 0.08 | $0.24^{\dagger}$ | 0.13 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.73^{***}$ | 0.85 | $0.73^{***}$ | 0.85 |
| $u_{T\text{-}INI\text{-}Vkeys,\, j}$ | - | - | $0.24^{***}$ | 0.49 |
| $e_{ij}$ | 0.32 | 0.57 | 0.31 | 0.56 |
| *Deviance* | 2914.07 | | 2905.10 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Initiated Verbal Self-Control.*** No instances of Toddler Initiated Verbal Self-Control (e.g., "I wait", "No touch") were observed. All Verbal Self-Control was directed toward or in response to mom and coded as Toddler Initiated Verbal Self-Control – Bids to Mom under dependent regulatory strategies.

***Lagged Toddler Initiated Verbal Desire.*** A two-level hierarchical model examined the effects of lagged Toddler Initiated Verbal Desire on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{T-INI-Vdes}}(\text{T-INI-Vdes}_{i-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was marginally associated with lagged Toddler Initiated Verbal Desire as hypothesized but in unexpected positive direction (Table 34). For every unit increase in lagged Toddler Initiated Verbal Desire (e.g., “I want it”, “I need it”) toddlers’ overall expression of negative emotion marginally increased by 0.11 on a scale of 0-3. Toddlers’ average overall expression of negative emotion was 0.31 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Initiated Verbal Desire and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Initiated Verbal Desire and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 0.016 x, df = 2, $p > 0.05$). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged Toddler Initiated Verbal Desire and ENE-O does not vary between dyads. However, in the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Initiated Verbal Desire, toddlers’ overall expression of negative emotion significantly (no longer marginal) increased by 0.15 on a scale of 0-3 ($p = 0.02$).

Table 34
*Effects of Lagged Toddler Initiated Verbal Desire on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.62^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 |
| Initiated Verbal Desire | $0.11^{\dagger}$ | 0.06 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.72^{***}$ | 0.85 |
| $e_{ij}$ | 0.32 | 0.57 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Self-Comfort.*** A two-level hierarchical model examined the effects of lagged Toddler Self-Comfort on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{T\text{-}Scomf}(\text{T-Scomf}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was significantly associated with lagged Toddler Self-Comfort as hypothesized in expected negative direction (Table 35). For every unit increase in lagged Toddler Self-Comfort (e.g., thumb sucking, rocking back and forth) toddlers' overall expression of negative emotion significantly decreased by 0.18 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.31 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Self-Comfort and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Self-Comfort and ENE-O to vary among dyads would significantly improve model fit ($X_D^2$ = 29.67, df = 2, $p$ < 0.001). Indeed, when the association between lagged Toddler Self-Comfort and ENE-O was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant (p <.05), suggesting that dyads varied in the association between lagged Toddler Self-Comfort and ENE-O. In the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Self-Comfort, toddlers' overall expression of negative emotion significantly decreased by 0.16 on a scale of 0-3.

Table 35
*Effects of Lagged Toddler Self-Comfort on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | 0.77 $^{***}$ | 0.15 | 0.79 $^{***}$ | 0.15 |
| Gender | 0.31 $^{*}$ | 0.15 | 0.28$^{\dagger}$ | 0.15 |
| Self-Comfort | -0.18 $^{***}$ | 0.04 | -0.16 $^{***}$ | 0.04 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | 0.72 $^{***}$ | 0.85 | 0.81$^{***}$ | 0.90 |
| $u_{\text{T-Scomf, j}}$ | - | - | 0.06$^{***}$ | 0.24 |
| $e_{ij}$ | 0.31 | 0.56 | 0.29 | 0.54 |
| *Deviance* | 2877.72 | | 2848.05 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 2A Summary of Results.** In summary, on average, toddler boys expressed higher overall levels of intensity and predominance of negative emotion (i.e., ENE-O) across the two-minute task, after each toddler independent regulatory strategy (Question 2A) from a previous 10s interval was accounted for in separate multilevel models. Toddlers' overall expression of negative emotion significantly differed between 10s intervals (within dyad variance) based on the amount of lagged initiated non-verbal distractions, lagged initiated verbal desire, and lagged self-comforting behaviors. No effects were found for lagged toddler initiated verbal distraction. Zero instances of independent verbalizations in the form of self-direction were observed.

While contrary to my hypotheses, more lagged initiated verbal keys (e.g., "keys" "wake up turtle") and more lagged initiated verbal desire (e.g., "I want it" "I need it") were associated with higher levels of overall expression of negative emotion, toddlers expressed lower levels of overall negative emotion as they initiated non-verbal distractions (e.g., shift focus away from keys for more than 3 seconds) and self-comforting physical behaviors (e.g., rocking back and forth) in previous intervals as expected. Among all significant predictors in Question 2A, more lagged toddler initiated non-verbal distraction was most strongly associated with lower levels of overall expression of negative emotion (random-intercept random slope), while more lagged toddler verbal desire was least strongly associated with higher levels of overall expression of negative emotion.

No statistically significant associations were found for linear or quadratic elapsed time but they were retained in the model since excluding them did not change significant coefficients and the results of the curve estimations revealed significant linear and quadratic trajectories of change for ENE-O across the task. As evident by the statistically significant residuals ($u_{oj}$), indicating significant remaining unexplained variance in average ENE-O between dyads when all predictors are taken into account, there is room to improve each of the above models.

**Research Question 2B: The Random Intercept Model Predicting Expression of Negative Emotion from Lagged Dependent Toddlers' Regulatory Strategies.** Effects of toddler variables in Question 2B were examined and are presented below. A summary of all model results in provided in Table 36[32]. Model results for each predictor are then presented in the following pages (Tables 37- 40). Model results for non-significant predictors (T-Vkeys-2M, T-Vdes-2M, T-ComfSk) are presented in Appendix I (Table I8-I10).

[32] Also provided in on page 5 of Supplemental Materials

Table 36

*Question 2B. Do Lagged Toddlers' Regulatory Strategies predict toddlers' Overall Expression of Negative Emotion (Continuous: 0-3)*

| | | Model 1 - Random Intercept Fixed Slope | | Model 2 - Random Intercept Random Slope | | | |
|---|---|---|---|---|---|---|---|
| Lagged Toddler Variables in Question 2B | Variable Label | Does X significantly predict Y? | Is directionality as hypothesized? | Does X predict Y? | Does X-Y slope vary over dyads? | Does freeing slope significantly reduce misfit? | Is directionality as hypothesized? |
| Dependent Regulatory Strategies | | | | | | | |
| Verbal Distraction-Bids to Mom | T-VDis-2M | Yes† | No (Pos) | Yes | Yes | Yes | No (Pos) |
| *Joined Verbal Distraction* | *T-JNT-VDis* | *No* | *Yes (Neg)* | *Yes* | *No* | *Yes* | *Yes (Neg)* |
| Joined Non-Verbal Distraction | T-JNT-nonVDis | Yes | Yes (Neg) | Yes | Yes | Yes | Yes (Neg) |
| Verbal Keys – Bids to Mom | T-Vkeys-2M | No | Yes (Neg) | No | Yes | Yes | Yes (Neg) |
| ***Verbal Self-Control- Bids to Mom*** | ***T-Vctrl-2M*** | ***No*** | ***No (Pos)*** | ***Yes*** | ***Yes*** | ***No*** | ***Yes (Neg)*** |
| Verbal Desire – Bids to Mom | T-Vdes-2M | No | No (Pos) | No | Yes† | No | Yes (Neg) |
| Toddler Physical Comfort Seeking | T-ComfSk | No | No (Pos) | No | Yes | Yes | No (Pos) |

Note. All Toddlers' Regulatory Strategies were predicted to be positively associated with outcome. 2A strategies are toddler initiated and don't involve mother, 2B strategies involve mother or are in response to mother. **Bold** font indicates largest slope coefficient. *Italics* font indicates X became significant predictor in model 2. * = *p*-value for slope coefficients with Non-Robust standard errors were < .05. All results report p-values for models estimated with robust standard errors. † = *p* < .10. Non-significant estimates and unexpected directionality are in red.

***Lagged Toddler Verbal Distraction-Bids to Mom***. A two-level hierarchical model examined the effects of lagged Toddler Verbal Distraction – Bids to Mom on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{T\text{-}Vdis\text{-}2M}\,(\text{T-Vdis-2M}_{\,i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was marginally associated with lagged Toddler Verbal Distraction – Bids to Mom as hypothesized but in unexpected positive direction (Table 37). For every unit increase in lagged Toddler Verbal Distraction – Bids to Mom (e.g., "I want bottle" said to mom or initiated singing while looking at mom) toddlers' overall expression of negative emotion marginally increased by 0.18 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.30 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Verbal Distraction – Bids to Mom and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Verbal Distraction – Bids to Mom and ENE-O to vary among dyads would significantly improve model fit ($X_D^2$ = 9.19, df = 2, $p$ =0.01) Indeed, when the association between lagged Toddler Verbal Distraction – Bids to Mom and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p$ <.05), suggesting that dyads varied in the association between lagged Toddler Verbal Distraction – Bids to Mom and ENE-O. In the random-intercept random-slope model

(Model 2), for every unit increase in lagged Toddler Verbal Distraction – Bids to Mom, toddlers' overall expression of negative emotion significantly increased by 0.21 on a scale of 0-3.

Table 37
*Effects of Lagged Toddler Verbal Distraction – Bids to Mom on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.63^{***}$ | 0.15 | $0.63^{***}$ | 0.15 |
| Gender | $0.30^{*}$ | 0.15 | $0.31^{*}$ | 0.15 |
| Verbal Distraction – Bids to Mom | $0.18^{\dagger}$ | 0.06 | $0.21^{**}$ | 0.08 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.73^{***}$ | 0.85 | $0.73^{***}$ | 0.85 |
| $u_{\text{T-Vdis-2M}}x_{,\text{ j}}$ | - | - | $0.7^{*}$ | 0.26 |
| $e_{ij}$ | 0.32 | 0.56 | 0.31 | 0.56 |
| *Deviance* | 2907.88 | | 2898.68 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Joined Verbal Distraction.*** A two-level hierarchical model examined the effects of lagged Toddler Joined Verbal Distraction on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{T-JNT-VDis}}(\text{T-JNT-VDis}_{\text{ i-1j}}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Joined Verbal Distraction (e.g., mother starts counting and child joins in) was not associated with ENE-O but was in expected negative direction (Table 38). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Joined Verbal Distraction and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Joined

Verbal Distraction and ENE-O to vary among dyads would significantly improve model fit ($X_D^2$ = 6.49, df = 2, $p < 0.05$). However, the $p$-value associated with random slope was not significant suggesting that the association between lagged Toddler Joined Verbal Distraction and ENE-O does not vary between dyads. Additionally, in the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Joined Verbal Distraction, toddlers' overall expression of negative emotion significantly decreased by 0.19 on a scale of 0-3 ($p < 0.001$) as hypothesized in the expected direction.

Table 38

*Effects of Lagged Toddler Joined Verbal Distraction on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.63^{***}$ | 0.15 | $0.62^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.32^{*}$ | 0.15 |
| Joined Verbal Distraction | -0.06 | 0.05 | $-0.19^{***}$ | 0.04 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.72^{***}$ | 0.85 | $0.72^{***}$ | 0.85 |
| $u_{\text{T-JNT-VDis, j}}$ | - | - | 0.07 | 0.26 |
| $e_{ij}$ | 0.32 | 0.56 | 0.32 | 0.57 |
| *Deviance* | 2916.46 | | 2909.97 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Joined Non-Verbal Distraction***. A two-level hierarchical model examined the effects of lagged Toddler Joined Non-Verbal Distraction on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{T-JNT-nonVDis}}\,(\text{T-JNT-nonVDis}_{i\text{-}1j)} + \gamma_{\text{ETL}}\,(\text{ET}_{ij}) + \gamma_{\text{ET}}{}^{2}\,(\text{ET}^{2}{}_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of ENE-O was significantly associated with lagged Toddler Joined Non-Verbal Distraction as hypothesized in the expected negative direction (Table 39). For every unit increase in lagged Toddler Joined

Non-Verbal Distraction (e.g., mother initiates play and child joins in, mother points to a direction away from keys and child looks where she is pointing) toddlers' overall expression of negative emotion significantly decreased by 0.11 on a scale of 0-3. Toddlers' average overall expression of negative emotion was 0.30 units higher for boys after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Joined Non-Verbal Distraction and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Joined Non-Verbal Distraction and ENE-O to vary among dyads would significantly improve model fit ($X_D^2$ = 7.09, df = 2, $p < 0.05$). Indeed, when the association between lagged Toddler Joined Non-Verbal Distraction and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p <.01$), suggesting that dyads varied in the association between lagged Toddler Joined Non-Verbal Distraction and ENE-O. In the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Joined Non-Verbal Distraction, toddlers' overall expression of negative emotion significantly decreased by 0.25 on a scale of 0-3.

Table 39
*Effects of Lagged Toddler Joined Non-Verbal Distraction on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.62^{***}$ | 0.15 | $0.66^{***}$ | 0.14 |
| Gender | $0.30^{*}$ | 0.15 | 0.21 | 0.13 |
| Joined Non-Verbal Distraction | $-0.11^{**}$ | 0.04 | $-0.25^{***}$ | 0.04 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.71^{***}$ | 0.84 | $0.73^{***}$ | 0.85 |
| $u_{\text{T-JNT-nonVDis, j}}$ | - | - | $0.06^{**}$ | 0.24 |
| $e_{ij}$ | 0.32 | 0.57 | 0.32 | 0.57 |
| *Deviance* | 2911.65 | | 2904.56 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Verbal Self-Control - Bids to Mom.*** A two-level hierarchical model examined the effects of lagged Toddler Verbal Self-Control – Bids to Mom on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{T\text{-}Vctrl\text{-}2M}\,(\text{T-Vctrl-2M}_{i-1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Self-Control- Bids to Mom (e.g., "I wait", "No touch" said while looking at or in response to mom) was not associated with ENE-O (Table 40). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Self-Control- Bids to Mom and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Self-Control- Bids to Mom and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 2.36, df = 2, $p > 0.05$). However, when the association between lagged Toddler Self-Control- Bids to Mom and ENE-O was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant (p <.01), suggesting that dyads varied in the association between lagged Toddler Self-Control- Bids to Mom and ENE-O. Additionally, in the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Self-Control- Bids to Mom, toddlers' overall expression of negative emotion significantly decreased by 0.47 on a scale of 0-3 ($p = 0.007$) as hypothesized in the expected direction.

Table 40

*Effects of Lagged Toddler Self-Control- Bids to Mom on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.63^{***}$ | 0.15 | $0.65^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.28^{\dagger}$ | 0.14 |
| Self-Control- Bids to Mom | 0.03 | 0.14 | $-0.47^{**}$ | 0.17 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.72^{***}$ | 0.85 | $0.72^{***}$ | 0.85 |
| $u_{\text{T-Vctrl-2M, j}}$ | - | - | $0.75^{**}$ | 0.86 |
| $e_{ij}$ | 0.32 | 0.57 | 0.32 | 0.57 |
| *Deviance* | 2915.34 | | 2912.98 | |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 2B Summary of Results.** In summary, on average, toddler boys expressed higher overall levels of intensity and predominance of negative emotion (i.e., ENE-O) across the two-minute task, after each toddler dependent regulatory strategy (Question 2B) from a previous 10s interval was accounted for in separate multilevel models. Toddlers' overall expression of negative emotion significantly differed between 10s intervals (within dyad variance) based on the amount of verbal distraction-bids to mom, joined verbal distraction, joined non-verbal distraction,  and verbalizations in the form of self-direction directed toward or in response to mother that they displayed in a previous interval. No effects were found for lagged toddler verbalization about keys directed toward mothers, lagged toddler verbalization expressive of desire states directed toward mothers, or lagged toddler comfort seeking.

While contrary to my hypotheses, more lagged verbal distraction –bids to mom (e.g., "I want bottle" said while looking at mom) was associated with higher levels of overall expression of negative emotion, toddlers expressed lower levels of overall negative emotion as they joined mother-initiated verbal (e.g., mother starts counting and toddler joins in counting) and non-verbal distraction (e.g., mother points to an object other than keys and toddler looks in that direction). Additionally, as hypothesized, toddlers who verbalized statements in the form of self-direction (e.g., “I wait”, “No touch”), in response to or directed toward mother, in previous intervals, expressed lower levels of intensity and predominance of negative emotions (anger or sadness). In fact, effect of lagged verbalizations in the form of self-direction was the strongest predictor of lowered expression of negative emotion among all significant dependent regulatory strategies while lagged toddler joined non-verbal distraction had the weakest significant slope.

No statistically significant associations were found for linear or quadratic elapsed time but they were retained in the model since excluding them did not change significant coefficients and the results of the curve estimations revealed significant linear and quadratic trajectories of change for ENE-O across the task. As evident by the statistically significant residuals ($u_{oj}$), indicating significant remaining unexplained variance in average ENE-O between dyads when all predictors are taken into account, there is room to improve each of the above models.

Summary of both 2A and 2B: In terms of overall expression of negative emotion, results provide evidence for effectiveness of lagged independent regulatory strategies and lagged dependent regulatory strategies. However, these effects must be considered separately for distracting strategies, verbalizations toward the delay task, and physical strategies. In terms of distracting strategies, effects of toddlers’ non-verbal distractions were similar between initiated and joined, however, effects of toddlers’ verbal distraction was only seen when toddlers’ verbal distraction was directed toward mothers (wrong direction positive) or joined mom’s initiated verbal distraction (right direction negative). Among independent verbalizations towards the delay task, toddler initiated talk that described the keys (e.g., Pooh) and toddler initiated talk expressive of internal states (e.g., I need it) were related to higher overall expression of negative emotion. However, among dependent verbalizations towards the delay task, although talk about keys and desire states directed toward or in response to mother were not significant, they were now in the expected negative direction. Also, verbalizations toward mothers in the form of self-direction were significantly related to lower overall expression of negative emotion. These verbalizations (“I wait) also had the strongest negative effect on ENE-O among all toddler regulatory strategies (both independent and dependent, both verbal and non-verbal). Additionally, while physically self-comforting behaviors were associated with lower overall expression of negative emotion, comfort seeking behaviors such as leaning body against mom did not have significant effects and were in an unexpected positive direction.

**Research Question 3A: The Random Intercept Model Predicting Overall Touch from Lagged Maternal Regulatory Attempts and Mind-Mindedness.** Effects of maternal variables in Question 3A were examined and are presented below. A summary of all model results in provided in Table 41[33]. Model results for each predictor are then presented in the following pages (Tables 42-xx). Model results for non-significant predictors (V-Comf, M-JNT-Dis, M-VO2D, and AMM) are presented in Appendix I (Table I11-I14).

[33] Also provided in on page 6 of Supplemental Materials

Table 41

*Question 3A. Do Lagged Maternal Regulatory Attempts and Lagged Mind-Mindedness predict toddlers' Overall Touch (Count)*

| | | Model 1 - Random Intercept Fixed Slope | | Model 2 - Random Intercept Random Slope | | | |
|---|---|---|---|---|---|---|---|
| Lagged Maternal Variables in Question 3A | Variable Label | Does X significantly predict Y? | Is directionality as hypothesized? | Does X predict Y? | Does X-Y slope vary over dyads? | Does freeing slope significantly reduce misfit? | Is directionality as hypothesized? |
| Verbal Comfort | V-Comf | No | Yes (Neg) | No | No | No | Yes (Neg) |
| *Physical Comfort* | *Phy-Comf* | *No* | *Yes (Neg)* | *Yes*† | *Yes*† | *Yes* | *Yes (Neg)* |
| **Initiated Distraction** | **M-INI-Dis** | **Yes** | **Yes (Neg)** | **Yes** | **No** | **Yes** | **Yes (Neg)** |
| Joined Distraction | M-JNT-Dis | No | Yes (Neg) | No | No | Yes | Yes (Neg) |
| Verbal Orientation to Delay | M-VO2D | No | No (Pos) | No | No | No | No (Pos) |
| Positive Commands | Pos-Comd | Yes† | Yes (Neg) | No | No | No | Yes (Neg) |
| Positive Emotional Reactions | Pos-Aff | Yes*† | No (Pos) | Yes† | Yes | Yes | No (Pos) |
| Appropriate MRC | AMM | No | Yes (Neg) | No | Yes | No | Yes (Neg) |

*Note*. MRC = Mind-Related Comments; 3A predictors were hypothesized to be negatively associated with outcome; **Bold** font indicates largest slope coefficient. *Italics* font indicates X became significant predictor in model 2. * = *p*-value for slope coefficients with Non-Robust standard errors were < .05. All results report *p*-values for models estimated with robust standard errors. † = $p < .10$. Non-significant estimates and unexpected directionality are in red.

***Lagged Maternal Physical Comfort.*** A two-level hierarchical model examined the effects of lagged maternal Physical Comfort on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{Phy-Comf}}(\text{Phy-Comf}_{i-1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Physical Comfort (e.g., giving hugs) was not associated with Overall Touch but was in expected direction (Table 42). Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Physical Comfort and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Physical Comfort and Overall Touch to vary among dyads would significantly improve model fit $X_D^2$ = 7.12, df = 2, $p < 0.05$. Indeed, when the association between lagged maternal Physical Comfort and Overall Touch was allowed to vary between dyads, the p-value associated with the random slope coefficient was marginally significant ($p$ <.10), suggesting that dyads tended to vary in the association between lagged maternal Physical Comfort and Overall Touch. Additionally, in the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Physical Comfort, toddlers' Overall Touch marginally decreased by 0.05 ($p$ = 0.06) in an average interval (mean per interval = .27, range per interval 0 - 6) as hypothesized in the expected direction.

Table 42
*Effects of Lagged Maternal Physical Comfort on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.60^{***}$ | 0.10 | $0.59^{***}$ | 0.10 |
| Gender | -0.02 | 0.05 | -0.02 | 0.05 |
| Physical Comfort | -0.03 | 0.03 | $-0.05^{\dagger}$ | 0.03 |
| Linear ET | $-0.01^{***}$ | 0.01 | $-0.01^{***}$ | 0.01 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 | $0.09^{***}$ | 0.29 |
| $u_{Phy\text{-}comf,\, j}$ | - | - | $0.01^{\dagger}$ | 0.11 |
| $e_{ij}$ | 0.28 | 0.53 | 0.28 | 0.53 |
| *Deviance* | 2467.82 | | 2460.70 | |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Initiated Distraction***. A two-level hierarchical model examined the effects of lagged maternal Initiated Distraction on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{M-INI-Dis}}(\text{M-INI-Dis}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, Overall Touch was significantly associated with lagged maternal Initiated Distraction as hypothesized and in expected direction (Table 43). For every unit increase in lagged maternal Initiated Distraction (e.g., "Show me your nose", playing) toddlers' Overall Touch significantly decreased by 0.06 in an average interval (mean per interval = .27, range per interval 0 - 6). Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Initiated Distraction and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X^2_D$ = chi squared difference) indicated that allowing the relationship between lagged maternal Initiated Distraction and Overall Touch to vary among dyads would significantly improve model fit $X^2_D$ = 12.81, df = 2, p < 0.01. However, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Initiated Distraction and Overall Touch does not vary between dyads. In the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Initiated Distraction, toddlers' Overall Touch significantly decreased by 0.08 in an average interval (mean per interval = .27, range per interval 0 - 6).

Table 43
*Effects of Lagged Maternal Initiated Distraction on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.60^{***}$ | 0.11 | $0.60^{***}$ | 0.12 |
| Gender | -0.01 | 0.06 | -0.03 | 0.05 |
| Initiated Distraction | $-0.06^{*}$ | 0.03 | $-0.08^{**}$ | 0.03 |
| Linear ET | $-0.01^{**}$ | 0.01 | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 | $0.09^{***}$ | 0.31 |
| $u_{M\text{-}INI\text{-}Dis,\, j}$ | - | - | 0.02 | 0.14 |
| $e_{ij}$ | 0.28 | 0.53 | 0.28 | 0.53 |
| *Deviance* | 2465.56 | | 2452.75 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Positive Commands.*** A two-level hierarchical model examined the effects of lagged maternal Verbal Positive Commands on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Pos\text{-}Comd}\,(\text{Pos-Comd}_{i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + \gamma_{Verb}\,(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, Overall Touch was marginally associated with lagged maternal Positive Commands as hypothesized in expected direction (Table 44). For every unit increase in lagged maternal Positive Commands (e.g., "you have to wait" "you need to sit down") toddlers' Overall Touch marginally decreased by 0.03 in an average interval (mean per interval = .27, range per interval 0 - 6). Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Positive Commands and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Positive Commands and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 4.39, df = 2, $p$ > 0.05). Additionally, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Positive Commands and Overall Touch does not vary between dyads. Effects of lagged maternal Positive Commands on Overall Touch become non-significant in Model 2.

Table 44

*Effects of Lagged Positive Commands on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.57^{***}$ | 0.11 |
| Gender | -0.02 | 0.06 |
| Positive Commands | $-0.03^{\dagger}$ | 0.02 |
| Linear ET | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| Verbosity | 0.02 | 0.01 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Positive Emotional Reactions***. A two-level hierarchical model examined the effects of lagged maternal Positive Emotional Reactions on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{Pos-Aff}}(\text{Pos-Aff}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of Overall Touch was marginally associated with lagged maternal Positive Emotional Reactions as hypothesized but was in unexpected direction (Table 45). For every unit increase in lagged maternal Positive Emotional Reactions (e.g., smiling, laughing with child) toddlers' Overall Touch tended to increase by 0.07 in an average interval (mean per interval = .27, range per interval 0 - 6). In the same model, the *p*-value associated with the slope coefficient estimated with non-robust standard errors was < 0.05. Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Positive Emotional Reactions and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Positive Emotional Reactions and Overall Touch to vary among dyads would significantly improve model fit $X_D^2$ = 9.58, df = 2, $p < 0.01$. Indeed, when the association between lagged maternal Positive Emotional Reactions and Overall Touch was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant (p <.05), suggesting that dyads varied in the association between lagged maternal Positive Emotional Reactions and Overall Touch. In the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Positive Emotional Reactions, toddlers' Overall Touch marginally increased by 0.07 ($p = 0.05$) in an average interval (mean per interval = .27, range per interval 0 - 6).

Table 45
*Effects of Lagged Maternal Positive Emotional Reactions on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.56^{***}$ | 0.11 | $0.55^{***}$ | 0.11 |
| Gender | -0.01 | 0.06 | 0.004 | 0.05 |
| Positive Emotional Reactions | $0.07^{\dagger}$ | 0.04 | $0.07^{\dagger}$ | 0.04 |

Table 45 (cont'd)

| | | | | |
|---|---|---|---|---|
| Linear ET | -0.01$^{***}$ | 0.00 | -0.01$^{***}$ | 0.00 |
| Quadratic ET | 0.00$^{**}$ | 0.00 | 0.00$^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | 0.08$^{***}$ | 0.28 | 0.06$^{***}$ | 0.25 |
| $u_{\text{Pos-Aff, j}}$ | - | - | 0.03$^{*}$ | 0.16 |
| $e_{ij}$ | 0.28 | 0.53 | 0.27 | 0.52 |
| *Deviance* | 2464.35 | | 2454.76 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 3A Summary of Results.** In summary, toddlers' average Overall Touch (higher scores indicate lower ability to wait)[34], significantly differed between 10s intervals (within dyad variance) based on the amount of Initiated Distraction their mothers displayed in a previous interval. Expectedly, as mothers initiated more distractions in a previous interval, toddlers touched and attempted to touch the keys less often. Furthermore, toddlers' average Overall Touch marginally differed between 10s intervals based on the amount of physical comfort, positive commands and positive emotional reactions their mothers displayed in a previous interval. Expectedly, as mothers offered more physical comfort or used more positive commands in a previous interval, toddlers tended to touch or attempt to touch the keys less often. However, unexpectedly, as mothers displayed positive emotional reactions in a previous interval, toddlers tended to touch or attempt to touch the keys more often. Among all significant predictors in Question 3A, more lagged maternal initiated distractions were most strongly related to less Overall Touch, while lagged maternal positive commands were least strongly (and marginally) related to Overall Touch. After accounting for variance within toddlers, while toddlers' Overall Touch scores were significantly different between toddlers ($u_{0j}$), gender

[34] Throughout the Results and Discussion section the term "Overall Touch" is interpreted in terms of ability to wait. Additionally, ability to wait is interchangeably used with "refraining from touching" and "delay of gratification". Higher "Overall Touch" indicates lower ability to wait or delay gratification while refraining from touch indicates higher ability to wait or more ability for delay of gratification.

differences could not significantly explain this amount of between toddler variance in Overall Touch scores.

