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You Get What You Get and You Don't Throw A Fit!: Emotion Socialization and Child Physiology Jointly Predict Early Prosocial Development

Meghan B. Scrimgeour[1], **Elizabeth L. Davis**[2], and **Kristin A. Buss**[1]

[1]The Pennsylvania State University

[2]University of California, Riverside

Abstract

Prosocial behavior in early childhood is a precursor to later adaptive social functioning. This investigation leveraged mother-reported, physiological, and observational data to examine children's prosocial development from age 2 to age 4 (N = 125). Maternal emotion socialization (ES) strategies and children's parasympathetic regulation have each been implicated in prosocial behavior, but are rarely examined together or prospectively. Given the transactional nature of parent-child relationships, the effects of maternal ES strategies on children's prosocial behavior are likely moderated by children's individual differences in parasympathetic regulation. As predicted, mothers' reported use of problem-focused ES strategies predicted prosocial behavior at age 4. Additionally, children who showed parasympathetic reactivity consistent with more effective emotion regulation during a lab-based disappointment task were rated as more prosocial at age 4. Several interactions with maternal ES strategies emerged. Children's parasympathetic regulation moderated the relations between observed physical comfort or cognitive reframing and prosocial behavior. Observed distraction (either behavioral or cognitive) moderated the link between mothers' reported use of problem-focused ES strategies and children's prosocial behavior. Findings suggest that children's emerging prosocial behavior is shaped by the interactive contributions of inter-personal maternal ES as well as intra-personal intrinsic physiological regulation.

Keywords

prosocial behavior; emotion regulation; RSA reactivity; socialization; early childhood

Children's ability to voluntarily engage in behavior intended to benefit another, such as helping, cooperating, sharing, and showing concern, develops in early childhood, and research has showcased these prosocial behaviors as an important element of forming positive social relationships later in life (Eisenberg, Fabes, & Spinrad, 2006). In general,

Correspondence concerning this article should be addressed to Meghan B. Scrimgeour, Department of Psychology, The Pennsylvania State University, 111 Bruce Moore Building, University Park, PA 16802-1003. Phone: 814-863-5674. Fax: 814-863-5658. mbs256@psu.edu.

Author Note

Meghan B. Scrimgeour, Department of Psychology, The Pennsylvania State University; Elizabeth L. Davis, Department of Psychology, University of California, Riverside; Kristin A. Buss, Department of Psychology, The Pennsylvania State University.

prosocial children are more accepted by peers and have better quality friendships (Clark & Ladd, 2000; Denham, McKinley, Couchoud, & Holt, 1990). Conversely, children who engage in low levels of prosocial behavior are not only viewed as less socially competent, but are also more likely to experience peer rejection and long-term consequences such as associations with deviant peer groups and antisocial behaviors in early and middle childhood (Eron & Huesman, 1984; Lansford et al., 2006).

Prosocial behavior emerges first within the family context, and daily interactions with caregivers scaffold young children's understanding of and responding to social situations. Children as young as 12-14 months can help pickup or point out dropped objects, cooperate in household tasks, and share information with adults (Brownell, 2013; Eisenberg et al., 2006; Liszkowski, Carpenter, Striano, & Tomasello, 2006; Paulus, 2014; Rheingold, 1982; Svetlova et al., 2010; Warneken, 2015; Warneken & Tomasello, 2007). By 18-months and into the third year, children expand on their repertoire of prosocial behaviors, expressing concern and comforting others who are in distress (Svetlova, Nichols, & Brownell, 2010; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992). For example, Dunfield and Kuhlmeier (2013) found that three- and four-year-olds were more likely than two-year-olds to verbally or physically comfort an adult experimenter expressing distress over a minor injury or breaking a toy. Overall, the toddler and preschool years are a key developmental period for children's ability to recognize situations that call for prosocial behavior and to engage prosocially. Although research on the development of prosocial behavior is growing, the underlying relational and individual mechanisms of these emerging behaviors are not fully understood.

Prosocial development is supported by both family (e.g., parent-child relationship dynamics) and individual regulatory processes (e.g., children's emerging self-regulatory abilities). To illustrate, imagine two preschoolers playing tag. One trips and falls down, skins her knee, and begins to cry. The ability of the second child to recognize that this situation necessitates prosocial behavior and to take appropriate action (e.g., go get help) would be supported by her own emotional competence. That is, the second child must first regulate her own emotions before helping the hurt friend in need. Emotion regulation (ER) is the process by which individuals pull from both inter- and intra-personal resources to monitor, maintain, or modify emotional reactions (Aldao, 2013; Bariola, Hughes, & Gullone, 2012; Grolnick, Kurowski, McMenamy, Rivkin, & Bridges, 1998; Thompson, 1994). Children who have difficulty regulating emotions tend to become overaroused and experience personal distress when with distressed others, likely inhibiting a prosocial response (e.g., crying or freezing instead of getting help from a teacher; Eisenberg et al., 1996b; Eisenberg et al., 2006). In contrast, well-regulated children are better able to modify their vicarious emotional arousal and focus their attention outwardly to others in need (Davidov & Grusec, 2006; Eisenberg et al., 1994; Eisenberg, Fabes, & Murphy, 1996; Paulus, 2014; Trommsdorff & Friedlmeier, 1999). The goal of the present study was to examine the contributions of parent emotion socialization and children's ER to prosocial behavior development.

