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MOTHER-TODDLER COREGULATION OF EMOTION

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Abstract

Emotion coregulation occurs when dyadic partners mutually, reciprocally, and bi-directionally influence each other's emotional experience (Cole, Teti, & Zahn-Waxler, 2003; Tronick, 1989). Coregulatory processes influence the development of child self-regulation skills and thus have mental health implications (Cole & Hall, 2008). Most research examining emotion coregulation has involved infants, but more recently its importance during other periods has been considered (e.g. Feng, Shaw, Skuban, & Lane, 2007). The proposed study focuses on toddlerhood because it is marked by rapid developmental changes, including heightened incidence of child assertion of goals that conflict with parental goals. How these developmental changes contribute to changes in coregulatory processes is not well understood.

This thesis assesses the degree of coregulation of emotion in mother-toddler interaction in a context that optimizes participants having divergent goals: over an 8 minute period toddlers waited to open a gift until mothers completed work. Employing second-by-second coding, the thesis examined the overall number of seconds and percentage of time in which toddlers and mothers expressed emotions and the number of times their task orientation and emotions changed (i.e., shifted from one emotion to another, or decreased or increased in expression intensity) during the task. We aimed to establish the frequency of (1) child emotion and behavior changes as precursors to mothers' orienting toward the child, and (2) change in expression in one interaction partner occurring after a change in the other while the two were oriented toward each other.

Results indicated that mothers oriented toward toddlers for about 20% of task time. They were more expressive overall and shifted their expressions more when oriented toward their toddlers than when working. Toddlers expressed more intense emotions, overall happiness, and focus on the gift, and showed fewer shifts in emotion expression, when mothers were oriented

toward them compared to when mothers worked. When we examined precursors to mothers' orienting toward toddlers, we found that changes in toddler anger expressions and focus on the gift were more likely to prompt the mother to orient toward their toddler than shifts in happy expressions. Once oriented toward toddlers, mothers expressed anger infrequently (about 10% of the time). Mothers' anger expressions evoked toddler anger expressions. However, toddler anger expressions were not as evocative for mothers, who were more likely to stop, rather than start, expressing anger after toddlers expressed anger.

Results are discussed in terms of providing evidence for mutual, reciprocal, and bi-directional influences of mother-toddler emotion expressions during a frustrating task in which dyadic partners have competing goals. The thesis provides a rich descriptive picture of the emotional nature of the challenging wait, and demonstrates how mothers and children influence each other's emotional expressions over the course of the task at a more micro-analytic level than most prior studies. Future research will build on this work to use variables generated from descriptive data to predict developmental outcomes and further explore the role of dyadic coregulation of emotion in the development of child self-regulation of emotion.

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MOTHER-TODDLER COREGULATION OF EMOTION

The transactional model of development proposes that outcomes are products of continuous, reciprocal, bidirectional influences (i.e. transactions) between children, their caregivers, and the environment (Sameroff, 2009). When broadly applied, this model describes the nature of ontogenetic development. However, it can also be applied to microsocial processes that influence development over time (Thompson, 1994). Everyday emotional exchanges, for instance, are thought to develop into patterns of interpersonal behavior that are reinforced over time (Dix, 1991; Sameroff, 2009; Reis, Collins, & Berscheid, 2000) and influence children's emotional development, including emotion regulation development (Eisenberg, Cumberland, & Spinrad, 1998; Morris, Silk, Steinberg, Myers, & Robinson, 2007; Thompson, 1994). That is, child and caregiver coregulate the other's emotions in a bi-directional fashion that may contribute to the manner in which children self-regulate (Feldman, Greenbaum, & Yirmiya, 1999; García-Sellers & Church, 2000; Kochanska, Aksan, Prisco, & Adams, 2008).

Although bi-directional emotional exchanges have mainly been studied as co-regulatory processes in infancy (e.g. Tronick, Cohn, & Shea, 1986), there is growing interest in parent and child influences during other important developmental periods, including toddlerhood (e.g., Feng et al., 2007). The toddler period marks a transition from infancy that is characterized by children's autonomous efforts to achieve goals that often conflict with parents' goals. Thus, it is different than infancy and the nature of coregulation in this period warrants empirical attention. In addition to providing important descriptive data, examination of the precise nature of emotion coregulation in toddlerhood has promise to contribute to our understanding of developmental trajectories toward emotional health, with implications for intervention. For example, the nature

of parent-child regulation of anger predicts the degree to which preschoolers' behavior problems worsen or ameliorate by the time they enter first grade (Cole et al., 2003).

An extensive literature relates mother-child coregulation in infancy to a number of desirable developmental outcomes (see Harrist & Waugh, 2002 for a review), including healthy neurological development, parent-child attachment, and appropriate emotion regulation strategies (e.g. distraction through gaze aversion). Thus, coregulation in infancy lays the groundwork for these domains' further development in toddlerhood (Feldman, 2007). Toddlerhood is marked by important transitions in children's emotional development, making it an essential period for the study of emotion regulation development. In toddlerhood, children self-initiate regulatory attempts and show greater voluntary control of their attention, including the ability to distract themselves from distress (Kopp, 1982, 1989; Ruff & Rothbart, 1996).

Emotion regulation skills are essential for the development of socio-emotional competence. Such competence entails managing emotional expressiveness and reacting to others' emotions in socially appropriate ways (Denham & Grout, 1993). Emotion regulation difficulties have implications for academic and mental health outcomes (Blair, 2000; Calkins, 1994; Cole & Hall, 2008; Halberstadt, Denham, & Dunsmore, 2001; Keenan, 2000). Indeed, improving regulatory skills is a common goal of preventative and therapeutic interventions (Bierman, Domitrovich, Nix, Gest, Welsh, Greenberg, et al., 2008; Greenberg & Kusché, 2006; Hannesdottir & Ollendick, 2007; Izard, Fine, Mostow, Trentacosta, & Campbell, 2002; Izard, Trentacosta, King, & Mostow, 2004; Kendall, Aschenbrand, & Hudson, 2003; Lochman, Barry, & Pardini, 2003; Macklem, 2008; Trosper, Buzzella, Bennett, & Ehrenreich, 2009). Therefore, a complete and detailed understanding of mother-toddler emotion coregulation contributes to our

knowledge of how child-parent emotional exchanges predict later emotion regulation outcomes, with potential translation to early interventions for at-risk dyads.

The thesis examines the degree to which coregulation occurs in the interactions of mothers and their 24 month old toddlers during a situation that increases the likelihood that the child's and mother's goals conflict. The theory of emotional development guiding the work indicates that anger is the appreciation that one's personal goals are blocked and readiness to act to achieve the goal, which includes both communicative and instrumental behavior (Barrett & Campos, 1987). Therefore, the proposed task was selected because it involves different goals for each individual and blocks the toddler's goal (i.e. to open the gift), permitting examination of the degree to which coregulation occurs in the context of demands on toddler self-regulation.

In addition, the selected task allows the microanalysis of emotional exchange in accord with Thompson's (1994) call to capture emotion regulation by examining emotion's temporal characteristics. To evaluate coregulation in emotional exchanges, we examine the frequency with which change in one partner's emotional expression or focus follows change in the other partner's emotional expression, in the context of how often such changes occur during the entire task. Although previous studies (Denham & Grout, 1993; Dumas, Serketich, & LaFreniere, 1995; Feng et al., 2007; Jameson, Gelfand, Kulcsar, & Teti, 1997; Kochanska & Aksan, 1995; Lorber & Slep, 2005; Martin, 2000) have examined coregulation during the toddler period, few have used microanalytic techniques to specifically examine patterns of emotional exchange.

Importance of the Transactional Approach

Psychologists have long theorized that interpersonal interactions, particularly those with parents, have a key contextual influence on children's development (Sameroff, 1975). The transactional model of development emphasizes the mutual influences that parents and children

have on each other (Sameroff, 2009). Although the transactional model is broadly applied to conceptualizing ontogenetic development, it emphasizes that development is a product of continuous, reciprocal, and bi-directional influences of partners interacting with each other. A key component is its elucidation of the importance of parent-child interactions for the development of children's self-regulatory abilities and for the development of the parent-child relationship over time (Olson & Lunkenheimer, 2009; Sameroff, 2009). It is therefore a valuable framework for examining emotion coregulation, i.e. each partner's influence on the other's emotion during developmentally sensitive situations. Indeed, recent theoretical and empirical work emphasizes emotion regulation as not only the individual's efforts to modulate emotion but also the manner in which exchanges between individuals, including children and their parents, involve mutual influences on each other's emotions (Cole et al., 2003; Denham & Grout, 1993; Dumas et al., 1995; Lorber & Slep, 2005; Olson & Lunkenheimer, 2009).

Emotional exchanges are microsocial processes in which emotions serve informational, evocative, and reinforcing functions within a relationship (Keltner & Kring, 1998). During the moment-to-moment temporal changes that characterize social exchanges, emotions (1) communicate needs and desires, (2) evoke shared or supportive emotions in social partners (e.g. a sad child evoking happiness from a parent attempting to cheer them) and (3) reinforce adaptive or maladaptive behaviors (e.g. a parent scolds a child who misbehaves). Emotional exchanges thus are fundamental parts of social interactions, including parent-child interactions. Studying microsocial emotional exchanges is helpful in further understanding of the evocative potential of child emotions. Although child effects' significance was first highlighted four decades ago (Bell, 1968, 1979), there remains a dearth of research examining these effects (Crouter & Booth, 2003). Understanding how parents and children use emotions to communicate their needs, influence each

others' emotions, and reinforce behaviors through emotional exchanges is essential to understanding the development of the parent-child relationship over time (Dix, 1991; Dix, Stewart, Gershoff, & Day, 2007; Sameroff, 2009).

Child effects on parent-child interaction. In a transactional framework, children are active co-participants in their own development; they are not passive recipients of parenting but actively influence their interactional experiences. The effects of child behavior and emotion on parent-child interaction have tended to be neglected relative to parenting effects, although there have been repeated calls for recognizing the importance of children's contributions to parent-child interaction and to their own development (Sears, Maccoby, & Levin, 1957). Bell (1968) questioned the prevailing assumption that parental influence is dominant, arguing that congenital child characteristics may evoke and reinforce different parenting responses. Lytton (1982) investigated micro-patterns in parent-child interactions, finding support for bi-directional influences on emotion and behavior and asserting that children's genetic predispositions and reciprocal influences were critical elements in conduct disorder development (Lytton, 1990a, 1990b). This prompted debate as other researchers argued that while there are mutual influences, parental influences are more potent than child influences in predicting developmental outcomes (Dodge, 1990; Wahler, 1990). The issue of how parent emotion is elicited by child misbehavior and negative emotion remains to be fully understood.

Scarr (1992) proposed that given an "average expectable environment", which included average parenting experiences, individual differences between children would be caused mainly by genetic differences that elicit particular types of experiences that in turn mold personality development. However, Scarr's work was criticized for failing to adequately operationalize the parameters of the "average expectable environment" and for failing to account for evidence

indicating that above-average parenting strongly contributes to developmental outcomes (Baumrind, 1993). Alternatively, much of the child development literature assumes that better parenting predicts better child outcomes without controlling for or examining child influences.

Emerging behavioral genetics research indicates that the extent of genetic and environmental influence on development varies according to parenting constructs, children's developmental stage, and reporters (Ulbricht & Neiderhiser, 2009). In studying parent-child interactions, Deater-Deckard and O'Conner (2000) found that mutuality (i.e. reciprocity, responsivity, and cooperation) between 3-year-old twins and their parents varied across families and within sibling-parent dyads. Genetic similarities explained relations between twins' mutuality with their parents, indicating that children evoked specific responses from their parents based on genetically driven traits. Follow-up studies with 8-year-old twin and adoptive children supported this evocative gene-environment correlation (Deater-Deckard & Petrill, 2004). Overall, theory and behavioral genetics studies of child effects emphasizes the importance of understanding bi-directional influences on development, and in regard to the focus of the present study, acknowledging that children play a noteworthy role in eliciting parenting emotion and behavior.

Although the present study focuses on proximal child factors (i.e. emotion expression) occurring during parent-child interactions, it is important to appreciate that more distal child factors, such as the child's gender and temperament, elicit particular types of parental emotion and behavior. For example, girls may evoke different parental socialization of emotion than boys, because they display more submissive emotions than boys, and fathers differentially attend to these submissive emotion displays (Chaplin, Cole, & Zahn-Waxler, 2005). Temperament studies indicate that individual differences in motivation to control rather than submit during parent-child interaction may explain why some children are defiant. These differences influence parents'

engagement in positive or negative emotion control strategies (Dix et al., 2007). Emotionally reactive infants elicit more variable parenting sensitivity and co-parenting from parents than children with easy temperaments (Crockenberg & Leerkes, 2003).