**Research Question 3B: The Random Intercept Model Predicting Overall Touch from Lagged Maternal Regulatory Attempts and Mind-Mindedness.** Effects of maternal variables in Question 3B are presented below. A summary of all model results in provided in Table 46. Model results for each predictor are then presented in the following pages (Tables 47-49). Model results for non-significant predictors (Pun, Min, NMM) are presented in Appendix I (Table I15-I17).

Table 46
*Question 3B. Do Lagged Maternal Regulatory Attempts and Lagged Mind-Mindedness predict toddlers' Overall Touch (Count)*

| | | Model 1 - Random Intercept Fixed Slope | | Model 2 - Random Intercept Random Slope | | | |
|---|---|---|---|---|---|---|---|
| Lagged Maternal Variables in Question 3B | Variable Label | Does X significantly predict Y? | Is directionality as hypothesized? | Does X predict Y? | Does X-Y slope vary over dyads? | Does freeing slope significantly reduce misfit? | Is directionality as hypothesized? |
| Negative Commands | Neg-Comd | Yes† | Yes (Pos) | No | No | Yes | Yes (Pos) |
| Punitive Reactions | Pun | No | No (Neg) | No | No | No | Yes (Pos) |
| Minimizing | Min | No | No (Neg) | No | Yes | No | No (Neg) |
| Physical Restraint | Phy-RST | Yes† | Yes (Pos) | Yes† | Yes | Yes | Yes (Pos) |
| **Negative Emotional Reactions** | **Neg-Aff** | **No*** | **Yes (Pos)** | **No** | **Yes** | **Yes** | **Yes (Pos)** |
| Non-Attuned MRC | NMM | No | No (Neg) | No | No | No | No (Neg) |

*Note*. MRC = Mind-Related Comments; 3B predictors were hypothesized to be positively associated with outcome; **Bold** font indicates largest slope coefficient. *Italics* font indicates X became significant predictor in model 2. * = $p$-value for slope coefficients with Non-Robust standard errors were < .05. All results report $p$-values for models estimated with robust standard errors. † = $p$ < .10. Non-significant estimates and unexpected directionality are in red

***Lagged Maternal Negative Commands***. A two-level hierarchical model examined the effects of lagged maternal Negative Commands on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Neg\text{-}Comd}\,(\text{Neg-Comd}_{i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + \gamma_{Verb}\,(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, Overall Touch was marginally associated with lagged maternal Negative Commands as hypothesized in expected direction (Table 47). For every unit increase in lagged maternal Negative Commands (e.g., "Don't touch", "I said no!"), toddlers' Overall Touch tended to decrease by 0.03 in an average interval (mean per interval = .27, range per interval 0 - 6). Toddlers' Overall Touch and gender were not significantly associated. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Negative Commands and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Negative Commands and Overall Touch to vary among dyads would significantly improve model fit $X_D^2$ = 6.99, df = 2, $p < 0.05$. However, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Negative Commands and Overall Touch does not vary between dyads. Effects of lagged maternal Negative Commands on Overall Touch become non-significant in Model 2.

Table 47
*Effects of Lagged Maternal Negative Commands on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.56^{***}$ | 0.11 | $0.57^{***}$ | 0.11 |
| Gender | -0.02 | 0.06 | -0.03 | 0.05 |
| Negative Commands | $0.03^{\dagger}$ | 0.02 | 0.03 | 0.02 |

Table 47 (cont'd)

| | | | | |
|---|---|---|---|---|
| Linear ET | $-0.01^{**}$ | 0.00 | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0 | $0.00^{**}$ | 0.00 |
| Verbosity | 0.002 | 0.01 | 0.002 | 0.01 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 | $0.07^{***}$ | 0.26 |
| $u_{\text{Neg-Comd},j}$ | - | - | 0.004 | 0.06 |
| $e_{ij}$ | 0.28 | 0.53 | 0.27 | 0.52 |
| *Deviance* | 2471.15 | | 2471.15 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Physical Restraint***. A two-level hierarchical model examined the effects of lagged maternal Physical Restraint on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Phy-RST}}\,(\text{Phy-RST}_{i-1j}) + \gamma_{\text{ETL}}\,(\text{ET}_{ij}) + \gamma_{\text{ET}^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, Overall Touch was marginally associated with lagged maternal Physical Restraint as hypothesized in expected direction (Table 48). For every unit increase in lagged maternal Physical Restraint (e.g., 2 = High-firmly holding child in lap, 1 = Low- gently pulls arm back, 0 = absence of any restraining behaviors) toddlers' Overall Touch tended to increase by 0.04 in an average interval (mean per interval = .27, range per interval 0 - 6). Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Physical Restraint and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Physical Restraint and Overall Touch to vary among dyads would significantly improve model fit ($X_D^2$ = 9.40, df = 2, $p < 0.01$). Indeed, when the association between lagged maternal Physical Restraint and Overall Touch was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant (p <.001), suggesting that dyads varied in the association between lagged maternal Physical Restraint and Overall Touch. In the random-intercept random-slope model (Model 2), for every unit increase in lagged maternal Physical Restraint, toddlers' Overall Touch marginally increased by 0.05 ($p$ = .05) in an average interval ( mean per interval = .27, range per interval 0 - 6).

Table 48

*Effects of Lagged Maternal Physical Restraint on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.57^{***}$ | 0.11 | $0.54^{***}$ | 0.11 |
| Gender | -0.02 | 0.05 | -0.04 | 0.06 |
| Physical Restraint | $0.04^{\dagger}$ | 0.03 | $0.05^{\dagger}$ | 0.03 |
| Linear ET | $-0.01^{**}$ | 0.00 | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.07^{***}$ | 0.27 | $0.09^{***}$ | 0.29 |
| $u_{\text{Phy-RST, j}}$ | - | - | 0.03 | 0.16 |
| $e_{ij}$ | 0.28 | 0.53 | 0.27 | 0.52 |
| *Deviance* | 2465.63 | | 2456.22 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Negative Emotional Reactions***. A two-level hierarchical model examined the effects of lagged maternal Negative Emotional Reactions on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{Neg-Aff}}(\text{Neg-Aff}_{i-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Negative Emotional Reactions (e.g., harsh tone, laughs to mock child) was not associated with Overall Touch but was in the expected direction (Table 49) in model with robust standard errors. However, in the same model, the $p$-value associated with the slope coefficient estimated with non-robust standard errors was < 0.05 suggesting that for every unit increase in lagged maternal Negative Emotional Reactions, toddlers' Overall Touch increased by 0.30 in an average interval (mean per interval = .27, range per interval 0 - 6). Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Negative Emotional Reactions and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Negative Emotional Reactions and Overall Touch to vary among dyads would significantly improve model fit ($X_D^2$ = 18.45, df = 2, $p < 0.001$). Indeed, when the association between lagged maternal Negative Emotional Reactions and Overall Touch was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant ($p < .05$), suggesting that dyads varied in the association between lagged maternal Negative Emotional Reactions and Overall Touch. Effects of lagged maternal Negative Emotional Reactions on Overall Touch remain non-significant in Model 2.

Table 49
*Effects of Lagged Maternal Negative Emotional Reactions on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.60^{***}$ | 0.11 | $0.59^{***}$ | 0.11 |
| Gender | -0.02 | 0.05 | -0.01 | 0.05 |
| Negative Emotional Reactions | $0.30^{*}$ | 0.24 | 0.17 | 0.00 |
| Linear ET | $-0.01^{**}$ | 0.00 | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.07^{***}$ | 0.27 | $0.06^{***}$ | 0.25 |
| $u_{\text{Neg-Aff, j}}$ | - | - | $0.00^{**}$ | 0.60 |
| $e_{ij}$ | 0.28 | 0.53 | 0.27 | 0.52 |
| *Deviance* | 2459.45 | | 2441.001 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$; for Model 1, the *p*-value associated with the slope coefficient estimated with non-robust standard errors was < 0.05 for Negative Emotional Reactions

**Question 3B Summary of Results.** In summary, toddlers' average Overall Touch (higher scores indicate lower ability to wait), significantly (non-robust *p*-value) differed between

10s intervals (within dyad variance) based on the amount of Negative Emotional Reactions their mothers displayed in a previous interval. As expected, as mothers displayed more Negative Emotional Reactions in a previous interval, toddlers touched and attempted to touch the keys more often. Furthermore, toddlers' average Overall Touch marginally differed between 10s intervals based on the amount of Negative Commands, and Physical Restraint their mothers displayed in a previous interval. As hypothesized, mothers' higher amounts of Negative Commands and higher levels of Physical Restraint in previous intervals were marginally associated with more toddlers' Overall Touch in current intervals. Among all significant predictors in Question 3B, lagged maternal Negative Emotional Reactions were most strongly related (*p*-value significant with non-robust standard errors) to more Overall Touch, while lagged maternal Overall Negative Commands was least strongly (and marginally) related to Overall Touch. After accounting for variance within toddlers, while toddlers' Overall Touch scores were significantly different between toddlers ($u_{0j}$), gender differences could not significantly explain this amount of variance. Given that there was not a large amount of between dyad variance in Overall Touch in the intercept only model ($u_{0j} = 0.08$, $p < .001$), and that only 20% of the overall variance was explainable by any level-2 fixed (e.g. toddler gender) and random effects (e.g., error terms associated with random intercept and slope), it was not surprising that level-2 explanatory variables were not significantly related to Overall Touch. In other words, there was very little between dyad variance to explain, suggesting that toddlers were more similar in their ability to refrain from touching the keys (i.e., delay gratification or wait) than they were different. As mentioned previously, toddlers' Overall Touch was observed as a count variable and was positively skewed (M = 0.27, SD = 0.61, Skewness = 2.94) such that majority of toddlers touched the keys 0 times for majority of intervals (94.0%, n = 1477).

**Research Question 4A: The Random Intercept Model Predicting Overall Touch from Lagged Independent Toddlers' Regulatory Strategies.** Effects of toddler variables in Question 4A were examined and are presented below. A summary of all model results in provided in Table 50[35]. Model results for each predictor are then presented in the following pages (Tables 51-54). Model results for non-significant predictors (T-INI-Vdes) are presented in Appendix I (Table I18).

Table 50

*Question 4A. Do Lagged Toddlers' Regulatory Strategies predict toddlers' Overall Touch (Count)*

| | | Model 1 - Random Intercept Fixed Slope | | Model 2 - Random Intercept Random Slope | | | |
|---|---|---|---|---|---|---|---|
| Lagged Toddler Variables in Question 4A | Variable Label | Does X significantly predict Y? | Is directionality as hypothesized? | Does X predict Y? | Does X-Y slope vary over dyads? | Does freeing slope significantly reduce misfit? | Is directionality as hypothesized? |
| Independent Regulatory Strategies | | | | | | | |
| **Initiated Verbal Distraction** | **T-INI-VDis** | **Yes** | **Yes (Neg)** | **Yes** | **No** | **No** | **Yes (Neg)** |
| Initiated Non-Verbal Distraction | T-INI-nonVDis | Yes† | Yes (Neg) | Yes | No | No | Yes (Neg) |
| Initiated Verbal Keys | T-INI-Vkeys | Yes† | Yes (Neg) | No | No | No | Yes (Neg) |
| Initiated Verbal Self-Control | T-INI-Vctrl | - | - | - | - | - | - |
| Initiated Verbal Desire | T-INI-Vdes | No | No (Pos) | No | Yes | No | No (Pos) |
| Self-Comfort | T-SComf | Yes | Yes (Neg) | Yes | No | Yes | Yes (Neg) |

*Note*. All Toddlers' Regulatory Strategies were predicted to be positively associated with outcome. 4A strategies are toddler initiated and don't involve mother, 4B strategies involve mother or are in response to mother. **Bold** font indicates largest slope coefficient. *Italics* font indicates X became significant predictor in model 2. * = *p*-value for slope coefficients with Non-Robust standard errors were < .05. All results report p-values for models estimated with robust standard errors. † = $p < .10$. Non-significant estimates and unexpected directionality are in red.

[35] Also provided in on page 7 of Supplemental Materials

***Lagged Toddler Initiated Verbal Distraction***. A two-level hierarchical model examined the effects of lagged toddler Initiated Verbal Distraction on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{\text{T-INI-Vdis}}\,(\text{T-INI-VDis}_{i-1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of Overall Touch was significantly associated with lagged Toddler Initiated Verbal Distraction as hypothesized in the expected negative direction (Table 51). For every unit increase in lagged Toddler Initiated Verbal Distraction (e.g., toddler says "chair" or sings) toddlers' Overall Touch significantly decreased by 0.23. On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6).

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Initiated Verbal Distraction and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Initiated Verbal Distraction and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 2.08, df = 2, $p > 0.05$). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged Toddler Initiated Verbal Distraction and Overall Touch does not vary between dyads. In the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Initiated Verbal Distraction, toddlers' overall expression of negative emotion significantly decreased by 0.20 ($p < 0.001$) in an average interval (mean per interval = .27, range per interval 0 - 6). The results of more parsimonious model are presented in Table 51.

Table 51

*Effects of Lagged Toddler Initiated Verbal Distraction on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.69^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 |
| Initiated Verbal Distraction | $-0.23^{**}$ | 0.08 |
| Linear ET | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Initiated Non-Verbal Distraction***. A two-level hierarchical model examined the effects of lagged Toddler Initiated Non-Verbal Distraction on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Vocab}}(\text{Vocab}_j) + \gamma_{\text{T-INI-nonVdis}}(\text{T-INI-nonVDis}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of Overall Touch was significantly associated with lagged Toddler Initiated Non-Verbal Distraction as hypothesized in the expected negative direction (Table 52). For every unit increase in lagged Toddler Initiated Non-Verbal Distraction (e.g., toddler says "chair" or sings) toddlers' Overall Touch decreased by 0.23. On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6).

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Initiated Non-Verbal Distraction and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Initiated Non-Verbal Distraction and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 2.11, df = 2, $p > 0.05$). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged Toddler Initiated Non-Verbal Distraction and Overall Touch does not vary between dyads. In the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Initiated Non-Verbal Distraction, toddlers' overall expression of negative emotion significantly decreased by 0.05 ($p = 0.04$) in an average interval (mean per interval = .27, range per interval 0 - 6). The results of more parsimonious model are presented in Table 52.

Table 52

*Effects of Lagged Toddler Initiated Non-Verbal Distraction on Overall Touch*

| | Model 1 | |
|---|---|---|
| Fixed Effects | Coefficient | S.E |
| Intercept | $0.71^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 |
| Initiated Non-Verbal Distraction | $-0.04^{\dagger}$ | 0.03 |
| Linear ET | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.27 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Initiated Verbal Keys.*** A two-level hierarchical model examined the effects of lagged Toddler Initiated Verbal Keys on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{\text{T-INI-Vkeys}}\,(\text{T-INI-Vkeys}_{i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of Overall Touch was marginally associated with lagged Toddler Initiated Verbal Keys as hypothesized in expected negative direction (Table 53). For every unit increase in lagged Toddler Initiated Verbal Keys (e.g., says "keys" "turtle is sleeping") toddlers' overall expression of negative emotion marginally decreased by 0.07. On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6).

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Initiated Verbal Keys and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Initiated Verbal Keys and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 0.36, df = 2, $p > 0.05$). Additionally, the p-value associated with random slope was not significant suggesting that the association between lagged Toddler Initiated Verbal Keys and Overall Touch does not vary between dyads. Effects of lagged Toddler Initiated Verbal Keys on Overall Touch become non-significant in Model 2.

Table 53

*Effects of Lagged Toddler Initiated Verbal Keys on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.70^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 |
| Initiated Verbal Keys | $-.07^{\dagger}$ | 0.04 |
| Linear ET | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Initiated Verbal Self-Control***. No instances of Toddler Initiated Verbal Self-Control (e.g., I wait", "No touch"" were observed. All Verbal Self-Control was directed toward or in response to mom and coded as Toddler Initiated Verbal Self-Control – Bids to Mom under dependent regulatory strategies.

***Lagged Toddler Self-Comfort***. A two-level hierarchical model examined the effects of lagged toddler Self-Comfort on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Vocab}}(\text{Vocab}_j) + \gamma_{\text{T-Scomf}}(\text{T-Scomf}_{\,i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of Overall Touch was significantly associated with lagged Toddler Self-Comfort as hypothesized in expected negative direction (Table 54). For every unit increase in lagged Toddler Self-Comfort (e.g., e.g., thumb sucking, rocking back and forth) toddlers' Overall Touch significantly decreased by 0.08. On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6).

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Self-Comfort and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Self-Comfort and Overall Touch to vary among dyads would significantly improve model fit ($X_D^2$ = 10.58, df = 2, $p$ < 0.01). However, the $p$-value associated with random slope was not significant suggesting that the association between lagged Toddler Self-Comfort and Overall Touch does not vary between dyads. In the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Self-Comfort, toddlers' Overall Touch significantly decreased by 0.09 ($p < 0.001$) in an average interval (mean per interval = .27, range per interval 0 - 6). Expressive vocabulary was no longer marginally associated with Overall Touch in Model 2.

Table 54
*Effects of Lagged Toddler Self-Comfort on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.76^{***}$ | 0.14 | $0.72^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 | -0.00 | 0.001 |
| Self-Comfort | $-0.08^{***}$ | 0.02 | $-.09^{***}$ | 0.02 |
| Linear ET | $-0.01^{**}$ | 0.00 | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.07^{***}$ | 0.27 | $0.10^{***}$ | 0.31 |
| $u_{\text{T-Scomf, j}}$ | - | - | 0.01 | 0.11 |
| $e_{ij}$ | 0.28 | 0.53 | 0.27 | 0.53 |
| *Deviance* | 2421.10 | | 2410.42 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 4A Summary of Results.** In summary, while no gender effects on Overall Touch were observed, on average, toddlers with more expressive vocabulary displayed marginally less amounts of Overall Touch across the two-minute task, after each toddler independent regulatory strategy (Question 4A) from a previous 10s interval was accounted for in separate multilevel models. Toddlers' Overall Touch significantly differed between 10s intervals (within dyad variance) based on the amount of initiated verbal and non-verbal distractions and self-comforting behaviors they displayed in a previous interval. Additionally, marginal associations were found for lagged verbalization about keys. No effects were found for lagged toddler independent verbal desire (unexpected positive direction). Zero instances of independent verbalizations in the form of self-direction were observed.

As hypothesized, toddlers touched or attempted to touch the keys less often, when they had initiated verbal distractions (e.g., "chair", singing) and non-verbal distractions (e.g., look away for more than 3s) in a previous interval. Additionally, as hypothesized, toddlers touched or attempted to touch the keys less often, when they had displayed self-comforting behaviors (e.g., rocking back and forth) in a previous interval. Although lagged independent verbalizations about desire states were not significantly associated with Overall Touch, as toddlers used more statements that described the keys or reframed the task (e.g., “keys” “wake up turtle”) in a previous interval, they displayed marginally fewer Overall Touch as expected. Among all significant predictors in Question 4A, lagged toddler initiated verbal distraction was most strongly associated with less Overall Touch, while lagged non-verbal initiated distraction was least strongly associated with less Overall Touch.

**Research Question 4B: The Random Intercept Model Predicting Overall Touch from Lagged Dependent Toddlers’ Regulatory Strategies.** Effects of toddler variables in Question 4B were examined and are presented below. A summary of all model results in provided in Table 55[36]. Model results for each predictor are then presented in the following pages (Tables 56-57). Model results for non-significant predictors (T-JNT-VDis, T-JNT-nonVDis, T-Vkeys-2M, T-Vctrl-2M, and T-Vdes-2M are presented in Appendix I (Table I19-I23).

[36] Also provided in on page 7 of Supplemental Materials

Table 55

*Question 4B. Do Lagged Toddlers' Regulatory Strategies predict toddlers' Overall Touch (Count)*

| | | Model 1 - Random Intercept Fixed Slope | | Model 2 - Random Intercept Random Slope | | | |
|---|---|---|---|---|---|---|---|
| Lagged Toddler Variables in Question 4B | Variable Label | Does X significantly predict Y? | Is directionality as hypothesized? | Does X predict Y? | Does X-Y slope vary over dyads? | Does freeing slope significantly reduce misfit? | Is directionality as hypothesized? |
| Dependent Regulatory Strategies | | | | | | | |
| ***Verbal Distraction-Bids to Mom*** | ***T-VDis-2M*** | ***No*** | ***Yes (Neg)*** | ***Yes*** | ***No*** | ***No*** | ***Yes (Neg)*** |
| Joined Verbal Distraction | T-JNT-VDis | No | Yes (Neg) | No | No | No | Yes (Neg) |
| Joined Non-Verbal Distraction | T-JNT-nonVDis | No | Yes (Neg) | No | No | No | Yes (Neg) |
| Verbal Keys – Bids to Mom | T-Vkeys-2M | No | No (Pos) | No | No | No | No (Pos) |
| Verbal Self-Control- Bids to Mom | T-Vctrl-2M | No | Yes (Neg) | No | No | No | Yes (Neg) |
| Verbal Desire – Bids to Mom | T-Vdes-2M | No | No (Pos) | No | Yes | Yes | No (Pos) |
| **Physical Comfort Seeking** | **T-ComfSk** | **Yes**† | **Yes (Neg)** | **Yes** | **Yes** | **Yes** | **Yes (Neg)** |

Note. All Toddlers' Regulatory Strategies were predicted to be positively associated with outcome. 4A strategies are toddler initiated and don't involve mother, 4B strategies involve mother or are in response to mother. **Bold** font indicates largest slope coefficient. *Italics* font indicates X became significant predictor in model 2. * = *p*-value for slope coefficients with Non-Robust standard errors were < .05. All results report p-values for models estimated with robust standard errors. † = *p* < .10. Non-significant estimates and unexpected directionality are in red.

***Lagged Toddler Verbal Distraction-Bids to Mom***. A two-level hierarchical model examined the effects of lagged Toddler Verbal Distraction-Bids to Mom on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{T\text{-}Vdis\text{-}2M}\,(\text{T-Vdis-2M}_{\,i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Verbal Distraction-Bids to Mom (e.g., "I want bottle" said to mom or initiated singing while looking at mom) was not associated with Overall Touch but was in expected negative direction (Table 56). On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6).

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Verbal Distraction-Bids to Mom and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Verbal Distraction-Bids to Mom and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 5.60, df = 2, $p > 0.05$). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged Toddler Verbal Distraction-Bids to Mom and Overall Touch does not vary between dyads. Additionally, in the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Verbal Distraction-Bids to Mom, toddlers' overall expression of negative emotion significantly decreased by 0.07 ($p = 0.02$) in an average interval (mean per interval = .27, range per interval 0 – 6) as hypothesized in the expected direction.

Table 56

*Effects of Lagged Toddler Verbal Distraction-Bids to Mom on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.70^{***}$ | 0.13 | $0.69^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 | $-0.00^{\dagger}$ | 0.001 |
| Verbal Distraction-Bids to Mom | -0.03 | 0.03 | $-0.07^{*}$ | 0.03 |
| Linear ET | $-0.01^{**}$ | 0.00 | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 | $0.08^{***}$ | 0.28 |
| $u_{\text{T-Vdis-2M}, j}$ | - | - | 0.03 | 0.16 |
| $e_{ij}$ | 0.28 | 0.53 | 0.28 | 0.53 |
| *Deviance* | 2430.19 | | 2424.58 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Physical Comfort Seeking***. A two-level hierarchical model examined the effects of lagged Toddler Physical Comfort Seeking on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Vocab}}(\text{Vocab}_j) + \gamma_{\text{T-ComfSk}}(\text{T-ComfSk}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Results of final estimated model revealed that on average, levels of Overall Touch was significantly associated with lagged Toddler Physical Comfort Seeking as hypothesized in expected negative direction (Table 57). For every unit increase in lagged Toddler Physical Comfort Seeking (e.g., e.g., reaching arms up to mother, hugging mother, leaning on mother's body) toddlers' Overall Touch marginally decreased by 0.07. On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6).

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Physical Comfort Seeking and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Physical Comfort Seeking and Overall Touch to vary among dyads would significantly improve model fit ($X_D^2$ = 14.59, df = 2, $p < 0.01$). Indeed, when the association between lagged Toddler Physical Comfort Seeking and Overall Touch was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p$ <.01), suggesting that dyads varied in the association between lagged Toddler Physical Comfort Seeking and Overall Touch. In the random-intercept random-slope model (Model 2), for every unit increase in lagged Toddler Physical Comfort Seeking, toddlers' overall expression of negative emotion significantly decreased by 0.07 ($p$ = 0.03) in an average interval (mean per interval = .27, range per interval 0 - 6).

Table 57

*Effects of Lagged Toddler Physical Comfort Seeking on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.71^{***}$ | 0.13 | $0.70^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 | $-0.00^{\dagger}$ | 0.001 |
| Physical Comfort Seeking | $-0.07^{\dagger}$ | 0.04 | $-0.07^{*}$ | 0.03 |
| Linear ET | $-0.01^{**}$ | 0.00 | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 | $0.10^{***}$ | 0.31 |
| $u_{\text{T-ComfSk, j}}$ | - | - | $0.02^{**}$ | 0.14 |
| $e_{ij}$ | 0.28 | 0.53 | 0.28 | 0.53 |
| *Deviance* | 2427.73 | | 2413.14 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 4B Summary of Results.** In summary, while no gender effects on Overall Touch were observed, on average, toddlers with more expressive vocabulary displayed marginally less amounts of Overall Touch across the two-minute task, after each toddler dependent regulatory strategy (Question 4B) from a previous 10s interval was accounted for in separate multilevel models. Toddlers' Overall Touch significantly differed between 10s intervals (within dyad variance) based on the amount of verbal distractions – bids to mom, and amount of physical comfort seeking they displayed in a previous interval.

As hypothesized, toddlers touched or attempted to touch the keys less often, when they had initiated verbal distractions (e.g., “chair”, singing while *also* looking at mom; random-intercept random slope model). Additionally, as expected, toddlers touched or attempted to touch the keys less often, when they had  sought physical comfort from mom (e.g., leaning on mom). Slope coefficients for both lagged initiated verbal distractions with Overall Touch and lagged physical comfort seeking with Overall Touch were the same.

Unexpectedly, majority of lagged dependent strategies were not significantly associated with Overall Touch including lagged toddler joined verbal distraction, lagged toddler joined non-verbal distraction, lagged verbalizations about keys, lagged verbalizations of self-control, or lagged verbalizations of desire states. While these associations were not significant, distraction strategies were in the expected negative direction with Overall Touch scores, while verbalizations about keys and desire states were in unexpected positive direction, expect for lagged verbalizations in the form of self-control which was in the negative direction as expected.

Summary of both 4A and 4B: In terms of Overall Touch (higher scores reflect lower ability to wait), results provide evidence for effectiveness of lagged independent regulatory strategies and lagged dependent regulatory Strategies. However, these effects must be considered separately for distracting strategies, verbalizations toward the delay task, and physical strategies. In terms of distracting strategies, effects of toddlers’ non-verbal distractions were only significant when they were initiated by toddlers but not when toddlers joined mothers’ initiated non-verbal strategies. Similarly, effects of toddlers’ verbal distractions were stronger when toddlers' verbal distraction was independently initiated, but *not* when directed toward mothers or joined with mothers' initiated verbal distractions.