Parent-Child Emotion Processes Implicated in Prosocial Development

The ability to regulate emotion develops across early childhood and largely originates with parents operating as external regulators of children's emotional reactions (Bariola, Gullone, & Hughes, 2011; Calkins & Keane, 2004; Eisenberg et al., 1996a; Fox & Calkins, 2003; Thompson, 1994; Trommsdorff & Friedlmeier, 1999). In response to children's fluctuating negative emotions (e.g., disappointment, distress, fear, sadness, anger), parents may model competent coping behavior or coach children to implement effective coping strategies (Bariola et al., 2011; Davidov & Grusec, 2006; Eisenberg, Cumberland, & Spinrad, 1998; Fox & Calkins, 2003; Gottman, Katz, & Hooven, 1996; Grusec & Davidov, 2007; Morris, Silk, Steinberg, Myers, & Robinson, 2007; Thompson, 1994). This supportive scaffolding may enable children to avoid becoming overaroused in emotionally-evocative situations, to internalize and imitate their parents' ways of regulating negative emotions, and ultimately may facilitate ER abilities that undergird prosociality (Bariola et al., 2012; Davidov & Grusec, 2006; Eisenberg et al., 1998, 2001, 2006; Grusec & Davidov, 2007; Hastings, Utendale, & Sullivan, 2007; Thompson, 1994). In fact, even though longitudinal studies are lacking, parents who engage in supportive emotion socialization (ES) tend to have children who are more empathic and prosocial (Davidov & Grusec, 2006; Eisenberg et al., 1998; Hastings et al., 2007).

Problem-focused

Problem-focused behavior, or helping to solve the problem causing the distress, is an ES strategy that has been robustly linked to children's prosocial behavior. Parents' observed use of problem-solving strategies in response to preschoolers' upset feelings positively relates to children's helping, sympathy, and social competence (Eisenberg, Fabes, Schaller, Carlo, & Miller, 1991; Eisenberg et al., 1993, 1996c; Roberts & Strayer, 1987). Given that emotional overarousal may impede socially competent behavior, experience with problem-solving strategies may foster children's ability to regulate their own arousal, focus on the problem at hand, and subsequently engage in solution-oriented behaviors.

Physical comfort

Another ES strategy parents may engage in during emotion-eliciting situations is providing physical comfort. Findings on parents' use of this strategy in early childhood have been inconsistent. For example, preschoolers' perceptions of their parents' comforting behaviors in response to their expressions of sadness and fear positively related to their cooperation (Denham, 1997). Similarly, fathers' reports of comforting behavior positively associated with children's prosocial behavior (Eisenberg et al., 1998; Roberts, 1994). In contrast, mothers' observed use of soothing behaviors in response to their 30-month-olds' negative affect was negatively related to their emotion regulation at age five (Spinrad, Stifter, Donelan-McCall, & Turner, 2004). Moreover, mothers' use of physical comfort in an emotionally distressing context was negatively associated with their children's helping behavior (Eisenberg et al., 1993). One explanation is that physical comforting does not provide children with strategies to actively reduce negative feelings, but instead focuses on the distress (Spinrad et al., 2004). These mixed findings may be further explained by children's individual needs. As children become more adept at generating and employing

their own (rather than parent-provided) ER strategies, less inter-personal support for regulation is needed. In line with this reasoning, parents tend to physically comfort their children less across early and middle childhood (Eisenberg et al., 1999).

Expressive encouragement

Expressive encouragement is another common supportive ES strategy that parents implement in early childhood. When a child is upset, parents may encourage discussion about feelings. In general, encouraging emotion expressiveness has been associated with positive outcomes such as peer acceptance and prosocial behavior (Boyum & Parke, 1995; Cassidy, Parke, Butkovsky, & Braungart, 1992; Eisenberg et al., 1993, 1998, 2001). However, the association between expressive encouragement and prosocial behavior may be nonlinear (Eisenberg et al., 1996c; Roberts & Strayer, 1987) such that emphasizing the expression of emotions may exacerbate the amount of distress a child feels by encouraging children to dwell on their distress, inhibiting an effective self-regulatory response, and interfering with subsequent socially competent behavior.

Distraction and cognitive reframing

Across the childhood years, parents may also engage in behavioral and cognitive strategies like behavioral distraction, cognitive distraction, or cognitive reframing, that allow children to re-direct their attention away from the source of distress, or change their thoughts or goals in order to alleviate negative emotions (Bariola et al., 2011, 2012; Davis, Levine, Lench, & Quas, 2010; Perry, Calkins, Nelson, Leerkes, & Marcovitch, 2012). Distraction and cognitive reframing strategies are generally effective for reducing children's distress. For example, mothers who suggested cognitive distraction during an inoculation had less distressed children than mothers who relied on comforting strategies (Gonzalez, Routh, & Armstrong, 1993). Cognitive reframing involves changing one's thoughts by redefining an emotion-eliciting event to modify its meaning (e.g., thinking about how a broken toy could still be played with in pieces) and has also been shown to be an effective, adaptive ER strategy (Bariola et al., 2011, 2012). Morris and colleagues (2011) found that when mothers and their children engaged in joint cognitive reframing, children expressed less sadness and anger in response to receiving a disappointing prize.

It is important to consider, however, that context plays a central role in ER (Aldao, 2013) and that each of these ES strategies may be more or less useful depending on the context (Bariola et al., 2011). Research has shown that mothers may change their use of ES strategies in challenging situations depending on the level of their children's distress (Grolnick et al., 1998; Spinrad et al., 2004). For example, children who were more distressed while waiting for a toy or snack had mothers who initiated more active engagement, redirection of attention, and physical comfort (Grolnick et al., 1998). In situations where avoiding the salient stimuli is impossible, behavioral and cognitive strategies that re-direct children's attention away from a distressing event are particularly effective means of regulating upset emotions (Thompson, 1994). In their examination of children's ability to generate ER strategies in response to hypothetical and autobiographical events, Davis and colleagues (2010) found that children modified their use of strategies to fit the characteristics of specific emotional situations. Specifically, children reported changing

thoughts more often in response to uncontrollable (e.g., sad, scary) emotional situations. In the current study, the disappointment setting was an uncontrollable context that was designed to elicit mild distress from children. Within this context, it may be more beneficial for mothers to suggest cognitive and behavioral ES strategies that enable children to change their own thoughts and behaviors to help them regulate negative emotions, but less beneficial to simply provide physical comfort or encourage emotion expression. Thus, we hypothesized that children whose mothers used problem-focused, behavioral distraction, cognitive distraction, or cognitive reframing emotion socialization strategies would be more prosocial, whereas children whose mothers used physical comforting or expressive encouragement strategies would be less prosocial.