In sum, after a history of extensive debate in the child development literature on the strength of child compared to parent effects on development, it is clear that child and parent characteristics interact in a mutual, reciprocal, and bi-directional fashion to shape parent-child relationships and determine child outcomes. The transactional approach thus fits with this evidence and provides a valid conceptual framework for the study of the macro and microsocial development of parent-child relationships. Of particular interest is the role of emotions and emotion regulation within the parent-child relationship, and especially within microsocial parent-child exchanges that develop into patterns of interaction over time. Therefore, we next present a brief review of the emotion and emotion regulation literature before focusing on ways in which emotion processes influence the parent-child relationship.

Defining Emotion and Emotion Regulation

Barrett and Campos (1987) define emotions as the co-terminous processes of (a) appreciating circumstances relative to significance for well-being and (b) readying to act upon circumstances to achieve wellbeing goals. Compared to historical emotion perspectives, this functionalist perspective emphasizes the importance of positive and negative emotion in healthy functioning. For example, rather than being inherently damaging, sadness signals the appraisal that a goal cannot be reached, motivates goal relinquishment, and encourages the reallocation of physiological and psychological resources toward more attainable goals. Emotions are experienced at varying intensity levels and change depending on environmental input.

The intensive and temporal features of emotions are monitored, evaluated, and modified via extrinsic and intrinsic processes, referred to as *emotion regulation,* that accomplish goals (Thompson, 1994). Further examination of the components of this definition is warranted. Defining emotion regulation as *process* implies that it is ongoing and dynamic. Emotions measured in the present study are thus conceptualized not static entities residing "inside" the person, but as reactions changing according to perceptions of the situation. Emotional exchanges, therefore, are *extrinsic* and *intrinsic* in nature, stemming from the interplay between unique traits and environmental context, including dyadic partner characteristics. Inherent in this definition is the necessity of detecting, evaluating, and reacting to environmental change. Thus, we focus on how changes or shifts in one dyadic partner's emotion and behavior contribute to contingent changes in the other's emotions and behavior.

Thompson (1994) highlights the importance of understanding emotion expressions' intensive and temporal properties as emotion regulation indices. Despite continued calls to do so (Cole, Martin, & Dennis, 2004; Feldman, 2007; Olson & Lunkenheimer, 2009; Reis et al., 2000), emotion regulation research has not fully examined these qualities, in part because they are challenging to both define (e.g. Cole et al., 2004; Eisenberg & Spinrad, 2004) and operationalize (Sameroff & Mackenzie, 2003). To study emotion regulation, researchers must confirm that an emotion was activated and regulated, but observational data focuses on behavior that may be the end-product of both emotion activation and regulation (Cole et al., 2003; Eisenberg & Spinrad, 2004). Nonetheless, in studying very young children, there continues to be reliance on observational data because their self-report of emotion is limited and obtaining physiological measures is challenging. When using observational data, one convention is to define emotion by nonverbal expressions and regulation as change in the activated emotion's valence, intensity, or

timing. Therefore, we use the frequency of valence (i.e., switching from one type of emotion expression to another) and intensity changes in emotion expressions, and changes in behaviors (focus on the gift and task orientation) to assess the occurrence of regulatory processes.

Since identification of these emotion regulation properties requires detailed coding, measuring regulation is painstaking and time-consuming. However, accurately measuring emotion regulation processes is conceptually and practically valuable. Chronic poor emotion regulation detracts from mental health (Cole et al., 2004; Cole, Michel, & Teti, 1994), while use of adaptive emotion regulation strategies is central to emotional competence (Olson & Lunkenheimer, 2009; Thompson, 1994). Thus, understanding the specific ways in which children regulate emotion in the face of blocked goals, and the ways their parents help encourage the development of these abilities, furthers our understanding of the eitology, prevention, and treatment of childhood disorders (Calkins, 1994; Cole & Hall, 2008; Keenan, 2000).

Coregulation: Examining Emotion Regulation within Interpersonal Transaction

Emotions are processes involving appraisal and motivation toward achieving goals for well-being, and emotion regulation involves monitoring, evaluating, and modifying emotional experience in service of goals (Barrett & Campos, 1987; Thompson, 1994). Within an interpersonal relationship, each partner expresses emotions to communicate their personal and relational goals, evaluates and monitors their own and their partner's emotions, and modifies their emotions according to their appraisal of their own and their partner's emotional state.

Although emotion and emotion regulation processes are important in all social relationships and interactions, the parent-child relationship may be especially evocative and thus driven by emotional processes. While engaging with children, parents must balance a number of sometimes competing socialization goals with situational demands and child characteristics.

Parents' emotional reactions to their children help to organize parental behaviors in the service of meeting these goals (Dix, 1991). In addition, because children, especially toddlers, have limited self-regulatory abilities, parents must regulate their own emotions and help their child to regulate during parent-child interactions (Dix, 1991). When a parent's ability to self-regulate their emotions is compromised due to mental illness, it may interfere with their ability to help their child self-regulate emotion, and may model maladaptive regulation strategies (Blandon, Calkins, Keane, & O'Brien, 2008; Feng, Shaw, Kovacs, Lane, O'Rourke, & Alarcon, 2008; Tronick, 1986). Thus, understanding parent-child co-regulatory processes sheds light on how child emotions evoke parenting emotions, and in turn, how parental emotions shape parenting behavior in the service of encouraging emerging child self-regulation abilities.

Defining coregulation. Many emotion coregulation definitions referred to mother-infant dyadic exchanges (Tronick, 1989) and then were extended to be applied to other age groups (e.g. Cole et al., 2003). Like the term *regulation,* the term coregulation can be mistakenly imbued with positive meaning, i.e. that if a dyad is coregulating they are influencing each other in adaptive, desirable ways. Drawing from the conceptual work of Cole and Hall (2008), we maintain that coregulation, like self-regulation of emotions, is a more neutral term that applies to interactions characterized both by positive and negative changes in emotion expression.

In infancy, coregulation refers to the ways dyadic partners mutually, reciprocally, and bi-directionally influence each other's emotions (Cole et al., 2003; Tronick, 1989). The *mutual* quality of coregulation implies that dyadic partners experience the same or similar emotions while interacting with each other. Mutuality may serve to enhance or detract from the quality of a relationship. Compare a mother and toddler who are laughing versus laughing at each other; in both situations, their emotions are mutual, but laughing together is assumed to be more beneficial

for their relationship. The *reciprocal* quality of coregulation implies that dyadic partners respond to each other in kind. For example, a mother shows reciprocity when she shifts her emotional expression from neutral to excitement after a child happily runs to her with a new toy.

Finally, the *bi-directional* quality of coregulation implies that both partners can effect change in the other. While the bi-directionality of adult relationships is often assumed, for many years, mother-child exchanges were presumed to be unidirectional. That is, it was assumed that infants could not modify their behavior and emotion expression in accord with feedback from adults. More recent research shows that infants modify their emotion expression and behavior based on their appraisal of adults' emotions and behaviors, and in turn, adults also modify their emotions and behavior to accommodate the infants' current state (e.g. Cohn & Tronick, 1987). Studying bi-directional emotion exchanges requires distinguishing between changes in emotional expression that are reactions to others rather than a general tendency toward reactivity. The proposed thesis furthers this theoretical approach by examining the frequency of changes in emotional expressivity within mother-toddler dyads, and placing this expressivity in the context of each individual's general level of expressivity.

Coregulation is a complex concept that is not always applied in a consistent manner and is operationalized in varying ways (Sameroff & Mackenzie, 2003) despite historic (Sameroff, 1975; Sears, 1951) and current (e.g. Crockenberg & Leerkes, 2003; Crouter & Booth, 2003) calls to more consistently conceptualize and measure coregulatory processes. The term has been used variously to refer to *mutual emotion regulation* (Cole et al., 2003; Tronick, 1989), *synchrony* (Feldman, 2007; Harrist & Waugh, 2002), and, in the dynamic systems literature, dyadic *rupture and repair* or *interactive coordination* (for examples, see Florsheim & Benjamin, 2001; Jameson et al., 1997). These concepts emphasize different features of parent-child interactions. *Mutual*

emotion regulation is synonymous with this proposal's definition of emotion, such that it is a continuing co-construction of events in which partners mutually influence each others' emotions (Cole et al., 2003; Martin, 2000). *Dyadic rupture and repair* represents one possible scenario in which a dyad may coregulate; for example, if negative emotions contribute to a temporary break in the relationship, the dyadic pair may work to resolve those negative emotions and return to a mutually neutral or positive emotion (Florsheim & Benjamin, 2001). *Interactive coordination* refers to the adjustment of behavior to react to mutually acceptable goals, emphasizing the coordination of behavior rather than emotion per se (Jameson et al., 1997).

The term *synchrony* has been used in diverse ways by various researchers. Over time the definition evolved from referring to when infants and mothers are simultaneously expressing the same emotion (Tronick & Gianino, 1986), to capturing more sophisticated physiological patterns related to emotional response (Feldman, 2007). Tronick and Gianino (1986) used the term to describe when mothers and infants felt and behaved the same way simultaneously. Feldman (2007) defined synchrony as "temporal coordination of micro-level social behavior", including a diverse range of self-regulatory (e.g. biologically rooted rhythms of pregnancy) and social (e.g. parent-child interactions) processes. This thesis thus does not use the term *synchrony* because it (1) historically emphasized interactional partners' emotional and behavioral matching and (2) currently describes a broad range of processes. Positive emotional exchanges in infancy have predicted advantageous outcomes for children; however, these "matching" positive emotional exchanges are infrequent when compared to time spent in "mismatching" states (Tronick, 1989).

Coregulation in infancy. Coregulation was first conceptualized by Stern (1974) as a process occurring during infancy. Tronick et al. (1986) developed a model of mutual emotion regulation based on micro-analytic analyses of infant-mother sequences of interactions during

which infants were distressed, mothers soothed them, and both returned to mutually positive states. Tronick (1989) labeled this interaction sequence as coregulation, conceptualizing infant-caregiver interaction as an organized emotional expression and comprehension system in which caregivers and infants communicate and attempt to meet each other's goals and needs by coordinating the timing and valence of their emotional responses. He theorized that such sequences contributed to secure attachment and encouraged adaptive outcomes, while chronic failure to return to calm after infant distress could interfere with the development of a secure attachment and therefore increase risk for a variety of problematic developmental outcomes.

Tronick's innovative work led to an explosion of coregulation and synchrony research in infancy (see Harrist & Waugh, 2002, for a comprehensive review of this literature) that supports the hypothesis that appropriate emotion coregulation is fundamental in establishing (1) a secure parent-child attachment, (2) affective parent-child interaction quality, and (3) an interactional context in which children develop socio-emotional skills, including emotion regulation. Further research supports Tronick's assertion that frequent successful repair sequences in infancy predict desirable child outcomes, including self-control (Feldman et al., 1999) and high child positive affect (Feldman, 2003). The literature on coregulatory processes in infancy indicates that early parent-child interactions lay the groundwork for the development of adaptive, mutually positive interactions in toddlerhood. The proposed study furthers this work by extending the construct of emotion coregulation a new developmental period wherein extensive maturational changes occur.

Coregulation in school-age children. In addition to infancy, there are a few coregulation studies in older children. Initial work used parent-child relationship ratings to assess links between child and parent emotion and behavior, concluding that relationships marked by chronic negative emotion, which communicates that each partner's goals are regularly unmet, undermines

the quality of parent-child interaction, parental competence, and child development. For instance, chronic negative emotion predicts a number of undesirable child outcomes, including poorer child emotion regulation skills (Eisenberg, Fabes, & Murphy, 1996; Morris et al., 2007) and reduced ability to delay gratification (Jacobsen, 1998). Chronic negative emotion is also associated with parenting practices that increase risk of child behavior problems (e.g., power-assertive discipline; Brenner & Fox, 1998; Rothbaum & Weisz, 1994).

Other work in school-age children is generally focused on linking coregulatory aspects of interaction to conduct problem development, drawing from Patterson's model of coercive cycles in the development of such problems (Patterson, Dishion, & Bank, 1984). In this model, certain parents-child dyads develop interaction patterns characterized by mutual but unsuccessful efforts to control the other escalate in intensity and end in reinforcement of problematic behavior. Finally, work in preschool samples has examined effects of maternal depression on child psychopathology. Over the course of challenging tasks, children of depressed mothers down or up-regulate their negative emotion expressions in response to maternal hostility or sadness, so as to avoid eliciting further anger or sadness from mothers (Dagne & Snyder, 2011).

Overall, work in older children demonstrates that it is the quality of mutual exchanges and not mutuality per se that differentiates desirable from problematic outcomes. For example, mutual positive expressivity was associated with prepubescent children's effortful control, such that children with higher levels of effortful control at age 5 had less problem behaviors by age 8 (Valiente et al., 2006). In their preschool sample, Cole at el. (2003) found that mutual anger during the waiting task predicted stability of school-age conduct problems, while mutual positivity did not. Interestingly, a small subsample of dyads expressed high levels of positive emotion *and* high levels of conduct problems. Further analysis revealed that these mothers and

children were positive *at one another's expense* (e.g. laughing at the others' frustration) while other dyads with lower levels of conduct problems were mutually positive in more supportive ways (e.g. happily playing with a toy together).