Among independent verbalizations towards the delay task, toddler-initiated talk that described the keys (e.g., Pooh) was marginally related to less Overall Touch as expected and toddler-initiated talk expressive of internal states (e.g., I need it) was not associated with Overall Touch and was in unexpected positive direction. However, compared to independent verbalizations toward delay task, among dependent verbalizations, talk about keys directed toward or in response to mother were no longer marginally significant and were in unexpected positive direction, verbalization of desire states directed toward or in response to mother remained non-significant and in unexpected positive direction, and verbalizations toward mother in the form of self-direction were in expected negative direction but not significant. Additionally, more physically self-comforting behaviors and comfort seeking behaviors were significantly associated with less Overall Touch.

# CHAPTER 5: Discussion

Given the critical role of self-regulation in developmental psychopathology (Cicchetti, Ackerman, & Izard, 1995), the focus of this study was to examine the contributions of the caregiving context on toddlers' emotional and behavioral regulation. Questions 1 and 2 examined the contributions of maternal regulatory attempts and mind-mindedness on toddlers' expression of negative emotion and delay of gratification. Questions 3 and 4 examined the contributions of toddlers' autonomously initiated (independent) and mother-dependent (dependent) regulatory strategies on toddlers' expression of negative emotion and delay of gratification.

## Overview

Children exposed to early psychosocial stress (e.g., poverty, maternal mental illness) are at greater risk for poor regulatory development and related sequela (Blair & Raver, 2012; Raikes et al., 2007). This study presents a first step in determination of effective parent-toddler co-regulation under a moment-to-moment lens in children from at risk families. The current results provide descriptive strength of each predictor (e.g., slope coefficient) and warrant future analyses examining interactions and combinations of predictors. Examination of interactions and combinations of predictors will provide more robust comparative evidence for effectiveness of each strategy, particularly when in reality strategies co-occur. The results of the study provided evidence for within-individual and between-individual differences in toddlers' expression of negative emotion and ability to wait as measured over 12 units of 10s intervals nested within 134 mother-toddler dyads. As hypothesized, lagged maternal positive emotional reactions (e.g., laughs with child) explained differences in expression of negative emotion (negative slope), while lagged maternal initiated distraction (e.g., counts child's toes) explained differences in ability to wait (negative slope). Within-individual differences in both expression of negative emotion and ability to wait were most strongly explained (positive slope) by lagged maternal negative emotional reactions (e.g., mother becomes upset, laughs at child's distress). Toddlers' lagged independent use of non-verbal distractions (e.g., looks away from delay task/object) and lagged mother-directed verbalizations of self-control ("I wait") were most strongly related to lower expression of negative emotion, while toddlers' lagged independent use of verbal distractions (e.g., sings) and lagged mother-dependent physical comfort (e.g., reaching arms up to mother) were most strongly related higher ability to wait or DG. Study results did not provide evidence for effects of lagged appropriate or non-attuned mind-related comments on expression of negative emotion or ability to wait. Boys expressed negative emotions with higher intensity compared to girls. Toddlers with more expressive language tended to touch the attractive keys less often compared to toddlers with lower scores on expressive language. No gender differences were found for ability to wait.

Next I discuss results for unique effects of Maternal Regulatory Attempts, Mind-Related Comments and Toddlers' Regulatory Strategies on Overall Expression of Negative Emotion and Delay of Gratification. Results are discussed for both emotion expression and ability to wait for each predictor in order to achieve a more cohesive presentation of study findings.

**Unique Effects of Maternal Regulatory Attempts on Emotion Regulation**

Results of multilevel models confirmed study hypotheses for significant effects of Maternal Regulatory Attempts, specifically, lagged positive emotional reactions, lagged negative emotional reactions, lagged initiated distraction, and lagged physical restraint on both expression of negative emotion (emotional regulation) and overall touch (behavioral regulation). Although, findings confirmed study hypotheses for effects of lagged verbal comfort, punitive reactions, and minimizing statements on emotional regulation, no effects were found for verbal comfort, punitive reactions, and minimizing on toddlers' ability to wait.

**Lagged Maternal Emotional Reactions**. As hypothesized lagged positive emotional reactions predicted lower intensity of negative emotional expression, but lower ability to wait. As hypothesized, lagged negative emotional reactions were related to higher intensity of emotional expression and lower ability to wait. As previously mentioned, among all Maternal Regulatory Attempts, lagged emotional reactions were most strongly related to expression of negative emotion and ability to wait, providing support for the relational mechanisms underlying emotional and behavioral regulation (Cole, 2014). Positive emotional reactions may be reflective of a larger supportive parenting construct that has been linked to optimal emotion regulation (Bocknek, Brophy-Herb, & Banerjee, 2009) and delay of gratification across toddler years (Brophy-Herb et al., 2012). Maternal expressions of positive affect influence toddlers' expression by modeling adaptive emotional expressivity and scaffolding positive emotional states (Eisenberg et al., 1998; Morris et al., 2007). Conversely, negative emotional reactions, such as laughing at or becoming angry with an impatient toddler in distress, may be reflective of a caregivers' own dysregulated emotional states, which likely compromise toddlers' attachment-related strategies that regulate affect and organize motivational states and behavior. For instance, maternal negative emotional reactions reflect misalignment of intersubjective states (e.g., continues to display positive affect when toddler is crying), while frightening behaviors (e.g., harshly yells at toddler for reaching for keys) communicate that the mother, herself, is a source of fear. Therefore, maternal expressions of laughter or anger in response to toddlers' frustration may be disorganizing and frightening and, in turn, ineffective in reducing heightened states of toddlers' distress. Not surprisingly, such relational disruptions reflective of frightening and misaligned parent-child interactions are predictive of disorganized attachment patterns characterized by disorganization and dysregulation of emotional and behavioral states, especially heightened emotional states (Lyons-Ruth, Bronfman, & Parsons, 1999; Madigan, Moran, Schuengel, Pederson, & Otten, 2007). Surprisingly, as mothers expressed or shared positive affect, toddlers' overall touch marginally increased in subsequent intervals suggesting that perhaps toddlers in the current sample interpreted maternal positive affect as permission to touch the keys.

**Lagged Maternal Punitive Reactions and Minimizing**. Similar to effects of lagged negative emotional reactions, lagged punitive and minimizing strategies reflective of a negative parent-child relationship contributed to higher intensity of negative emotion expression consistent with previous findings (Feldman et al., 2011), but did not exert main effects on ability to wait. Punitive reactions (e.g., "Bad boy/girl", "You want a spanking?") lead to heightened states of arousal that may be frightening and disorganizing. Minimizing statements encourage children's suppression of emotional expression which may compromise development of physiological regulatory mechanisms by activating the sympathetic nervous system (Gross, 2015). In support of this, previous findings have linked both punitive and minimizing strategies to lower ability to regulate emotional distress and delay gratification across early childhood, which in turn, contribute to social and behavioral problems reflective of deficits in regulatory skills (Eisenberg et al., 2010b; Spinrad et al., 2007b). Null effects of punitive and minimizing on Overall Touch may be related to a number of factors. For one, punitive and minimizing strategies were rarely observed and may only be sufficient to explain variation in emotional intensity (recall that there was more within and between-dyad variation for ENE than Overall Touch). Additionally, while some toddlers may adaptively comply with a punitive and minimizing mother, others may be too emotionally distressed to reach for or touch the keys, all resulting in zero observed instances of Overall Touch. This methodological challenge is further discussed in future directions.

**Lagged Maternal Verbal Comfort**. Contrary to my hypotheses, as mothers provided more verbally comforting statements, toddlers' intensity of negative emotions increased while lagged verbal comfort did not appear to affect ability to wait in the current interval. These findings were not expected because verbally comforting statements, reflective of warm and supportive emotion-related parenting practices, promote competence in emotional and behavioral regulation (Eisenberg et al., 1998). The positive associations between verbally comforting statements and toddlers' expression of higher intensity of negative emotion may be explained by serval factors. For one, statements that acknowledged the child's efforts to wait (e.g., I know you can wait" "I know it is hard to wait", "I know this is not fun") may be perceived as permission to express or continue to express frustration. Second, statements that reassured the child he or she would get the keys soon (e.g. "You can play with them in a minute") may be directing the toddlers' focus on the frustrating task that increases levels of arousal. Third, statements that encourage expression of emotional states (e.g., "Are you ok?", "What is the matter?") may be facilitating expression of negative emotion.  Additionally, it is also likely that toddlers who expressed more intense anger for longer durations elicited more verbally comforting statements from mothers, underscoring the need for future examinations of bidirectional processes not examined in the current study. Furthermore, it may be that comforting statements may not reduce intensity of anger expression but may be more useful to regulate fear or pain in older children. In a study of 3-12 year old cancer patients, children who were offered verbally comforting statements, experienced lower pain and distress related to treatment procedures, likely because verbally comforting statements assure the child that he or she is not alone in experiencing their distress (Cline et al., 2006). However, in the current study, mothers' requests to wait are the source of the toddlers' distress which may make it hard to believe that she really "knows it is hard to wait". Additionally, it may be that the use of verbally comforting statements without offering alternative ways to cope with waiting-induced frustration is not enough to regulate heightened arousal in toddlers but may be effective for older children who have gained alternative regulatory skills as they have transitioned to self-regulation.

**Lagged Physical Comfort and Physical Restraint**. Findings confirmed study hypotheses for marginally positive effects of lagged physical comfort on toddlers' ability to wait, but results did not support effects of lagged physical comfort on toddlers' anger expression, although lagged physical comfort was positively correlated with ENE-O. Similarly, Grolnick et al. (1998) found positive associations for maternal physically comforting behaviors and toddlers' expression of distress during a delay task. These findings suggest that while mothers' initiated physically soothing behaviors such as hugging or kissing the toddler may facilitate behavioral compliance; they do not necessarily regulate emotional arousal but may facilitate expression of frustration related to waiting as evidenced by positive correlations between lagged physical comfort and ENE-O. Furthermore, effects of physical comfort differed among dyads suggesting the need to examine differences in relational characteristics that would moderate the effects of physical comfort. For instance, toddlers may not equally find physical touch soothing based on their attachment status with their mothers. Additionally, higher use of physical restraint was related to lower ability to regulate both emotion and behavior. Physically restraining behaviors may reflect intrusive parenting practices and as suggested by the current findings may not scaffold toddlers' emotional and behavioral in adaptive ways, particularly, at a transitional developmental period in which emerging self-control necessitates parental support for autonomy (Kopp, 1982).

**Lagged Positive and Negative Commands.** Finally, marginal effects were found for lagged positive and negative commands on toddlers' ability to wait. While, only lagged positive commands marginally predicted higher intensity of anger expression, negative commands didn't contribute to intensity of emotional expression. Similarly, Putnam et al., (2002) found that maternal use of negative commands (e.g., "Don't touch", "No") was related to lower compliance in a delay of gratification task for toddlers. These findings suggest that the use of positive commands, such as asking a toddler to wait or reminding them about rules of the task without reason (e.g., "You have to sit down) may hardly be a useful strategy in helping them comply. Also, positive commands do not help toddlers regulate negative emotions while waiting and might even be slightly annoying as evidenced by marginally positive effects on ENE-O. However, the use of negative commands is neither helpful in scaffolding compliance nor does it regulate intensity of anger. In fact, higher use of negative commands was correlated with higher intensity of anger suggesting that "No" "Don't" statements are related to more intense expressions of anger.

**Lagged Maternal Distraction and Verbal Orientation to Delay.** Results of multilevel analyses did not provide evidence for two Maternal Regulatory Attempts including lagged joined distraction and lagged verbal orientation to delay. It should be noted that lagged maternal joined distraction occurred with very little frequency per interval, and, the lack of observed effects may be explained by small amount of variation in these strategies per interval. In fact, while toddlers initiated either verbal or non-verbal distractions not directed toward mothers (range = 0-6), and, verbal distractions specifically directed toward mothers (range = 0-4), maternal joined distractions only occurred 0-2 times per interval suggesting that mothers were not joining toddlers in their initiated distractions all that often. Although study hypotheses were not confirmed in multilevel models for effects of lagged joined distraction, it appears that as mothers joined toddlers' initiated distractions (e.g., toddler starts counting her toes and mother joins in counting toes), toddlers expressed lower intensity of negative emotions and less overall touch as suggested by negative slopes and significant negative correlations. These findings are consistent with previous studies in which mothers initiated more attention shifting strategies compared to joining their children's initiated distracting behaviors in a sample of children between 4 and 9 years old (Morris et al., 2011). As hypothesized, lagged maternal initiated distractions (e.g., engaging child in non-task related activity) predicted lower anger expression and higher ability to wait suggesting that distractions are useful in immediate regulation of emotional distress and may facilitate compliance in the short term. Similarly, Putnam et al. (2002) found that maternal use of distraction facilitates toddler's ability to wait. However, given previous mixed findings on the effectiveness of distraction as an adaptive regulatory strategy (Grolnick et al., 1998, Spinrad et al., 2004), long-term effects of distraction on children's self-regulation remain to be understood. In the current study, lagged maternal initiated distraction was most strongly related to toddlers' higher compliance but least strongly related to lower levels of overall expression of negative emotion. Thus, distraction may be an adaptive short term strategy for behavioral regulation, specifically ability to wait (Cole et al., 2011), but may not contribute in the same way or magnitude to emotion regulation. Finally, lagged verbal orientation to delay (e.g., "Keys" "Pooh is sleeping") did not predict differences in expression of negative emotion or delay of gratification. Similarly, orientation to delay occurred very infrequently per interval and, as evidenced by significant negative correlations, regulatory effects of describing or reframing the task may have been more pronounced for current interval expression of negative emotion discussed further in future directions below.

**Unique Effects of Mind-Mindedness on Emotion Regulation and Delay of Gratification**

Contrary to my hypotheses, lagged mind-related comments did not contribute to differences in toddlers' overall expression of negative emotion or their ability to wait. These null findings may be explained and interpreted in several ways. Null results are discussed separately for appropriate and for non-attune mind-related comments.

**Appropriate Mind-Related Comments.** To date, studies that provide evidence for effects of appropriate mind-related comments on developmental outcomes have often assessed mind-mindedness in the first and second years of life, while social, emotional, and behavioral outcomes have been assessed in 3-10 year olds. Thus, suggesting that effects of appropriate mind-related comments may be expected to manifest as development unfolds over time. For instance, exposure to appropriate mind-related comments in infancy contributes to mechanisms underlying emotional expression and delay of gratification, such as effortful control (Eisenberg et al., 2010a; Spinrad et al., 2007b), in the third and fourth years of life (Bernier et al., 2017; Gagne et al., 2017). Additionally, exposure to appropriate mind-related comments in infancy contribute to lower behavioral problems reflective of deficits in emotional and behavioral regulation (e.g., impulsivity) in 4-5 year olds (Meins et al., 2013), and 10 year olds (Centifanti et al., 2016). In our own work, we have found that maternal representational mind-mindedness and emotion bridging, reflective of a larger mentalization-related parenting construct measured in 18-35 month-olds is associated with toddlers' effortful control and generation of adaptive regulatory strategies 6 months later (Senehi et al., 2018). Therefore, it seems reasonable that effects of appropriate mind-related comments on emotion expression or the ability to wait may not be sustained immediately (as suggested by current findings). Instead, appropriate mind-related comments may be expected to be consequential for regulatory competence *over time* through maturation of multiple mechanisms that underlie variations in emotion expression and delay of gratification (e.g., effortful control, generation of effective regulatory strategies, mental state talk/understanding).

First, development of effortful control undergoes rapid maturational shifts in the second and third years of life (Eisenberg et al., 2010a; Spinrad et al., 2007a). Also, as children enter the third and fourth years of life, they become markedly more effective (compared to 18-24 month olds) in generation of regulatory strategies (e.g. distraction) to regulate anger related to waiting (Cole et al., 2011). In fact, subcomponents of self-regulation including emotional, attentional, and behavioral control continue to mature and do not become fully integrated until the fourth and fifth years of life (Bell & Deater-Deckard, 2007; Bridgett et al., 2015; Cole et al., 2011; McClelland & Cameron, 2012).

Secondly, as previously mentioned, exposure to mind-related comments facilitate children's identification, understanding, and interpretation of mental states in themselves and others (Laranjo et al.., 2010; Symons et al., 2006), and promote toddlers' mental state language (Taumoepeau & Ruffman 2008). In turn, these skills are used to generate adaptive regulatory strategies (e.g., bids to caregiver) that help regulate emotion, attention and behavior (Eisenberg et al., 1998; Cole et al., 2010). Similar to maturation of effortful control and self-regulation, mental state understanding and mental state language develop over time. For instance, children understand desire states before they can accurately judge a person's beliefs or emotional states (Wellman & Liu, 2004). Additionally, longitudinal findings (Becker-Razuri, Hiles-Howard, Purvis, & Cross, 2017), suggest that children's use of mental state language emerges in the second year of life and significantly increase in third and fourth years with consistently more use of desire words (e.g., want) than cognitive words (e.g., know). Previous studies that have assessed mind-related comments during play or book sharing task have similarly found that mind-related comments occur with low frequency (Brophy-Herb et al., 2015; Meins et al., 2001). In spite of small amounts of variation, mind-related comments still uniquely contribute to child outcomes (Brophy-Herb et al., 2015; Meins et al., 2001). Thus, although appropriate mind-related comments may not contribute to expression and ability to wait immediately, accumulation of exposure to mind-related comments may exert effects over time.

**Non-Attuned Mind-Related Comments.** To our knowledge, this is the first study to examine effects of non-attuned mind-related comments on toddlers' overall expression of negative emotion and delay of gratification. It was expected that lagged non-attuned mind-related comments reflective of maternal imposition of her own agenda (e.g., "You want to play with mama") and misunderstanding of toddlers' mental states (e.g., "You don't want to touch the keys" while toddler is ) would be related to higher expression of negative emotion and lower ability to wait in current intervals. However, lagged non-attuned mind-related comments did not predict toddler's differences in overall intensity of negative emotion expression or ability to wait in current intervals. These null findings may be explained by small amount of variance in maternal mind-related comments per interval. But, these findings may also be clarified by significant fixed effects of current interval non-attuned mind-related comments on current-interval expression of negative emotion and delay of gratification, and, significant correlations between non-attuned mind-related comments with maternal and toddler regulatory strategies as discussed in future directions.

## Unique Effects of Toddlers' Regulatory Strategies on Emotion Regulation and Delay of Gratification

Overall toddlers used distractions, verbalizations about the delay task, and physically comforting behaviors to regulate emotional intensity and ability to wait. On average, toddlers most frequently used non-verbal strategies including self-comforting, physical comfort seeking, as well as initiated and joined non-verbal distraction, while they least frequently used verbal strategies such as verbal distraction directed to self or mothers or in response to mothers' initiated distractions. Additionally, toddlers displayed verbalization strategies about the delay task least frequently either toward self or toward mothers. Presentations of these strategies confirm previous studies (Cole et al., 2011; Grolnick et al. 1996) that found similar variations in toddlers' emerging regulatory skills. These findings are also in line with developmental models that emphasize the emergence of self-control during the 2$^{nd}$ year of life as toddlers begin to acquire more autonomy in motor and language skills (Kopp, 1982, Spinrad et al., 2004; Premo & Kiel, 2014). Given the current study's findings, it appears that toddlers' regulatory strategies were more strongly effective for regulation of emotions than they were for regulation of behavior. This finding may be explained by low amounts of between-dyad variation in toddlers' ability to wait relative to high amount of between-dyad variation in toddlers' overall intensity of negative emotion. In general, the effectiveness of toddlers' regulatory strategies on both emotion regulation and delay of gratification appeared to be of equal magnitudes and directionality (based on slope coefficients), regardless of independently initiated (not directed toward mothers) or mother-dependent strategy use (mother-initiated or directed toward mother). Notably, similar amounts of variations were observed for both autonomously initiated strategies not directed toward mother (independent regulatory strategies) and initiated and joined strategies that were directed or in response to mother (dependent regulatory strategies). These similarities in effects and variations between independent and dependent regulatory strategies may be explained by Calkins and colleagues' (2008) findings, which suggest that the mere presence of a caregiver contributes to adaptive physiological regulation (e.g., suppression of respiratory sinus arrhythmia) in toddlers compared to tasks in which children are left to regulate independently. Given that the mothers were sitting next to the toddlers on the same mat and were not told to refrain from interacting with the toddlers, independent regulatory strategies are only "independent" in that they are self-initiated and not in response to mother. Therefore, it is plausible that toddlers' selection, generation, and effectiveness of independent regulatory strategies may differ in tasks where mothers are absent or directly asked not to interact with their toddlers.

**Lagged Toddlers' Distraction.** As hypothesized, toddlers' ability to utilize distraction as a regulatory strategy was associated with lower intensity and predominance of anger expression and higher ability to wait, consistent with previous findings (Cole et al., 2011). As previously discussed, use of distraction appears to be an adaptive short-term strategy for tolerating frustration while waiting. The current findings also suggest that verbal distractions help toddlers wait, but, do not help them tolerate frustration while waiting, unless they are joining their mothers' initiated verbal distractions. However, non-verbal distractions (either initiated or joined) appear to help toddlers tolerate frustration (e.g., express lower intensity of negative emotions), but don't necessarily affect their ability to wait to the same extent. These findings point to different pathways (e.g. joint attention) for effects of verbal and non-verbal distraction.

**Lagged Toddlers' Physical Self-Comfort and Comfort Seeking**. Additionally, toddlers' ability to self-comfort (e.g., thumb sucking) was related to lower intensity of overall expression and higher ability to wait as hypothesized. However, toddlers' comfort seeking behaviors (e.g., leans on mother) were effective in delaying gratification but exerted no effects on regulation of emotional expression. Similarly, Gilliom et al. (2002) found that toddlers' comfort seeking was unrelated to changes in toddlers' anger expression in low-income families. This null finding may have been a result of coding challenges. Recall that toddlers received a code for comfort seeking if they leaned on their mothers. It is possible that we may have overlapped leaning with other "leaning-like" behaviors such as wiggling or arching back that were not necessarily leaning for comfort but reflective of bodily movements common when one is attempting to regulate while waiting. Also, effects of comfort seeking may be more pronounced in fear induced tasks where environmental threats such as novelty activate attachment-related behaviors such as seeking physical proximity.

**Lagged Toddlers' Verbalizations about Delay Task/Object**. Consistent with previous findings, toddlers lagged verbalizations about the keys (e.g. "Pooh", "Turtle is sleeping"), predicted higher intensity of negative emotion (Gilliom et al., 2002; Grolnick et al., 1996), but lower overall touch, suggesting that as toddlers focused on the delay task, expression of frustration was harder to suppress, especially when this specific form of focus was enabling them to wait. On the other hand, toddlers' verbalizations of desire states (e.g., "I want it") made it harder to suppress intensity of emotional expression but had no effects on ability to wait. However, in models where the association between toddlers' verbalization of desire states and expression of negative emotion was allowed to vary between dyads, slopes were in expected negative directionality. These results suggest that as toddlers made more verbalizations expressive of their internal desire states, they tended to display higher intensity levels of negative emotion, but this finding was not true when verbalizations were in response to mother or directed toward mother. In addition, using desire talk not directed toward mother was correlated with higher negative emotion intensity and lower ability to wait, while these associations disappeared when toddlers engaged their mothers in their expressions of desire states. These findings provide preliminary empirical support for Cole et al.'s (2010) theoretical assertion that children use language to facilitate self-regulation by expressing needs to caregivers. This is further supported by the negative effects of toddlers' verbalization of rule-statements on toddlers' overall expression of negative emotion, which only occurred in response to or directed toward mother. As toddlers verbalized statements reflective of self-control ("I wait"), directed that verbalization toward mother, or responded with that verbalization to their mothers, they suppressed anger expression in next intervals. Toddlers' verbalization in form of self-control appeared to be the most effective regulatory strategy among all regulatory strategies for both emotion and behavioral regulation. These findings further suggest that verbalization of desire states and self-control may only facilitate regulation in context of a positive parent-child relationship beyond toddlers' expressive language skills. In other words, toddlers who have the expressive language but don't have access to their mothers' engaged or available attention don't use their verbal strategies to regulate.

**Strengths and Limitations**

It should be noted that findings of the current study present preliminary models in the examination of maternal socialization efforts and toddlers' regulatory strategies on overall intensity of negative emotion expression and ability to wait. Given that I did not propose any interactional effects to explain variance in slopes of explanatory variables, each model only focused on the unique contribution of one regulatory strategy at a time. However, in real time these strategies co-occurred. For example, a mother who initiated a distracting activity may have also expressed positive affect while doing so. Such co-occurrences of socialization strategies warrant future analyses where multiple regulatory strategies are tested in a single model and point to future directions in modeling interactions between strategies and accounting for effects of more than one strategy in a single model.

One of the strengths of the current study lies in the multilevel modeling approach utilized to answer study questions. First, the examination of effects of lagged strategies on current-interval ENE-O and Overall Touch adequately address the temporal contingencies embedded in the operationalization of emotion regulation (Cole et al., 2011). While majority of studies to date have provided cross-sectional and correlational evidence for links between maternal socialization efforts (often assessed with questionnaires) and toddlers' self-regulation, the results of this study provide evidence for directionality of effects (e.g., ENE and DG follow maternal or toddler strategies). In line with previous work on effects of time-varying maternal behaviors on emotion regulation, significant effects of strategy use on emotion expression in the current study provide evidence for effectiveness of a strategy's regulatory role (Morris et al., 2011).

Maternal socialization efforts are often measured with interview or self-report methods concurrently or with large time gaps between predictors and outcomes. However, results of the currently employed longitudinal approach (10s repeated measurement occasions), highlight immediacy of effects (e.g., within 20s time frame) of observed moment-to-moment socialization and regulation strategies. Furthermore, results of the currently employed multilevel approach (nesting repeated measurements in mother-toddler dyads), identified the amount of observed variation in overall expression of negative emotion and ability to wait associated with time-varying influences (e.g., MRAs) above and beyond trait-like factors (e.g., gender).

**Coding Related Challenges.** It should be noted that the current study's frustration paradigm, The Delay of Gratification Task, did produce sufficient distress in toddlers. While around 10% of toddlers did not express any negative emotion at any point during the task, around 60% expressed mild levels of intensity, and 30 % of toddlers expressed moderate to severe levels of intensity at some point during the task. Also, while minority (around 20% ) of toddlers did not touch or make any attempts to touch the keys at any point during the task, majority of toddlers (around 80%) either touched or attempted to touch the keys at some point during the task.

One of the strengths of the present study is the way in which variables were coded in every 10s interval using extensive observational coding schemes. However, coding related challenges were present. For instance, maternal regulatory attempts and toddlers' regulatory strategies were not always mutually exclusive and could simultaneously co-occur. For instance, mothers could hug the toddler while praising him/her verbally, or mothers could hug the toddler while minimizing his/her expression of negative emotion. One way to account for these overlaps is to examine effects of multiple regulatory attempts in a single model. Additionally, in some cases mind-related comments could be classified as maternal initiated distractions (e.g., "Do you want to count your toes?"; see Appendix A). Future examinations need to consider distinctions between the effects of non-attuned mind-related comments that cannot be distractions (e.g., "You don't want to touch the keys") and those that could be distractions. Furthermore, appropriate mind-minded vs. not attuned should be separated into task related ("You are frustrated") vs. non task related ("You want to take off your socks"). These challenges point to future directions that assess quantity and type of mind-related comments and need to be assessed across several parent-child interaction contexts (e.g., play), to help provide support for interval validity of mind-related comments. Additionally, maternal Verbal Orientation to Delay included differences in the types of talk involved. For instance, we coded both “Keys” and “Pooh is sleeping, don’t wake him up” as maternal Verbal Orientation to Delay. Clearly, “Pooh is sleeping, don’t wake him up” represents a more sophisticated way of speaking about the task that involves cognitive reframing which has been associated with less anger expression in preschoolers (Morris et al., 2011). Additionally, we didn’t code for passive strategies such as giving in to the child’s request, and verbal statements that demand affection from the child (e.g., “Come give mama a kiss” or “Show mama love”) as they were only observed in one case. Additionally, in the current study, expression of negative emotion was coded using facial, vocal, and postural cues for both anger and sadness combined as negative emotion. The limited visual quality of the video-taped Delay of Gratification Task did not allow us to differentially code toddler anger from sadness, a distinction that has been made in previous research (Morris et al., 2011). However, it was not surprising that the majority of the displayed negative expressions reflected anger cues given that anger is elicited when a goal is blocked (Cole, 2014), as the attractive toy was blocked in the Delay of Gratification Task. Future steps should include examination of maternal regulatory strategies as related to expressions of sadness and fear. Additionally, coding Delay of Gratification was limited in the current study such that duration and latency to touch were not measured.