Individual Differences in the Physiological Underpinnings of Emotion Regulation

Effective and increasingly sophisticated ER behaviors result, in part, from the maturation of biological systems across childhood (Calkins & Hill, 2007). A widely examined intrinsic psychophysiological substrate of ER is parasympathetic nervous system (PNS) regulation of heart rate variability (Calkins & Dedmon, 2000; Porges, Doussard-Roosevelt, & Maiti, 1994). PNS regulation is often measured as respiratory sinus arrhythmia (RSA), which is heart rate variability that corresponds with the natural respiration cycle (Porges, 2007). Baseline RSA reflects an individual's capacity for ER (Porges, 1995, 2007) and dynamic shifts in RSA reactivity in response to task demands represent regulatory efforts that support effective coping (Calkins, 1997; Porges, 1995). A decrease in RSA relative to resting levels (i.e., RSA suppression) indicates a readiness for action in response to environmental stimuli, whereas an increase (i.e., RSA augmentation) signifies the maintenance of internal equilibrium (Porges, 2007; Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996). In general, children's RSA suppression during challenging situations predicts positive outcomes including better ER in preschool (Calkins, 1997), fewer behavior problems during toddlerhood and preschool (Calkins & Dedmon, 2000; Calkins & Keane, 2004), and more positive adjustment in early childhood (Calkins, Blandon, Williford, & Keane, 2007a; Calkins, Graziano, & Keane, 2007b). Conversely, less RSA suppression during challenging episodes has been linked to children's dysregulated behavior such as aggression, negative affect, low attention, and greater distraction (Calkins, 1997; Calkins & Dedmon, 2000; El-Sheikh, 2001).

Demonstrating the importance of examining RSA reactivity, Calkins and Keane (2004) found that children who displayed high and stable RSA suppression in response to emotionally and behaviorally challenging tasks across toddlerhood and into the preschool years displayed better social skills and fewer behavior problems. Additionally, Brooker and Buss (2010) found that temperamentally fearful toddlers who were able to suppress heightening levels of RSA (i.e., rising, then decreasing RSA) when interacting with a stranger showed greater positive affect. Finally, children with greater RSA reactivity during an anger-eliciting film (i.e., RSA suppression followed by a return to baseline) showed better regulation of aggression (Miller et al., 2013). Together, these findings highlight the association between distress, physiological regulatory processes, and children's

socioemotional development; however, the specific relation between effective physiological regulation and children's prosocial behavior has yet to be examined. In the current study, we predicted that children who demonstrated more effective RSA regulation in response to mild distress (i.e., more RSA suppression) would be more prosocial.

The Interplay of Parent-Child Emotion Processes and Physiological Emotion Regulation

Given the transactional nature of the parent-child relationship, the effects of parental ES strategies on children's prosocial behavior are likely moderated by individual differences in ER. Relatedly, early emerging individual differences in RSA regulation are not fixed and can be modified by parents' ES efforts (Hastings et al., 2008a; Thompson, 1994). Research has shown a fairly consistent pattern in which children exposed to negative parental socialization (e.g., parental negativity) are less effective at RSA regulation (Calkins, Smith, Gill, & Johnson, 1998; Katz, 2007). Similarly, Hastings et al. (2008a) found that mothers who used more supportive parenting had children with better behavioral and RSA regulation and fewer externalizing and internalizing problems.

Support for a model of the interactive contributions of familial experiences and RSA regulation to social outcomes in early and middle childhood is accumulating (Hastings et al., 2008a; Hastings, Kahle, & Nuselovici, 2014). Gottman et al. (1996) found that children whose parents helped them understand and manage their negative emotions could regulate RSA more effectively. In turn, RSA regulation predicted their ability to self-regulate emotions and competence with peers three years later. Leary and Katz (2004) reported that hostile-withdrawn coparenting was associated with higher levels of peer conflict for children who were less effective at suppressing RSA. Finally, Perry and colleagues (2012) provide support for the moderating role of RSA suppression; non-supportive maternal ES strategies in reaction to children's negative emotions predicted lower observed use of distraction for children who were less effective at regulating their frustrations. Given that less pronounced RSA regulation during emotionally challenging situations characterizes children with lower social and emotional competence, we hypothesized that children with lower RSA regulation may depend more on supportive parental ES strategies in comparison to children with higher RSA regulation.

Current Study

In this study, we used multiple methods and assessments to examine the joint contributions of inter-personal (i.e., mothers' reported and observed ES strategies of their children's negative emotions) and intra-personal (i.e., children's RSA regulation during a mildly emotionally challenging situation) emotion processes to the emergence of children's prosocial behavior from age 2 to age 4. Maternal report of problem-focused reactions in response to their children's negative emotions was assessed as a specific supportive ES strategy that could be particularly beneficial for children's prosocial development. Additionally, observation of mothers' use of six ES strategies during a mildly emotion-eliciting disappointment task was examined in relation to children's prosocial development. We predicted that children would be rated as more prosocial when (1) their mothers both

self-reported and were observed using more problem-focused strategies, (2) their mothers suggested the use of behavioral distraction, cognitive distraction, or cognitive reframing during the emotion-eliciting task, and (3) they themselves demonstrated more effective RSA regulation during the emotion-eliciting task. Furthermore, we hypothesized that children would be rated as less prosocial when (1) their mothers engaged in physical comfort and (2) their mothers used expressive encouragement. We also expected that children's RSA regulation during the disappointment task would moderate the associations between mothers' ES strategies and children's prosocial behavior such that mothers' strategies would be associated with prosocial behavior more strongly for children with less effective RSA regulation.