Related work supports this view of mutuality; mutuality characterized by emotional reciprocity, co-responsiveness, and cooperation predicted lower levels of behavior problems in 8-year-olds, while mutual anger and noncooperation predicted higher levels (Deater-Deckard & Petrill, 2004). In another study, mutually positive parent-child synchrony inversely predicted antisocial behavior while mutual negativity predicted antisocial behavior (Criss, Shaw, & Ingoldsby, 2003). Examinations of parent-child interactions before and after participating in therapeutic interventions, including parent management training and cognitive-behavioral therapy, indicates that these interventions shift interaction patterns from mutually negative to mutually positive exchanges (Granic, O'Hara, Pepler, & Lewis, 2007). This work highlights the potential therapeutic implications of better understanding how parents and children can better respond to each others' emotions in challenging situations to encourage coping and prevent coercive cycles.

Overall, the mutuality literature in school-age children highlights that mutuality quality matters more than overall frequency when predicting adaptive child outcomes. However, studies are limited by use of at-risk samples; there is little understanding of coregulatory processes in typical dyads. The present study better elucidates how positive mutuality is co-constructed during a challenging task in a typically-developing sample and encourages a better understanding of how mutual positivity contributes to desirable child outcomes.

Change in Toddlerhood: The Context of Coregulatory Processes

There is surprisingly little work on emotion coregulation in toddlerhood, despite that it is a transition period between the mutual positive emotion exchanges and distress-repair sequences of

infancy to the development of negative, coercive cycles in school-age children at risk for behavior problems. Information regarding frequency of synchronous interactions in toddlerhood is sparse; it is estimated that parents and toddlers spend about 30% of total interaction time in synchronous states (Hann, Osofsky, Barnard, & Leonard, 1994). Thus, it is important to understand how toddlers and parents negotiate situations in which they feel different emotions and therefore have different interaction goals. This thesis focuses on understanding one facet of the parent-toddler relationship (emotional exchanges), but it is important to appreciate the broader context in which these exchanges occur. Here, we how maturational change in toddlerhood influence the parent-child relationship in general and microsocial emotional exchanges in particular.

Maturational changes. Brownell and Kopp (2007) point out that the word *toddler* is rarely defined in the literature; some scientists refer to 18 month olds as toddlers while others refer to them as infants. Generally, toddlerhood can be defined as the period beginning when all children are walking (toddling), around 18 months of age to 3 years of age, with flexibility regarding these end points. The proposed study examines children at 24 months of age, a time that is solidly within Brownell and Kopp's (2007) definition of toddlerhood. Parents and children face several challenges during the toddler years as children rapidly develop across motor, language, cognitive, and socio-emotional domains.

Physical growth, greater mobility and motor control, and language development all contribute to the toddler's increased autonomy compared to infancy. This alters toddlers' and parents' experience as parents must socialize more autonomous children. Although self-locomotion begins in infancy, locomotor skill increases in the toddler years and continues to contribute to updating and maintaining perceptual skills, spatial reasoning, and socio-emotional skills (Campos et al., 2000). Calkins (1994) argues that changes in basic biological functioning

during the toddler years contribute to the hierarchical organization of socio-emotional skills, including changes in the frontal cortex, which supports planning of regulatory behaviors, in the parasympathetic nervous system, which supports emotion regulation (Porges, 1996), and in the anterior cingulated gyrus, which supports executive attention, including the ability to distract attention away from forbidden, desirable objects (Posner, Rothbart, Sheese, & Tang, 2007).

In addition to the greater autonomy associated with the second year, toddlers are developing foundational skills for appropriate social behavior and self-regulation. Socially, toddlers become more active interactional partners in that they can chose to initiate or withdraw from interactions of their own volition and lead the direction of exchanges (Harrist & Waugh, 2002; Kaye & Fogel, 1980). Cognitively, toddlers' develop more sophisticated representational thinking skills and evocative memory, which help form associations between actions and consequences regarding acceptable and unacceptable behaviors. Growth in cognitive abilities occurs with change in language ability (Cole, Armstrong, & Pemberton, 2010) and ability to intentionally direct attention (Ruff & Rothbart, 1996). Language development related to emotion may be important to increasing toddlers' self-awareness of emotional states (Nelson, 2007).

These social and cognitive developments drive the shift from self-control to self-regulation that occurs in toddlerhood (Kopp, 1989). At around 24 months of age, the age studied in this thesis, toddlers begin to show a form of self-control that is characterized by the ability to comply with parent requests, delay gratification, and meet social expectations for proper behaviors unsupervised. Self-control, a precursor to mature self-regulation abilities, is marked by inconsistently effective regulation attempts because toddlers have limited flexibility in independently adapting to environmental input. Compared with older children able to self-regulate, toddlers remain largely dependent on adult directives to engage in appropriate behaviors.

Toddlers' emotional development is also notable. The second year is often called "terrible" because of many 2-year-olds' tendency to be emotionally reactive and tantrum (Potegal, Kosorok, & Davidson, 1996; Wakschlag & Danis, 2009; Wakschlag, Tolan, & Leventhal, 2010). When asked to delay gratification, child anger expressions are quicker, longer, and more intense at ages 18 and 24 months than at later ages (Cole et al., 2011). Despite increased negative expressivity, toddlers can engage in appropriate social emotions. For instance, empathy, guilt and shame emerge during toddlerhood and contribute to the development of moral reasoning and prosocial behavior (Kagan, 1981; Kagan, 2005; Lewis, 2008; Zahn-Waxler & Robinson, 1995).

Infants use strategies such as gaze aversion and thumb sucking to self-soothe. Toddlers begin to use other self-regulation strategies. For example, children between ages 24 and 48 months use distraction and seek maternal support while waiting instead of being disruptive (Cole et al., 2011). During 24 to 36 months of age, these strategies are not highly effective at regulating frustration, but become more effective with age (Cole et al., 2011; see also Houck & LeCuyer-Maus, 2004). Children's ability to self-distract during a frustrating situation has been linked to desirable developmental outcomes, including the ability to forestall and modulate anger and delay gratification (Cole et al., 2011; Peake, Hebl, & Mischel, 2002), while focusing attention on frustrating stimuli is associated with distress and poorer regulation abilities (Buss & Goldsmith, 1998; Peake et al., 2002). Therefore, this thesis examines mother-child interaction during a waiting task designed to elicit child regulatory attempts and evoke negative expressivity.

Implications for Parent-Child Emotional Exchanges

This thesis' focus on the study of emotion coregulation is of value because of (1) the value of the toddler period on parent-child relationships and (2) the unique characteristics of toddler emotion expression and regulation in contrast to infants and school age children. Dysfunctional

coregulation patterns established in toddlerhood may lay the groundwork for coercive cycling and the development of behavior problems in the school-age years (Cole & Hall, 2008; Granic & Patterson, 2006). By describing the general interaction patterns of toddlers and mothers during a delay of gratification challenge, it becomes possible to formulate hypotheses about how coregulation in this period predicts outcomes and is predicted by child, parent, and other contextual factors. From infancy to toddlerhood, coregulation is still conceptualized as a dynamic, interactive process in which parents and children influence each other's' emotions; however, the ways in which they do so become more sophisticated and complex.

Child maturational changes challenge the parent-child relationship as infants grow into toddlers. As noted, toddlers are more active and autonomous interactional partners, express more intense negative emotion, and attempt to assert their autonomy in parent-child interactions more than infants (Kaye & Fogel, 1980; Potegal et al., 1996). Competent parents must balance encouraging child autonomy and setting limits (Bell & Chapman, 1986; Houck & LeCuyer-Maus, 2004), while modifying emotional response according to childrearing goals (Dix, 1991). In doing so, toddlers' parents may use mild or moderate negative emotion expressions strategically to emphasize the importance of meeting behavioral expectations. Therefore, parents' expression of negative emotions, especially anger, may not always be detrimental to child outcomes if used strategically and parents remain in control (Dix, 1991). Assessing toddlers' responses to mothers' negative emotion expressions at a more fine-grained level may help researchers better understand ways in which negative emotion can be helpful or detrimental to parents' ability to set limits. Since many interventions involve helping mothers react in optimal ways to their children's emotions, a fine-grained and nuanced understanding of the function of negative emotion expressions in the parent-child relationship is critical for advancing and translating knowledge.

The existing literature supports the assumption that mother's negative emotion expression is detrimental to children, but has not investigated these expressions with fine-grained methods. Using questionnaire responses to hypothetical parenting situations (e.g. Valiente et al., 2006), observers' global ratings of expressions during parent-child interactions (e.g. Deater-Deckard, Atzaba-Poria, & Pike, 2004; Martin, Clements, & Crnic, 2002), and self-report of emotion ratings (Cole, LeDonne, & Tan, in press) limits our understanding of how the timing and valence of parents' negative emotion expressions influences toddlers contingent emotional expressions and regulatory attempts. The present study therefore compares the percentage of time in which mothers' anger expression contributes to subsequent increases or decreases in child anger expressions to examine the extent to which maternal expressions of anger are immediately precede escalation of children's anger expressions.

Parents differ in their management of child frustration. Some harness toddlers' emerging verbal and cognitive skills (e.g. attention) to help children regulate. For example, mothers purposefully encourage children to distract themselves while waiting (Grolnick, Kurowski, McMenamy, Rivkin, & Bridges, 1998). Such maternal reactions are important for teaching toddlers how to use emerging cognitive skills to manage frustration. However, parents may also choose not to engage with their toddler in such situations because they (1) want to avoid getting into an angry exchange with the child, (2) they expect or want to encourage the child to handle the frustrating task more autonomously than an infant, and/or (3) want to attend to their work. Therefore, unlike studies of mother-infant coregulation, mothers and toddlers may not engage in continuous streams of coregulation during a waiting task that encouraging child self-regulation.

Although many studies use waiting tasks, few describe how much time mothers spend attending to children in the task. We surmise that toddlers' parents are not likely to orient toward

children unless a change in child behavior or emotion expression signals that it is necessary to do so. Therefore, we first describe (1) how frequently mothers shift away from work toward children and (2) whether changes in children's behavior or expression prompt attempts to engage. Furthermore, mothers are not likely to contribute to change in children's expressions or behavior during the wait unless oriented toward child rather than toward work. Therefore, we also contrast periods when mother works with periods in which she is engaged with the child, to see which are more likely to foster coregulatory exchanges.

Parents may also differ in how much toddlers provoke positive and negative emotions. Two toddler behaviors may evoke parental emotion: (1) emotion expressions and (2) self-regulation attempts. Positive child emotion expressions may evoke positive emotions from parents and encourage coregulatory interactions characterized by cooperation, mutual positive emotion, and appropriate management of negative emotions. Such interactions are related to parental satisfaction (Martin, 2000), child social competence (Denham & Grout, 1993), moral reasoning and child compliance (Kochanska et al., 2008), and reduced risk of behavioral problems (Cole et al., 2003; Martin, 2000), and mitigate risk associated with maternal depression (Feng et al., 2007). Toddlers whose parents more frequently display contingent positive emotion during interactions display more positive emotion with peers in their preschool classrooms and have more emotion knowledge than children whose parents were contingently neutral or negative (Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997).

Parents may find child negativity to be particularly evocative in situations where parent and child goals conflict and children have limited ability to adapt their emotional expressions to situational demands. Martin et al. (2002) found that during a challenging wait, mothers of highly negative children from emotionally distressed families report higher negative emotions during the

task, displayed more negative facial, vocal, and postural emotion cues, and engaged in less sensitive parenting than mothers from less emotionally distressed families. Like many studies, findings are limited by broad negative and positive affect measures. Positive and negative affect expression was rated on a 1 (no expressed affect) to 5 (high levels of negative affect scale), and scores were dichotomized to reflect the presence or absence of observed negativity for analysis.

More recent work expanded on Martin et al. (2002) by predicting mothers' self-rated positive and negative emotions based on toddlers' positive and negative expressivity, regulatory attempts, and misbehavior during the waiting task (Cole et al., in press). Mothers rated themselves as more negative if their child was higher in anger expression (i.e. quicker to anger, stayed angry longer and expressed more intense anger) relative to peers and did not decrease in anger expression from early toddlerhood to preschool. While this study incorporated temporal measures of children's emotions and behavior, related these variables to maternal self-reported emotions. It does not inform us of the timing and valence of mothers' emotion expressions during the wait, and how these expressions may evoke child happy or anger expressions. More knowledge of the timing and valence of mothers' negative and positive emotional expressions during the task is needed to increase our understanding of how child emotions organize parents' emotional expressions. The present thesis utilizes second-by-second emotion expression coding to explicitly describe temporal links between mother and child emotion expressions.