## Future Directions

The findings in the current study point to several avenues for future research including (1) examination of self-regulation differentiating between emotion-related regulation and emotionality (2) examination of moderated effects of multiple lagged Maternal Regulatory Attempts and lagged toddlers’ regulatory strategies on toddlers’ overall expression of negative emotion and delay of gratification, (3) examination of significant fixed effects as moderated by maternal psychosocial characteristics and toddlers' trait-like characteristics (e.g., gender), specifically, for effects of maternal and toddler strategies that varied over dyads, (4) examination of bidirectional effects of toddlers' regulatory strategies, overall expression of negative emotion, and ability to wait on maternal regulatory strategies and mind-mindedness, (5) assessment of mind-mindedness and other mentalization related parenting behaviors (MRPBs) across multiple parent-child interactional contexts, and,  examination of effects of MRPBs on emotion expression and ability to wait as moderated by maternal regulatory attempts and toddlers' regulatory strategies.

First, results of the current study point to several implications regarding the construct of toddlers' self-regulation. While results of Intercept-Only Models suggested that, within toddlers, both ENE-O and Overall Touch varied in similar amounts from other intervals, much more between-toddler variance was observed for ENE-O compared to Overall Touch suggesting that the ability to wait upon request is more equally uniform among toddlers, than the ability to remain in control of one's negative emotions. In other words, it appears that most toddlers wanted to comply with mothers' wishes and wait when asked to wait, but not all of them were equally happy about it. Additionally, the ability to wait is compromised in highly distressed toddlers (Calkins & Johnson, 1998). Results of curve estimations reflected this challenge in measurement of outcomes variables (see Appendix D). As time elapsed, the direction of ENE-O and Overall Touch followed opposite quadratic curves. While ENE-O levels started out low, peaked toward the middle of the task, and returned to lower levels toward the end of the task, amount of Overall Touch started out high, bottomed out toward the middle of the task and increased toward the end of the task, suggesting that having to wait elicits more intense negative emotions while touching the keys was associated with lower intensity of expression.

Furthermore, lack of ability to wait does not necessarily constitute low effortful control but may be related to less voluntary forms of control such as reactive overcontrol (e.g. fearfulness/shyness) or reactive undercontrol (e.g., impulsivity) (Spinrad, et al., 2007a). Accordingly a major challenge in the present study concerns difficulty in differentiating between lack of touch due to intentionally regulated behavior and lack of touch due to dysregulated emotional states. However, this concern was addressed via differentiation between emotion-related self-regulation (e.g., toddlers' regulatory strategies) and emotionality (overall intensity and predominance of negative emotion) from its regulation (within-individual differences in ENE-O across intervals) as suggested by current theoretical models of emotion regulation (Eisenberg et al., 2010a, Eisenberg et al., 2005). Furthermore, results of the current study are limited in that I did not control for effects of lagged ENE-O or lagged Overall Touch on current-interval ENE-O and current-interval Overall Touch. Thus, I cannot say that significant maternal and toddlers strategies had effects above and beyond the effects of ENE-O and Overall Touch in previous intervals. However, this concern was addressed by controlling for both linear and quadratic elapsed time to account for effects of fatigue and correlated error terms in the outcome given that overall expression of negative emotion and ability to wait in two intervals closer together in time would be more correlated than two intervals farther apart. Additionally, given the bidirectional processes between expression of negative emotion and ability to wait, future examinations of effects should include measures of toddlers' temperament to explain differences in intercepts and slopes of overall expression of negative emotion and ability to wait. Future studies should also examine variation in toddlers' regulatory strategies as explained by between-toddler differences in physiological indicators of adaptive regulation (e.g., suppression of respiratory sinus arrhythmia).

Second, future analyses must include multiple maternal regulatory attempts and toddlers' regulatory strategies to further clarify effectiveness of each strategy as they contribute to variations in overall expression and delay of gratification together in single multilevel models. Examination of interactional effects of significant predictors in one model will also help fine-tune interpretation of unique and joint contributions of regulatory strategies.

Third, as evident by significant unexplained variance between dyads in their average intercept after all predictors were accounted for in each model, there is room to improve the current models. Specifically, future analysis should consider adding explanatory variables for models in which effects of lagged predictors varied over dyads (e.g., effects of lagged maternal minimizing as moderated by toddlers' gender). Effects of maternal regulatory attempts and toddlers' regulatory strategies may be moderated by maternal psychosocial characteristics. For instance, maternal ability to effectively scaffold motivational and emotional states during challenging tasks is compromised in depressed parents (Hoffman, Crnic, and Baker, 2006). Toddlers of depressed mothers are socialized with maladaptive regulation strategies (Premo & Kiel, 2015). Also the type of response and frequency with which parents model regulatory strategies is informed by beliefs about negative emotions (Gottman, Fainsilber Katz, & Hooven, 1996; Morris et al., 2007), which are in turn related to toddlers' regulatory competence. For instance, maternal beliefs reflective of disapproving philosophies about toddlers' anger and sadness are negatively related to toddlers' self-regulation (Senehi et al., 2018). Therefore, maternal psychosocial functioning such as maternal depression and their beliefs about negative emotions (e.g., approving or disapproving) are likely trait-like characteristics that can be examined to explain slope differences for effects of maternal regulatory attempts such as minimizing and negative emotional reactions. Additionally, developmental models of emotion socialization point to examination of cultural variations in parental regulatory strategies as well as cultural variations in parental beliefs about emotional expressivity which inform parental emotion socialization practices (Friedlmeier, Corapci, & Cole, 2011; Halberstadt & Lozada, 2011). Also, toddlers' gender should also be examined as moderators of slopes between maternal regulatory attempts (e.g. minimizing) and expression of negative emotion.

Fourth, future studies need to consider bidirectional associations between toddlers' regulatory strategies with toddlers' overall expression in negative emotion and delay of gratification. For instance, toddlers with more frequent and quicker tendencies to display highly intense and long periods of distress when frustrated in response to delay of gratification are more likely to use aggression, and less likely to voluntarily shift attention from desirable objects (i.e., self-distraction), or seek maternal support (Calkins & Johnson, 1998). Moreover, bidirectional associations between toddlers' regulatory strategies, overall expression of negative emotion, and delay of gratification need to be examined as each may elicit different maternal regulatory attempts and mind-related comments. For instance, Eisenberg et al., (2010c) has found that maternal supportive regulatory strategies are elicited for toddlers with higher effortful control.

Finally, the current study's null findings related to effects of maternal mind-related comments on toddler's expression of negative emotion and ability to wait point to several future directions. Notably, in the current study, very little variation was observed for both appropriate and non-attuned mind-related comments per interval suggesting the need to examine effects of mind-related comments as assessed in parent-child play contexts which are likely to elicit sufficient variability in mind-related comments (Meins et al., 2001). In fact, maternal references to mental states occur less frequently in negative parent-child interactional contexts (e.g. conflict) compared to positive or neutral contexts (Howe, Rinaldi, & Recchia, 2010). Also, in our own work (Senehi et al., 2018), we have found that maternal representational mind-mindedness, maternal tendency to attribute mental descriptors when describing her child (“she is persistent”) is associated with higher effective coping strategies (e.g., self-soothing behaviors when distressed) and effortful control reflective of attentional and behavioral regulatory skills (e.g., attention shifting and inhibitory control). Thus, future directions should consider effects of maternal mind-mindedness, assessed in positive contexts (e.g., play), and other indicators of mentalization-related parenting behaviors on toddlers’ emotional expression and delay of gratification.

Additionally, maternal mind-mindedness, indicative of a larger mentalization-related parenting construct, contributes to toddlers’ acquisition of regulatory strategies (Senehi et al., 2018) that support development of optimal emotional and behavioral regulatory competence over time (Brophy-Herb et al., 2015; Centifanti et al., 2016, Meins et al., 2013). Therefore, future studies need to examine direct (e.g. toddlers’ regulatory strategies, effortful control) and indirect mechanisms (e.g., maternal regulatory attempts, toddlers’ mental state talk/understanding) through which mind-related comments contribute to emotional and behavioral regulation over time. Notably, in the current sample, more appropriate mind-related comments, and fewer non-appropriate mind-related comments were associated with more toddlers’ regulatory strategies including toddlers’ initiated non-verbal and joined verbal distraction, more verbalizations in the form of desire states (“I need it”) and self-control (“I wait”), and more physically self-soothing behaviors, that had exerted significant main effects on either toddlers’ emotional expression or ability to wait (or both) in multilevel models. Also, negative associations were observed between maternal appropriate mind-related comments with maternal negative commands, and, positive associations between maternal non-attuned mind-related comments with maternal minimizing statements and physical restraint.

Moreover, correlational results revealed that more current-interval and lagged non-attuned mind-related comments were correlated with higher overall expression of negative emotion and greater ability to wait. Therefore, exploratory multilevel analyses were conducted on effects of current-interval non-attuned mind-related comments on study outcomes. Significant fixed effects revealed that for every unit increase in current-interval maternal non-attuned mind-related comments, toddlers' overall intensity of negative emotional expression significantly increased by 0.21 and overall touch significantly decreased 0.18 units in an average interval.[37] These findings suggest that non-attuned comments ("you don't want to play with those", said while toddler clearly wants to play with the keys) may directly (and immediately) suppress toddlers' motivational states that enables them to refrain from touching the keys and to comply with caregiver, but evidently, also activate higher levels of emotional arousal. These findings point to future analyses of current-interval effects of maternal behaviors, specifically, non-attuned mind-related comments.

In conclusion, the current study offers empirical support for the effects of maternal regulatory attempts and toddlers' regulatory strategies on moment-to-moment differences in toddlers' emotional and behavioral regulation. The study's multilevel approach to examination of these effects contributes to current understandings of toddlers' emergent self-regulation within the parent-child relationship. Additionally, correlational evidence points to associations between maternal efforts to mentalize and toddlers' emergent regulatory strategies, emotional expression,

[37] To explore bidirectional associations, I also tested effects of current-interval ENE-O and Overall Touch on current-interval non-attuned mind-related comments and found small estimates of .03 that were significant.

and ability to wait. These findings provide new directions in examination of nuanced contributions of the caregiving context to development of self-regulation as toddlers make the transition from other-regulated to self-regulated emotional and behavioral states.

APPENDICES

# APPENDIX A

## Maternal Regulatory Attempts & Mind-Mindedness Overlap

To ensure mutual exclusivity and help with interpretation of effects, I coded all mind-related comments for overlap with any Maternal Regulatory Attempts (Table D1). Meins and Fernyhough (2012) note that mind-related comments would be considered non-attuned comments if the child was actively engaged in attending to or playing with something else. As described previously, Maternal Distraction was coded when mother shifted attention (distracted) child by holding a conversation about non-task related topics or by pointing out objects in the room, or making suggestions for activities (e.g., “Do you want to count?”). In cases that non-attuned mind-related comments could be classified as distractions, they were coded as non-attuned comments. Majority of Appropriate Mind-Related Comments did not overlap with any MRA (60.50%) while majority of Non-Attuned Mind-related Comments could also serve as Maternal Initiated Distractions (73.79%; e.g., “Do you want to sing a song? “Do you want to count?”). Although Cognitive Reframe was not coded as a Maternal Regulatory Attempt, 5.04% of Appropriate Mind-Related Comments used mental state words to describe the toddler’s behaviors while reframing the nature of the waiting task (e.g. “Pooh is sleeping, you just want to watch him sleep don’t want to wake him up” while toddler was watching the keys and said “He is snoring”). I also categorized all comments in their corresponding mental state category as outlined by Meins & Fernyhough (2015). Majority of mind-related comments identified, interpreted, or described toddlers’ desire states in appropriate (83.19%; e.g., “You want to play with the keys”, “You really like Pooh”) and non-attuned (88.3%; “You don’t want those keys” or “Do you want to sing a song?” when toddler is reaching for keys) ways.

Table A1

*Percentages of Appropriate and Non-Attuned Comments Further Coded for MRA Overlap and Mental State Category*

| | Appropriate Mind-Related Comments | Non-Attuned Mind-Related Comments |
|---|---|---|
| | MRA Overlap | |
| No Overlap | 72 (60.50%) | 23 (22.33%) |
| Initiated Distraction | 11 (9.24%) | 76 (73.79%) |
| Joined Distraction | 22 (18.49%) | 1 (0.97%) |
| Cognitive Reframe | 6 (5.04%) | 0 |
| Physical Comfort | 3 (2.52%) | 0 |
| Minimizing | 1 (0.84%) | 0 |
| Positive Command | 0 (0.00%) | 1 (0.97%) |
| To Experimenter | 2 (1.68%) | 0 |
| | Mental State Category | |
| Emotion | 14 (11.76%) | 3 (2.91%) |
| Cognition | 6 (5.04%) | 1 (0.97%) |
| Desire | 99 (83.19%) | 91 (88.35%) |
| Physical | 0 | 8 (7.77%) |
| Criteria C | 0 | 3 (2.91%) |
| Total | 119 | 103 |

Note. MRA = Maternal Regulatory Attempts, Criteria C = “What do you want to do?” When toddler is asking for or attending to Keys. Cognitive Reframe was coded as a type of Maternal Verbal Orientation to Delay

# APPENDIX B

## Coder Training and Inter-Coder Reliability

**Coder Training.** Coders were instructed to familiarize themselves with the Coding System for Delay of Gratification Task – Mother's Regulatory Attempts (Friedlmeier, Corapci, & Benga, 2015a ), Mind-Mindedness Coding Manual, version 2.2 (Meins & Fernyhough, 2015), Coding System for Delay of Gratification Task – Child Behavior and Regulatory Attempts (Friedlmeier, Corapci, & Benga, 2015b), and Coding System for Delay of Gratification Task- Intensity of Emotion Expression (Friedlmeier, Corapci, & Benga 2015c) before the first training meeting. During the first training meeting, the experimenter reviewed the coding manuals with each coder. Different coders were trained in coding maternal behaviors and toddlers' behaviors in order to ensure unbiased coding. Therefore, no coder was assigned both child and parent of the same dyad. All videos were transcribed verbatim for all verbal statements made by mother and child by one coder before coding began. Transcription was done in order to ensure accuracy in coding verbal regulatory strategies made by mother and toddler and mind-mindedness given the guidelines in Meins & Fernyhough (2015).

**Initial Training Phase.** During the initial training phase, coders were instructed to code a frustrating episode each. Coders were instructed to watch the entire frustrating episode from start to end without coding. This was done to ensure familiarity with the video and more accuracy in coding. Each coder was then asked to watch each episode a second time in 10s intervals during which they coded for the variable they had been trained in and assigned. The frustrating episode started when the experimenter placed the keys in front of the parent-child dyad regardless of when she said "You can begin now" and ended when the experimenter said, "That is the end of this activity". To ensure accuracy in identification of start and end times of each interval, all videos for all subjects were watched and assigned start and end times for each 10s interval by the first author. Each frustrating episode lasted 2 minutes, totaling 120 seconds, except for cases in which the experimenter ended the task due to extreme toddler distress that lasted for more than 30 seconds (N = 6). Initial training phase was conducted for 5%-20% of cases depending on the variable being coded, all disagreements were discussed and finalized during training meetings. Discrepancies between coders were addressed until coders felt that they understood all coding criteria clearly.

**Baseline Training Phase.** During the baseline training phase, 5%-15% of cases were coded by two independent coders to achieve inter-coder reliability of .8 or greater for all variables before coders could be considered reliable to code independently. All disagreements were discussed and finalized during weekly meetings. Before independent coding took place, a baseline reliability estimate of .8 or higher was achieved for all variables expect for *Toddler Initiated Non-Verbal Distraction*, toddler shifts focus away from keys for more than 3 seconds (e.g., looks away, walks out of the room, engages in play) ($\alpha$ = .78, ICC = 1.00), *Toddler Joined Verbal Distraction*, toddler joins in alternative verbal activity that mother has initiated (e.g., mom starts counting and child joins in) ($\alpha$ = .77, ICC = 1.00), and *Toddler Joined Non-Verbal Distraction*, child joins in alternative non-verbal activity that mother has initiated (e.g., mom initiates play and child joins in, mom points to a direction away from keys and child looks where mom is pointing) ($\alpha$ = .76, ICC = 1.00). Slightly lower alphas may be explained by the level of coding difficulty of these variables due to poor video quality and difficulty in assessment of eye direction.

**Independent Coding Phase.** After establishing baseline reliability, coders were assigned independent coding. During the independent coding phase, 35% of cases were randomly double coded for all variables in order to ensure consistent and accurate coding. The first author met weekly with each pair of coders to discuss disagreements and assess inter-coder reliability. All disagreements were discussed and finalized during coding meetings.

**Inter-Coder Reliability**

A total of 4 undergraduate research assistants coded maternal variables, and a separate set of 3 undergraduate research assistants coded toddler variables. All variables were assigned to pairs of coders. All pairs were identified during training phases and were selected based on mastery of their understanding of conceptual and operational definitions of variables and higher inter-coder reliability estimates.  During all inter-coder reliability meetings, questions regarding variables were clarified and inter-rater reliability was assessed.

# APPENDIX C

## Equations

**Research Question 1: The Random Intercept Model Predicting Expression of Negative Emotion from Lagged Maternal Regulatory Attempts and Mind-Mindedness.** The models were specified with the following equations:

Maternal Verbal Comfort

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{V-Comf},j}(\text{V-Comf}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + \beta_{Verb,j}(Verb_{i-1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{v-comf},j} = \gamma_{\text{V-Comf}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{\text{V-Comf}}(\text{V-Comf}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + \gamma_{Verb}(Verb_{i-1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}(Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{\text{V-Comf}}(\text{V-Comf}_{i-1j})$ = the average slope between ENE-O and maternal lagged Verbal Comfort times score of maternal lagged Verbal Comfort in dyad j
$\gamma_{ETL}(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}(Verb_{i-1j})$ = the average slope between ENE-O and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Physical Comfort

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{Phy-Comf},j}(\text{Phy-Comf}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$

$$\text{Slopes: } \beta_{\text{Phy-Comf},j} = \gamma_{\text{Phy-Comf}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{Phy-Comf}}(\text{Phy-Comf}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{\text{Phy-Comf}}(\text{Phy-Comf}_{i-1j})$ = the average slope between ENE-O and maternal lagged Physical Comfort times score of maternal lagged Physical Comfort in dyad j
$\gamma_{ETL,j}(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Initiated Distraction</u>

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{M-INI-Dis},j}(\text{M-INI-Dis}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{M-INI-Dis},j} = \gamma_{\text{M-INI-Dis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{M-INI-Dis}}(\text{M-INI-Dis}_{-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{\text{M-INI-Dis}}(\text{M-INI-Dis}_{i-1j})$ = the average slope between ENE-O and maternal lagged Initiated Distraction times score of maternal lagged Initiated Distraction in dyad j
$\gamma_{ETL,j}(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Joint Distraction

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{M-JNT-Dis},j}\,(\text{M-JNT-Dis}_{\,i\text{-}1j}) + \beta_{\text{ETL},j}\,(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{M-JNT-Dis},j} = \gamma_{\text{M-JNT-Dis}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}^2}$$

Mixed Model

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{M-JNT-Dis}}\,(\text{M-JNT-Dis}_{\,\text{-}1j}) + \gamma_{\text{ETL}}\,(\text{ET}_{ij}) + \gamma_{\text{ET}^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{\text{Gender}}$ (Gender$_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{\text{M- JNT-Dis}}$(M- JNT-Dis$_{i\text{-}1j}$) = the average slope between ENE-O and maternal lagged Joined Distraction times score of maternal lagged Joined Distraction in dyad j
$\gamma_{\text{ETL},j}$ (ET$_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{\text{ET}^2,j}$(ET$^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Verbal Orientation to Delay

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{M-VO2D},j}\,(\text{M-VO2D}_{\,i\text{-}1j}) + \beta_{\text{ETL},j}\,(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + \beta_{\text{Verb},j}(\text{Verb}_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{v-comf},j} = \gamma_{\text{M-VO2D}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}^2}$$
$$\beta_{\text{Verb},j} = \gamma_{\text{Verb}}$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{M-VO2D}}\,(\text{M-VO2D}_{i\text{-}1j}) + \gamma_{\text{ETL}}\,(\text{ET}_{ij}) + \gamma_{\text{ET}^2}\,(\text{ET}^2_{ij}) + \gamma_{\text{Verb}}\,(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{M\text{-}VO2D}$ (M-VO2D $_{i-1j}$) = the average slope between ENE-O and maternal lagged Verbal Orientation to Delay times score of maternal lagged Verbal Orientation to Delay in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}$ ($Verb_{i-1j}$) = the average slope between ENE-O and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Positive Commands</u>

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{Pos\text{-}Comd,j}\,(\text{Pos-Comd}_{i-1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + \beta_{Verb,j}(Verb_{i-1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{Pos\text{-}Comd,j} = \gamma_{Pos\text{-}Comd} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Pos\text{-}Comd}\,(\text{Pos-Comd}_{i-1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + \gamma_{Verb}\,(Verb_{i-1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$($Gender_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Pos\text{-}Comd}$ (Pos-Comd $_{i-1j}$) = the average slope between ENE-O and maternal lagged Positive Commands times score of maternal lagged Positive Commands in dyad j
$\gamma_{ETL}$($ET_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$($ET^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}$ ($Verb_{i-1j}$) = the average slope between ENE-O and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Negative Commands

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{Neg\text{-}Comd,j}(Neg\text{-}Comd_{i\text{-}1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + \beta_{Verb,j}(Verb_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{Neg\text{-}Comd,j} = \gamma_{Neg\text{-}Comd} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$ENE\text{-}O_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Neg\text{-}Comd}(Neg\text{-}Comd_{i\text{-}1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + \gamma_{Verb}(Verb_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}(Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Neg\text{-}Comd}(Neg\text{-}Comd_{i\text{-}1j})$ = the average slope between ENE-O and maternal lagged Negative Commands times score of maternal lagged Negative Commands in dyad j
$\gamma_{ETL}(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}(Verb_{i\text{-}1j})$ = the average slope between ENE-O and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Punitive Reactions

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{Pun,j}(M\text{-}Pun_{i\text{-}1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{Pun,j} = \gamma_{Pun} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{M\text{-}Pun}(\text{M-Pun}_{-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($\text{Gender}_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Pun,j}$ ($\text{M-Pun}_{i\text{-}1j}$) = the average slope between ENE-O and maternal lagged Punitive Reactions times score of maternal lagged Punitive Reactions in dyad j
$\gamma_{ETL,j}$ ($\text{ET}_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}$($\text{ET}^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Minimizing</u>
Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{MIN,j}(\text{Min}_{i\text{-}1j}) + \beta_{ETL,j}(\text{ET}_{ij}) + \beta_{ET^2,j}(\text{ET}^2_{ij}) + \beta_{Verb,j}(\text{Verb}_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

Intercept: $\beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$
Slopes: $\beta_{MIN,j} = \gamma_{Min} + u_{1j}$
$\beta_{ETL,j} = \gamma_{ETL}$
$\beta_{ETL,j} = \gamma_{ETL^2}$
$\beta_{Verb,j} = \gamma_{Verb}$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Min}(\text{Min}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($\text{Gender}_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Min}$ ($\text{Min}_{i\text{-}1j}$) = the average slope between ENE-O and maternal lagged Minimizing statements times score of maternal lagged Minimizing statements in dyad j
$\gamma_{ETL}$ ($\text{ET}_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($\text{ET}^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}$ ($\text{Verb}_{i\text{-}1j}$) = the average slope between ENE-O and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j

$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval $i$ from its dyad $j$

Maternal Physical Restraint

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{Phy\text{-}RST,j} (Phy\text{-}RST_{i\text{-}1j}) + \beta_{ETL,j} (ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

Intercept: $\beta_{0j} = \gamma_{00} + \gamma_{Gender} (Gender_j) + u_{0j}$
Slopes: $\beta_{Phy\text{-}RST,j} = \gamma_{Phy\text{-}RST} + u_{1j}$
$\beta_{ETL,j} = \gamma_{ETL}$
$\beta_{ETL,j} = \gamma_{ETL^2}$

Mixed Model

$$ENE\text{-}O_{ij} = \gamma_{00} + \gamma_{Gender} (Gender_j) + \gamma_{Phy\text{-}RST} (Phy\text{-}RST_{i\text{-}1j}) + \gamma_{ETL} (ET_{ij}) + \gamma_{ET^2} (ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender} (Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Phy\text{-}RST} (Phy\text{-}RST_{i\text{-}1j})$ = the average slope between ENE-O and maternal lagged Physical Restraint times score of maternal lagged Positive Emotional Reactions in dyad j
$\gamma_{ETL,j} (ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad $j$
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval $i$ from its dyad $j$

Maternal Positive Emotional Reactions

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{Pos\text{-}Aff,j} (Pos\text{-}Aff_{i\text{-}1j}) + \beta_{ETL,j} (ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

Intercept: $\beta_{0j} = \gamma_{00} + \gamma_{Gender} (Gender_j) + u_{0j}$
Slopes: $\beta_{Pos\text{-}Aff,j} = \gamma_{Pos\text{-}Aff} + u_{1j}$
$\beta_{ETL,j} = \gamma_{ETL}$
$\beta_{ETL,j} = \gamma_{ETL^2}$

Mixed Model

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{Pos-Aff}}(\text{Pos-Aff}_{i-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{\text{Pos-Aff}}(\text{Pos-Aff}_{i-1j})$ = the average slope between ENE-O and maternal lagged Positive Emotional Reactions times score of maternal lagged Positive Emotional Reactions in dyad j
$\gamma_{ETL,j}(\text{ET}_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(\text{ET}^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Negative Emotional Reactions

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{Neg-Aff},j}(\text{Neg-Aff}_{i-1j}) + \beta_{ETL,j}(\text{ET}_{ij}) + \beta_{ET^2,j}(\text{ET}^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{Neg-Aff},j} = \gamma_{\text{Neg-Aff}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{Neg-Aff}}(\text{Neg-Aff}_{i-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{\text{Neg-Aff}}(\text{Neg-Aff}_{i-1j})$ = the average slope between ENE-O and maternal lagged Negative Emotional Reactions times score of maternal lagged Negative Emotional Reactions in dyad j
$\gamma_{ETL,j}(\text{ET}_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(\text{ET}^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Appropriate Mind-Related Comments

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{AMM,j}(\text{AMM}_{i-1j}) + \beta_{ETL,j}(\text{ET}_{ij}) + \beta_{ET^2,j}(\text{ET}^2_{ij}) + \beta_{Verb,j}(\text{Verb}_{i-1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{AMM,j} = \gamma_{AMM} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{AMM}(\text{AMM}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET}{}^2(\text{ET}^2{}_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{AMM}(\text{AMM}_{i\text{-}1j})$ = the average slope between ENE-O and maternal lagged Appropriate Mind-Related Comments times score of maternal lagged Appropriate Mind-Related Comments in dyad j
$\gamma_{ETL}(\text{ET}_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET}{}^2(\text{ET}^2{}_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}(\text{Verb}_{i\text{-}1j})$ = the average slope between ENE-O and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Non-Attuned Mind-Related Comments