Method

Participants

The current study used data drawn from a larger prospective longitudinal study exploring the development of children's emotions. 125 two-year-old children (M_{age} = 24.43 months, SD_{age} = .47 months; 62 girls) and their parents (M_{age} = 32.49 years, SD_{age} = 4.27 years; only one father participated, so parents hereafter will be referred to as mothers) who were primarily non-Hispanic Caucasian (children, 90.4%; mothers, 92.8%) participated in multiple longitudinal assessments. Participants were recruited through newspaper birth announcements, flyers posted at daycares, and a database of local families interested in participating in research studies in a medium-sized town (and surrounding counties) in the Northeastern region of the United States. Annual family income ranged from $15,000 or less to above $60,000 per year ($M$ = $41,000 − $50,000 per year) and mothers averaged 16.22 years of education (e.g., a college degree; SD = 2.32 years).

Participating families originally agreed to be followed at ages 2, 3, 4, and 5. The assessment at age 3.5 was made possible by additional funding and 36 new participants were recruited into the larger study. 37 of the original 125 families were unable to participate in the extra assessment due to schedule constraints. Because the current study utilizes data only from participants who took part in the age 2 assessment, the N at the age 3.5 assessment was constrained by participants' availability for an additional assessment time point (70% of original 125 came in for this visit). There were no significant differences between participants who participated in both assessments and those who participated in the age 2 assessment but not the age 3.5 visit in terms of child's gender (t (123) = .53, p = .60), child's age (t (123) = .27, p = .79), child's race (t (123) = .08, p = .94), mother's age (t (123) = .32, p = .75), mother's race (t (123) = .03, p = .98), income level (t (113) = 1.67, p = .10), age 2 prosocial behavior (t (116) = .43, p = .67), age 2 reported problem-focused reactions (t (109) = .27, p = .79), or age 4 prosocial behavior (t (91) = .05, p = .96). Thus, data for the age 3.5 assessment were imputed (described in the Results) for the 37 participants who were unable to visit the lab for this time point.

Procedure

Overview—The current study leveraged mother-reported, physiological, and observational data from multiple assessments when children were 2, 3.5, and 4 years old. At the 2- and 4-

year assessments, mothers completed mailed questionnaire packets. At the 3.5-year laboratory assessment, mothers and their children participated in several tasks designed to elicit a range of emotional and behavioral reactions (Laboratory Temperament Assessment Battery/LabTAB; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1993). The tasks took place in observational rooms and were video recorded through a one-way mirror. The university's Institutional Review Board approved this project. Parent consent and child assent were also obtained.

2-Year Assessment

Prosocial behavior—Mothers completed the Infant Toddler Social Emotional Assessment (ITSEA; Briggs-Gowan & Carter, 1998), a reliable and valid measure of children's social-emotional competencies (Carter, Briggs-Gowan, Jones, & Little, 2003). We used the prosocial peer relations subscale. The prosocial peer relations subscale (5 items; e.g., "Takes turns when playing with others") is rated on a 3-point scale (0 = *not true/rarely*, 1 = *somewhat true/sometimes*, 2 = *very true/often*). Scores were calculated as average ratings such that higher scores indicate higher levels of prosocial behavior. For the current sample, Cronbach's α was .51.

Self-report of maternal emotion socialization—Mothers also completed a modified version of the Coping with Children's Negative Emotions Scale for use with Toddlers (CCNES-T; Eisenberg et al., 1996c; Fabes, Eisenberg, & Bernzweig, 1990), which assesses mothers' typical supportive (e.g., problem-focused reactions) and non-supportive (e.g., distress reactions) reactions to their children's negative emotions in a variety of contexts. According to published reports, this measure has sound reliability and validity (e.g., Eisenberg & Fabes, 1994). Twelve vignettes in which a child feels distress are presented, with mothers asked to rate the likelihood of their having six specific reactions to each (1 = *Very Unlikely* to 7 = *Very Likely*). Given our specific interest in mothers' self-reported supportive ES strategies, only the problem-focused reactions (PFR) subscale was used. The PFR subscale is made up of the 12 reactions that assess the degree to which mothers help their children solve the problem that caused their distress (e.g., "If my child loses some prized possession and reacts with tears, I would: help my child think of places he/she hasn't looked yet"). Scores were averaged and higher scores indicate higher levels of problem-focused reactions (α = .82).

3.5-Year Assessment

Baseline cardiac physiology—Children's cardiac physiology (i.e., RSA) data were acquired using an ambulatory electrocardiograph (ECG). RSA data from a 5-min *Baseline Task* (BL) and a later *Disappointment Task* (DT) are the focus here. Seven physiological sensors were placed on children's torsos (i.e., three self-adhesive electrodes acquired ECG; four additional sensors gathered impedance data not described in this report). During BL, children were seated at a child-sized table with the experimenter. Children sat quietly while coloring or reading a book with the experimenter while resting RSA was collected.

Disappointment task—Children's RSA and mothers' use of ES strategies were assessed during a mild affectively challenging lab challenge, *Disappointment Task* (DT). This task

included segments to assess children's behavior across multiple social contexts: when alone, when with a friendly but somewhat unfamiliar experimenter, and when with their mothers. The task is modeled after a structured disappointment paradigm commonly used in developmental studies (e.g., Cole, 1986), and involves meticulously determining which object from an array of toys is a child's most-desired prize, so that the experimenter may "accidentally" gift the child an unwanted prize later in the visit. Children worked with a secondary experimenter to rank five prizes in order of preference, and were told that their preferred toy would be given to them later.

There were three phases to the DT. (1) *Waiting for Gift.* After the child completed several lab tasks designed to assess positive affect, inhibitory control, and receptive language abilities, the primary experimenter announced that the prize had been earned. The experimenter left the room for 30s and returned with a wrapped box containing the prize that had been ranked as the *least* desired.