Child self-regulation attempts may also be evocative for parents. For example, mothers rate themselves as experiencing more positive emotions if their children self-distract more than peers during a wait (Cole et al., under review). Parents may be distressed by child failures to self-distract. Negative reactions to child emotion or focus may impede parents' ability to manage the situation. Emerging evidence indicates that child disruptive behavior and focus on the gift are not

associated with maternal negative emotion in toddlerhood (Cole et al., in press; Lorber & Slep, 2005), but are associated by preschool age (Davidov & Grusec, 2006; Fabes, Leonard, Kupanoff, & Martin, 2001; Gentzeler, Contreras-Grau, Kerns, & Weimer, 2005; Valiente et al., 2006). However, these studies did not specifically examine temporal relations between toddlers' focus on the gift and mothers' emotion expressions during the waiting task. Lorber and Slep (2005) coded children's rule-breaking, which may include but is not limited to children's focus on the gift. Cole et al. (in press) utilized a similar measure of focus on the gift, but related it to self-reported maternal negative emotion ratings rather than to specific instances of maternal anger expressions within the task. Therefore, to expand on this literature, this thesis examines whether changes in child focus or emotion expressions are more likely to prompt an emotional exchange with the mother at a microsocial level.

The Present Study: What Does Coregulation Look Like in Toddlerhood?

The thesis describes mother-toddler emotion expression and behavior (toddler focus on the gift and mother orientation toward toddler) during the challenging wait, and ascertains whether mothers and toddlers engage in co-regulatory emotion exchanges characterized by:

(1) mutuality, in that toddler emotion expression frequency is associated with maternal emotion expression frequency, and that mother-toddler expressions co-occur,

(2) bi-directionality, in that an expression change contributes to a subsequent partner expression change, and

(3) reciprocity, in that an expression change is followed by a subsequent, identical change in the other's expression.

To examine these possibilities, preliminary analyses determined whether mother and toddler expressiveness differed as a function of maternal orientation. Specifically, we examine whether

mothers and toddlers expressed more emotion when mothers oriented toward toddlers compared to when mothers worked. These analyses established whether coregulation patterns should be studied throughout the entire task or, as expected, only when mothers oriented toward children. To address this issue, we examined the number of seconds and percentage of time in which mothers and toddlers expressed each emotion as a function of maternal orientation.

Aim 1 of the thesis identifies toddler cues preceding maternal orientation toward toddler. Two types of toddler cues were examined: emotion expression (angry, happy) and focus on the gift. Specifically, we examined the likelihood of a change in mothers' orientation (i.e. away from work and toward toddler) as a function of either a change in toddler's (1) emotion expression or (2) focus on the gift occurring 5 sec before a maternal orientation change. We used a 5-sec window based on findings of few differences in associations between toddler and parent behavior from *t*-1 to *t*-5 (Ekas, Braungart-Rieker, Lickenbrock, Zentall, & Maxwell, 2011).

Aim 2 of the thesis describes the frequency with which changes in a dyadic partner's anger expressions are followed by the other's anger expression change within 5 sec, in light of general expressiveness. Although we could have examined a number of coregulatory patterns in Aim 2, focused on anger exchanges because the context of the waiting evokes anger, as both mother and child have blocked goals. As noted, while parental anger expressions are related to negative outcomes, few studies examine parent anger's effects on toddlers at a micro-level. Examining anger expression patterns is conceptually related both to the distress-recovery cycles studied in mother-infant interactions (Cohn & Tronick, 1987; Tronick, 1986, 1989; Tronick et al., 1986) and to the coercive cycles studied in behavior problem school-age children (Granic & Patterson, 2006; Patterson et al., 1984). Therefore, patterns of angry exchanges during mother-toddler interactions may be valuable for predicting important child outcomes.

Method

Thesis data was from the Development of Toddlers Study (D.O.T.S.), a longitudinal investigation of emotion regulation development (Cole, Nelson, Crnic, & Blair, 2000). Children were recruited to be age 18 months at study Time 1 and seen nine times over four years of life. Data were collected at home at ages 18, 30, 36, and 42 months and in the laboratory at 18, 24, 36, 48 months and five years. Thesis data were collected during the 24 month laboratory visit; only those procedures from which thesis data were drawn are described below.

Recruitment and Enrollment

Recruitment procedures. Families were recruited from rural and semi-rural communities in central Pennsylvania. Eligible families had a toddler who would be 18 months of age at the first visit without disabilities interfering with toddler ability to participate in study procedures (e.g. hearing problems, autism) and had lived with caregivers since at least three months of age. In addition, given the longitudinal nature of the study, families had to indicate intention to live in the same area. Finally, eligible families had an annual household income at Time 1 above the U.S. government's definition of poverty but at or below the national median income for their family size. This population was chosen because children from these communities are underrepresented in the literature but have mental health needs relevant to emotion regulation development.

Before recruitment, the team identified census tracts with a high proportion of households with young children and within the target income range, and then contacted community leaders, (clergy, daycare providers, preschool administrators, medical practices, and local officials) to familiarize them with the study. Subsequently, families were recruited though (1) distributing flyers at community events, including health and Head Start fairs and town festivals, (2) writing

letters to families publishing birth announcements in local newspapers, and (3) encouraging enrolled families to refer friends and family with an 18 month old child.

Screening. Potential participants completed phone interviews in which they were asked whether they met eligibility requirements for household income, maternal education, and child age and legal guardianship. After determining eligibility, families were asked about family composition, family racial/ethnic status, child daycare history, parental educational level, religious affiliation, parental employment, and salary information.

Participants

Initially, 128 families enrolled in D.O.T.S. Of those enrolled, six mother-child dyads were excluded from the present analysis because they did not complete the 24 month laboratory visit (n = 4), or completed the visit but not the waiting task (n = 2). Of the remaining 122 dyads, seven were excluded because they completed less than half of the wait task. Mothers or toddlers opened the gift too early in the task (n = 5) or toddlers became too distressed and the task was terminated (n = 2). Thus, we included a total of 115 mother-toddler dyads in the present study.

Of the 115 toddlers, 62 were male. Mothers identified 93% of toddlers (n = 107) as of Caucasian/Anglo heritage and the remainder (n = 8; 7%) as of African American, Hispanic, or Asian ethnicities. In addition, 52 (45%) were first-born, 43 (37%) second-born, and 20 (18%) later- born. At the laboratory visit, toddlers were 24.41 months of age (SD = 1.31) on average. Visits were scheduled within two weeks of second birthdays. This limited age variation permitted study of individual variation on key child characteristics (e.g. emotion development).

Mothers' average age at Time 2 was 31.50 years old (SD = 5.43). In terms of education, 3 mothers (3%) had attended some high school, 22 (19%) had completed high school, 17 (15%) participated in vocational school. Most mothers (n = 68, 59%) had at least some college courses,

and 5 (4%) had advanced degrees. In terms of employment, 34 mothers (30%) were homemakers, 37 (32%) worked part-time, and 44 (38%) worked full-time. Average household annual income at 18 months was $41,004.29 (*SD* = 15,019.85). Average income to needs ratio, a measure of a family's ability to meet basic needs based on their income, was 2.36 (*SD* = 0.95) indicating that on average families were economically strained.

Lab Visit Procedures

General procedures. The 24 month laboratory visit was two and a half hours long and, to avoid separation anxiety, mothers remained with toddlers for the entire visit. Visits were at the Child Study Center at The Pennsylvania State University. Trained undergraduate and graduate research assistants (RAs) administered a series of challenging tasks (e.g. waiting task, clean-up), designed to elicit anger, alternated with non-challenging tasks (e.g. free play, reading), which provided relief from challenges and opportunities to study other child characteristics. All tasks were videotaped through a one-way mirror. After the visit mothers were paid for their time and toddlers received a project t-shirt, certificate of participation, and small toys.

Wait task procedure. This thesis used the wait task procedure to study dyadic emotion coregulation. The task introduced by Block and Block (1980) and adapted by Vaughn, Kopp, Krakow, Johnson, and Schwartz (1986), required children to wait for a desired object. Variations of this task are frequently used to study self-regulation. The wait task frustrates young children by requiring them to wait to open an attractive gift while mother completes questionnaires (see Carmichael-Olsen, Greenberg, & Slough, 1985; Cole et al., 2003). Previous research has demonstrated that the task successfully elicits anger in young children and has been used to demonstrate the long term effects of patterns of mutual regulation at preschool age on early school age changes in externalizing symptoms (Cole et al., 2003; Martin et al., 2002).

Mothers were briefed about the task and shown the materials. RAs cleared the room, then handed mothers clipboards with questionnaires, saying "Here is the work that I told you about." The questionnaires asked mothers to (1) rate her own and her child's emotions during the wait, (2) rate how she and her child usually felt while waiting, and (3) answer questions about how her child usually managed waiting. In addition to the questionnaires, there were instructions to help her remember the procedure. Next, the RA placed a shiny, wrapped gift on a child-size table, saying "Here is a surprise for you." Finally, the RA gave the child one cloth cymbal, which was intended to be a boring toy for 24 month olds, saying, "Here is something for you to play with. I'll be back in a few minutes." As the RA left the room, the mother said to the child, "That surprise is for you, but you can't open it until I finish my work." Mothers were instructed to do whatever they would normally do when their children had to wait for them. After eight minutes, the RA returned and signaled to the mother that she could allow the child to open the gift.

Coding Systems

Emotion coding. Two separate RA teams were trained in a standard emotion expression coding system. Coders first coded videotapes until reaching inter-rater agreement of 80% with master coders. Coders met frequently to review unclear coding situations and maintain reliability. Cohen's kappa for the overall coding system was acceptable (average $\kappa = .76$, range .70 to .82) for anger and joy, but was lower for some individual codes that occurred infrequently (sadness and anxiety). However, inter-rater agreement was acceptable for these codes (70% or above).

For each second, coders judged the presence of anger, anxiety, sadness, and happiness, based on established emotion indicators involving facial activity, vocal tone, and posture (Cole et al., 2003). Seconds containing no evidence of emotion were neutral. When emotion was present, coders rated its intensity on a 1 (*least intense*) to 3 (*most intense*) scale. When more than one

emotion was observed, coders recorded intensity for each, permitting consideration of emotion blends. However, blends occurred infrequently and were not included in the study.

Coders noted mothers' social orientation to place emotion expressions. Specifically, coders noted whether the mother was oriented toward work (i.e., looking at questionnaire), looking at the work but reacting to child (e.g., smiling at the child's frustration without looking at child), or communicating with the child. This code helped to distinguish emotional exchanges between mothers and children from mothers' reactions to completing questionnaires.

Coding child focus on the gift. A third independent team of undergraduate RAs, also naïve to study aims, were trained in a standard system for coding child misbehavior and regulatory attempts during challenging laboratory tasks at the second-by-second level. For the present study, we examined toddler's focus during the wait, specifically on seconds during which the child focused on the task demands. Focus on task demands was one code that captured when a child looked at, touched, attempted to reach for the gift, or asked to open the gift without being prompted to do so by their mother. The kappa for child focus on the gift was $\kappa = .80$.

Data Preparation

Screening missing data. Some dyads had missing data because the task was stopped 1-2 minutes early. Toddlers became too distressed ($n = 4$), or mother or toddler opened the gift before RAs ended the task ($n = 2$). Seven dyads were missing the last 10-40 seconds of the task because the RA re-entered the room too early by mistake. For all dyads that ended the task early, we duplicated the coding from the previous seconds completed. We surmised, for example, that children who had to end the task because they were exceptionally distressed would have continued to be distressed if the task had continued, per the expectation of RAs ending the task.

Other dyads (n = 7) had some portion of videotape (3-40 seconds) in which participants were hidden by poor lighting or camera angles. In these situations, emotion expressions were coded from vocal cues only, and received a neutral code if no codable vocal cues were present. For all dyads with missing data, we tested whether the percentage of emotion cues was statistically different if we used only the time they actually completed the task compared to duplicating coding. These results indicated that there were no statistical differences, $p > .05$.

Preliminary data reduction. We calculated the following variables for each dyad's emotion expression, orientation, and focus: (1) total number of seconds observed, (2) number of seconds observed when mother was oriented toward or away from child, and (3) number of seconds of each emotion intensity level. The group-level mean number of seconds of emotion expression, maternal orientation, and toddler attention focus were then calculated (Table 1).

To contrast emotion expression frequency as a function of maternal orientation, we calculated percentages controlling for the variation in time in each orientation. Specifically, for each mother and for each child, the total seconds for each emotion expression during each maternal orientation type was divided by the total seconds the mother spent in that orientation type. Table 1 shows mean percentages of time participants expressed each emotion and toddlers focused on the task demands as a function of the entire task and time mothers were oriented toward or away from toddler. Percentage scores were also broken out by intensity level for happy and angry emotion expression. Table 2 gives correlations between these percentage scores.