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{NMM,j}(\text{NMM}_{i\text{-}1j}) + \beta_{ETL,j}(\text{ET}_{ij}) + \beta_{ET^2,j}(\text{ET}^2{}_{ij}) + \beta_{Verb,j}(\text{Verb}_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{NMM,j} = \gamma_{NMM} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{NMM}(\text{NMM}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET}{}^2(\text{ET}^2{}_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{NMM}$ ($NMM_{i-1j}$) = the average slope between ENE-O and maternal lagged Non-Attuned Mind-Related Comments times score of maternal lagged Non-Attuned Mind-Related Comments in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}$ ($Verb_{i-1j}$) = the average slope between ENE-O and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

**Research Question 2: The Random Intercept Model Predicting Expression of Negative Emotion from Lagged Toddlers' Regulatory Strategies.** The models were specified with the following equations:

Toddler Initiated Verbal Distraction

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{T-INI-VDis},j}(\text{T-INI-VDis}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-INI-VDis},j} = \gamma_{\text{T-INI-VDis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + \gamma_{\text{T-INI-Vdis}}(\text{T-INI-VDis}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ ($Vocab_j$) = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{\text{T-INI-VDis}}$ ($\text{T-INI-VDis}_{i-1j}$) = the average slope between ENE-O and lagged Toddler Initiated Verbal Distraction times score of lagged Toddler Initiated Verbal Distraction in dyad j

$\gamma_{ETL}$ $(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ $(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Initiated Non-Verbal Distraction

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{\text{T-INI-nonVDis},j}\,(\text{T-INI-nonVDis}_{i-1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-INI-nonVDis},j} = \gamma_{\text{T-INI-nonVDis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$ENE\text{-}O_{ij} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + \gamma_{\text{T-INI-Vdis}}\,(\text{T-INI-nonVDis}_{i-1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$ $(Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ $(Vocab_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{\text{T-INI-nonVDis}}$ $(\text{T-INI-nonVDis}_{i-1j})$ = the average slope between ENE-O and lagged Toddler Initiated Non-Verbal Distraction times score of lagged Toddler Initiated Non-Verbal Distraction in dyad j
$\gamma_{ETL}$ $(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ $(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Initiated Verbal Keys

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{\text{T-INI-Vkeys},j}\,(\text{T-INI-Vkeys}_{i-1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{T\text{-}INI\text{-}Vkeys,j} = \gamma_{T\text{-}INI\text{-}Vkeys} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model:

$$ENE\text{-}O_{ij} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + \gamma_{\,T\text{-}INI\text{-}Vkeys}\,(T\text{-}INI\text{-}Vkeys_{\,i\text{-}1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{\,ET^2}\,(ET^2_{\,ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}\,(Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}\,(Vocab_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma$ T-INI-Vkeys (T-INI-Vkeys $_{i\text{-}1j}$) = the average slope between ENE-O and lagged Toddler Initiated Verbal Keys times score of lagged Toddler Initiated Verbal Keys in dyad j
$\gamma_{ETL}\,(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}\,(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Initiated Verbal Self-Control

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{\,T\text{-}INI\text{-}Vctrl,j}\,(T\text{-}INI\text{-}Vctrl_{\,i\text{-}1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{\,ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{T\text{-}INI\text{-}Vctrl,j} = \gamma_{T\text{-}INI\text{-}Vctrl} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model:

$$ENE\text{-}O_{ij} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + \gamma_{\,T\text{-}INI\text{-}Vctrl}\,(T\text{-}INI\text{-}Vctrl_{\,i\text{-}1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{\,ET^2}\,(ET^2_{\,ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}\,(Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}\,(Vocab_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j

$\gamma$ T-INI-Vctrl (T-INI-Vctrl$_{i-1j}$) = the average slope between ENE-O and lagged Toddler Initiated Verbal Self-Control times score of lagged Toddler Initiated Verbal Self-Control in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Initiated Verbal Desire</u>

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{T-INI-Vdes},j}(\text{T-INI-Vdes}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-INI-Vctrl},j} = \gamma_{\text{T-INI-Vctrl}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + \gamma_{\text{T-INI-Vdes}}(\text{T-INI-Vdes}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ ($Vocab_j$) = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma$ T-INI-Vdes (T-INI-Vdes$_{i-1j}$) = the average slope between ENE-O and lagged Toddler Initiated Verbal Desire times score of lagged Toddler Initiated Verbal Desire in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept
$e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Self-Comfort</u>

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{T-Comf},j}(\text{T-Scomf}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{T\text{-}Comf,j} = \gamma_{T\text{-}Scomf} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model:

$$ENE\text{-}O_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + \gamma_{T\text{-}Scomf}(T\text{-}Scomf_{\ i\text{-}1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0

$\gamma_{Gender}(Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j

$\gamma_{Vocab}(Vocab_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j

$\gamma_{T\text{-}Scomf}(T\text{-}Scomf_{\ i\text{-}1j})$ = the average slope between ENE-O and lagged Toddler Self-Comfort times score of lagged Toddler Self-Comfort in dyad j

$\gamma_{ETL}(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j

$\gamma_{ET^2}(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*

$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

## Toddler Verbal Distraction-Bids to Mom

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{T\text{-}Vdis\text{-}2M,j}(T\text{-}Vdis\text{-}2M_{\ i\text{-}1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{T\text{-}Vdis\text{-}2M,j} = \gamma_{T\text{-}Vdis\text{-}2M} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model:

$$ENE\text{-}O_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + \gamma_{T\text{-}Vdis\text{-}2M}(T\text{-}Vdis\text{-}2M_{\ i\text{-}1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0

$\gamma_{Gender}$ (Gender$_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ (Vocab$_j$) = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}Vdis\text{-}2M}$ (T-Vdis-2M $_{i-1j}$) = the average slope between ENE-O and lagged Toddler Verbal Distraction-Bids to Mom times score of lagged Toddler Verbal Distraction-Bids to Mom in dyad j
$\gamma_{ETL}$ (ET$_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ (ET$^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Joined Verbal Distraction</u>

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{T-JNT-VDis},j}(\text{T-JNT-VDis}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Vocab}(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-JNT-VDis},j} = \gamma_{\text{T-JNT-VDis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Vocab}(\text{Vocab}_j) + \gamma_{\text{T-JNT-VDis}}(\text{T-JNT-VDis}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}$ (Gender$_j$) = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ (Vocab$_j$) = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{\text{T-JNT-VDis}}$ (T-JNT-VDis $_{i-1j}$) = the average slope between ENE-O and lagged Toddler Joined Verbal Distraction times score of lagged Joined Verbal Distraction in dyad j
$\gamma_{ETL}$ (ET$_{ij}$) = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ (ET$^2_{ij}$) = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Joined Non-Verbal Distraction</u>

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{T-JNT-nonVDis},j}\,(\text{T-JNT-nonVDis}_{\,i\text{-}1j}) + \beta_{\text{ETL},j}\,(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-JNT-nonVDis},j} = \gamma_{\text{T-JNT-nonVDis}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}{}^2$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + \gamma_{\text{T-JNT-nonVDis}}\,(\text{T-JNT-nonVDis}_{\,i\text{-}1j}) + \gamma_{\text{ETL}}\,(\text{ET}_{ij}) + \gamma_{\text{ET}^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0

$\gamma_{\text{Gender}}\,(\text{Gender}_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j

$\gamma_{\text{Vocab}}\,(\text{Vocab}_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j

$\gamma_{\text{T-JNT-nonVDis}}\,(\text{T-JNT-nonVDis}_{\,i\text{-}1j})$ = the average slope between ENE-O and lagged Toddler Joined Non-Verbal Distraction times score of lagged Toddler Joined Non-Verbal Distraction in dyad *j*

$\gamma_{\text{ETL}}\,(\text{ET}_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*

$\gamma_{\text{ET}^2}\,(\text{ET}^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*

$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Verbal Keys – Bids to Mom</u>

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{T-Vkeys-2M},j}\,(\text{T-Vkeys-2M}_{\,i\text{-}1j}) + \beta_{\text{ETL},j}\,(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-Vkeys-2M},j} = \gamma_{\text{T-Vkeys-2M}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}{}^2$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + \gamma_{\text{T-Vkeys-2M}}\,(\text{T-Vkeys-2M}_{\,i\text{-}1j}) +$$

$$\gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}\,(Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}\,(Vocab_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}Vkeys\text{-}2M}\,(T\text{-}Vkeys\text{-}2M_{\,i\text{-}1j})$ = the average slope between ENE-O and lagged Toddler Verbal Keys – Bids to Mom times score of lagged Toddler Verbal Keys – Bids to Mom in dyad j
$\gamma_{ETL}\,(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*
$\gamma_{ET^2}\,(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

## Verbal Self-Control- Bids to Mom

Level-1 Equation:

$$ENE\text{-}O_{ij} = \beta_{0j} + \beta_{T\text{-}Vctrl\text{-}2M,j}\,(T\text{-}Vctrl\text{-}2M_{\,i\text{-}1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{T\text{-}Vctrl\text{-}2M,j} = \gamma_{T\text{-}Vctrl\text{-}2M} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$ENE\text{-}O_{ij} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + \gamma_{T\text{-}Vctrl\text{-}2M}\,(T\text{-}Vctrl\text{-}2M_{\,i\text{-}1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{Gender}\,(Gender_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{Vocab}\,(Vocab_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}Vctrl\text{-}2M}\,(T\text{-}Vctrl\text{-}2M_{\,i\text{-}1j})$ = the average slope between ENE-O and lagged Toddler Verbal Self-Control – Bids to Mom times score of lagged Toddler Verbal Self-Control – Bids to Mom in dyad j
$\gamma_{ETL}\,(ET_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*
$\gamma_{ET^2}\,(ET^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Verbal Desire – Bids to Mom

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{T-Vdes-2M},j}\,(\text{T-Vdes-2M}_{\,i\text{-}1j}) + \beta_{\text{ETL},j}\,(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-Vdes-2M},j} = \gamma_{\text{T-Vdes-2M}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}{}^2$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + \gamma_{\text{T-Vdes-2M}}\,(\text{T-Vdes-2M}_{\,i\text{-}1j}) +$$
$$\gamma_{\text{ETL}}\,(\text{ET}_{ij}) + \gamma_{\text{ET}^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0
$\gamma_{\text{Gender}}\,(\text{Gender}_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j
$\gamma_{\text{Vocab}}\,(\text{Vocab}_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{\text{T-Vdes-2M}}\,(\text{T-Vdes-2M}_{\,i\text{-}1j})$ = the average slope between ENE-O and lagged Toddler Verbal Desire Bids to Mom times score of lagged Toddler Verbal Desire – Bids to Mom in dyad j
$\gamma_{\text{ETL}}\,(\text{ET}_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*
$\gamma_{\text{ET}^2}\,(\text{ET}^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Physical Comfort Seeking

Level-1 Equation:

$$\text{ENE-O}_{ij} = \beta_{0j} + \beta_{\text{T-ComfSk},j}\,(\text{T-ComfSk}_{\,i\text{-}1j}) + \beta_{\text{ETL},j}\,(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-ComfSk},j} = \gamma_{\text{T-ComfSk}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}{}^2$$

Mixed Model:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Vocab}(\text{Vocab}_j) + \gamma_{T\text{-}ComfSk}(\text{T-ComfSk}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0

$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between ENE-O and Gender times score of Gender in dyad j

$\gamma_{Vocab}(\text{Vocab}_j)$ = the average slope between ENE-O and Vocabulary Production times score of Vocabulary Production in dyad j

$\gamma_{T\text{-}ComfSk}(\text{T-ComfSk}_{i\text{-}1j})$ = the average slope between ENE-O and lagged Toddler Physical Comfort Seeking times score of lagged Toddler Physical Comfort Seeking in dyad j

$\gamma_{ETL}(\text{ET}_{ij})$ = the average slope between ENE-O and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*

$\gamma_{ET^2}(\text{ET}^2_{ij})$ = the average slope between ENE-O and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*

$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

**Research Question 3: The Random Intercept Model Predicting Overall Touch from Lagged Maternal Regulatory Attempts and Mind-Mindedness.** The models were specified with the following equations:

Maternal Verbal Comfort

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{V\text{-}Comf,j}(\text{V-Comf}_{i\text{-}1j}) + \beta_{ETL,j}(\text{ET}_{ij}) + \beta_{ET^2,j}(\text{ET}^2_{ij}) + \beta_{Verb,j}(\text{Verb}_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{v\text{-}comf,j} = \gamma_{V\text{-}Comf} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{V\text{-}Comf}(\text{V-Comf}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0

$\gamma_{Gender}$ ($Gender_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{V\text{-}Comf}$ ($V\text{-}Comf_{i\text{-}1j}$) = the average slope between Overall Touch and maternal lagged Verbal Comfort times score of maternal lagged Verbal Comfort in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}$ ($Verb_{i\text{-}1j}$) = the average slope between Overall Touch and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Physical Comfort</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{Phy\text{-}Comf,j}(Phy\text{-}Comf_{i\text{-}1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{Phy\text{-}Comf,j} = \gamma_{Phy\text{-}Comf} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$

Mixed Model

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Phy\text{-}Comf}(Phy\text{-}Comf_{i\text{-}1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Phy\text{-}Comf}$ ($Phy\text{-}Comf_{i\text{-}1j}$) = the average slope between Overall Touch and maternal lagged Physical Comfort times score of maternal lagged Physical Comfort in dyad j
$\gamma_{ETL,j}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}$($ET^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Initiated Distraction</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{M-INI-Dis},j}(\text{M-INI-Dis}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{M-INI-Dis},j} = \gamma_{\text{M-INI-Dis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{\text{M-INI-Dis}}(\text{M-INI-Dis}_{-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}(Gender_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{\text{M-INI-Dis}}(\text{M-INI-Dis}_{i-1j})$ = the average slope between Overall Touch and maternal lagged Initiated Distraction times score of maternal lagged Initiated Distraction in dyad j
$\gamma_{ETL,j}(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Joint Distraction</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{M-JNT-Dis},j}(\text{M-JNT-Dis}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{M-JNT-Dis},j} = \gamma_{\text{M-JNT-Dis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{\text{M-JNT-Dis}}(\text{M-JNT-Dis}_{-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0

$\gamma_{Gender}$ (Gender$_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{M\text{- }JNT\text{-}Dis}$(M- JNT-Dis$_{i\text{-}1j}$) = the average slope between Overall Touch and maternal lagged Joined Distraction times score of maternal lagged Joined Distraction in dyad j
$\gamma_{ETL,j}$ (ET$_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}$(ET$^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Verbal Orientation to Delay</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{M\text{-}VO2D,j}\,(\text{M-VO2D}_{i\text{-}1j}) + \beta_{ETL,j}\,(\text{ET}_{ij}) + \beta_{ET^2,j}(\text{ET}^2_{ij}) + \beta_{Verb,j}(\text{Verb}_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{v\text{-}comf,j} = \gamma_{M\text{-}VO2D} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{M\text{-}VO2D}\,(\text{M-VO2D}_{i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + \gamma_{Verb}\,(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ (Gender$_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{M\text{-}VO2D}$ (M-VO2D$_{i\text{-}1j}$) = the average slope between Overall Touch and maternal lagged Verbal Orientation to Delay times score of maternal lagged Verbal Orientation to Delay in dyad j
$\gamma_{ETL}$ (ET$_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ (ET$^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}$ (Verb$_{i\text{-}1j}$) = the average slope between Overall Touch and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Positive Commands</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{Pos-Comd},j}(\text{Pos-Comd}_{i\text{-}1j}) + \beta_{\text{ETL},j}(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + \beta_{\text{Verb},j}(\text{Verb}_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{Pos-Comd},j} = \gamma_{\text{Pos-Comd}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}{}^2$$
$$\beta_{\text{Verb},j} = \gamma_{\text{Verb}}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{Pos-Comd}}(\text{Pos-Comd}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + \gamma_{\text{Verb}}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0

$\gamma_{\text{Gender}}(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j

$\gamma_{\text{Pos-Comd}}(\text{Pos-Comd}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal lagged Positive Commands times score of maternal lagged Positive Commands in dyad j

$\gamma_{\text{ETL}}(\text{ET}_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j

$\gamma_{\text{ET}^2}(\text{ET}^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*

$\gamma_{\text{Verb}}(\text{Verb}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j

$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Negative Commands</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{Neg-Comd},j}(\text{Neg-Comd}_{i\text{-}1j}) + \beta_{\text{ETL},j}(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + \beta_{\text{Verb},j}(\text{Verb}_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{Neg-Comd},j} = \gamma_{\text{Neg-Comd}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}{}^2$$

$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Neg\text{-}Comd}(\text{Neg-Comd}_{i\text{-}1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0

$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j

$\gamma_{Neg\text{-}Comd}(\text{Neg-Comd}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal lagged Negative Commands times score of maternal lagged Negative Commands in dyad j

$\gamma_{ETL}(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j

$\gamma_{ET^2}(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*

$\gamma_{Verb}(\text{Verb}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j

$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Punitive Reactions</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{Pun,j}(\text{M-Pun}_{i\text{-}1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{Pun,j} = \gamma_{Pun} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{M\text{-}Pun}(\text{M-Pun}_{\text{-}1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0

$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j

$\gamma_{Pun,j}(\text{M-Pun}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal lagged Punitive Reactions times score of maternal lagged Punitive Reactions in dyad j

$\gamma_{ETL,j}(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j

$\gamma_{ET^2,j}(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Minimizing</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{MIN,j}\,(\text{Min}_{i\text{-}1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + \beta_{Verb,j}(\text{Verbi-1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{MIN,j} = \gamma_{Min} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Min}(\text{Min}_{i\text{-}1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + \gamma_{Verb}\,(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}\,(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Min}\,(\text{Min}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal lagged Minimizing statements times score of maternal lagged Minimizing statements in dyad j
$\gamma_{ETL}\,(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}\,(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}\,(\text{Verb}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Maternal Physical Restraint</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{Phy\text{-}RST,j}\,(\text{Phy-RST}_{i\text{-}1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{Phy\text{-}RST,j} = \gamma_{Phy\text{-}RST} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}^{2}$$

Mixed Model

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Phy\text{-}RST}(Phy\text{-}RST_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}(Gender_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Phy\text{-}RST}(Phy\text{-}RST_{i-1j})$ = the average slope between Overall Touch and maternal lagged Physical Restraint times score of maternal lagged Positive Emotional Reactions in dyad j
$\gamma_{ETL,j}(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Positive Emotional Reactions

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{Pos\text{-}Aff,j}(Pos\text{-}Aff_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{Pos\text{-}Aff,j} = \gamma_{Pos\text{-}Aff} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}^{2}$$

Mixed Model

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Pos\text{-}Aff}(Pos\text{-}Aff_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}(Gender_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j

$\gamma_{\text{Pos-Aff}}$ (Pos-Aff $_{i-1j}$) = the average slope between Overall Touch and maternal lagged Positive Emotional Reactions times score of maternal lagged Positive Emotional Reactions in dyad j
$\gamma_{ETL,j}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Negative Emotional Reactions

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{Neg-Aff},j} (\text{Neg-Aff}_{i-1j}) + \beta_{ETL,j} (ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender} (Gender_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{Neg-Aff},j} = \gamma_{\text{Neg-Aff}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender} (Gender_j) + \gamma_{\text{Neg-Aff}} (\text{Neg-Aff}_{i-1j}) + \gamma_{ETL} (ET_{ij}) + \gamma_{ET^2} (ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{\text{Neg-Aff}}$ (Neg-Aff $_{i-1j}$) = the average slope between Overall Touch and maternal lagged Negative Emotional Reactions times score of maternal lagged Negative Emotional Reactions in dyad j
$\gamma_{ETL,j}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2,j}(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Appropriate Mind-Related Comments

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{AMM,j} (AMM_{i-1j}) + \beta_{ETL,j} (ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + \beta_{Verb,j}(Verb_{i-1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{AMM,j} = \gamma_{AMM} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{AMM}(\text{AMM}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2{}_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{AMM}(\text{AMM}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal lagged Appropriate Mind-Related Comments times score of maternal lagged Appropriate Mind-Related Comments in dyad j
$\gamma_{ETL}(\text{ET}_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}(\text{ET}^2{}_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}(\text{Verb}_{i\text{-}1j})$ = the average slope between Overall Touch and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Maternal Non-Attuned Mind-Related Comments

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{NMM,j}(\text{NMM}_{i\text{-}1j}) + \beta_{ETL,j}(\text{ET}_{ij}) + \beta_{ET^2,j}(\text{ET}^2{}_{ij}) + \beta_{Verb,j}(\text{Verb}_{i\text{-}1j}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{NMM,j} = \gamma_{NMM} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$
$$\beta_{Verb,j} = \gamma_{Verb}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{NMM}(\text{NMM}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2{}_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ $(Gender_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{NMM}$ $(NMM_{i-1j})$ = the average slope between Overall Touch and maternal lagged Non-Attuned Mind-Related Comments times score of maternal lagged Non-Attuned Mind-Related Comments in dyad j
$\gamma_{ETL}$ $(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ $(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$\gamma_{Verb}$ $(Verb_{i-1j})$ = the average slope between Overall Touch and maternal verbosity times score of maternal verbosity (Total Comments) in interval *i* in dyad j
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

**Research Question 4: The Random Intercept Model Predicting Overall Touch from Lagged Toddlers' Regulatory Strategies.** The models were specified with the following equations:

<u>Toddler Initiated Verbal Distraction</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{T-INI-VDis},j}(\text{T-INI-VDis}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-INI-VDis},j} = \gamma_{\text{T-INI-VDis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + \gamma_{\text{T-INI-Vdis}}(\text{T-INI-VDis}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ $(Gender_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ $(Vocab_j)$ = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j

$\gamma_{T\text{-}INI\text{-}VDis}$ (T-INI-VDis $_{i\text{-}1j}$) = the average slope between Overall Touch and lagged Toddler Initiated Verbal Distraction times score of lagged Toddler Initiated Verbal Distraction in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

## Toddler Initiated Non-Verbal Distraction

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{T-INI-nonVDis},j}(\text{T-INI-nonVDis}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Vocab}(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-INI-nonVDis},j} = \gamma_{\text{T-INI-nonVDis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Vocab}(\text{Vocab}_j) + \gamma_{\text{T-INI-Vdis}}(\text{T-INI-nonVDis}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($\text{Gender}_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ ($\text{Vocab}_j$) = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}INI\text{-}nonVDis}$ (T-INI-nonVDis $_{i\text{-}1j}$) = the average slope between Overall Touch and lagged Toddler Initiated Non-Verbal Distraction times score of lagged Toddler Initiated Non-Verbal Distraction in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

## Toddler Initiated Verbal Keys

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{T-INI-Vkeys},j}(\text{T-INI-Vkeys}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-INI-Vkeys},j} = \gamma_{\text{T-INI-Vkeys}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + \gamma_{\text{T-INI-Vkeys}}(\text{T-INI-Vkeys}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0

$\gamma_{Gender}(Gender_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j

$\gamma_{Vocab}(Vocab_j)$ = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j

$\gamma_{\text{T-INI-Vkeys}}(\text{T-INI-Vkeys}_{i-1j})$ = the average slope between Overall Touch and lagged Toddler Initiated Verbal Keys times score of lagged Toddler Initiated Verbal Keys in dyad j

$\gamma_{ETL}(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j

$\gamma_{ET^2}(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*

$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Initiated Verbal Self-Control</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{T-INI-Vctrl},j}(\text{T-INI-Vctrl}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-INI-Vctrl},j} = \gamma_{\text{T-INI-Vctrl}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + \gamma_{\text{T-INI-Vctrl}}(\text{T-INI-Vctrl}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ ($Vocab_j$) = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma$ T-INI-Vctrl ($\text{T-INI-Vctrl}_{i-1j}$) = the average slope between Overall Touch and lagged Toddler Initiated Verbal Self-Control times score of lagged Toddler Initiated Verbal Self-Control in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Initiated Verbal Desire

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{T-INI-Vdes},j}(\text{T-INI-Vdes}_{i-1j}) + \beta_{ETL,j}(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-INI-Vctrl},j} = \gamma_{\text{T-INI-Vctrl}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(Gender_j) + \gamma_{Vocab}(Vocab_j) + \gamma_{\text{T-INI-Vdes}}(\text{T-INI-Vdes}_{i-1j}) + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ ($Vocab_j$) = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma$ T-INI-Vdes ($\text{T-INI-Vdes}_{i-1j}$) = the average slope between Overall Touch and lagged Toddler Initiated Verbal Desire times score of lagged Toddler Initiated Verbal Desire in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*

$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Self-Comfort

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{T\text{-}Comf,j}\,(\text{T-Scomf}_{\ i\text{-}1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Vocab}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{T\text{-}Comf,j} = \gamma_{T\text{-}Scomf} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL^2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{T\text{-}Scomf}\,(\text{T-Scomf}_{\ i\text{-}1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}\,(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}\,(\text{Vocab}_j)$ = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}Scomf}\,(\text{T-Scomf}_{\ i\text{-}1j})$ = the average slope between Overall Touch and lagged Toddler Self-Comfort times score of lagged Toddler Self-Comfort in dyad j
$\gamma_{ETL}\,(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET^2}\,(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Verbal Distraction-Bids to Mom

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\ T\text{-}Vdis\text{-}2M,j}\,(\text{T-Vdis-2M}_{\ i\text{-}1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Vocab}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\ T\text{-}Vdis\text{-}2M,j} = \gamma_{\ T\text{-}Vdis\text{-}2M} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$

$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{T\text{-}Vdis\text{-}2M}\,(\text{T-Vdis-2M}_{\,i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{\,ET}{}^2\,(\text{ET}^2{}_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ $(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ $(\text{Vocab}_j)$ = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}Vdis\text{-}2M}$ $(\text{T-Vdis-2M}_{\,i\text{-}1j})$ = the average slope between Overall Touch and lagged Toddler Verbal Distraction-Bids to Mom times score of lagged Toddler Verbal Distraction-Bids to Mom in dyad j
$\gamma_{ETL}$ $(\text{ET}_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET}{}^2$ $(\text{ET}^2{}_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Joined Verbal Distraction

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\,T\text{-}JNT\text{-}VDis,j}\,(\text{T-JNT-VDis}_{\,i\text{-}1j}) + \beta_{ETL,j}\,(\text{ET}_{ij}) + \beta_{ET}{}^2{}_{,j}(\text{ET}^2{}_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Vocab}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\,T\text{-}JNT\text{-}VDis,j} = \gamma_{\,T\text{-}JNT\text{-}VDis} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{T\text{-}JNT\text{-}VDis}\,(\text{T-JNT-VDis}_{\,i\text{-}1j)} + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{\,ET}{}^2\,(\text{ET}^2{}_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ $(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ $(\text{Vocab}_j)$ = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j

$\gamma_{T\text{-}JNT\text{-}VDis}$ (T-JNT-VDis $_{i-1j}$) = the average slope between Overall Touch and lagged Toddler Joined Verbal Distraction times score of lagged Joined Verbal Distraction in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval i in dyad j
$\gamma_{ET}{}^{2}$ ($ET^{2}{}_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Joined Non-Verbal Distraction</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{T-JNT-nonVDis},j} (\text{T-JNT-nonVDis}_{i-1j}) + \beta_{ETL,j} (ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender} (\text{Gender}_j) + \gamma_{Vocab} (\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-JNT-nonVDis},j} = \gamma_{\text{T-JNT-nonVDis}} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender} (\text{Gender}_j) + \gamma_{Vocab} (\text{Vocab}_j) + \gamma_{\text{T-JNT-nonVDis}} (\text{T-JNT-nonVDis}_{i-1j}) + \gamma_{ETL} (ET_{ij}) + \gamma_{ET^2} (ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($\text{Gender}_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ ($\text{Vocab}_j$) = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{\text{T-JNT-nonVDis}}$ (T-JNT-nonVDis $_{i-1j}$) = the average slope between Overall Touch and lagged Toddler Joined Non-Verbal Distraction times score of lagged Toddler Joined Non-Verbal Distraction in dyad *j*
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*
$\gamma_{ET}{}^{2}$ ($ET^{2}{}_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Verbal Keys – Bids to Mom</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{T-Vkeys-2M},j}\,(\text{T-Vkeys-2M}_{\,i-1j}) + \beta_{\text{ETL},j}\,(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-Vkeys-2M},j} = \gamma_{\text{T-Vkeys-2M}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}^2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + \gamma_{\text{T-Vkeys-2M}}\,(\text{T-Vkeys-2M}_{\,i-1j}) + \gamma_{\text{ETL}}\,(\text{ET}_{ij}) + \gamma_{\,\text{ET}^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{\text{Gender}}\,(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{\text{Vocab}}\,(\text{Vocab}_j)$ = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{\text{T-Vkeys-2M}}\,(\text{T-Vkeys-2M}_{\,i-1j})$ = the average slope between ENE-O and lagged Toddler Verbal Keys – Bids to Mom times score of lagged Toddler Verbal Keys – Bids to Mom in dyad j
$\gamma_{\text{ETL}}\,(\text{ET}_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*
$\gamma_{\text{ET}^2}\,(\text{ET}^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Verbal Self-Control- Bids to Mom