(2) *Wrong Gift.* The experimenter maintained a neutral expression and detached demeanor (attending to paperwork, making occasional eye contact with child) as the undesirable gift was opened, remained in the room for an additional 30s, and then exited. Sixty seconds later, the secondary experimenter entered, feigned surprise that the child had received the wrong gift, and asked how the child felt when she or he received the least-desired prize. Then, this experimenter left the room and the mother entered. At the beginning of the visit during consent, mothers read through the following description of the disappointment task: "Your child will first be asked to rank a set of five prizes in terms of which they like the most to which they like the least. After playing a few games, your child will receive the wrong prize (not the prize that they picked as their favorite). We would like to see how your child reacts when alone, with the experimenter, and with you. Your child will then be allowed to switch prizes if he/she would like to do so." During the actual task, before mothers entered the room to join their children, the primary experimenter again explained that their children had just received an unappealing toy and asked mothers to interact with her children however they normally would.

(3) *Resolution.* Finally, after 60s, the primary experimenter re-entered the room, explained that there had been a mix-up with the prizes, and gave the child the opportunity to exchange the least-desired toy for any of the four other prizes. Children's RSA, as well as mothers' observed behavior during the *wrong gift* phase were the intra- and inter-personal ES-related measures of interest.

Observation of maternal emotion socialization—We also examined mothers' ES strategy suggestions at the 3.5-year assessment during the *wrong gift* phase of the DT. Mothers' spontaneous suggestions of things children could do or think about to modulate upset feelings about the disappointment were coded using a frequency-based scheme. Trained coders reliably summed the number of times mothers suggested any of the following broad strategies for managing negative emotions that children in early childhood are typically aware of and can generate (e.g., Davis et al., 2010): (1) problem focused, (2) physical comfort, (3) expressive encouragement, (4) behavioral distraction, (5) cognitive distraction, and (6) cognitive reframing. Details of this coding scheme are found in Table 1.

Four strategies referred to actions children could take (physical comfort, expressive encouragement, problem focused, behavioral distraction) and two strategies referred to ways that children could change their thoughts or goals regarding the disappointment (cognitive distraction, cognitive reframing).

20% of the episodes included in this report (24 cases) were double-scored to calculate inter-rater reliability. Reliability for physical comfort (ICC = .80), expressive encouragement (ICC = 1.00), problem focused (ICC = 1.00), behavioral distraction (ICC = .95), cognitive distraction (ICC = .98), and cognitive reframing (ICC = .98) were good.

Cardiovascular data acquisition, processing, and reduction—Children's RSA was assessed during the age 3.5 BL and DT. Measures of cardiac output were collected using the Mindware WiFi ACQ software, Version 3.0.1 (Mindware Technologies, Ltd, Westerville, OH). RSA analyses were performed offline. The ECG signal was sampled at a rate of 500ms and bandpass filtered at 40 and 250 Hz. The Mindware editing program, Mindware HRV, Version 3.0.6, identified IBIs and detected physiologically improbable intervals based on the overall distribution using a validated algorithm (Berntson, Quigley, Jang, & Boysen, 1990). Data were detrended using a first order polynomial to remove the mean and any linear trends, cosine tapered, and submitted to fast Fourier transform (FFT). RSA was defined as the natural log integral of the .24 to 1.04 Hz power band and calculated in 30s epochs. All data were visually inspected for artifact identification and edited by a second team of coders. Inter-rater reliability for RSA data processing was conservatively defined as 30s epoch average RSA values independently obtained by three coders that fell within 0.10 of one another. 26% of the cases were selected to calculate inter-rater reliability. For the BL and DT episodes, coders achieved 88.5% and 86% average agreement, respectively.

BL and DT RSA values from each 30s epoch were averaged within each episode. Changes in RSA from BL to task were computed as residualized change scores, which are widely used in studies of cardiovascular reactivity, particularly when the baseline and tasks are significantly and positively correlated (Calkins & Keane, 2004; Hastings, Sullivan, McShane, Coplan, & Vyncke, 2008b). Residualized change scores were chosen rather than traditional difference scores for two reasons. First, they account for individual differences in baseline RSA values because the baseline level is used to predict the task level. Second, they provide a measure of RSA change for each child *relative to the other children in the sample* because each child's distance from the average change (regression line) is computed. In the current study, BL and DT RSA values were significantly positively correlated, $r = .89$, $p < .01$; therefore, the standardized residual of DT RSA predicted from BL RSA was an appropriate index of RSA change during an emotionally-evocative task. A negative change score indicates that a child suppressed RSA relatively more during the DT (i.e., showed a more pronounced RSA decrease from BL to task than average), and a positive change score indicates that a child suppressed RSA relatively less during the DT, relative to other children in the sample.

4-Year Assessment

Prosocial behavior—When children were four years old, mothers completed the MacArthur Health and Behavior Questionnaire that was designed to measure mental and physical health, and academic and social functioning (HBQ; Armstrong, Goldstein, & The MacArthur Working Group on Outcome Assessment, 2003). The HBQ has good internal consistency and test-retest reliability (Lemery-Chalfant et al., 2007). The 20-item prosocial behavior subscale that assesses a range of sharing, helping, and empathy-related behaviors was used (e.g., "Comforts a child who is crying or upset"). Items are rated on a 3-point scale (0 = *Rarely applies*, 1 = *Applies somewhat*, 2 = *Certainly applies*). Scores were averaged and higher scores indicate higher levels of prosocial behavior. For the current study, Cronbach's α was .88.

Results

Preliminary analyses are presented first. We then present descriptive analyses examining mothers' engagement in each of the six observed maternal ES strategies. Finally, the results from six regression models addressing the independent and joint contributions of mothers' reported and observed ES strategies of their children's negative emotions and children's RSA regulation during a mildly emotionally challenging situation to the emergence of children's prosocial behavior are presented.