Creating transitional variables. Study aims examined whether changes in child emotion expressions or focus influenced maternal emotion expression and orientation changes. It was first necessary to create variables reflecting whether a change in maternal or toddler emotions occurred. Table 3 gives a visual example of how these variables where calculated. First, lagged

variables were created for each mother and child reflecting the status of their orientation, focus, and emotion expressions one second before second *t*. Then, a new variable (*trans*) was created using syntax identifying whether codes occurring at second *t* had occurred in the previous second (*t*-1). If codes at *t* and *t*-1 differed, *trans* captured that a change had occurred. The frequency of toddlers' focus and emotion expression shifts is given in Table 4; frequency of mothers' emotion expression shifts is given in Table 5. Frequencies of shifts in mothers' orientation are in the text.

In Aim 1, we examined toddler shifts in the 5 sec prior to mothers' orientation toward toddler. To do this, we calculated lagged variables for toddler shifts, and calculated the total number of times each mother oriented toward her child. The number of toddler shifts occurring before the total number of maternal orientation shifts was then calculated (Table 6). To assess how often mothers oriented toward the toddler, given the toddlers' overall focus or expressiveness, we divided the shifts occurring in the 5 sec before mothers' orientation shifts by each toddler's total number of focus or expression shifts while the mother was working (Table 6).

In Aim 2 of the study, we examined the frequency of anger expression shifts occurring 5 sec after changes in the dyadic partner's anger expressions. To do this, we calculated lagged variables for emotion shifts, and calculated the total emotion shifts. The total number of each individual's emotion shifts occurring before the total number of their dyadic partner's coding shifts was calculated as a mean and percentage (Table 7). To assess how often each individual's emotion expression shifts occurred before a their partner's expression shift, given the individual's own level of expressiveness, we also divided the number of emotion expression shifts occurring before a dyadic partner's orientation shifts by the individual's total number of expression shifts occurring while mother was oriented toward the child (Table 7).

Results

Preliminary Analyses

Variable frequencies. To examine whether there were (1) toddler cues that drew mothers away from their work and toward the child, and (2) emotion exchanges once the mother and toddler were interacting, analyses began with examining the distributions for the mean number of seconds and percent of time mothers were in each of three orientations: oriented away from, partially oriented toward, and oriented toward toddlers (Table 1). On average, mothers spent about 104.41 seconds (*SD* = 74.79, 21.7% of task) oriented toward toddlers, 11.06 seconds (*SD* = 11.29, 2.3% of task) partially oriented toward toddlers, and 364.65 seconds (*SD* = 74.43, 76.00% of task) oriented toward work. Infrequent partial orientation codes were not considered further. Descriptive statistics indicated considerable variability in time mothers oriented toward toddlers. Visual examination (Figure 1) indicated that 106 out of the 115 mothers spent between 0 and 300 seconds (0 - 62% of total task time) oriented toward toddlers; the remaining nine mothers spent nearly the entire task oriented toward toddlers.

Next, paired t-tests compared the mean percentage of time in which mothers and toddlers expressed emotion and toddlers focused on the gift as a function of maternal orientation (Table 1). Toddlers spent more time focused on the gift when mothers oriented toward them than when mothers worked, $t(1, 113) = 6.54$, $p < .05$. Toddlers expressed happiness more when mothers oriented toward them than toward work, $t(1, 113) = -2.37$, $p < .05$. Toddlers' percentage of time expressing anger or neutral expressions did not differ according to maternal orientation, $ps > .05$.

As with toddlers, mothers spent a larger percentage of time expressing happiness while oriented toward children compared to work, $t(1, 113) = -8.71$, $p < .05$. However, mothers also spent a larger percentage of time expressing anger while oriented toward toddlers than when

working, $t(1, 113) = -9.30$, $p < .05$. Finally, mothers spent a smaller percentage of time with neutral expressions when oriented toward child than when working, $t(1, 113) = 13.26$, $p < .05$.

Table 1 also displays the total number of seconds and percentage of time that participants expressed mild, moderate, and intense anger and happiness during each maternal orientation type. Toddlers mainly expressed mild happiness; the percentage of time they expressed more intense happiness did not differ by maternal orientation, *ps* > .05. Toddlers spent a higher percentage of time expressing mild anger, $t(1, 113) = -3.33$, $p < .05$, and a lower percentage of time expressing intense anger, $t(1, 113) = -3.29$, $p < .05$, when mothers were oriented toward them compared to working. Toddlers did not differ in the percentage of time they expressed moderate anger, $p > .05$. Mothers rarely expressed moderate or intense emotion. However, they spent a higher percentage of time showing moderate and intense happiness, $t_{moderate}(1, 113) = -3.96$, $t_{intense}(1, 113) = -3.99$, *ps* < .05, and moderate and intense anger, $t_{moderate}(1, 113) = -4.48$, $t_{intense}(1, 113) = -4.59$, *ps* < .05, when oriented toward toddlers rather than work.

Correlations between emotion expression frequencies. Relations between the percent of time mothers and toddlers expressed each emotion within each maternal orientation were also examined (Table 2). Child emotion expression inter-correlations were consistent for each maternal orientation. The percentage of time toddlers expressed anger and happiness was inversely related. The percentage of time children expressed anger and neutrality was also inversely related. Child happy and neutral expressions were not significantly related. The percentage of time mothers expressed anger and happiness was not related while mothers oriented toward toddlers. However, the percentage of time mothers showed happiness and anger while working was significantly related. Mothers' happiness and anger were inversely related to neutral expressions across orientation contexts.

Next, we examined relations between mother and child emotion expressions by maternal orientation. When mothers oriented toward toddlers, the percentage of time mothers and toddlers expressed happiness, but not anger, was significantly related. In addition, the percentages of time toddlers expressed anger and mothers expressed happiness were inversely related. Unexpectedly, the percentage of time mothers expressed anger while oriented toward their child was not related to the total percentage of time children expressed anger. These relations were further examined within each toddler anger intensity level, but these also were nonsignificant. When oriented toward toddlers, the percentage of time mothers were neutral was associated with less child happy and more anger expressions, but the percentage of time toddlers were neutral was not related to mothers' emotions. Finally, when mothers were working, the percentage of time that children expressed any emotion or were neutral was not related to mothers' emotion expressions.

Frequency of expression and focus shifts. Preliminary analyses also examined the distribution of shifts in mother orientation, toddler focus on the gift, and emotion expressions for each maternal orientation (Tables 4, 5). On average, mothers oriented toward toddlers 10.82 times during the task (*SD* = 6.48, range = 1-34). While orienting toward toddlers, mothers were most likely to have a neutral expression (80% of orientations). Once oriented, mothers remained oriented toward toddlers for an average of 8.55 seconds (*SD* = 15.56, range = 1-323) before returning to work. Mothers were most likely to turn their attention toward their child during the first 15 seconds of the waiting task (12% of orientations). Otherwise, the likelihood of a mother orienting toward her child was evenly spread throughout the remainder of the task.

Next, the mean number of shifts in toddler variables was examined (Table 4). Paired *t*-tests contrasted the number of shifts in toddlers' focus and emotion expression as a function of maternal orientation. All toddlers shifted attention toward the gift during the task; 10 toddlers

shifted to the gift and stayed focused on it for the rest of the task. On average, toddlers shifted their attention toward the gift more when mothers were working than when oriented toward them, $t(1, 113) = -5.27$, $p < .05$, and shifted their attention away from the gift more when mothers where oriented toward them than working, $t(1, 113) = -2.64$, $p < .05$.

All toddlers shifted between emotion expressions during the task. They showed significantly more emotion shifts while mothers were working than when oriented toward them, with one exception (see Table 4 for significance test results). When mothers oriented toward toddlers, toddlers were more likely to shift from neutral to angry expressions. Few toddlers shifted between happy expression intensity levels; only 16 toddlers showed moderate to intense happiness during the entire task. Toddlers were more likely to shift from neutral to mild, and from mild to moderate happy expressions, when mothers were oriented toward them. Toddlers also had more shifts from mild to no happy expression during times when mother was oriented toward them (see Table 4). Over half of the toddlers expressed at least moderate anger ($n = 80$) during the entire task. Fewer ($n = 34$) expressed intense anger; of those who did, 2 toddlers maintained high levels of anger during the rest of the task and did not shift back to lower levels (Table 4). Toddlers had less shifts from mild to moderate, and moderate to mild, anger intensity expression when mothers oriented toward them than when working (Table 4).

Finally, we examined the mean frequency of mothers' emotion expression shifts (Table 5). All mothers shifted between mild emotion expressions during the task. Overall, mothers shifted between emotion expressions more when oriented toward toddlers compared to toward work (see Table 5 for test results). Differences in the frequency of mothers' shifts between happy to angry and angry to neutral expressions were not significant across maternal orientations (Table 5). Examination of the frequency of shifts in intensity of happy expressions revealed that few

mothers (n = 32) shifted into moderate expressions during the entire task, and only six shifted into intense expressions during the entire task. Nearly all of these shifts in the intensity of happy expressions occurred during times when children were oriented toward their toddler; only four shifts occurred when working (Table 5). Examination of the number of shifts in intensity of anger showed that 18 mothers showed moderate to intense anger, and all of these shifts occurred during times when mothers oriented toward children.

Summary. Mothers oriented toward toddlers for 104.41 seconds, or 21.70% of task time. On average, mothers oriented toward toddlers 10.82 times during the task, and remained oriented for 8.55 seconds. Toddlers spent more time focused on the gift, expressing happiness, and expressing more intense emotions when mothers oriented toward them than when working. Toddlers were less likely to shift their focus onto task demands, and shift their emotion expressions and intensity, when their mothers were oriented toward them than when working. Mothers spent more time expressing emotions and more frequently shifted expressions when oriented toward toddlers than when working. Mothers rarely expressed moderate and intense anger and happiness. Frequency of mother and toddler emotion expressions were significantly related mothers oriented toward toddlers, but were not related when mothers were working. Findings supported further investigation of (1) child cues (i.e. changes in emotion expression, emotion intensity, or focus on task demands) triggering mothers to orient toward toddlers and (2) emotion expression exchanges when mothers were oriented toward toddlers.

Aim 1

The thesis first aimed to identify toddler cues preceding mothers' orientation shifts from work to child. We examined two toddler cues to predict orientation shifts: emotion expression and focus changes. Emotion expression changes included (1) shifts from one emotion to another, or

(2) changes in emotion expression intensity. Table 6 presents the mean number of times toddlers' emotion expression or focus changed in the 5 seconds prior to mothers' orientation changes.

To account for individual differences in how often mothers oriented toward toddlers, the number of times each child shifted emotion expression or focus in the 5 seconds prior to mothers' orienting toward child was divided by the number of times each mother shifted orientation toward each toddler. Examination of these percentages (Column 2, Table 5) reveals that toddler emotion expression shifts, especially anger, triggered mothers' orientation toward toddlers. Toddler shifts from angry to neutral expressions occurred before 21.39% of mothers' orienting toward toddlers, and toddler shifts from neutral to angry expressions occurred before 22.01% of mothers' orienting toward toddlers. Repeated measures analysis of variance (ANOVA) with planned contrasts compared the percentage of mothers' orientation shifts occurring after a shift in child anger expression with the percentage of mothers' orientation shifts occurring after a shift in happiness expression. Overall, mothers were more likely to shift their orientation toward the child after the child had shifted from angry to neutral or neutral to angry than after the child had shifted in to or from a happy expression, $F(5, 555) = 64.52$, $p < .05$.

We also examined changes in toddler anger expression intensity (Table 6). In terms of percentage of mothers' orientation shifts, 9.57% of shifts occurred after an increase in toddler anger expression intensity and 10.05% of shifts occurred after a decrease in toddler anger expression intensity. The percentage differences were not significant, $p > .05$. Few toddler happiness expression shifts occurred before mothers oriented toward toddlers (Table 3) and so shifts in child happy expression intensity could not be examined.

A percentage (22.76%) of mothers' orientations towards toddlers occurred after toddler focus shifted toward or away from the gift. A higher percentage of mothers' orientation shifts

occurred after toddlers focused on the gift (12.38% of orientations) compared to away from the gift (10.38% of orientations), $t(1, 113) = 2.19$, $p < .05$. Mothers were more likely to orient toward their child after an anger expression shift than after a focus shift, $t\ (1, 111) = -4.97$, $p < .05$. Child anger and focus shifts rarely co-occurred; incidents where children's anger and focus both shifted in the 5 seconds prior to mothers' orienting towards toddlers comprised only 7% of the total number of times mothers oriented toward toddlers.

To show that toddler emotion expression and focus changes triggered to mothers' orientation changes, it is also important to examine whether changes in toddler behavior were more likely to occur during the 5 seconds before mothers' orientation shifts than during the rest of the time mothers were working (Bakeman & Gottman, 1997). Therefore, the number of toddler emotion and focus shifts occurring 5 seconds before each mother oriented toward toddler (Column 1, Table 6) was divided by the number of shifts occurring when the mother was working (Table 4). This percentage reflects how often mothers oriented toward toddler after change in toddler emotion or focus while they were working (Column 3, Table 6).