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{\text{T-Vctrl-2M},j}\,(\text{T-Vctrl-2M}_{\,i-1j}) + \beta_{\text{ETL},j}\,(\text{ET}_{ij}) + \beta_{\text{ET}^2,j}(\text{ET}^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{\text{T-Vctrl-2M},j} = \gamma_{\text{T-Vctrl-2M}} + u_{1j}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}}$$
$$\beta_{\text{ETL},j} = \gamma_{\text{ETL}^2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}\,(\text{Gender}_j) + \gamma_{\text{Vocab}}\,(\text{Vocab}_j) + \gamma_{\text{T-Vctrl-2M}}\,(\text{T-Vctrl-2M}_{\,i-1j}) + \gamma_{\text{ETL}}\,(\text{ET}_{ij}) + \gamma_{\,\text{ET}^2}\,(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ ($Vocab_j$) = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}Vctrl\text{-}2M}$ (T-Vctrl-2M $_{i-1j}$) = the average slope between Overall Touch and lagged Toddler Verbal Self-Control – Bids to Mom times score of lagged Toddler Verbal Self-Control – Bids to Mom in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

<u>Toddler Verbal Desire – Bids to Mom</u>

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{T\text{-}Vdes\text{-}2M,j}\,(\text{T-Vdes-2M}_{\,i-1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + u_{0j}$$
$$\text{Slopes: } \beta_{T\text{-}Vdes\text{-}2M,j} = \gamma_{T\text{-}Vdes\text{-}2M} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^2$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(Gender_j) + \gamma_{Vocab}\,(Vocab_j) + \gamma_{T\text{-}Vdes\text{-}2M}\,(\text{T-Vdes-2M}_{\,i-1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}$ ($Gender_j$) = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}$ ($Vocab_j$) = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}Vdes\text{-}2M}$ (T-Vdes-2M $_{i-1j}$) = the average slope between Overall Touch and lagged Toddler Verbal Desire Bids to Mom times score of lagged Toddler Verbal Desire – Bids to Mom in dyad j
$\gamma_{ETL}$ ($ET_{ij}$) = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*
$\gamma_{ET^2}$ ($ET^2_{ij}$) = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

Toddler Physical Comfort Seeking

Level-1 Equation:

$$\text{Overall Touch}_{ij} = \beta_{0j} + \beta_{T\text{-}ComfSk,j}\,(\text{T-ComfSk}_{\,i\text{-}1j}) + \beta_{ETL,j}\,(ET_{ij}) + \beta_{ET^2,j}(ET^2_{ij}) + e_{ij}$$

Level-2 Equations:

$$\text{Intercept: } \beta_{0j} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Vocab}\,(\text{Vocab}_j) + u_{0j}$$
$$\text{Slopes: } \beta_{T\text{-}ComfSk,j} = \gamma_{T\text{-}ComfSk} + u_{1j}$$
$$\beta_{ETL,j} = \gamma_{ETL}$$
$$\beta_{ETL,j} = \gamma_{ETL}{}^{2}$$

Mixed Model:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{T\text{-}ComfSk}\,(\text{T-ComfSk}_{\,i\text{-}1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + u_{0j} + e_{ij}$$

where $\gamma_{00}$ indicates the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0
$\gamma_{Gender}\,(\text{Gender}_j)$ = the average slope between Overall Touch and Gender times score of Gender in dyad j
$\gamma_{Vocab}\,(\text{Vocab}_j)$ = the average slope between Overall Touch and Vocabulary Production times score of Vocabulary Production in dyad j
$\gamma_{T\text{-}ComfSk}\,(\text{T-ComfSk}_{\,i\text{-}1j})$ = the average slope between Overall Touch and lagged Toddler Physical Comfort Seeking times score of lagged Toddler Physical Comfort Seeking in dyad j
$\gamma_{ETL}\,(ET_{ij})$ = the average slope between Overall Touch and linear elapsed time times score of linear elapsed time in interval *i* in dyad *j*
$\gamma_{ET^2}\,(ET^2_{ij})$ = the average slope between Overall Touch and quadratic elapsed time times score of quadratic elapsed time in interval i in dyad *j*
$u_{0j}$ = deviation for dyad j from overall intercept, $e_{ij}$ = deviation for interval *i* from its dyad *j*

# APPENDIX D

## Patterns of Study Variables across 12 Intervals

**Toddler Expression of Negative Emotion and Delay of Gratification – Patterns Across 12 Intervals.** Descriptive analyses were conducted for toddlers' expression of negative emotion and delay of gratification to identify and describe patterns of change across all 12 measurement occasions. Overall Expression of Negative Emotion (ENE-O) scores increased over the 12 intervals, while Overall Touch scores decreased over the 12 intervals. Additionally, one-way analysis of variance (ANOVA) was conducted to test mean differences of ENE-O and Overall Touch as a function of elapsed intervals (i.e., Elapsed Time) (Table D1). Means in ENE-O were not significantly different across 12 intervals but means in Overall Touch $F(11, 1559) = 6.32$, $p = 0.000$, $\eta^2 = .04$ were significantly different across 12 intervals (Table D1).

To further examine patterns of ENE-O and Overall Touch across the 12 intervals, to address the intercept-only models descriptively, and examine the linearity of effects of time on outcomes when all predictors were zero, I conducted Curve Estimation to estimate regression statistics between Elapsed Time and all dependent variables using linear and quadratic curves (Figure D1). Analysis of variance (ANOVA) was used to test linear and quadratic curves for goodness of fit for all dependent variables. Results revealed that the best fit linear models were not statistically significant for any of the outcome variables while the best fit quadratic models were significant for all dependent variables. These results revealed that in addition to a linear relationship, the relationship between Elapsed Time and ENE-O [$F(2, 1568) = 4.05$, $p = 0.02$, $r^2 = .005$], fit a quadratic curve which suggests that, on average, toddlers' Overall Expression of Negative Emotion followed an inverse U-shaped pattern by starting off with lower levels of intensity expression in the first half of the task, reached peak intensity towards the middle of the task, and returned to lower levels towards the end of the task. Additionally, compared to a linear model, a quadratic model was used to describe the pattern of observed scores for Overall Touch

[$F$(2, 1568) = 31.53, $p$ = 0.000, $r^2$ = .04] . As Elapsed Time increased, on average toddlers followed a U-Shaped curve in which they started off with higher amounts of Touch, Attempted Touch, and Overall Touch, followed by a decrease in Touch, Attempted Touch, and Overall Touch in the middle of the task, and a return to higher amounts of Touch, Attempted Touch, and Overall Touch towards the end of the task (Figure D1). Thus, Elapsed Time (Linear) and Elapsed Time$^2$ (Quadratic) were used as time-related predictor variables in all multilevel analyses.

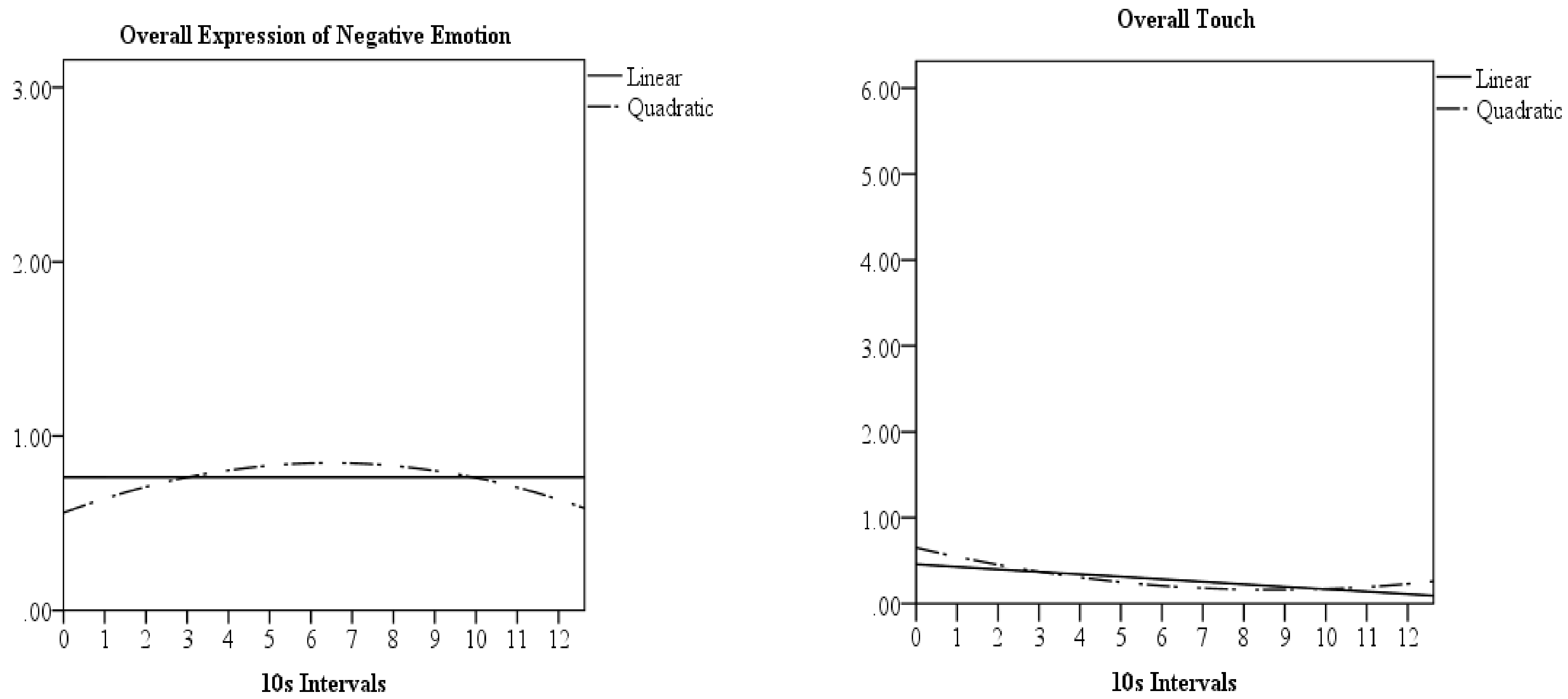
Table D1

*Analysis of Variance (ANOVA) Between Toddler Expression of Negative Emotion and Overall Touch with Elapsed Time Across 12 Intervals*

| Variable Name | ENE-O *M (SD)* | Overall Touch *M (SD)* |
|---|---|---|
| Interval 1 | 0.51 (0.74) | 0.58 (0.65) |
| Interval 2 | 0.81 (0.98) | 0.41 (0.76) |
| Interval 3 | 0.82 (1.00) | 0.35 (0.70) |
| Interval 4 | 0.88 (1.02) | 0.34 (0.77) |
| Interval 5 | 0.85 (1.04) | 0.19 (0.44) |
| Interval 6 | 0.74 (1.04) | 0.26 (0.59) |
| Interval 7 | 0.87 (1.06) | 0.17 (0.67) |
| Interval 8 | 0.79 (1.04) | 0.18 (0.54) |
| Interval 9 | 0.78 (1.00) | 0.12 (0.35) |
| Interval 10 | 0.75 (0.98) | 0.18 (0.43) |
| Interval 11 | 0.69 (0.98) | 0.24 (0.65) |
| Interval 12 | 0.69 (0.97) | 0.19 (0.47) |
| Variable Name | ENE-O | Overall Touch |
| $df$ | 11.00 | 11.00 |
| $F$ | 1.39 | 6.32 |
| $p$ | 0.17 | 0.00 |
| $\eta^2$ | 0.01 | 0.04 |

*Note*. ENE-O = Overall Intensity of Expression of Negative Emotion (Average of ENE-I and ENE-P); Overall Touch = sum of Touch and Attempted Touch.

Figure D1. *Linear and Quadratic fit for Overall Expression of Negative Emotion and Overall Touch Across 12 intervals*



Additionally, descriptive analyses were conducted to describe direction of change in predictor variables including Maternal Regulatory Attempts, Appropriate, and Non-Attuned Mind-Related Comments (Table D2), Toddlers' Regulatory Strategies (Table D3).

**Maternal Regulatory Attempts and Mind-Mindedness – Patterns across 12 Intervals**. Descriptive analyses were conducted for Maternal Regulatory Attempts, Appropriate Mind Related Comments, and Non-Attuned Mind Related Comments to identify and describe patterns of change across all 12 measurement occasions. Additionally, one-way analysis of variance was conducted for observed Maternal Regulatory Attempts and Mind-Mindedness as a function of elapsed intervals (i.e., Elapsed Time). Overall, Appropriate and Non-Attuned Mind Related Comments and all Maternal Regulatory Attempts increased over time except for Positive Commands, Negative Commands, Physical Restraint, and Positive Emotional Expressions, Positive Verbal Control and Negative Control which decreased over the 12 intervals. For parsimony, only significant main effects of Elapsed Time are reported (Table D2). Specifically, means for maternal Physical Comfort, Maternal Initiated Distraction, Negative Commands, and Physical Restraint differed as a function of Elapsed Time.

Table D2

*Analysis of Variance (ANOVA) Between Maternal Regulatory Strategies and Elapsed Time Across 12 Intervals*

| Variable Name | Phy-Comf<br>*M (SD)* | M-INI-Dis<br>*M (SD)* | Neg-Comd<br>*M (SD)* | Phy-RST<br>*M (SD)* |
|---|---|---|---|---|
| Interval 1 | 0.04 (0.21) | 0.11 (0.32) | 1.07 (1.53) | 0.83 (0.80) |
| Interval 2 | 0.13 (0.40) | 0.21 (0.43) | 0.98 (1.66) | 0.84 (0.89) |
| Interval 3 | 0.17 (0.45) | 0.25 (0.45) | 0.66 (1.24) | 0.69 (0.85) |
| Interval 4 | 0.18 (0.50) | 0.30 (0.51) | 0.57 (1.33) | 0.61 (0.82) |
| Interval 5 | 0.25 (0.57) | 0.33 (0.50) | 0.66 (1.48) | 0.63 (0.85) |
| Interval 6 | 0.22 (0.53) | 0.36 (0.59) | 0.49 (1.14) | 0.60 (0.81) |
| Interval 7 | 0.17 (0.43) | 0.38 (0.50) | 0.50 (1.04) | 0.67 (0.85) |
| Interval 8 | 0.22 (0.53) | 0.32 (0.53) | 0.59 (1.29) | 0.61 (0.84) |
| Interval 9 | 0.16 (0.44) | 0.31 (0.69) | 0.32 (0.70) | 0.49 (0.79) |
| Interval 10 | 0.22 (0.52) | 0.40 (0.59) | 0.54 (1.34) | 0.61 (0.86) |
| Interval 11 | 0.21 (0.53) | 0.34 (0.65) | 0.35 (0.93) | 0.61 (0.85) |
| Interval 12 | 0.21 (0.48) | 0.29 (0.51) | 0.31 (0.81) | 0.52 (0.82) |
| Variable Name | Phy-Comf | M-INI-Dis | Neg-Comd | Phy-RST |
| $df$ | 11 | 11 | 11 | 11 |
| $F$ | 1.8 | 3 | 4.79 | 2.03 |
| $p$ | 0.05 | 0.000 | 0.000 | 0.02 |
| $\eta^2$ | 0.01 | 0.02 | 0.03 | 0.01 |

*Note.* Phy-Comf = Physical Comfort, M-INI-Dis = Maternal Initiated Distraction, Neg-Comd = Negative Commands, Phy-RST = Physical Restraint, Scales: M-Dis = Maternal Distraction (sum of M-INI-Dis and M-JNT-Dis), Neg-Ctrl = Negative Control (sum of Neg-Comd, Pun, and Min).

**Toddler Regulatory Strategies – Patterns across 12 Intervals.** Descriptive analyses were conducted for toddlers' regulatory strategies to identify and describe patterns of change across all 12 measurement occasions. Additionally, one-way analysis of variance was conducted for observed toddlers' regulatory strategies as a function of elapsed intervals (i.e., Elapsed Time). Overall, Independent Regulatory Strategies decreased over time, except for toddler's Initiated Verbal and Initiated Non-Verbal Distraction which increased over time. Toddlers' use of Dependent Regulatory Strategies increased over the 12 intervals, except for Comfort Seeking which decreased over time. For parsimony, only significant main effects of Elapsed Time are reported (Table D3). Amongst Independent Regulatory Strategies, means for Toddler Initiated Non-Verbal Distraction and Toddler Initiated Verbal Keys differed as a function of Elapsed Time. Amongst Dependent Regulatory Strategies, means for Toddler Verbal Distraction – Bids to Mom and Toddler Joined Non-Verbal Distraction differed as a function of Elapsed Time.

Table D3

*Analysis of Variance (ANOVA) Between Toddler Regulatory Strategies and Elapsed Time Across 12 Intervals*

| | Independent Regulatory Strategies (IRS) | | Dependent Regulatory Strategies (DRS) | |
|---|---|---|---|---|
| Variable Name | T-INI-nonVDis *M (SD)* | T-INI-Vkeys *M (SD)* | T-VDis-2M *M (SD)* | T-JNT-nonVDis *M (SD)* |
| Interval 1 | 0.26 (0.47) | 0.11 (0.45) | 0.01 (0.09) | 0.04 (0.19) |
| Interval 2 | 0.40 (0.55) | 0.10 (0.50) | 0.01 (0.09) | 0.06 (0.27) |
| Interval 3 | 0.41 (0.58) | 0.04 (0.24) | 0.01 (0.12) | 0.12 (0.35) |
| Interval 4 | 0.46 (0.58) | 0.00 (0.00) | 0.03 (0.17) | 0.13 (0.33) |
| Interval 5 | 0.54 (0.70) | 0.03 (0.21) | 0.02 (0.15) | 0.19 (0.48) |
| Interval 6 | 0.45 (0.61) | 0.03 (0.24) | 0.05 (0.22) | 0.23 (0.56) |
| Interval 7 | 0.48 (0.66) | 0.02 (0.15) | 0.06 (0.27) | 0.16 (0.39) |
| Interval 8 | 0.45 (0.54) | 0.02 (0.12) | 0.10 (0.46) | 0.14 (0.37) |
| Interval 9 | 0.48 (0.58) | 0.02 (0.15) | 0.06 (0.27) | 0.19 (0.60) |
| Interval 10 | 0.50 (0.59) | 0.02 (0.15) | 0.10 (0.43) | 0.13 (0.42) |
| Interval 11 | 0.53 (0.63) | 0.02 (0.12) | 0.14 (0.50) | 0.12 (0.45) |
| Interval 12 | 0.45 (0.56) | 0.01 (0.09) | 0.11 (0.41) | 0.13 (0.34) |
| Variable Name | T-INI-nonVDis | T-INI-Vkeys | T-VDis-2M | T-JNT-nonVDis |
| $df$ | 11 | 11 | 11 | 11 |
| $F$ | 1.98 | 2.55 | 3.00 | 2.26 |
| $p$ | 0.03 | 0.00 | 0.00 | 0.01 |
| $\eta^2$ | 0.01 | 0.02 | 0.02 | 0.02 |

*Note*. T-INI-nonVDis = Toddler Initiated Non-Verbal Distraction, T-INI-Vkeys = Toddler Initiated Verbal Keys, T-VDis-2M = Toddler Verbal Distraction-Bids to Mom, T-JNT-nonVDis = Toddler Joined Non-Verbal Distraction

# APPENDIX E

## Descriptive Statistics across Task (120s)

Descriptive statistics were conducted for all study variables in (1) overall scores across the entire 2-minute delay of gratification task (all 120 seconds) for each parent-child dyad (sums and averages for all 12 intervals) (Tables E1-E3). Differences in means of observed toddler independent regulatory strategies and dependent regulatory strategies were analyzed across task (Table E4) and per interval (Table E5) using paired sample t-tests.

**Toddler Expression of Negative Emotion and Delay of Gratification – across Task (120 seconds).** Descriptive statistics for Overall Expression of Negative Emotion (ENE-O), and Overall Touch are reported (Table E1). On average, on average, toddlers expressed a mild level of intensity (ENE-O: $M$ = 0.75, $SD$ = 0.78) on a scale of 0-3 (0 indicating no cues for negative emotion, 1 = mild, 2 = moderate, 3 = severe level of intensity of negative emotion). Overall Touch scores suggest that on average toddlers either touched or attempted to touch the keys about 3 times during the entire 120 seconds ($M$ = 3.18, $SD$ = 3.66).

Table E1

*Descriptive Statistics for Toddler Expression of Negative Emotion and Overall Touch Across Task (All 120 Seconds)*

| Outcome Variables | Min | Max | Mean | SD | Skewness (SE) |
|---|---|---|---|---|---|
| ENE-O | 0.00 | 2.88 | 0.75 | 0.78 | 0.94 (.21) |
| Overall Touch | 0.00 | 21.00 | 3.18 | 3.66 | 1.77 (.21) |

*Note*. ENE-O = Overall Expression of Negative Emotion (average of ENE-I and ENE-P); Overall Touch = sum of Touch and Attempted Touch

**Maternal Regulatory Attempts and Mind-Mindedness – across Task (120 seconds).** In general, Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments were used infrequently and on average occurred less than 7 times across the 2-mintute task. Maximum variation in frequency of strategies used was observed for Negative Commands (e.g., “No!, “Don’t touch!”) and Maternal Verbal Orientation to Delay (e.g., “Pretty keys”, “Pooh is sleeping”). Minimum variation in frequency of strategies used was observed for

Maternal Joined Distraction, Minimizing, Appropriate and Non-Attuned Mind-Related Comments during the entire 120 seconds task. The most frequently used regulatory attempts were Negative Commands (e.g., “No!, “Don’t touch!”). The least frequently used regulatory attempts were Negative Emotional Reactions (e.g., yells at child), Minimizing (e.g., “Stop crying”) and Punitive Reactions (e.g., slapping child’s hand) per interval. On average moms used more physical comfort than verbal comfort. Mothers initiated distractions more often than joined in to their toddler’s initiated distractions. Punitive reactions were more frequently used than minimizing statements but less than any amount of physical restraint. Maternal display of negative emotional reactions was used less often than positive emotional reactions. Overall means for maternal mind related comments for all 12 intervals suggest that on average mothers made more Appropriate Mind-Related Comments compared to Non-Attuned Mind-Related Comments (Table E2).

Table E2

*Descriptive Statistics of for Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments across Task (All 120 Seconds)*

| Variable Name | Min | Max | Mean | SD | Skewness (SE) |
|---|---|---|---|---|---|
| Verbal Comfort | 0 | 12 | 1.69 | 2.63 | 2.20 (.21) |
| Physical Comfort | 0 | 24 | 2.12 | 3.43 | 3.06 (.21) |
| Initiated Distraction | 0 | 22 | 3.51 | 4.11 | 1.47 (.21) |
| Joined Distraction | 0 | 7 | 0.78 | 1.44 | 2.21 (.21) |
| Verbal Orientation to Delay | 0 | 38 | 4.24 | 7.02 | 2.45 (.21) |
| Positive Commands | 0 | 22 | 4.93 | 5.29 | 1.15 (.21) |
| Negative Commands | 0 | 65 | 6.93 | 8.02 | 3.35 (.21) |
| Punitive Reactions | 0 | 14 | 0.57 | 1.61 | 5.20 (.21) |
| Minimizing | 0 | 6 | 0.34 | 0.99 | 3.74 (.21) |
| Physical Restraint | 0 | 2 | 0.63 | 0.60 | 0.74 (.21) |
| Positive Emotional Reactions | 0 | 1 | 0.39 | 0.30 | 0.41 (.21) |
| Negative Emotional Reactions | 0 | 0.67 | 0.02 | 0.08 | 5.71 (.21) |
| Appropriate Mind Related Comments | 0 | 10 | 0.89 | 1.56 | 2.84 (.21) |
| Non-Attuned Mind Related Comments | 0 | 11 | 0.77 | 1.59 | 3.23 (.21) |

**Toddler Regulatory Strategies – across Task (120 seconds).** Overall means for the frequency of toddler regulatory strategies are reported (Table E3).

***Independent Regulatory Strategies across Task (120 seconds).*** In general, Independent Regulatory Strategies were used infrequently and on average occurred less than 6 times during the entire 2-minute task. Maximum variation in frequency of strategies used was observed for toddler initiated Non-Verbal Distraction (e.g., looks away for more that 3s, walks out of the room) and physically self-comforting behaviors (e.g., thumb sucking, rocking back and forth) during the entire two-minute task. Minimum variation in frequency of strategies used was observed for toddler initiated verbal distractions (e.g., "chair" or singing). The most frequently displayed independent strategy by toddlers was Self-Comfort (e.g., thumb sucking, rocking back and forth), while the least frequently displayed independent strategy was Initiated Verbal Distractions (e.g., "Chair" or singing).

On average, toddlers initiated fewer Verbal Distraction (e.g., "Chair" or singing) than Non-Verbal Distraction (e.g. looks away for more than 3 seconds) during the entire 2-minute task. Toddlers vocalized more words or phrases describing the keys or reframing the task (e.g., "Keys" "Wake up Turtle") than they vocalized words expressing desire for the keys (e.g. "I want it", "I need it") (while all verbalizations in the form of self-direction or in reference to the rules of the task (e.g. "I wait", "No touch") were directed towards or involved mother (described below).

***Dependent Regulatory Strategies across Task (120 seconds).*** In general, Dependent Regulatory Strategies were used infrequency and on average occurred less than 3 times during the entire 2-mintue task. Maximum variation in frequency of strategies used was observed for toddler Joint Non-Verbal Distraction (e.g., looks to where mother points, joins in mothers' initiated distracting activity). Minimum variation in frequency of strategies used was observed for toddler verbalizations in the form of self-direction or in reference to the rules of the task (e.g. “I wait”, “No touch”) in response to mother during the entire 2-minute task. The most frequently displayed strategy directed toward or in response to mother was Physical Comfort Seeking (e.g., leaning on mothers’ body, turning body toward mother), while the least frequently displayed strategy directed toward or in response to mother were verbalizations in the form of self-direction or in reference to the rules of the task (e.g. “I wait”, “No touch”) during the entire 2-minute task. On average, toddlers displayed more Joined Non-Verbal Distraction than Joined Verbal Distraction. On average, toddlers vocalized more words or phrases describing the keys or reframing the task (e.g., “Keys”, “Wake up Turtle”) than then vocalized words expressing desire for the keys (e.g. “I want it”, “I need it”) or verbalizations in the form of self-direction or in reference to the rules of the task (e.g. “I wait”, “No touch”).