Preliminary Analyses

Listwise deletion of cases without complete data is increasingly recognized as problematic because it has been shown to bias parameter estimates and unnecessarily limit power (e.g., Howell, 2007; Widaman, 2006). 104 participants (83.2%) had complete data at age 2, 55 participants (44%) had complete data at age 3.5, 93 participants (74.4%) had complete data at age 4, and 44 participants (35.2%) had complete data for all assessments. Little's MCAR $X^2 = 284.12$, $p = 1.00$ suggests that missing data were likely missing completely at random. Thus, missing data were imputed in SPSS 21 using the recommended expectation/ maximization (EM) algorithm (Howell, 2007; Jeličií;, Phelps, & Lerner, 2009) for all 125 children.

Descriptive statistics and correlations are presented in Tables 2 and 3, respectively. We report the inter-correlations among all study variables in Table 3 for descriptive purposes, though our primary analyses focus on examining specific hypothesized associations among mothers' problem-focused reactions, provision of certain emotion socialization strategies, and children's prosocial behavior. Prosocial behavior was relatively stable across age 2 and age 4 ($r = .18$, $p = .05$). As expected, maternal report of problem-focused reactions and stronger RSA suppression during the DT were positively associated with children's age 4 prosocial behavior ($r = .31$, $p < .01$and $r = -.19$, $p = .04$, respectively). Maternal report of problem-focused reactions was negatively associated with mothers' observed use of cognitive distraction ($r = -.20$, $p = .02$). Stronger RSA suppression during the DT was associated with mothers' observed use of cognitive distraction ($r = -.19$, $p = .03$). In contrast, less strong RSA suppression during the DT was associated with mothers' observed use of behavioral distraction ($r = .28$, $p < .01$). Among mothers' observed ES strategies,

physical comfort was negatively related to behavioral distraction ($r = -.21$, $p = .02$), expressive encouragement was negatively associated with cognitive reframing ($r = -.28$, $p < .01$), and cognitive distraction was negatively associated with cognitive reframing ($r = -.44$, $p < .01$).

There were no gender differences in children's prosocial behavior at either age (age 2 t (123) = 1.86, $p = .07$ and age 4 t (123) = .19, $p = .85$). Additionally, no gender differences emerged for age 2 reported or age 3.5 observed maternal ES strategies (all ts < 1.71, ps > .05). Given that gender differences were not central to our hypotheses, gender is not considered further.

Maternal Emotion Socialization Strategy Use

At least once in response to their children's disappointment, 24 (19.2%) mothers used problem-focused strategies, 46 (36.8%) provided physical comfort, 41 (32.8%) endorsed expressive encouragement, 56 (44.8%) suggested behavioral distraction, 74 (59.2%) engaged in cognitive distraction, and 65 (52%) employed cognitive reframing. 19 (15.2%) mothers did not use any ES strategies. A repeated measures ANOVA indicated that mothers differed significantly in their use of ES strategies, $F(5, 119) = 17.46$, $p = .000$. Post-hoc tests applying a Bonferroni alpha correction for multiple comparisons revealed that mothers more frequently engaged in cognitive distraction ($M = .51$, $SD = .62$) and cognitive reframing ($M = .54$, $SD = .84$) in comparison to physical comfort ($M = .17$, $SD = .48$, ps = .000), expressive encouragement ($M = .10$, $SD = .28$, ps = .000), and problem-focused behaviors ($M = .05$, $SD = .26$, ps = .000). Additionally, mothers engaged in more behavioral distraction ($M = .33$, $SD = .66$) in comparison to expressive encouragement ($M = .10$, $SD = .28$, $p = .01$) and problem-focused behaviors ($M = .05$, $SD = .26$, $p = .001$). Thus, in line with predictions, mothers more commonly suggested that children use distraction or reframing strategies to modulate their upset feelings in response to receiving a disappointing prize.

To capture the quantitative relation among mothers' observed use of each of the six specific ES strategies relative to their overall use of ES strategies, proportion scores were created for each strategy. For example, the cognitive reframing proportion score was created by summing the number of times a mother engaged in cognitive reframing and dividing this number by the total number of times she engaged in physical comfort, expressive encouragement, problem focused, behavioral distraction, cognitive distraction, and cognitive reframing (i.e., the total number of ES strategies of any kind provided by the mother during DT). Proportion scores closer to 1.0 signify that mothers used the particular strategy more exclusively, whereas proportion scores closer to 0 indicate that mothers used a variety of the strategies or that they preferentially used a different strategy. Thus, for each individual mother, proportions across the six strategies sum to 1.0, but sample mean proportion scores for each of the strategies are as follows: problem focused, .02; physical comfort, .08; expressive encouragement, .06; behavioral distraction, .16, cognitive distraction, .24, cognitive reframing, .27. Each of these strategy proportions ranged from 0 to 1.0, suggesting variability in mothers' use. Maternal ES strategy proportion scores were used in the following regression analyses.

Regression Analyses

To examine the associations among proportion of maternal ES strategy use, children's RSA regulation, and children's age 4 prosocial behavior, we conducted 6 hierarchical regression analyses—one for each observed maternal ES strategy proportion score (i.e., problem focused, physical comfort, expressive encouragement, behavioral distraction, cognitive distraction, and cognitive reframing).

In each model, variables were entered in the following order: (Step 1) prosocial behavior at age 2 covariate, (Step 2) maternal self-reported problem-focused reactions, observed ES strategy proportion score, RSA change score, (Step 3) problem-focused reactions × ES strategy interaction, problem-focused reactions × RSA change score interaction, ES strategy × RSA change score interaction, (Step 4) problem-focused reactions × ES strategy × RSA change interaction. Significant interactions were plotted and simple slopes were probed at +/−1 SD from the mean unless otherwise indicated (Aiken & West, 1991; Preacher, Curran, & Bauer, 2006). Model statistics for all six ES strategy regressions are presented in Table 4.