In terms of emotion expression shifts, mothers oriented toward toddlers 59.38% of the time their emotion expression shifted. Repeated measures ANOVA contrasted the percentage of time mothers oriented toward different emotion shifts. Of total expression shifts while mothers worked, mothers were most likely to orient toward toddlers after a shift from neutral to angry or angry to neutral expressions (45.62% of shifts). They were less likely to turn toward a happiness expression shift than an anger expression shift, $t(1, 113) = -2.70$, $p < .05$. The likelihood of mothers' orienting toward child anger intensity shifts was not significantly different (Table 6).

In terms of toddler focus on the gift, when mothers worked, they oriented toward toddlers about a third of the time toddlers' focus shifted (27.77% of shifts toward gift, 36.20% of shifts

away from gift). The percentages of times mothers oriented toward toddlers after toddlers oriented toward compared to away from the gift were not significantly different. Mothers' orientation toward toddlers after toddler anger expression shifts was not significantly different from toddler focus shifts, t (1,114) = -1.23, $p > .05$.

Summary. We examined changes in toddler emotion expressions and focus on the desirable gift in the 5 seconds before mothers oriented toward the toddler. Mothers were equally as likely to turn toward a change in toddlers' focus on the gift as toward a change in toddlers' anger expressions. Closer examination of change in focus on the gift revealed that mothers were more likely to orient toward a child after the child focused their attention toward, rather than away from, the attractive gift. In terms of change in emotion expression, mothers were most likely to orient toward their toddlers after a change in anger expression (i.e. shifting from neutral to angry or angry to neutral) rather than in happy and neutral expressions.

When examining how many shifts mothers oriented toward out of the total number of child shifts occurring while mothers worked, we found that mothers oriented to toddlers over half of the time toddlers shifted from one type of emotion expression to another. Mothers oriented toward a higher percentage of toddler anger expression shifts and focus shifts than happiness shifts. Mothers did not differ in their orientation toward increases or decreases in child anger.

Aim 2

The thesis also aimed to identify emotion expression exchanges occurring during the wait task. Preliminary analyses justified examining only times when mothers were oriented toward toddlers because (1) mothers expressed the most emotion during these times, (2) the percentage of time during which mothers and toddlers expressed emotions was significantly related during these times, but was not related when mothers were oriented toward their work, and (3) mothers

showed more emotion expression shifts when oriented toward toddlers than when working. We focused on examining mother and toddler anger expression shifts (i.e., neutral to angry and angry to neutral) because examining patterns in the onset and offset of anger is conceptually related to distress-recovery cycles studied in mother-infant interactions (Cohn & Tronick, 1987; Tronick, 1986, 1989, Tronick et al., 1986, Tronick & Gianino, 1986) and to coercive cycles studied in school-age children with behavior problems (Granic & Patterson, 2006; Patterson et al., 1984).

For ease of interpretation, a shift from neutral to angry expression is referred to as the *onset* or *start* of an anger expression and a shift from angry to neutral is referred to as the *offset* or *stop* of an anger expression. First, during times mothers oriented toward toddlers, we examined the frequency of onsets and offsets in toddler anger expressions after mothers started or stopped expressing anger (Table 7). Second, we examined the frequency of onsets and offsets in mothers' anger expressions after toddlers started or stopped showing anger (Table 7). To help put these frequencies in the context of the rest of the task, we also calculated two percentage scores. First, we calculated the frequency divided by the total number of each participant's shifts during the time mothers oriented toward toddlers. For example, the first row of Table 6 shows the average number of times toddlers started to show anger expressions 5 seconds after mothers started to show anger expressions. Then, the frequency of toddler anger expression onsets is divided by the total number of times mothers started to get angry to give the percentage of mother shifts. Second, the frequency of toddler anger expression onsets occurring before mothers showed angry expressions is divided by the total number of toddler anger expression onsets during the time when mother is oriented toward toddler to give the percentage of toddler shifts.

First, we examined the extent to which mothers' anger expressions influenced toddler anger expressions. Toddlers started to express anger after 1.45 (SD = 1.84) of maternal anger

expression onsets, which comprised 23.66% of the total number of onsets of maternal anger while mothers oriented toward toddlers. Toddlers stopped expressing anger after 1.16 (*SD* = 1.21) of maternal anger expression onsets, which comprised 16.46% of the total number of onsets of maternal anger while mothers oriented toward toddlers. Thus, toddlers were more likely to start rather than stop expressing anger after mothers started to express anger, $t(1, 113) = 2.91$, $p < .05$. In terms of the total number of toddler anger expressions, 40.95% of toddler anger expression onsets occurred after maternal anger expressions started; 20.59% of toddler anger expression offsets occurred after maternal anger expressions started.

Second, the extent to which offsets in maternal anger influenced child anger expressions was examined. Toddlers started to express anger after 1.17 (*SD* = 1.49) of maternal anger expression offsets, which comprised 25.20% of the total number of mothers' anger expression onsets while mothers oriented toward toddlers. Toddlers stopped expressing anger after 0.99 (*SD* = 1.33) of maternal anger expression offsets, which comprised 16.03% of the total number of mothers' anger onsets while mothers oriented toward toddlers. Thus, toddlers were more likely to start rather than stop expressing anger after mothers stopped expressing anger, $t(1, 113) = -2.60$, $p < .05$. In terms of the total number of toddler anger expressions, 33.58% of toddler anger expression onsets occurred after maternal anger expressions stopped; 15.37% of toddler anger expression offsets occurred after maternal anger expressions stopped.

Third, we examined the extent to which toddler anger expression onsets influenced maternal anger expressions. Mothers started to express anger after 0.73 (*SD* = 1.04) of toddler anger expression onsets, which comprised 14.82% of the total number of toddler anger expression onsets while mothers oriented toward toddlers. Mothers stopped expressing anger after 0.95 (*SD* = 1.21) of toddler anger expression onsets, which comprised 16.94% of the total number of toddler

anger onsets while mothers oriented toward toddlers. Thus, mothers were more likely to stop rather than start expressing anger after toddlers started to express anger, $t\ (1, 113) = -2.50$, $p < .05$. In terms of the total number of mother anger expressions, 12.69% of instances of mothers' anger expression onsets occurred after toddler anger expressions started; 24.44% of mothers' anger expression offsets occurred after toddler anger expressions started.

Fourth, the extent to which toddler anger offsets influenced maternal anger expressions was examined. Mothers started to express anger after 0.76 ($SD = 1.28$) of toddler anger expression offsets, which comprised 13.17% of the total number of toddler anger offsets while mothers oriented toward toddlers. Mothers stopped expressing anger after 1.14 ($SD = 1.86$) of toddler anger expression offsets, which comprised 17.32% of the total number of toddler anger expression offsets while mothers oriented toward toddlers. Thus, mothers were more likely to stop rather than start expressing anger after toddlers stopped to expressing anger, $t\ (1, 113) = 2.81$, $p < .05$. In terms of the total mother anger expressions, 14.85% of instances of mothers' anger expression onsets occurred after toddler anger expressions stopped; 29.11% of mothers' anger expression offsets occurred after toddler anger expressions stopped.

Summary. Taken together, Aim 2 results provide evidence that maternal anger expressions evoked toddler anger; toddlers were more likely to start, rather than stop, expressing anger after mothers did so. Toddler anger expressions were also more likely to start, rather than stop, after their mothers' anger expressions ceased. Toddler anger expressions were not as evocative for mothers, who were more likely to stop, rather than start, expressing anger after changes in toddler anger expressions.

Discussion

The thesis contributes to the literature on mother-toddler coregulatory emotional exchanges (Dumas et al., 1998; Feng et al., 2007; Jameson et al., 1997; Kochanska et al., 2008; Lorber & Slep, 2005; Martin et al., 2002). It focuses specifically on coregulation in sequences of emotion expressions occurring during a task in which mothers and toddlers had divergent goals: toddlers had to wait for a gift while mothers completed work. The study conceptualized coregulation as (1) mutual, in that dyadic partners expressed the same emotions, (2) bi-directional, in that change in one partner's emotional expression occurred as a function of change in the other's expression or focus (Cole et al., 2003; Tronick, 1989), and (3) reciprocal, in that a change in one partner's emotion expression was followed by the same change in the other. Findings are discussed in light of existing literature, clinical implications, future directions, and limitations.

The present study found evidence of mutuality in toddler-parent emotion expression, in that the overall frequencies of happy and angry expressions were related in directions consistent with prior research (Dumas et al., 1998; Feng et al., 2007; Martin et al., 2002). Although our participants did not express as much mutual anger as at-risk participants (Dumas et al., 1995; Feng et al., 2008), our use of micro-level rather than global emotion codes led to detection of more negative emotion expressions than in other studies with typically-developing samples (e.g., Martin et al., 2002). Mothers mainly focused on completing work, suggesting that they were absorbed in writing about how toddlers typical handle waiting. Even though the task was not designed to elicit parent-child interaction, we nonetheless find support for coregulatory exchanges; mothers expressed more emotion, and mother-child emotion expressions were more strongly related, when mothers were oriented toward children compared to when working.

Most prior coregulation studies in toddlerhood rely on two tasks designed to elicit parent-child interaction: playtime tasks such as free play, snack, special toy, or game time (Dumas et al., 1998; Feng et al., 2007; Jameson et al., 1997; Kochanska et al., 2008; Lorber & Slep, 2005; Martin et al., 2002) and compliance tasks requiring toddlers to clean up toys or avoid forbidden objects (Kochanska & Aksan, 1995; Lorber & Slep, 2005). In both types of tasks, mothers focus on their child with minimal distractions. Our findings extend this work by demonstrating mutuality in emotion expressions even in a context in which mothers were distracted by completing work and not encouraged to engage with their child. Playtime and compliance tasks replicate important components of the parent-child relationship, but it is also necessary to understand situations in which mothers juggle multiple demands and must choose whether to intervene if their child struggles to cope with frustration. Furthermore, both playtime and compliance tasks can be limited in assessing negative emotion exchanges. Playtime tasks are often fun and therefore do not elicit much negativity. Compliance tasks elicit negativity, but emotional expressions are often coded only *after* the parents have given a command or shown other specific parenting behaviors (Dumas et al., 1995; Kochanska & Aksan, 1995), making the examination of coregulation more about a behavioral-emotional sequence rather than capturing emotion expression sequences.

Only two previous studies of coregulation in the toddler period utilized tasks in which mothers were busy and required their child to wait. In one study (Lorber & Slep, 2005), mothers participated in a variety of different playtime, compliance, and mother busy/child waiting tasks, and analyses collapsed emotion data across all tasks. Therefore, mother-toddler emotional exchanges are not clearly situated within the task context, and the meaning of an emotional expression is obscured. In another study (Martin et al., 2002) mothers completed the Positive and Negative Affect Scale (PANAS) after participation in the waiting task. These global, self-reported

emotion ratings were related to child observed emotions, yielding evidence of mutual, but not bidirectional and reciprocal, effects of child emotion expression on mothers. Our study builds on the work of Martin and colleagues by examining maternal emotion using micro-coded observed emotion expressions, rather than global ratings, allowing for temporal analyses of bidirectional and reciprocal effects of emotional expressions that cannot be captured by correlations alone. By using micro-coded data analyses, and by situating emotional exchanges within a specific context, our work begins to reveal a more complete picture of mother-toddler emotional exchanges than currently exists in the literature.

To understand coregulation, i.e., ways mothers and toddlers influenced each other's self-regulation during the task, we operationalized self-regulation as occurring when a change in focus or emotion expression occurred. For Aim 1 of our study, we found evidence of toddlers influencing maternal behavior, in that toddler anger expression or focus changes prompted mothers to turn away from work. Evidence of mutual anger expressions was not found when mothers turned toward toddler. Findings help to clarify the lack of relations between frequency of child focus on the gift and reported maternal negative emotion in the literature (Cole et al., in press). Mothers may expect toddlers to have difficulty maintaining distraction independently and thus are not angered by toddlers' focus on the gift or mild anger displays in the waiting task. Future research could explore this issue by relating expectations for how toddlers handle waiting to the frequency with which mothers intervene or express anger when toddlers start to become angry or focus on the gift. Mothers expecting toddlers to distract independently may be more upset when toddlers do not do so than mothers expecting toddlers to need assistance.

Surprisingly, very few changes in toddler anger expressions were accompanied by simultaneous changes in toddler attention to the gift prior to mothers attending to toddlers. Many

studies of coregulation (Feng et al., 2007; Jameson et al., 1997; Kochanska et al., 2008) utilize coding systems lumping negative emotion expressions and poor child regulation strategies or misbehavior together to form an overall child negativity variable. By examining child emotion expressions and behaviors separately, our work adds to an emerging literature showing that child emotion expression and behavior may differentially elicit parental attention and emotional responses (Cole et al., in press; Lorber & Slep, 2005).