Table E3

*Descriptive Statistics for Toddler Regulatory Strategies Across Task (All 120 Seconds)*

| Variable Name | Min | Max | Mean | SD | Skewness (SE) |
|---|---|---|---|---|---|
| | Independent Regulatory Strategies (IRS) | | | | |
| Initiated Verbal Distraction | 0.00 | 6.00 | 0.12 | 0.60 | 7.74 (.21) |
| Initiated Non-Verbal Distraction | 0.00 | 20.00 | 5.28 | 4.51 | 0.59 (.21) |
| Initiated Verbal Keys | 0.00 | 9.00 | 0.42 | 1.25 | 4.32 (.21) |
| Initiated Verbal Self-Control | 0.00 | 0.00 | 0.00 | 0.00 | . |
| Initiated Verbal Desire | 0.00 | 8.00 | 0.18 | 0.91 | 6.67 (.21) |
| Self-Comfort | 0.00 | 22.00 | 5.89 | 4.94 | 0.79 (.21) |
| | Dependent Regulatory Strategies (DRS) | | | | |
| Verbal Distraction-Bids to Mom | 0.00 | 10.00 | 0.69 | 1.59 | 3.06 (.21) |
| Joined Verbal Distraction | 0.00 | 11.00 | 0.68 | 1.90 | 3.51 (.21) |
| Joined Non-Verbal Distraction | 0.00 | 18.00 | 1.59 | 2.98 | 2.72 (.21) |
| Verbal Keys-Bids to Mom | 0.00 | 16.00 | 0.99 | 2.36 | 3.92 (.21) |
| Verbal Self-Control-Bids to Mom | 0.00 | 7.00 | 0.11 | 0.72 | 7.98 (.21) |
| Verbal Desire- Bids to Mom | 0.00 | 8.00 | 0.37 | 1.03 | 4.30 (.21) |
| Physical Comfort Seeking | 0.00 | 14.00 | 2.80 | 3.47 | 1.35 (.21) |

For exploratory purposes, differences in means of observed toddler independent regulatory strategies and dependent regulatory strategies were analyzed across task (Table E4) and per interval (Table E5) using paired sample t-tests.

Table E4

*Comparison between means for frequency of toddlers' Independent Regulatory Strategies and Dependent Regulatory Strategies Across Task (All 120 Seconds)*

| **Independent Regulatory Strategies** | | **Dependent Regulatory Strategies** |
|---|---|---|
| Toddler Initiated Verbal Distraction | $<^{***}$ | Toddler Verbal Distraction-Bids to Mom |
| Toddler Initiated Verbal Distraction | $<^{***}$ | Toddler Joined Verbal Distraction |
| Toddler Initiated Non-Verbal Distraction | $>^{***}$ | Toddler Joined Non-Verbal Distraction |
| Toddler Initiated Verbal Keys | $<^{**}$ | Toddler Verbal Keys – Bids to Mom |
| Toddler Initiated Verbal Self-Control | $<^{\dagger}$ | Toddler Verbal Self-Control- Bids to Mom |
| Toddler Initiated Verbal Desire | $<$ | Toddler Verbal Desire- Bids to Mom |
| Toddler Self-Comfort | $>^{***}$ | Toddler Physical Comfort Seeking |
| Total Toddler Independent Regulatory Strategies | $>^{***}$ | Total Toddler Dependent Regulatory Strategies |

*Note.* Paired Samples T-Tests $^{*}p < .05$, two-tailed. $^{**}p < .01$, two-tailed. $^{***}p < .001$, two-tailed. $^{\dagger}p < .10$, two-tailed.

Table E5

*Comparison between means for frequency of toddlers Independent Regulatory Strategies and Dependent Regulatory Strategies per 10-Second Interval*

| **Independent Regulatory Strategies** | | **Dependent Regulatory Strategies** |
|---|---|---|
| Toddler Initiated Verbal Distraction | $<^{***}$ | Toddler Verbal Distraction-Bids to Mom |
| Toddler Initiated Verbal Distraction | $<^{***}$ | Toddler Joined Verbal Distraction |
| Toddler Initiated Non-Verbal Distraction | $>^{***}$ | Toddler Joined Non-Verbal Distraction |
| Toddler Initiated Verbal Keys | $<^{***}$ | Toddler Verbal Keys – Bids to Mom |
| Toddler Initiated Verbal Self-Control | $<^{**}$ | Toddler Verbal Self-Control- Bids to Mom |
| Toddler Initiated Verbal Desire | $<^{**}$ | Toddler Verbal Desire- Bids to Mom |
| Toddler Self-Comfort | $>^{***}$ | Toddler Physical Comfort Seeking |
| Total Toddler Independent Regulatory Strategies | $>^{***}$ | Total Toddler Dependent Regulatory Strategies |

*Note.* Paired Samples T-Tests $^{*}p < .05$, two-tailed. $^{**}p < .01$, two-tailed. $^{***}p < .001$, two-tailed. $^{\dagger}p < .10$, two-tailed.

# APPENDIX F

## Correlations of Outcomes with Current-Interval Predictors

**Current-Interval Maternal Variables and Overall Expression of Negative Emotion**

First, correlations for current interval Maternal Regulatory Attempts, current-interval Appropriate and current-interval Non-Attuned Mind-Related Comments with ENE-O are presented (Table F1). All correlations for current-interval Maternal Regulatory Attempts with ENE-O were small but significant ($r = -.35$ to $.06$), except for non-significant correlations for current-interval Positive Commands. Unexpectedly, as current-interval Verbal Comfort and current-interval Physical Comfort increased, ENE-O increased. All other correlations were in expected directions.

Strongest negative associations for current interval predictors were between maternal Positive Emotional Reactions and toddlers' Expression of Negative Emotion, while strongest positive associations were between maternal Physical Restraint followed by Negative Emotional Reactions and Toddlers' Expression of Negative Emotion. Toddlers expressed lower intensity negative emotions as mothers expressed or shared positive affect with their toddlers in current interval. However, as mothers' use of highly forceful and continuous physically restrictive behavior increased and when mothers laughed at their toddlers' expression of negative affect in a mocking way or when they became angry themselves, toddlers tended to express higher intensity of negative emotions. Appropriate Mind-Related Comments were not associated with Expression of Negative Emotion while Non-Attuned Mind-Related Comments were positively related to Expression of Negative Emotion as expected; suggesting that higher use of lagged Non-Attuned Mind-Related Comments was associated with higher intensity of Expression of Negative Emotion as expected.

Table F1

*Correlations for Current Interval Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments with Expression of Negative Emotion (n=1571)*

| Variable Name | ENE-O |
|---|---|
| Verbal Comfort | $.12^{**}$ |
| Physical Comfort | $.09^{**}$ |
| Initiated Distraction | $-.17^{**}$ |
| Joined Distraction | $-.06^{*}$ |
| Verbal Orientation to Delay | $-.11^{**}$ |
| Positive Commands | .03 |
| Negative Commands | $.15^{**}$ |
| Punitive Reactions | $.15^{**}$ |
| Minimizing | $.22^{**}$ |
| Physical Restraint | $.30^{**}$ |
| Positive Emotional Reactions | $-.35^{**}$ |
| Negative Emotional Reactions | $.19^{**}$ |
| Appropriate Mind Related Comments | -.02 |
| Non-Attuned Mind Related Comments | $.10^{**}$ |

*Note.* ENE-O = Overall Expression of Negative Emotion (average of ENE-I and ENE-P). $^{*}p < .05$, one-tailed. $^{**}p < .01$, one-tailed. $^{\dagger}p < .10$, one-tailed.

**Current-Interval Toddlers Regulatory Strategies and Expression of Negative Emotion.** Correlations for lagged Independent Regulatory Strategies and lagged Dependent Regulatory Strategies with ENE-O are presented (Table F2). Correlations for current-interval Independent Regulatory Strategies with ENE-O were small but significant (r = -.33 to .06). Unexpectedly, current-interval Toddler Initiated Verbal Desire (e.g., “I want it”, “I need it”) was positively associated with ENE-O suggesting that as toddlers vocalized desire states, they tended to express more intense levels of negative emotion. These associations suggest that verbalization of desire words may facilitate expression of negative emotion. All other correlations were in expected negative directions. Strongest associations were observed for current-interval Toddler Initiated Non-Verbal Distraction and ENE-O. As toddlers initiated engagement in non-verbal distracting behaviors such as play or looking away from the keys, they tended to express milder levels of negative emotions.

Correlations for current-interval Dependent Regulatory Strategies with ENE-O were small but significant (r= -.05 to -.18). Current-interval Toddler Verbal Distraction-Bids to Mom (e.g. toddler said “I want bottle” or initiated singing while looking at mom), current-interval Toddler Verbal Desire-Bids to Mom (e.g., toddler said “I want it, I need it” directed towards or in response to mom), current-interval Toddler Physical Comfort Seeking (e.g., reaching arms up to mother, hugging mother, leaning on mother’s body) were not significantly related to ENE-O. All significant associations were in expected negative direction. Strongest associations were observed for current-interval Toddler Joined Non-Verbal Distraction and ENE-O. As toddlers joined their mothers’ initiated non-verbal distractions (e.g., Mother points to a direction away from keys and child looks where she is pointing), they expressed lower levels of ENE-O.

Table F2

*Correlations for Current Interval Toddler Regulatory Strategies with Expression of Negative Emotion (n = 1571)*

| Variable Name | ENE-O |
|---|---|
| Independent Regulatory Strategies (IRS) | |
| Initiated Verbal Distraction | $-.05^{*}$ |
| Initiated Non-Verbal Distraction | $-.33^{**}$ |
| Initiated Verbal Keys | $-.06^{*}$ |
| Initiated Verbal Self-Control | - |
| Initiated Verbal Desire | $.06^{**}$ |
| Self-Comfort | $-.09^{**}$ |
| Dependent Regulatory Strategies (DRS) | |
| Verbal Distraction-Bids to Mom | -.03 |
| Joined Verbal Distraction | $-.13^{**}$ |
| Joined Non-Verbal Distraction | $-.18^{**}$ |
| Verbal Keys-Bids to Mom | $-.09^{**}$ |
| Verbal Self-Control-Bids to Mom | $-.05^{*}$ |
| Verbal Desire- Bids to Mom | .02 |
| Physical Comfort Seeking | .00 |

*Note.* ENE-O = Overall Expression of Negative Emotion (average of ENE-I and ENE-P); $^{*}p < .05$, one-tailed. $^{**}p < .01$, one-tailed. $^{\dagger}p < .10$, one-tailed.

**Current-Interval Maternal Variables and Delay of Gratification**

Next, correlations for current-interval Maternal Regulatory Attempts, current-interval Appropriate, and current-interval Non-Attuned Mind-Related Comments with Delay of Gratification operationalized as amount of Overall Touch are presented (Table F3). All correlations for current interval Maternal Regulatory Attempts with Overall Touch, were small but significant (r = -.06 to .32). Current-interval Verbal Comfort, Verbal Orientation to Delay, Punitive Reactions, and Minimizing statements were not significantly related to Overall Touch. Unexpectedly, current-interval Positive Commands and Positive Emotional Reactions were positively correlated with Overall Touch. As mothers used more Positive Commands (e.g., “You have to wait”) or shared positive affect (e.g., smiling), toddlers tendency to touch or attempt to touch the keys increased. All other correlations were in the expected direction.
Strongest negative associations for current-interval predictors were between maternal Initiated Distraction and Overall Touch, while strongest positive associations were between Negative Commands and Physical Restraint with Overall Touch. As mothers’ use of Negative Commands (e.g., “Don’t touch”) or use of highly forceful and continuous physically restrictive behavior increased, toddlers’ tendency to touch or attempt to touch the keys increased as expected. Current-interval Appropriate and Non-Attuned Mind-Related Comments were not correlated with Overall Touch. [38]

[38] Appropriate mind-related comments and Touch were negatively associated ($r$ = -.05, $p$ < .10), suggesting that as mothers displayed more appropriate mind-related comments, toddlers’ tendency to touch the keys decreased as expected. Unexpectedly, higher frequency of Non-Attuned Mind-Related Comments was related to lower frequency of Touch ($r$ = -.05, $p$ < .05), suggesting that as mothers displayed more Non-Attuned Mind-Related Comments, toddlers’ tendency to touch the keys decreased. However, this association may be explained by a large amount of overlap between Non-Attuned Mind-Related Comments and Maternal Initiated Distraction (76.8 %).

Table F3

*Correlations for Current Interval Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-Related Comments with Touch (n=1571)*

| Variable Name | Overall Touch |
|---|---|
| Verbal Comfort | -.03 |
| Physical Comfort | $-.12^{**}$ |
| Initiated Distraction | $-.12^{**}$ |
| Joined Distraction | $-.06^{**}$ |
| Verbal Orientation to Delay | .04 |
| Positive Commands | $.16^{**}$ |
| Negative Commands | $.32^{**}$ |
| Punitive Reactions | .02 |
| Minimizing | .01 |
| Physical Restraint | $.25^{**}$ |
| Positive Emotional Reactions | $.06^{**}$ |
| Negative Emotional Reactions | $.12^{**}$ |
| Appropriate Mind Related Comments | -.04 |
| Non-Attuned Mind Related Comments | -.03 |

*Note.* Overall Touch = sum of Touch and Attempted Touch. $^{*}p < .05$, one-tailed. $^{**}p < .01$, one-tailed. $^{\dagger}p < .10$, one-tailed.

**Current Interval Toddler Regulatory Strategies and Delay of Gratification.**

Correlations for lagged Independent Regulatory Strategies and lagged Dependent Regulatory Strategies with Delay of Gratification operationalized as amount of Overall Touch are presented (Table F4). Correlations for current-interval Independent Regulatory Strategies with Overall Touch were small but significant (r = -.21 to .06). Current-interval Toddler Initiated Verbal Distraction (e.g., “Chair”) was not associated with Overall Touch. Unexpectedly, current-interval Toddler Initiated Verbal Desire (e.g., “I want it”, “I need it”) was positively associated with Overall Touch suggesting that as toddlers vocalized desire states, they tended to touch or attempted to touch the keys. These associations suggest that verbalization of desire words that are not directed toward mother may impede ability to wait. All other correlations were in expected negative directions. Strongest associations were observed for current-interval Toddler Initiated Non-Verbal Distraction (e.g., looking away for more than 3s). As expected, as toddlers initiated more non-verbal distractions, they tended to display less Overall Touch.

Correlations for current-interval Dependent Regulatory Strategies with Overall Touch were also small but significant (r= -.11 to .07). Current-interval Toddler Initiated Verbal Keys (e.g., “Keys”, “Turtle is sleeping, wake up turtle”) was not significantly related to Overall Touch. Unexpectedly, current-interval Toddler Verbal Desire (e.g., “I want it”, I need it”) when directed toward mother or in response to mother, was positively associated with Overall Touch. Also unexpectedly, current-interval Toddler Initiated Verbal Self-Control (e.g., “I wait”, “No Touch”) was positively but marginally associated with Overall Touch. These results suggest that as toddlers vocalized desire states or task-related rules in current interval, they tended to touch or attempted to touch the keys. All other correlations were in expected negative directions. Strongest associations were observed for current-interval Toddler Physical Comfort Seeking. As expected, as toddlers displayed more Physical Comfort Seeking (e.g. leaning in to mom, reaching up for hug), they tended to display less Overall Touch.

Table F4

*Correlations for Current Interval Toddler Regulatory Strategies with Expression of Negative Emotion and Overall Touch (n = 1571)*

| Variable Name | Overall Touch |
|---|---|
| Independent Regulatory Strategies (IRS) | |
| Initiated Verbal Distraction | -0.02 |
| Initiated Non-Verbal Distraction | $-.21^{**}$ |
| Initiated Verbal Keys | $.09^{**}$ |
| Initiated Verbal Self-Control | - |
| Initiated Verbal Desire | $.06^{**}$ |
| Self-Comfort | $-.09^{**}$ |
| Dependent Regulatory Strategies (DRS) | |
| Verbal Distraction-Bids to Mom | $-.07^{**}$ |
| Joined Verbal Distraction | $-.06^{**}$ |
| Joined Non-Verbal Distraction | $-.09^{**}$ |
| Verbal Keys-Bids to Mom | .01 |
| Verbal Self-Control-Bids to Mom | $.04^{\dagger}$ |
| Verbal Desire- Bids to Mom | $.07^{**}$ |
| Physical Comfort Seeking | $-.11^{**}$ |

*Note.* Overall Touch = sum of Touch and Attempted Touch. $^{*}p < .05$, one-tailed. $^{**}p < .01$, one-tailed. $^{\dagger}p < .10$, one-tailed.

# APPENDIX G

## Independence of Errors and Intraclass Correlations

**Independence of Errors.** Intraclass correlations (ICCs) were calculated from the two-level base model (null or unconditional model) to determine amount of variability in Expression of Negative Emotion when all predictors were zero. In other words, (1) does toddlers' ENE-O and Overall Touch differ across the two-minute task? Operationalized in multilevel modeling framework: Are there intraindividual differences in means of ENE-O *within* toddlers across 12 intervals?

Level-1 Equation: The Intercept-Only Model (Outcome 1)

$$\text{ENE-O}_{ij} = \beta_{0j} + e_{ij}$$

where *i* indicates the time interval within a dyad and j indicates a mother-child dyad, $\beta_{0j}$ indicates the intercept (mean) for ENE-O in dyad j (varies over j dyads), $e_{ij}$ indicates random errors of prediction for level-1 equation (deviation for interval *i* from its dyad *j*).

Level-2 Equation: The Intercept-Only Model (Outcome 1)

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

where $\beta_{0j}$, an intercept (mean) for group j is the sum of the overall intercept, the grand mean of the ENE-O scores across all dyads when all predictors = 0, $\gamma_{00}$, and the random error associated with the group intercept, $u_{0j}$ (deviation for group j from overall intercept)

Operationalized in multilevel modeling framework: Are there intraindividual differences in means of Overall Touch *within* toddlers across 12 intervals?

Level-1 Equation: The Intercept-Only Model (Outcome 2)

$$\text{OverallTouch}_{ij} = \beta_{0j} + e_{ij}$$

where *i* indicates the time interval within a dyad and j indicates a mother-child dyad, $\beta_{0j}$ indicates the intercept (mean) for Overall Touch in dyad j (varies over j dyads), $e_{ij}$ indicates random errors of prediction for level-1 equation (deviation for interval *i* from its dyad *j*).

Level-2 Equation: The Intercept-Only Model (Outcome 2)

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

where $\beta_{0j}$, an intercept (mean) for group j is the sum of the overall intercept, the grand mean of the Overall Touch scores across all dyads when all predictors = 0, $\gamma_{00}$, and the random error associated with the group intercept, $u_{0j}$ (deviation for group j from overall intercept)

**Intraclass Correlations (ICC).** ICCs were calculated as the amount of variance among toddlers (between groups) divided by the sum of variance among toddlers and within dyad (i.e., between measurement occasions) variance. ICC's are presented in Table G1. There was 64% of variability in ENE-I, 65% of variability in ENE-P, 17 % of variability in Touch, 17 % of variability in Attempted Touch. There was 64% of variability in ENE-I, 65% of variability in ENE-P, 17 % of variability in Touch, 17 % of variability in Attempted Touch. Only ENE-O and Overall Touch were specified as outcomes in random coefficient models.

Table G1

*Intraclass correlations for Intercept-Only Models for Expression of Negative Emotion and Delay of Gratification*

| Outcome Variables | Within Group Variance $e_{ij}$ | Between Group Variance $u_{oj}$ | ICC |
|---|---|---|---|
| ENE-O | 0.3464 | 0.67454 | 0.66 |
| Overall Touch | 0.30138 | 0.07512 | 0.20 |

*Note.* ENE-O = Overall Expression of Negative Emotion (average of ENE-I and ENE-P); Overall Touch = sum of Touch and Attempted Touch. ICC = Between Group Variance / Sum of Within and Between Group Variance.

# APPENDIX H

## Model Specification of Covariates

For models in Questions 1 (MRA, MM & ENE-O) and 3 (MRA, MM, &Overall Touch), covariates included lagged maternal verbosity (e.g., Total Comments), toddler gender, linear elapsed time, and quadratic elapsed time. Lagged maternal verbosity was included in models specified with lagged Verbal Comfort, Verbal Orientation to Delay, Positive Commands, Negative Commands, Minimizing, as well as Appropriate Mind-Related Comments, and Non-Attuned Mind-related Comments. Child gender was specified as a level 2 predictor (of overall intercept) in models predicted from level-1 Maternal Regulatory Attempts, Appropriate and Non-Attuned Mind-related Comments for both outcomes.

Covariates for questions 2 (TRS & ENE-O) and 4 (TRS & Overall Touch) were included based on correlational and main effect findings from the Intercept-Only models for both outcomes. Correlational analyses (Table 19) revealed significant associations for toddlers' gender (higher for boys) with ENE-O but not with Overall Touch. Additionally, while gender was a significant predictor of differences in overall mean of ENE-O (higher for boys), it was not related to Overall Touch (Intercept-Only Model).

Conversely, while toddlers' vocabulary production was not significantly associated with their ENE-O, it was negatively associated with Overall Touch (correlational analyses). Additionally, while expressive vocabulary was not a significant predictor of ENE-O , it was marginally and negatively associated with Overall Touch ($\beta$ = - 0.002, $p$ = 0.08) suggesting that higher scores in expressive vocabulary (mother-report) were associated with lower Overall Touch, an association that was not found for ENE-O (intercept-only model). Therefore, gender was included in random coefficient models predicting ENE-O from lagged Toddler Regulatory Strategies (Question 2), and expressive language was included in random coefficient models predicting Overall Touch from lagged Toddler Regulatory Strategies (Question 4). Time varying predictors, included Elapsed Time-Linear (ET) and Elapsed Time$^2$ – Quadratic (ET$^2$), and were used as level-1 explanatory variables in all models to account for linear and quadratic effects of time on average ENE-O and Overall Touch and were specified with fixed slopes.

Table H1

*Variable names and labels for study covariates*

| Covariate Label | Covariate Name | Computed | Included in Questions | Variable Level |
|---|---|---|---|---|
| Lagged Maternal Verbosity | Verb | Total Comments per 10s | 1 & 3 | Level 1 |
| Linear Elapsed Time | ET | 10s | 1 - 4 | Level 1 |
| Quadratic Elapsed Time | ET$^2$ | (10s)$^2$ | 1 - 4 | Level 1 |
| Toddler Gender | Gender | 0 = Girls, 1 = Boys | 1-3 (Not 4) | Level 2 |
| Toddler Expressive Language | Vocab | Vocabulary Production | Only 4 | Level 2 |

*Note*. Level-1 indicates that variable was observed in 10s intervals. Level-2 indicates variable was observed at dyad level.

# APPENDIX I

## Models of Non-Significant Predictors

**Question 1A.** Model results for non-significant predictors in Question 1A (Phy-Comf, M-JNT-Dis, M-VO2D, and AMM) are presented in Tables I1-I4.

***Lagged Maternal Physical Comfort.*** A two-level hierarchical model examined the effects of lagged maternal Physical Comfort on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{Phy-Comf}}(\text{Phy-Comf}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Physical Comfort (e.g., giving hugs) was not associated with ENE-O (Table 23). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Physical Comfort and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Physical Comfort and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2 = 4.20$, df = 2, $p > 0.05$). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged maternal Physical Comfort and ENE-O does not vary between dyads. Effects of lagged maternal Physical Comfort on ENE-O remain non-significant in Model 2.

Table I1
*Effects of Lagged Maternal Physical Comfort on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.63^{***}$ | 0.15 |
| Gender | $0.31^{**}$ | 0.15 |
| Physical Comfort | 0.01 | 0.05 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.72^{***}$ | 0.85 |
| $e_{ij}$ | 0.32 | 0.57 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Joined Distraction***. A two-level hierarchical model examined the effects of lagged maternal Joined Distraction on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{M-JNT-Dis}}(\text{M-JNT-Dis}_{-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Joined Distraction (e.g. child plays with toes and mother says "Let's count your toes") was not associated with ENE-O (Table I2). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Joined Distraction and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Joined Distraction and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2 = .59$, df = 2, $p > 0.05$). Additionally, the $p$-value associated with random slope was not significant suggesting that the association between lagged maternal Joined Distraction and ENE-O does not vary between dyads. Effects of lagged maternal Joined Distraction on ENE-O remain non-significant in Model 2.

Table I2

*Effects of Lagged Maternal Joined Distraction Comfort on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.63^{***}$ | 0.15 |
| Gender | $0.31^{**}$ | 0.15 |
| Joined Distraction | -0.08 | 0.06 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.72^{***}$ | 0.85 |
| $e_{ij}$ | 0.32 | 0.57 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{†}p < .10$

***Lagged Maternal Verbal Orientation to Delay.*** A two-level hierarchical model examined the effects of lagged maternal Verbal Orientation to Delay on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{M\text{-}VO2D}(\text{M-VO2D}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Verbal Orientation to Delay (e.g., mom said "keys" or "What color are they?" "Pooh is sleeping") was not associated with ENE-O but was in the expected direction (Table I3). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Verbal Orientation to Delay and ENE-O were allowed to vary between dyads. Results of deviance tests ($X^2_D$ = chi squared difference) indicated that allowing the relationship between lagged maternal Verbal Orientation to Delay and ENE-O to vary among dyads would significantly improve model fit $X_D^2 = 9.20$, df = 2, $p < .05$. Indeed, when the association between lagged maternal Verbal Orientation to Delay and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p < .01$), suggesting that dyads varied in the association between lagged maternal Verbal Orientation to Delay and ENE-O. Effects of lagged maternal Verbal Orientation to Delay on ENE-O remain non-significant in Model 2.

Table I3
*Effects of Lagged Maternal Verbal Orientation to Delay on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.51^{***}$ | 0.15 | $0.51^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.31^{*}$ | 0.15 |
| Verbal Orientation to Delay | -0.02 | 0.03 | -0.01 | 0.03 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Verbosity | $0.04^{***}$ | 0.01 | $0.04^{***}$ | 0.01 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.73^{***}$ | 0.85 | $0.74^{***}$ | 0.86 |
| $u_{M\text{-}VO2D,\,j}$ | - | - | $0.01^{**}$ | 0.12 |
| $e_{ij}$ | 0.32 | 0.56 | 0.31 | 0.55 |
| *Deviance* | 2902.29 | | 2893.08 | |

Note. Elapsed Time (ET) is in 10s intervals. *p < .05, **p < .01, *** p < .001, †p < .10

***Lagged Maternal Appropriate Mind-Related Comments.*** A two-level hierarchical model examined the effects of lagged maternal Appropriate Mind-Related Comments on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{AMM}\,(\text{AMM}_{i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + \gamma_{Verb}\,(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Appropriate Mind-Related Comments (e.g., “You are frustrated” said while toddler is frustrated, “You want the keys”, said while toddler is pointing at keys) was not significantly associated with ENE-O, but associations were in the expected direction (Table I4). Toddlers’ average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Appropriate Mind-Related Comments and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Appropriate Mind-Related Comments and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 0.05, df = 2, $p > 0.05$). Additionally, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Appropriate Mind-Related Comments and ENE-O does not vary between dyads. Effects of lagged maternal Appropriate Mind-Related Comments on ENE-O remain non-significant in model I4.

Table I4
*Effects of Lagged Appropriate Mind-Related Comments on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | 0.51*** | 0.15 |
| Gender | 0.31* | 0.15 |
| Appropriate Mind-Related Comments | -0.03 | 0.05 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| Verbosity | 0.04*** | 0.01 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | 0.73*** | 0.85 |
| $e_{ij}$ | 0.32 | 0.56 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 1B.** Model results for non-significant predictors in Question 1B (Neg-Comd and NMM) are presented in Tables I5-I6.

***Lagged Maternal Negative Commands***. A two-level hierarchical model examined the effects of lagged maternal Negative Commands on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Neg\text{-}Comd}(\text{Neg-Comd}_{i-1j})$$
$$+ \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i-1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Negative Commands (e.g., "Don't touch" "I said no") was not associated with ENE-O but in the expected direction (Table I5). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Negative Commands and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Negative Commands and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 3.73, df = 2, $p > 0.05$). However, when the association between lagged maternal Negative Commands and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p < .05$), suggesting that dyads varied in the association between lagged maternal Negative Commands and ENE-O. Effects of lagged Negative Commands on ENE-O remain non-significant in Model 2. Results of more parsimonious model are presented in Table I5.