Problem focused—The first regression model tested the hypotheses that mothers' reported and observed use of problem-focused strategies would be positively associated with prosocial behavior, children's RSA regulation would be positively associated with prosocial behavior, and that children's RSA regulation would moderate the relation between maternal ES strategy use and prosocial behavior. The overall model was significant, $F(8, 116) = 4.36$, $p < .001$, $R^2 = .23$. Consistent with predictions, maternal report of problem-focused reactions related to children's age 4 prosocial behavior ($\beta = .31$, $p = .000$) such that mothers who reported using more problem-focused reactions at age 2 had children who were more prosocial at age 4. Also consistent with our hypotheses, RSA change was associated with children's age 4 prosocial behavior ($\beta = -.23$, $p = .01$) such that children who showed greater RSA suppression in response to a disappointment were higher in prosocial behavior. No other significant effects emerged. Thus, contrary to our hypotheses, mothers' observed use of problem-focused strategies was not associated with prosocial behavior, nor did children's RSA regulation moderate this association.

Physical comfort—The second regression model tested the hypotheses that mothers' reported use of problem-focused reactions would be positively associated with prosocial behavior, mothers' observed use of physical comfort would be negatively associated with prosocial behavior, children's RSA regulation would be positively associated with prosocial behavior, and that children's RSA regulation would moderate the relation between maternal ES strategy use and prosocial behavior. The overall model was significant, $F(8, 116) = 4.52$, $p < .001$, $R^2 = .24$. Problem-focused reactions again related to children's age 4 prosocial behavior ($\beta = .26$, $p = .01$) in the expected direction. In alignment with predictions, physical comfort was associated with children's age 4 prosocial behavior ($\beta = -.21$, $p = .05$) such that mothers who used a higher proportion of physical comfort had children who were less prosocial. RSA change was again associated with children's age 4 prosocial behavior ($\beta = -.19$, $p = .04$) in the expected direction. A significant two-way interaction emerged between physical comfort and RSA change ($\beta = -.26$, $t = -2.31$, $p = .02$; Figure 1). Probing this interaction, results indicated that physical comfort was not associated with age 4 prosocial

behavior for children who showed greater RSA suppression while coping with the disappointing toy (b = .04, p = .80). Furthermore, physical comfort was negatively associated with age 4 prosocial behavior for children who showed less RSA suppression (b = −.71, p = .02). In other words, consistent with our hypotheses, a higher proportion of maternal provision of physical comforting during a mild disappointment predicted less prosocial behavior at age 4, but only for children who evinced less RSA suppression.

Expressive encouragement—The third regression model tested the hypotheses that mothers' reported use of problem-focused reactions would be positively associated with prosocial behavior, mothers' observed use of expressive encouragement would be negatively associated with prosocial behavior, children's RSA regulation would be positively associated with prosocial behavior, and that children's RSA regulation would moderate the relation between maternal ES strategy use and prosocial behavior. The overall model was significant, $F(8, 116) = 3.80$, $p < .01$, $R^2 = .21$. Problem-focused reactions again related to children's age 4 prosocial behavior (β = .29, p = .003) in the expected direction. RSA change was again associated with children's age 4 prosocial behavior (β = −.22, p = .02) in the expected direction. No other significant effects emerged. Thus, contrary to our predictions, mothers' use of expressive encouragement was not associated with prosocial behavior, nor did children's RSA regulation moderate this association.

Behavioral distraction—The fourth regression model tested the hypotheses that mothers' reported use of problem-focused reactions would be positively associated with prosocial behavior, mothers' observed use of behavioral distraction would be positively associated with prosocial behavior, children's RSA regulation would be positively associated with prosocial behavior, and that children's RSA regulation would moderate the relation between maternal ES strategy use and prosocial behavior. The overall model was significant, $F(8, 116) = 5.52$, $p < .001$, $R^2 = .28$. Problem-focused reactions again related to children's age 4 prosocial behavior (β = .45, p = .000) in the expected direction. As predicted, behavioral distraction was associated with children's age 4 prosocial behavior (β = .19, p = .05) such that mothers who used a higher proportion of behavioral distraction had children who were more prosocial at age 4. RSA change was again associated with children's age 4 prosocial behavior (β = −.28, p = .01) in the expected direction. Even though the two-way interaction between behavioral distraction and RSA regulation was not significant, a significant two-way interaction emerged between problem-focused reactions and behavioral distraction (β = −.24, t = −2.40, p = .02; Figure 2). Probing this interaction showed that the slope of the line representing low behavioral distraction was significantly different from zero (b = .40, p = .000). Specifically, there was a positive association between problem-focused reactions and children's age 4 prosocial behavior for children whose mothers engaged in less behavioral distraction. At high levels of behavioral distraction, there was also a significant association between problem-focused reactions and prosocial behavior (b = .13, p = .04). Specifically, there was a positive association between problem-focused reactions and children's age 4 prosocial behavior for children whose mothers engaged in higher levels of behavioral distraction. Thus, the same positive association between age 2 problem-focused reactions and age 4 prosocial behavior was detected for both lower and higher levels of behavioral

distraction, although this relation was stronger when mothers used less behavioral distraction.

Cognitive distraction—The fifth regression model tested the hypotheses that mothers' reported use of problem-focused reactions would be positively associated with prosocial behavior, mothers' observed use of cognitive distraction would be positively associated with prosocial behavior, children's RSA regulation would be positively associated with prosocial behavior, and that children's RSA regulation would moderate the relation between maternal ES strategy use and prosocial behavior. The overall model was significant, $F(8, 116) = 4.42$, $p < .001$, $R^2 = .23$. Contrary to our predictions, mothers' reported use of problem-focused reactions was not associated with prosocial behavior. RSA change was again associated with children's age 4 prosocial behavior ($\beta = -.30$, $p = .01$) in the expected direction. Even though the two-way interaction between cognitive distraction and RSA regulation was not significant, a significant two-way interaction emerged between problem-focused reactions and cognitive distraction ($\beta = .30$, $t = 2.17$, $p = .03$; Figure 3). Probing this interaction, results indicated that the slope of the line representing low cognitive distraction was not significantly different from zero ($b = -.02$, $p = .88$), suggesting that no association between problem-focused reactions and prosocial behavior existed for children whose mothers suggested cognitive distraction less frequently. At high levels of cognitive distraction, there was a significant association between problem-focused reactions and prosocial behavior ($b = .23$, $p = .000$). This suggests that children whose mothers suggested cognitive distraction more frequently were more prosocial at age 4 as mothers' level of engagement in problem-focused reactions at age 2 increased. In other words, children exhibited higher levels of prosocial behavior when their mothers reported providing more problem-focused reactions and were observed to engage in more cognitive distraction.