What was particularly interesting was that both the onset and *offset* of toddler anger or focus on the gift drew mothers' attention. To our knowledge, no studies of coregulation to date have examined the effects of the offsets of child anger expressions and attention on maternal attention and emotion expression. To better understand findings, we reviewed exemplar videos of mothers responding to toddler anger expression and focus onsets and offsets. At onsets, mothers often attempted to reduce toddlers' anger or distract toddlers from the gift. At offsets, mothers either checked in on toddlers or reinforced calming down or shifting attention away from the gift. These observations are consistent with evidence that toddler anger displays and limited use of regulatory strategies (e.g., distraction) prompt parental involvement, emotion coaching, and encouragement of distraction in typically-developing samples (Grolnick et al., 1998; Lorber & Slep, 2005). Future research could clarify this issue by contrasting parenting behavior after toddler anger expression and focus onsets compared to offsets.

On average, mothers attended to about half of toddlers' total anger expression shifts and one-third of toddlers' focus shifts, but large variability indicates that mothers may be differentially responsive to child emotion and behavior. This is to be expected given the large body of work demonstrating variability in parental responsiveness based on child factors, both distal (e.g. temperament, genetic effects; Deater-Deckard & O'Conner, 2000; Deater-Deckard & Petrill,

2004), and proximal (e.g. child behavior and emotion expression, Cole et al., in press), as well as parents' overall parenting style and philosophies (Coplan et al., 2002; Gottman, Katz, & Hooven, 1996), cultural background (Cheah & Rubin, 2004), sense of parenting self-efficacy (Coleman & Karraker, 1997), psychopathology (Blandon et al., 2008) and perceptions of past child behavior (Cole et al., in press). Future work will examine these distal and proximal predictors of maternal responsiveness during the wait.

Aim 2 of the study examined contingent changes in anger expressions after mothers oriented toward toddlers. Prior studies of emotion coregulation in toddlerhood did not focus specifically on anger expressions; rather, they asked mothers to rate their negative versus positive emotional responses (Lorber & Slep, 2005) or created latent negative and positive emotion variables based on mothers' ratings of discrete emotions during the wait (Martin et al., 2002). These ratings incorporate anger, sadness, and anxiety together. However, within the framework of functional emotions theory (Barrett & Campos, 1987) these negative emotions function differently within interpersonal contexts (Reis et al., 2000). Anger signals desire to overcome a blocked goal (e.g., for the child to open the gift even though mother says no), while sadness signals goal relinquishment (e.g., child gives up on gift). Such expressions have been shown to elicit different emotional and behavioral responses from parents of infants and older children (Cole et al., 2003; Dagne & Snyder, 2011; Dumas et al., 1998; Tronick, 1986). Thus, our work clarifies and extends previous studies examining negative emotions in mother-toddler exchanges by examining anger separately from sadness and anxiety expressions.

Aim 2 findings demonstrated that mothers and toddlers bi-directionally influenced each other in two ways: (1) maternal anger expressions triggered onset of toddler anger, and (2) mothers stopped expressing anger when toddlers became angry. In other words, toddlers tended to

reciprocate maternal anger, while mothers did not reciprocate toddler anger. Results are consistent with evidence that maternal anger expression, and, more broadly, chronic maternal negativity, is distressing for infants (Tronick, 1986, 1989) and preschool and school-age children (Cole et al., 2003; Criss et al., 2003; Eisenberg et al., 1996). Results are particularly interesting because many behavior problem interventions focus on improving mothers' reactions to child anger (Hannesdottir & Ollendick, 2007; Kendall et al., 2003; Lochman et al., 2003; Macklem, 2008; Trosper et al., 2009). Thesis findings show that on average, mothers of typically developing toddlers limit their anger expressions' intensity and frequency, and inhibit their anger expressions if children's anger escalates. Consistent with other work in typically-developing families (Dumas et al., 1995) these mothers may use anger expressions deliberately and instrumentally; that is, they may use anger expressions as a tool to communicate limits for appropriate child behavior, but reign in their anger expressions if their child's anger escalates. In contrast, mothers of children with behavior problems are more likely to reciprocate child anger expressions and report a diminished sense of control over their expressivity (e.g. Cole et al., 2003; Criss et al., 2003; Dumas et al., 1998; Granic et al., 2007; Lorber & Slep, 2005). Current parent training programs (Hannesdottir & Ollendick; Izard et al., 2004; Trosper et al., 2009) often focus on teaching parents specific behavioral strategies for managing child behavior, but do not explicitly teach parents emotion regulation skills. In practice, we find these interventions unsuccessful when parents' own emotional distress impedes implementation of new behavioral strategies.

Taken together, Aim 1 and 2 findings highlight difficulties in operationalizing bi-directionality when using micro-coded dyadic emotion expressions. When two-step emotion sequences are examined, as in this study, evidence of bi-directionality is found by examining effects of mothers on children and children on mothers at different points in the task. Such two-

step sequences allow for examination of immediate partner effects, but do not allow for examination of immediate, subsequent effect in the opposite direction. For example, it does not allow for examination of whether the onset of child anger triggers maternal anger, which in turn inhibits or exacerbates further child anger. Future research will employ multi-step sequential analyses (also referred to as "chain events" in Dumas et al., 1995) to better illuminate immediate bi-directional effects occurring between mothers and toddlers. Although the present study does not examine multi-step emotion sequences, the use of two-step sequences strengthens the inference that, over the course of challenging, emotion-eliciting tasks, mothers and children influence each other's emotion expressions in bi-directional and sometimes reciprocal ways.

Happy expressions occurred more rarely than anger expressions, and so were not examined sequentially. However, there was evidence of mutual happiness, in that happy expressions were more strongly related, frequent, and intense when mothers were oriented toward toddlers than when working. Previous studies estimate that about one-third of mother-toddler interaction time is mutually positive (Hann et al., 1994); this thesis likely found a lower percentage because participants were not observed in a task designed to elicit mutual positivity. Despite low levels of happiness, it is important to consider how mothers and toddlers establish mutual positivity in spite of being in a frustrating-eliciting situation, as mutual exchanges are linked to decreased risk for internalizing and externalizing problems (Dumas et al., 1998), and more internalized compliance (Kochanska & Aksan, 1995). Maternal depression and other forms of psychopathology may hinder mothers' ability to maintain positive expressivity during challenging tasks (Feng et al., 2007). Although our sample was not selected for risk of psychopathology, future research in more diverse samples could explore links between psychopathology and the frequency and intensity of mutually positive exchanges in tasks challenging toddlers' self-regulation skills.

Study findings must be understood in light of design limitations. Wait task instructions may have discouraged some mothers from interacting with their child during the task. Mothers were instructed to (1) complete questionnaires, and (2) do whatever they normally do when their child must wait. Requiring mothers to work may prompt some to ignore the child more than they would in real-world situations. Mothers also may vary in their adherence to the second instruction, because a desire to appear as a competent parent may cause them to behave differently than they normally would in when their child must wait. Finally, some mothers reported that their child struggled to wait more than usual in our task, because mothers would typically provide children with distractions in waiting situations. Despite these limitations, task instructions increase the task's ecological validity by explicitly telling mothers we are interested in their normative responses to child frustration. Although work may discourage mother-child interactions to an extent, we suspect that mothers often must attend to other tasks (e.g., completing chores) while also helping toddlers wait, and are not always able to provide distractions in waiting situations. By not explicitly encouraging parent-child interaction, the task may have decreased the frequency of interactions, but it does not necessarily follow that the actual patterns of emotional exchanges occurring during the task would differ from each dyad's typical interactions, especially since such patterns are thought to be habitual by the time children reach their second year (Harrist & Waugh, 2002). These instructions also increase the likelihood that the task will be evocative for dyads by creating a situation in which they have divergent goals.

Although the wait task is frequently used to study regulatory processes in young children (e.g. Martin et al., 2002), findings are limited by the use of only one procedure that may not be equally evocative across children. However, qualitative examination of mothers' reports of typical child waiting behavior indicated that most reported that child reactions to waiting did not differ

from waiting behavior in everyday situations. Of many toddler behaviors and regulatory strategies coded, we included only one we felt most directly relevant to attracting mothers' attention during the challenging wait: focus on the gift. However, mothers' attention may also have shifted toward toddlers after toddlers behaved in other potentially evocative ways (e.g., misbehaving or speaking; Dix, 2009). Future research could explore whether such behaviors evoke different parent emotion expressions than toddler focus on the desirable gift.

Finally, study findings may not generalize to families of higher or lower socioeconomic status than those in our economically strained sample, or families living in urban or suburban areas. However, since the most research on parent-child relationships is conducted with high or middle income families, our work contributes to the diversity of samples in the overall literature.

In sum, we found evidence of mutual, bi-directional, and reciprocal influences on mother and toddler emotion expressions, even in a task not explicitly designed to elicit parent-child interaction. Our work furthers prior studies of coregulation in the toddler period (Lorber & Slep, 2005; Martin et al., 2002) by utilizing micro-coded data to richly describe emotion expressions' frequency and intensity and ways emotion expression shifts influenced partner emotion expressions. Findings highlight how mothers of typically-developing toddlers modulate the anger expression intensity and frequency when toddler anger escalates. They highlight how understanding optimal parental reactions to child frustration is essential to improving interventions for children with behavior problems (Cole & Hall, 2008). Finally, this study generated descriptive variables that will be used to examine predictors and outcomes of mother-toddler co-regulatory exchanges and examine multi-step sequences of mother-toddler expression to capture more fully how coregulation unfolds during parent-child interactions.

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Table 1. *Frequency of Mother and Toddler Emotion Expressions, Task Orientation, and Focus on Gift*

	Maternal Orientation											
	Towards Child				Towards Work				Entire Task			
	# Seconds		% Time		# Seconds		% Time		# Seconds		% Time	
Mother	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Task Orientation												
Towards Child	--	--	--	--	--	--	--	--	104.14	*(74.79)*	21.70	*(15.58)*
Partial	--	--	--	--	--	--	--	--	11.06	*(11.29)*	2.30	*(2.35)*
Towards Work	--	--	--	--	--	--	--	--	364.65	*(74.43)*	76.00	*(15.51)*
Emotion Expression												
Happy	9.53	*11.52*	9.10	*10.96*	0.95	*2.83*	0.27	*0.83*	12.70	*14.03*	2.64	*2.92*
Intensity 1	7.93	*9.02*	7.60	*8.38*	0.90	*2.64*	0.25	*0.77*	10.77	*11.04*	2.24	*2.30*
Intensity 2	1.49	*3.34*	1.44	*3.84*	0.05	*0.32*	0.02	*0.10*	1.83	*3.81*	0.38	*0.79*
Intensity 3	0.11	*0.47*	0.06	*0.30*	0	*0*	0	*0*	0.10	*0.46*	0.02	*0.09*
Angry	8.90	*8.82*	9.23	*9.52*	3.83	*5.52*	1.05	*1.50*	14.41	*11.92*	3.00	*2.48*
Intensity 1	8.10	*7.60*	8.53	*8.58*	3.77	*5.40*	1.04	*1.47*	13.50	*10.69*	2.81	*2.23*
Intensity 2	0.74	*1.73*	0.70	*1.63*	0.05	*0.32*	0.01	*0.08*	0.83	*1.76*	0.17	*0.36*
Intensity 3	0.07	*0.51*	0.06	*0.45*	0.01	*0.09*	0.01	*0.03*	0.08	*0.59*	0.02	*0.12*
Neutral	86.31	*66.1*	81.47	*13.72*	358.77	*73.93*	98.42	*2.88*	451.25	*21.27*	93.95	*4.43*
Toddler												
Focus on Gift	18.67	*18.04*	19.42	*17.72*	38.12	*43.29*	10.56	*11.68*	58.40	*55.87*	12.17	*11.64*
Emotion Expression												
Happy	5.79	*15.58*	4.83	*8.92*	11.69	*18.27*	3.14	*4.82*	18.37	*26.83*	3.83	*5.59*
Intensity 1	5.06	*10.69*	4.61	*8.45*	11.26	*17.69*	3.02	*4.67*	17.08	*23.95*	3.56	*4.98*
Intensity 2	0.58	*4.73*	0.18	*1.24*	0.43	*1.55*	0.12	*0.45*	1.10	*5.06*	0.23	*1.05*
Intensity 3	0.15	*1.50*	0.04	*0.38*	0.01	*0.09*	0.01	*0.03*	0.17	*1.53*	0.04	*0.32*
Angry	32.90	*39.08*	29.63	*24.60*	103.98	*104.87*	29.34	*27.99*	139.48	*126.15*	29.05	*0.26*
Intensity 1	21.27	*28.10*	18.48	*14.06*	54.64	*41.27*	15.41	*11.80*	77.31	*56.86*	16.11	*11.85*
Intensity 2	8.53	*12.72*	7.96	*11.52*	34.36	*60.12*	9.62	*15.73*	43.53	*67.88*	9.07	*14.14*
Intensity 3	3.11	*9.10*	3.19	*10.12*	14.96	*42.82*	4.30	*11.41*	18.61	*49.99*	3.88	*10.41*
Neutral	63.80	*45.51*	63.54	*23.29*	242.08	*117.16*	65.53	*27.40*	312.55	*122.71*	65.11	*25.56*

Note. SD = Standard deviation. % = Percentage of time participants expressed emotion during the entire task or during times when the mother was oriented towards child or work.