Table I5

*Effects of Lagged Negative Commands on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | 0.51*** | 0.15 |
| Gender | 0.31* | 0.15 |
| Negative Commands | 0 | 0.02 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| Verbosity | 0.04** | 0.01 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | 0.72*** | 0.85 |
| $e_{ij}$ | 0.32 | 0.56 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Maternal Non-Attuned Mind-Related Comments.*** A two-level hierarchical model examined the effects of lagged maternal Non-Attuned Mind-Related Comments on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{NMM}(\text{NMM}_{i-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i-1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Non-Attuned Mind-Related Comments (e.g. "You don't want the keys" – said when toddler is reaching for keys, "You are so tired" – said while toddler shows no overt signs of fatigue) was not associated with ENE-O, but was in the expected direction (Table I6). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Non-Attuned Mind-Related Comments and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X^2_D$ = chi squared difference) indicated that allowing the relationship between lagged maternal Non-Attuned Mind-Related Comments and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 3.47, df = 2, $p > 0.05$). However, when the association between lagged maternal Non-Attuned Mind-Related Comments and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p < .05$), suggesting that dyads varied in the association between lagged maternal Non-Attuned Mind-Related Comments and ENE-O. Effects of lagged maternal Non-Attuned Mind-Related Comments on ENE-O remain non-significant in Model 2. Results of more parsimonious model are presented in Table I6.

Table I6
*Effects of Lagged Non-Attuned Mind-Related Comments on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.51^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 |
| Non-Attuned Mind-Related Comments | 0.05 | 0.06 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| Verbosity | $0.04^{***}$ | 0.001 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.73^{***}$ | 0.85 |
| $e_{ij}$ | 0.32 | 0.56 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{†}p < .10$

**Question 2A.** Model results for non-significant predictor in Question 2A (T-INI-VDis) is presented in Table I7.

***Lagged Toddler Initiated Verbal Distraction.*** A two-level hierarchical model examined the effects of lagged Toddler Initiated Verbal Distraction on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-Oij} = \gamma 00 + \gamma\text{Gender (Genderj)} + \gamma \text{ T-INI-Vdis (T-INI-VDisi-1j)} + \gamma\text{ETL (ETij)} + \gamma \text{ ET2 (ET2ij)} + \text{u0j} + \text{eij}$$

Unexpectedly, lagged Toddler Initiated Verbal Distraction (e.g., Toddler says “chair”, or sings) was not associated with ENE-O but was in the negative direction as expected (Table I7). Toddlers’ average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Initiated Verbal Distraction and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Initiated Verbal Distraction and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 1.36, df = 2, $p$ > 0.05). However, when the association between lagged Toddler Initiated Verbal Distraction and ENE-O was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was trending toward significance ($p$ <.01), suggesting that dyads tended to vary in the association between lagged Toddler Initiated Verbal Distraction and ENE-O. Effects of lagged Toddler Initiated Verbal Distraction on ENE-O remain non-significant in Model 2. Results of more parsimonious model are presented in Table I7.

Table I7

*Effects of Lagged Initiated Verbal Distraction on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | 0.63*** | 0.15 |
| Gender | 0.31* | 15 |
| Initiated Verbal Distraction | -0.08 | 0.18 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | 0.72*** | 0.85 |
| eij | 0.32 | 0.57 |

Note. Elapsed Time (ET) is in 10s intervals. *p < .05, **p < .01, *** p < .001, †p < .10

**Question 2B.** Model results for non-significant predictors in Question 2B (T-Vkeys-2M, T-Vdes-2M, T-ComfSk) are presented in Appendix I (Table I8-I10).

***Lagged Toddler Verbal Keys – Bids to Mom***. A two-level hierarchical model examined the effects of lagged Toddler Verbal Keys – Bids to Mom on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-Oij} = \gamma 00 + \gamma\text{Gender (Genderj)} + \gamma\text{T-Vkeys-2M (T-Vkeys-2M}_{\text{ i-1j}}) + \gamma_{\text{ETL}}\ (\text{ET}_{\text{ij}}) + \gamma_{\text{ ET}}{}^{2}\ (\text{ET}^{2}{}_{\text{ij}}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Verbal Keys – Bids to Mom (e.g., "keys", "Pooh Bear", "The turtle is sleeping, wake up turtle" said while looking at or in response to mom) was not associated with ENE-O but were in expected negative direction (Table I8). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Verbal Keys – Bids to Mom and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Verbal Keys – Bids to Mom and ENE-O to vary among dyads would significantly improve model fit ($X_D^2$ = 12.56, df = 2, $p < 0.01$). Indeed, when the association between lagged Toddler Verbal Keys – Bids to Mom and ENE-O was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p$ <.001), suggesting that dyads varied in the association between lagged Toddler Verbal Keys – Bids to Mom and ENE-O. Effects of lagged Toddler Verbal Keys – Bids to Mom on ENE-O remain non-significant in Model 2 but in the same negative direction as expected.

Table I8
*Effects of Lagged Toddler Verbal Keys – Bids to Mom on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.63^{***}$ | 0.15 | $0.64^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.30^{*}$ | 0.15 |
| Verbal Keys – Bids to Mom | -0.01 | 0.06 | -0.06 | 0.06 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.72^{***}$ | 0.85 | $0.74^{***}$ | 0.86 |
| $u_{\text{T-Vkeys-2M, j}}$ | - | - | $0.09^{***}$ | 0.31 |
| $e_{ij}$ | 0.32 | 0.56 | 0.32 | 0.56 |
| *Deviance* | 2917.97 | | 2905.41 | |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Verbal Desire – Bids to Mom***. A two-level hierarchical model examined the effects of lagged Toddler Verbal Desire – Bids to Mom on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{T-Vdes-2M}}(\text{T-Vdes-2M}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Verbal Desire – Bids to Mom (e.g., "I want it", "I need it" "I like it" "Mine", said while looking at or in response to mom) was not associated with ENE-O (Table I9). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Verbal Desire – Bids to Mom and ENE-O were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Verbal Desire – Bids to Mom and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 1.35, df = 2, $p > 0.05$).

However, when the association between lagged Toddler Verbal Desire – Bids to Mom and ENE-O was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was marginally significant ($p < .10$), suggesting that dyads varied in the association between lagged Toddler Verbal Desire – Bids to Mom and ENE-O. Effects of lagged Toddler Verbal Desire – Bids to Mom on ENE-O remain non-significant in Model 2; however, the association becomes negative as expected. Results of more parsimonious model are presented in Table I9.

Table I9
*Effects of Lagged Toddler Verbal Desire – Bids to Mom on Overall Expression of Negative Emotion*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | 0.63 $^{***}$ | 0.15 |
| Gender | 0.31 $^{*}$ | 0.15 |
| Verbal Desire – Bids to Mom | 0.02 | 0.10 |
| Linear ET | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | 0.72 $^{***}$ | 0.85 |
| $e_{ij}$ | 0.32 | 0.57 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Physical Comfort Seeking***. A two-level hierarchical model examined the effects of lagged Toddler Physical Comfort Seeking on toddlers' Expression of Negative Emotion (ENE-O) while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{ENE-O}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{T-ComfSk}}(\text{T-ComfSk}_{i-1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Physical Comfort Seeking (e.g., reaching arms up to mother, hugging mother, leaning on mother's body) was not associated with ENE-O (Table I10). Toddlers' average overall expression of negative emotion was 0.31 units higher for boys (scale of 0-3) after accounting for effects for all predictors. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Physical Comfort

Seeking and ENE-O were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Physical Comfort Seeking and ENE-O to vary among dyads would significantly improve model fit ($X_D^2$ = 30.96, df = 2, $p < 0.001$). Indeed, when the association between lagged Toddler Physical Comfort Seeking and ENE-O was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant ($p < .001$), suggesting that dyads varied in the association between lagged Toddler Comfort Seeking and ENE-O. Effects of lagged Toddler Physical Comfort Seeking on ENE-O remain non-significant in Model 2.

Table I10

*Effects of Lagged Toddler Physical Comfort Seeking on Overall Expression of Negative Emotion*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.63^{***}$ | 0.15 | $0.57^{***}$ | 0.15 |
| Gender | $0.31^{*}$ | 0.15 | $0.36^{*}$ | 0.15 |
| Physical Comfort Seeking | 0.01 | 0.05 | 0.04 | 0.06 |
| Linear ET | 0.00 | 0.00 | 0.00 | 0.00 |
| Quadratic ET | -0.00 | 0.00 | -0.00 | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.72^{***}$ | 0.85 | $0.77^{***}$ | 0.88 |
| $u_{\text{T-ComfSk, j}}$ | - | - | $0.17^{***}$ | 0.41 |
| $e_{ij}$ | 0.32 | 0.57 | 0.30 | 0.55 |
| *Deviance* | 2918.22 | | 2887.26 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 3A.** Model results for non-significant predictors in Question 3A (V-Comf, M-JNT-Dis, M-VO2D, and AMM) are presented in Appendix I (Table I11-I14).

***Lagged Maternal Verbal Comfort***. A two-level hierarchical model examined the effects of lagged maternal Verbal Comfort on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender.[39] The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{V\text{-}Comf}\,(\text{V-Comf}_{i\text{-}1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2_{ij}) + \gamma_{Verb}\,(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Verbal Comfort (e.g., “It is hard to wait”, “What happened?”), was not associated with Overall Touch, but was in the expected direction (Table I11). Toddlers’ Overall Touch and gender were not significantly associated. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Verbal Comfort and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Verbal Comfort and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 0.21, df = 2, $p >$ 0.05). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged maternal Verbal Comfort and Overall Touch does not vary between dyads. Effects of lagged maternal Verbal Comfort on Overall Touch remain non-significant in Model 2.

[39] Lagged maternal verbosity and toddler gender did not have significant main effects on Overall Touch in any of the models for Questions 3A or 3B. Toddler gender was not correlated with Touch, Attempted Touch or Overall Touch but was retained in all models given previous findings in literature. Models for Overall Touch were compared with and without lagged maternal verbosity and results did not differ, but verbosity was retained in models for consistency in models for Questions 1 and 3.

Table I11

*Effects of Lagged Maternal Verbal Comfort on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.57^{***}$ | 0.08 |
| Gender | -0.02 | 0.06 |
| Verbal Comfort | -0.004 | 0.03 |
| Linear ET | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{***}$ | 0.00 |
| Verbosity | 0.01 | 0.01 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Joined Distraction***. A two-level hierarchical model examined the effects of lagged maternal Joined Distraction on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}\,(\text{Gender}_j) + \gamma_{\text{M-JNT-Dis}}\,(\text{M-JNT-Dis}_{i\text{-}1j}) + \gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Joined Distraction (e.g., child plays with toes and mother says "Let's count your toes") was not associated with Overall Touch, but was in expected direction (Table I12). Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Joined Distraction and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Joined Distraction and Overall Touch to vary among dyads would significantly improve model fit $X_D^2$ = 6.84, df = 2, $p < 0.05$. However, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Joined Distraction and Overall Touch does not vary between dyads. Effects of lagged maternal Joined Distraction on Overall Touch remain non-significant in Model 2.

Table I12

*Effects of Lagged Maternal Joined Distraction on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.60^{***}$ | 0.11 | $0.60^{***}$ | 0.11 |
| Gender | -0.02 | 0.06 | -0.02 | 0.06 |
| Joined Distraction | -0.04 | 0.05 | -0.05 | 0.04 |
| Linear ET | $-0.01^{***}$ | 0.00 | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 | $0.08^{***}$ | 0.29 |
| $u_{M\text{-}JNT\text{-}Dis,\,j}$ | - | - | 0.03 | 0.17 |
| $e_{ij}$ | 0.28 | 0.53 | 0.28 | 0.53 |
| *Deviance* | 2466.92 | | 2460.08 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Verbal Orientation to Delay***. A two-level hierarchical model examined the effects of lagged maternal Verbal Orientation to Delay on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Gender}}(\text{Gender}_j) + \gamma_{\text{M-VO2D}}(\text{M-VO2D}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + \gamma_{\text{Verb}}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Verbal Orientation to Delay (e.g., "keys", "What color are they?") was not associated with Overall Touch (Table I13). Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Verbal Orientation to Delay and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Verbal Orientation to Delay and ENE-O to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 5.32, x, df = 2, $p > 0.10$). Additionally, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Verbal Orientation to Delay and Overall Touch does not vary between dyads. Effects of lagged maternal Verbal Orientation to Delay on Overall Touch remain non-significant in Model 2.

Table I13

*Effects of Lagged Maternal Verbal Orientation to Delay on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | 0.57*** | 0.11 |
| Gender | -0.02 | 0.06 |
| Verbal Orientation to Delay | 0.01 | 0.01 |
| Linear ET | -0.01*** | 0.00 |
| Quadratic ET | 0.00** | 0.00 |
| Verbosity | 0.01 | 0.01 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | 0.08*** | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Appropriate Mind-Related Comments***. A two-level hierarchical model examined the effects of lagged maternal Appropriate Mind-Related Comments on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{AMM}(\text{AMM}_{i-1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i-1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Appropriate Mind-Related Comments (e.g., "You are frustrated" said while toddler is frustrated, "You want the keys", said while toddler is pointing at keys) was not associated with Overall Touch but were in expected direction (Table I14). Toddlers' Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Appropriate Mind-Related Comments and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Appropriate Mind-Related Comments and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 0.10, df = 2, $p > 0.05$). However, when the association between lagged maternal Appropriate Mind-Related Comments and Overall Touch was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant ($p <.05$), suggesting that dyads varied in the association between lagged maternal Appropriate Mind-Related Comments and Overall Touch. Effects of lagged maternal Appropriate Mind-Related Comments on Overall Touch remain non-significant in Model 2. Results of more parsimonious model are presented in Table I14.

Table I14
*Effects of Lagged Appropriate Mind-Related Comments on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.57^{***}$ | 0.11 |
| Gender | -0.02 | 0.06 |
| Appropriate Mind-Related Comments | -0.007 | 0.04 |
| Linear ET | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| Verbosity | 0.02 | 0.01 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 3B.** Model results for non-significant predictors (Pun, Min, NMM) are presented in Appendix I (Table I15-I17).

***Lagged Maternal Punitive Reactions***. A two-level hierarchical model examined the effects of lagged maternal Punitive Reactions on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{\text{M-Pun}}(\text{M-Pun}_{-1j}) \\ + \gamma_{ETL}(ET_{ij}) + \gamma_{ET^2}(ET^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Punitive Reactions (e.g., “Bad boy/girl”, “You want a spanking?”) was not associated with Overall Touch and in unexpected direction (Table I15). Toddlers’ Overall Touch and gender were not significantly associated.

Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Punitive Reactions and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Punitive Reactions and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 0.023, df = 2, $p > 0.05$). Additionally, the p-value associated with random slope was not significant suggesting that the association between lagged maternal Punitive Reactions and Overall Touch does not vary between dyads. Effects of lagged maternal Punitive Reactions on Overall Touch remain non-significant in Model 2 but directionality became negative as expected.

Table I15
*Effects of Lagged Punitive Reactions on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.60^{***}$ | 0.11 |
| Gender | -0.02 | 0.06 |
| Punitive Reactions | -0.003 | 0.06 |
| Linear ET | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Minimizing***. A two-level hierarchical model examined the effects of lagged maternal Minimizing on toddlers’ Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{Min}(\text{Min}_{i\text{-}1j}) +$$
$$\gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Minimizing (e.g., "Stop crying", "Don't be upset") was not associated with Overall Touch (Table I16). Toddlers' Overall Touch and gender were not significantly associated. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Minimizing and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Minimizing and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 0.66, df = 2, $p > 0.05$). However, when the association between lagged maternal Minimizing and Overall Touch was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant ($p < .05$), suggesting that dyads varied in the association between lagged maternal Minimizing and Overall Touch. Effects of lagged maternal Minimizing on Overall Touch remain non-significant in Model 2. Results of more parsimonious model are presented in Table I16.

Table I16
*Effects of Lagged Minimizing on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.57^{***}$ | 0.11 |
| Gender | -0.02 | 0.06 |
| Minimizing | -0.03 | 0.05 |
| Linear ET | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| Verbosity | 0.01 | 0.01 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Maternal Non-Attuned Mind-Related Comments***. A two-level hierarchical model examined the effects of lagged maternal Non-Attuned Mind-Related Comments on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, lagged maternal verbosity, and toddler gender. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Gender}(\text{Gender}_j) + \gamma_{NMM}(\text{NMM}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + \gamma_{Verb}(\text{Verb}_{i\text{-}1j}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged maternal Non-Attuned Mind-Related Comments (e.g., "You don't want to touch it"), was not associated with Overall Touch (Table I17). Toddlers' Overall Touch and gender were not significantly associated. Additionally, the current model was compared against a model (Model 2) in which slopes between lagged maternal Non-Attuned Mind-Related Comments and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged maternal Non-Attuned Mind-Related Comments and Overall Touch to vary among dyads would not significantly help to explain more variance in ENE-O between toddlers ($X_D^2$ = 5.03, df = 2, $p > 0.10$). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged maternal Non-Attuned Mind-Related Comments and Overall Touch does not vary between dyads. Effects of lagged maternal Non-Attuned Mind-Related Comments on Overall Touch remained non-significant in Model 2.

Table I17
*Effects of Lagged Maternal Non-Attuned Mind-Related Comments on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.57^{***}$ | 0.11 |
| Gender | -0.02 | 0.06 |
| Non-Attuned Mind-Related Comments | -0.06 | 0.04 |
| Linear ET | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| Verbosity | 0.01 | 0.01 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

**Question 4A.** Model results for non-significant predictors in Question 4A (T-INI-Vdes) are presented in Appendix I (Table I18).

***Lagged Toddler Initiated Verbal Desire***. A two-level hierarchical model examined the effects of lagged Toddler Initiated Verbal Desire on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Vocab}}(\text{Vocab}_j) + \gamma_{\text{T-INI-Vdes}}(\text{T-INI-Vdes}_{i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Initiated Verbal Desire (e.g., "I want it", "I need it") was not associated with Overall Touch (Table I18). On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6). Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Initiated Verbal Desire and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Initiated Verbal Desire and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 2.17, df = 2, $p$ > 0.05). However, when the association between lagged Toddler Initiated Verbal Desire and Overall Touch was allowed to vary between dyads, the *p*-value associated with the random slope coefficient was significant ($p$ <.05), suggesting that dyads varied in the association between lagged Toddler Initiated Verbal Desire and Overall Touch. Effects of lagged Toddler Initiated Verbal Desire on Overall Touch remain non-significant in Model 2. Results of more parsimonious model are presented in Table I18.

Table I18

*Effects of Lagged Toddler Initiated Verbal Desire on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.69^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 |
| Initiated Verbal Desire | 0.09 | 0.07 |
| Linear ET | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p$ < .05, $^{**}p$ < .01, $^{***}$ $p$ < .001, $^{\dagger}p$ < .10

**Question 4B.** Model results for non-significant predictors (T-JNT-VDis, T-JNT-nonVDis, T-Vkeys-2M, T-Vctrl-2M, and T-Vdes-2M are presented in Appendix I (Table I19-I23).

***Lagged Toddler Joined Verbal Distraction.*** A two-level hierarchical model examined the effects of lagged Toddler Joined Verbal Distraction on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{T\text{-}JNT\text{-}VDis}\,(\text{T-JNT-VDis}_{i-1j)} + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET^2}\,(\text{ET}^2{}_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Joined Verbal Distraction (e.g., mother starts counting and child joins in) was not associated with Overall Touch but was in the negative direction as expected (Table I19). On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6).Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Joined Verbal Distraction and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Joined Verbal Distraction and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 0.11, df = 2, $p > 0.05$). Additionally, the *p*-value associated with random slope was not significant suggesting that the association between lagged Toddler Joined Verbal Distraction and Overall Touch does not vary between dyads. Effects of lagged Toddler Joined Verbal Distraction on Overall Touch remain non-significant in Model 2.

Table I19

*Effects of Lagged Toddler Joined Verbal Distraction on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | 0.69*** | 0.13 |
| Productive Vocab | -0.00† | 0.001 |
| Joined Verbal Distraction | -0.02 | 0.04 |
| Linear ET | -0.01** | 0.00 |
| Quadratic ET | 0.00** | 0.00 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | 0.08*** | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note*. Elapsed Time (ET) is in 10s intervals. *$p < .05$, **$p < .01$, *** $p < .001$, †$p < .10$

***Lagged Toddler Joined Non-Verbal Distraction***. A two-level hierarchical model examined the effects of lagged Toddler Joined Non-Verbal Distraction on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Vocab}(\text{Vocab}_j) + \gamma_{T\text{-}JNT\text{-}nonVDis}(\text{T-JNT-nonVDis}_{i\text{-}1j}) +$$

$$\gamma_{ETL}\,(ET_{ij}) + \gamma_{ET^2}\,(ET^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Joined Non-Verbal Distraction (e.g., mother initiates play and child joins in, mother points to a direction away from keys and child looks where she is pointing) was not associated with Overall Touch but was in expected negative direction (Table I20). On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6).Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Joined Non-Verbal Distraction and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Joined Non-Verbal Distraction and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 3.73, df = 2, $p$ > 0.05). Additionally, the $p$-value associated with random slope was not significant suggesting that the association between lagged Toddler Joined Non-Verbal Distraction and Overall Touch does not vary between dyads. Effects of lagged Toddler Joined Non-Verbal Distraction on Overall Touch remain non-significant in Model 2.

Table I20

*Effects of Lagged Toddler Joined Non-Verbal Distraction on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | 0.69$^{***}$ | 0.13 |
| Productive Vocab | -0.00$^{†}$ | 0.001 |
| Joined Non-Verbal Distraction | | |
| Linear ET | -0.01$^{**}$ | 0.00 |
| Quadratic ET | 0.00$^{**}$ | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | 0.08$^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p$ < .05, $^{**}p$ < .01, $^{***}$ $p$ < .001, $^{†}p$ < .10

***Lagged Toddler Verbal Keys – Bids to Mom***. A two-level hierarchical model examined the effects of lagged Toddler Verbal Keys – Bids to Mom on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Vocab}\,(\text{Vocab}_j) + \gamma_{T\text{-}Vkeys\text{-}2M}\,(\text{T-Vkeys-2M}_{i-1j}) + \gamma_{ETL}\,(\text{ET}_{ij}) + \gamma_{ET}{}^{2}\,(\text{ET}^{2}{}_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Verbal Keys – Bids to Mom (e.g., e.g., "keys", "Pooh Bear", "The turtle is sleeping, wake up turtle" said while looking at or in response to mom) was not associated with Overall Touch (Table I21). On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6). Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Verbal Keys – Bids to Mom and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Verbal Keys – Bids to Mom and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 5.47, df = 2, $p > 0.05$). Additionally, the p-value associated with random slope was not significant suggesting that the association between lagged Toddler Verbal Keys – Bids to Mom and Overall Touch does not vary between dyads. Effects of lagged Toddler Verbal Keys – Bids to Mom on Overall Touch remain non-significant in Model 2.

Table I21

*Effects of Lagged Toddler Verbal Keys – Bids to Mom on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.69^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 |
| Verbal Keys – Bids to Mom | 0.01 | 0.03 |
| Linear ET | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| **Random Effects** | **Variance Components** | **SD** |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Verbal Self-Control-Bids to Mom***. A two-level hierarchical model examined the effects of lagged Toddler Verbal Self-Control – Bids to Mom on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{\text{Vocab}}(\text{Vocab}_j) + \gamma_{\text{T-Vctrl-2M}}(\text{T-Vctrl-2M}_{\,i\text{-}1j}) + \gamma_{\text{ETL}}(\text{ET}_{ij}) + \gamma_{\text{ET}^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Self-Control-Bids to Mom (e.g., e.g., "I wait", "No touch" said while looking at or in response to mom) was not associated with Overall Touch but was in expected negative direction (Table I22). On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6). Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Verbal Self-Control – Bids to Mom and Overall Touch were allowed to vary between dyads. However, results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Verbal Self-Control – Bids to Mom and Overall Touch to vary among dyads would not significantly help to explain more variance in Overall Touch between toddlers ($X_D^2$ = 2.14, df = 2, $p > 0.05$).

Additionally, the p-value associated with random slope was not significant suggesting that the association between lagged Toddler Verbal Self-Control – Bids to Mom and Overall Touch does not vary between dyads. Effects of lagged Toddler Verbal Self-Control – Bids to Mom on Overall Touch remain non-significant in Model 2.

Table I22

*Effects of Lagged Toddler Verbal Self-Control – Bids to Mom on Overall Touch*

| Fixed Effects | Coefficient | S.E |
|---|---|---|
| Intercept | $0.70^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 |
| Verbal Self-Control – Bids to Mom | -0.12 | 0.14 |
| Linear ET | $-0.01^{**}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 |
| $e_{ij}$ | 0.28 | 0.53 |

*Note*. Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

***Lagged Toddler Verbal Desire – Bids to Mom***. A two-level hierarchical model examined the effects of lagged Toddler Verbal Desire – Bids to Mom on toddlers' Overall Touch while controlling for effects of linear elapsed time, quadratic elapsed time, and toddlers' expressive language. The model was specified with the following equation:

$$\text{Overall Touch}_{ij} = \gamma_{00} + \gamma_{Vocab}(\text{Vocab}_j) + \gamma_{T\text{-}Vdes\text{-}2M}(\text{T-Vdes-2M}_{i\text{-}1j}) + \gamma_{ETL}(\text{ET}_{ij}) + \gamma_{ET^2}(\text{ET}^2_{ij}) + u_{0j} + e_{ij}$$

Unexpectedly, lagged Toddler Verbal Desire – Bids to Mom (e.g., e.g., "I want it", "I need it" "I like it" "Mine", said while looking at or in response to mom) was not associated with Overall Touch (Table I23). On average, less Overall Touch was marginally associated with higher scores on expressive language such that for every unit increase in vocabulary production, Overall Touch decreased by 0.002 in an average interval (mean per interval = .27, range per interval 0 - 6). Additionally, the current model was compared against a model (Model 2) in which slopes between lagged Toddler Verbal Desire – Bids to Mom and Overall Touch were allowed to vary between dyads. Results of deviance tests ($X_D^2$ = chi squared difference) indicated that allowing the relationship between lagged Toddler Verbal Desire – Bids to Mom and Overall Touch to vary among dyads would significantly improve model fit ($X_D^2$ = 10.92, df = 2, $p <$ 0.01). Indeed, when the association between lagged Toddler Verbal Desire – Bids to Mom and Overall Touch was allowed to vary between dyads, the p-value associated with the random slope coefficient was significant ($p$ <.05), suggesting that dyads varied in the association between lagged Toddler Verbal Desire – Bids to Mom and Overall Touch. Effects of lagged Toddler Verbal Desire – Bids to Mom on Overall Touch remain non-significant in Model 2.

Table I23
*Effects of Lagged Toddler Verbal Desire – Bids to Mom on Overall Touch*

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| Fixed Effects | Coefficient | S.E | Coefficient | S.E |
| Intercept | $0.69^{***}$ | 0.13 | $0.70^{***}$ | 0.13 |
| Productive Vocab | $-0.00^{\dagger}$ | 0.001 | $-0.00^{\dagger}$ | 0.001 |
| Verbal Desire – Bids to Mom | 0.07 | 0.14 | 0.12 | 0.10 |
| Linear ET | $-0.01^{**}$ | 0.00 | $-0.01^{***}$ | 0.00 |
| Quadratic ET | $0.00^{**}$ | 0.00 | $0.00^{**}$ | 0.00 |
| Random Effects | Variance Components | SD | Variance Components | SD |
| $u_{0j}$ | $0.08^{***}$ | 0.28 | $0.08^{***}$ | 0.28 |
| $u_{\text{T-Vdes-2M, j}}$ | - | - | $0.13^{*}$ | 0.35 |
| $e_{ij}$ | 0.28 | 0.53 | 0.28 | 0.53 |
| *Deviance* | 2428.82 | | 2417.90 | |

*Note.* Elapsed Time (ET) is in 10s intervals. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

# APPENDIX J

## Acknowledgement of Grants

Acknowledgement of Grants

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