Table 2. *Correlations between Percentages of Emotion Expression by Maternal Orientation*

	Emotion Expression				
	Toddlers		Mothers		
Mothers' Orientation	Angry	Neutral	Happy	Angry	Neutral
Towards toddler					
Toddler					
Happy	-.34*	-.09	.42*	.04	-.35*
Angry		-.91*	-.23*	-.11	.23*
Neutral			.08	.11	-.12
Mother					
Happy				-.05	-.73*
Angry					-.63*
Towards work					
Toddler					
Happy	-.31*	.16	.09	-.05	-.01
Angry		-.97*	-.11	.02	.11
Neutral			.10	.03	-.11
Mother					
Happy				.33*	-.49*
Angry					-.67*

Table 3. *Calculating Emotion Expression Shifts Using SAS Data Management Functions.*

Second	Orientation	$MoAng_t$	$MoAng_{t-1}$	Trans_MoAng
1	3	0	0	0
2	3	1	0	start
3	3	1	0	0
4	3	2	0	1→2
5	3	3	1	2→3
6	3	2	1	3→2
7	3	1	1	2→1
8	3	1	1	0
9	3	0	0	stop

Note. Mo = Mother, Ang = Anger, Trans = Transition variable, dummy-coded to signify different types of transitions. Orientation code of 3 signifies that the mother was oriented towards the child. MoAng codes 1-3 signify mild, moderate, and intense emotion expressions.

Table 4. *Frequency of Shifts in Toddlers' Focus on Task Demands and Emotion Expressions.*

	Maternal Orientation								Tests of Differences By Maternal Orientation	
	Towards Child			Towards Work			Entire Task			
Focus	*n*	Mean	*SD*	*n*	Mean	*SD*	*n*	Mean	*SD*	*t* (1,113) =	*p* <
Towards	114	2.69	*2.93*	115	5.25	*4.76*	115	8.09	*6.21*	-5.44	.05
Away	94	4.24	*3.43*	95	1.23	*4.28*	105	9.33	*5.85*	-2.64	.05
Emotion Expression											
Happy →											
Angry	114	0.16	*0.47*	115	0.45	*1.09*	115	0.63	*1.31*	-3.02	.05
Neutral	114	1.22	*2.06*	115	2.82	*4.25*	115	4.23	*5.31*	-4.06	.05
Angry →											
Happy	114	0.15	*0.43*	115	0.37	*0.95*	115	0.54	*1.12*	-2.47	.05
Neutral	114	5.19	*5.23*	115	11.88	*8.19*	115	17.45	*10.76*	-8.11	.05
Neutral →											
Happy	114	1.22	*2.09*	115	2.75	*4.07*	115	4.13	*5.09*	-3.99	.05
Angry	114	4.42	*4.48*	115	2.94	*2.06*	115	15.41	*9.35*	-8.21	.05
Expression Intensity											
Happy											
0→1	114	1.39	*2.35*	115	3.17	*4.78*	115	4.74	*5.93*	-4.01	.05
1→ 2	4	4.25	*2.98*	9	1.44	*0.73*	14	2.42	*2.21*	0.36	*ns*
2 → 3	1	3.00	*0.00*	--	--	--	2	2.00	*1.41*	--	--
3 → 2	1	3.00	*0.00*	--	--	--	2	2.50	*0.71*	--	--
2 → 1	3	3.5	*2.38*	8	2.13	*0.83*	12	2.83	*1.69*	--	--
1→0	48	3.10	*2.39*	73	1.07	*1.09*	82	6.65	*6.14*	-4.49	.05
Angry											
0→1	114	4.77	*4.87*	115	11.71	*8.19*	115	16.78	*10.29*	-7.28	.05
1→ 2	53	2.79	*2.26*	72	6.89	*7.40*	80	8.26	*8.72*	-4.15	.05
2 → 3	20	2.15	*1.53*	34	7.52	*9.10*	38	8.03	*10.14*	-1.45	*ns*
3 → 2	20	2.50	*1.64*	32	7.59	*9.53*	36	8.01	*9.77*	-2.10	*ns*
2 → 1	54	3.02	*2.51*	74	6.01	*7.29*	78	8.55	*8.83*	-4.25	.05
1→0	99	5.77	*5.04*	115	11.43	*7.83*	115	16.81	*10.39*	-7.06	.05

Note. → change in expression or intensity within 5 sec. *n* = Number of toddlers showing each shift type. *SD* = Standard deviation. 0 = none, 1 = mild, 2 = moderate, 3 = intense.

Table 5. *Frequency of Mothers' Emotion Expression Shifts as a Function of Orientation.*

	Maternal Orientation									Tests of Differences By Maternal Orientations	
	Towards Child			Towards Work			Entire Task				
	n	Mean	*SD*	*n*	Mean	*SD*	*n*	Mean	*SD*	*t* (1,113)	*p* <
Emotion Expression											
Happy →											
Angry	114	0.21	*0.71*	115	0.09	*0.41*	115	0.36	*0.97*	1.86	*ns*
Neutral	114	3.03	*3.58*	115	2.22	*2.28*	115	5.31	*1.11*	2.25	.05
Angry →											
Happy	114	0.27	*0.91*	115	0.06	*0.36*	115	*0.40*	*1.13*	2.56	.05
Neutral	114	3.94	*3.82*	115	4.40	*3.37*	115	*8.47*	*5.41*	-0.95	*ns*
Neutral →											
Happy	114	4.10	*4.33*	115	0.28	*0.57*	115	5.01	*4.55*	9.30	.05
Angry	114	4.91	*4.38*	115	2.34	*2.51*	115	1.68	*1.07*	5.43	.05
Expression Intensity											
Happy											
0→1	114	4.24	*4.43*	115	0.30	*0.62*	115	5.20	*4.68*	9.33	.05
1→ 2	28	2.25	*1.46*	1	1.00	--	35	2.23	*1.53*	--	--
2 → 3	6	1.17	*0.41*	--	--	--	6	1.17	*0.41*	--	--
3 → 2	2	1.00	--	--	--	--	3	1.00	--	--	--
2 → 1	22	2.00	*1.41*	3	1.00	--	34	1.91	*1.52*	--	--
1→0	80	4.19	*3.46*	82	2.98	*2.00*	103	5.76	*4.50*	2.31	.05
Angry											
0→1	114	5.11	*4.60*	115	2.38	*2.52*	115	8.34	*5.35*	5.57	.05
1→ 2	16	1.13	*0.34*	--	--	--	19	1.16	*0.37*	3.11	.05
2 → 3	1	1.00	--	--	--	--	1	2.00	--	--	--
3 → 2	2	1.00	--	--	--	--	2	1.00	--	--	--
2 → 1	18	1.56	*0.70*	3	1.00	--	22	1.50	*0.74*	--	--
1→0	94	4.76	*3.56*	105	4.80	*3.25*	110	8.85	*5.14*	-0.96	*ns*

Note. n = Number of mothers displaying each shift type. → denotes emotion expression shift within 5 sec. *SD* = Standard deviation. 0 = none, 1 = mild, 2 = moderate, 3 = intense.

Table 6. *Toddler Shifts 5 Seconds before Mothers Orients towards Toddlers*

		# of Shifts		% of Mothers' Orientation Shifts		% of Child's Shifts while Mother is Working	
	n	Mean	*SD*	Mean	*SD*	Mean	*SD*
Focus							
Towards	112	1.43	*1.91*	12.38	*14.78*	27.77	37.67
Away	112	1.12	*1.54*	10.38	*15.33*	36.20	64.69
Emotion Expression							
Happy →							
Angry	112	0.12	*0.41*	1.00	*3.06*	7.46	24.83
Neutral	112	0.48	*0.98*	4.66	*9.43*	12.71	30.91
Angry →							
Happy	112	0.08	*0.36*	0.75	*3.96*	3.47	17.70
Neutral	112	2.21	*2.47*	21.39	*21.37*	20.35	24.80
Neutral →							
Happy	112	0.56	*1.07*	5.22	*9.79*	15.39	31.11
Angry	112	2.42	*2.46*	22.01	*19.13*	25.27	27.49
Expression Intensity							
Angry							
1 → 2	112	0.71	*1.49*	6.05	*11.74*	*14.14*	28.64
2 → 3	112	0.23	*0.66*	3.52	*11.98*	*7.52*	22.20
3 → 2	112	0.15	*0.43*	2.39	*10.61*	*3.67*	14.83
2 → 1	112	0.71	*1.28*	6.66	*12.87*	*13.13*	29.13

Note. → denotes a shift in emotion or intensity within 5 sec. *SD* = Standard deviation. 1 = mild, 2 = moderate, 3 = intense.

Table 7. *Anger Expression Shifts 5 Sec after Partner Anger Expression Shifts*

	Frequency		% Mother Shifts		% Toddler Shifts	
Event	Mean	*SD*	Mean	*SD*	Mean	*SD*
Maternal Anger Starts						
Toddler Anger Expression						
Starts	1.45	*1.84*	23.66	*22.03*	40.95	*58.17*
Stops	1.16	*1.50*	16.46	*20.82*	20.59	*38.44*
Maternal Anger Stops						
Toddler Anger Expression						
Starts	1.17	*1.49*	25.20	*27.85*	33.58	*47.99*
Stops	0.99	*1.33*	16.03	*22.77*	15.37	*27.41*
Toddler Anger Starts						
Mother Anger Expression						
Starts	0.73	*1.04*	12.69	*17.65*	14.82	*22.10*
Stops	0.95	*1.21*	24.44	*39.42*	16.94	*25.50*
Toddler Anger Stops						
Mother Anger Expression						
Starts	0.76	*1.28*	14.85	*23.37*	13.17	*21.03*
Stops	1.14	*1.86*	29.11	*37.43*	17.32	*26.14*

Appendix B: Figure

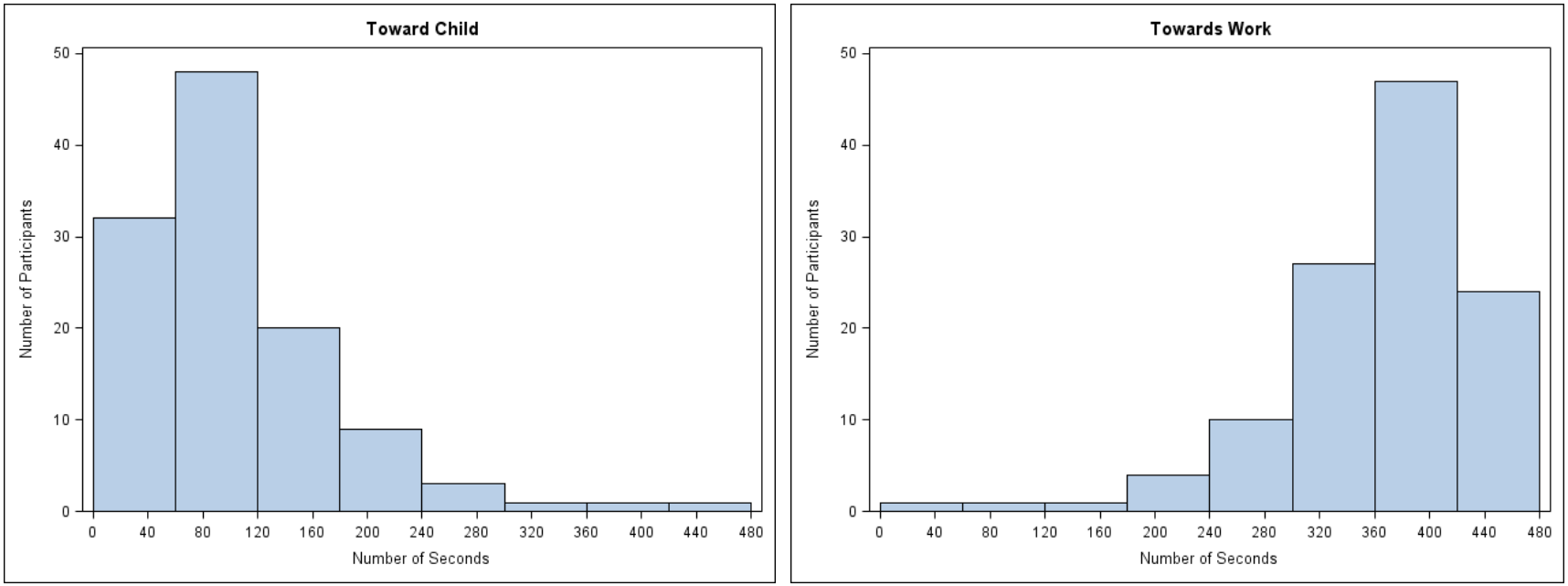

Figure 1. Histograms indicating the number of seconds mothers were orientated towards or away from their child during the 480 second waiting task.