Cognitive reframing.—The final regression model tested the hypotheses that mothers' reported use of problem-focused reactions would be positively associated with prosocial behavior, mothers' observed use of cognitive reframing would be positively associated with prosocial behavior, children's RSA regulation would be positively associated with prosocial behavior, and that children's RSA regulation would moderate the relation between maternal ES strategy use and prosocial behavior. The overall model was significant, $F(8, 116) = 4.12$, $p < .001$, $R^2 = .22$. Problem-focused reactions again related to children's age 4 prosocial behavior ($\beta = .31$, $p = .01$) in the expected direction. Contrary to our hypotheses, RSA change was not directly associated with prosocial behavior in this model. However, a significant two-way interaction emerged between cognitive reframing and RSA change ($\beta = -.20$, $t = -1.96$, $p = .05$; Figure 4). Despite this interaction, probing the simple slopes indicated that cognitive reframing was not associated with age 4 prosocial behavior for children who showed greater RSA suppression while coping with the disappointing toy ($b = .14$, $p = .21$), nor for children who showed less RSA suppression ($b = -.20$, $p = .10$). Although neither simple slope was statistically significant, the difference in the overall pattern still suggests that children's physiology moderates the impact of suggestions to use cognitive reframing on prosocial behavior, consistent with our predictions.

Discussion

Occurring first and foremost within the family environment, the development of prosocial behavior transpires across the toddler and preschool years. Research has demonstrated diverse pathways of prosocial development deriving both from inter-personal (i.e., family level) and intra-personal (i.e., individual level) emotion processes. It is in part through daily interactions with caregivers and maturation of biological systems that young children develop the ability to regulate their own emotions—a process underlying the ability to prosocially engage with others in need. Maternal ES strategies and children's RSA regulation have each been implicated in prosocial behavior, but have not been examined together or prospectively. We investigated the influence of six specific supportive maternal ES strategies and children's RSA regulation on the development of prosocial behavior to provide a more comprehensive picture of this aspect of social development. RSA regulation is important to examine because children who have difficulty regulating emotions often become personally distressed when with distressed others, which may inhibit a prosocial response (Eisenberg et al., 1996b; Eisenberg et al., 2006). Well-regulated children, however, are better able to manage this vicarious emotional arousal and refocus their attention away from their own distress and toward others in need (Davidov & Grusec, 2006; Eisenberg et al., 1994; Eisenberg et al., 1996; Paulus, 2014; Trommsdorff & Friedlmeier, 1999). Context plays a central role in ER (Aldao, 2013), so the success of supportive maternal ES strategies in helping children reduce their distress may depend on children's regulatory ability as well as the type of negative event in question (Davis et al., 2010; Thompson, 1994). Examining multiple ES strategies allowed us to clarify the functional role of each strategy in relating to children's prosocial behavior.

We found support for our hypothesis that children with better RSA regulation in response to a disappointment at age 3.5 would be more prosocial at age 4. This fits with our existing knowledge that children's RSA regulation during challenging situations is associated with positive socioemotional outcomes such as better ER in preschool, fewer behavior problems during toddlerhood and preschool, and more positive adjustment in early childhood (Calkins, 1997; Calkins & Dedmon, 2000; Calkins & Keane, 2004; Calkins et al., 2007a, 2007b). Importantly, our findings provide new evidence that children's parasympathetic physiology has unique associations with their ability to engage prosocially. The sympathetic nervous system (SNS) works in conjunction with the PNS to regulate cardiac activity and has previously been linked to children's prosocial behavior. Increases in SNS activation prepare the body for responding to environmental threat whereas decreases in SNS activation restore the body to homeostasis, thereby supporting social engagement (Porges, 2011). Hepach, Vaish, and Tomasello (2012) examined sympathetic arousal in response to witnessing an adult express mild distress, and found that two-year-olds demonstrated increased sympathetic arousal when the adult did not receive help, but reduced arousal when the adult was helped. A follow-up study revealed that the more sympathetically aroused children were after viewing the adult in need, the faster they engaged in helping behavior (Hepach et al., 2013). Thus, a promising avenue for further investigation is examining the complementary and dynamic roles of the PNS and SNS in supporting children's ability to engage in prosocial behavior.

The pattern of findings across the models also supported our expectations that mothers' reported use of problem-focused reactions in response to their children's negative emotions at age 2 positively related to children's prosocial behavior at age 4. These results are in alignment with earlier research linking mothers' endorsement of problem-solving strategies with children's helping, sympathy, and social competence (Eisenberg et al., 1991, 1993, 1996c; Roberts & Strayer, 1987). Through the use of problem-focused reactions, mothers demonstrate how to effectively take action in order to resolve the problem at hand, thereby alleviating negative affect and fostering proactive behaviors that undergird prosocial behavior. In contrast to our predictions, however, mothers' observed use of problem-focused strategies in response to children's disappointment at age 3.5 was not associated with children's age 4 prosocial behavior. This could be due to the low frequency of problem-focused reactions observed during the task. Before mothers entered the room to join their children, the experimenter explained that their children had just received a least-preferred prize. Given that mothers knew their children were gifted with a disappointing toy by design, presumably they realized that the constructed and uncontrollable situation was one in which children's problem of receiving a disappointing toy was unlikely to be resolved through creative problem-solving such as proposing to ask the experimenter what happened or ask to exchange gifts. As a result, they may have opted to engage in fewer problem-solving strategies than they may have in a more naturalistic setting.

We found marginal support for our hypothesis that mothers who used more physical comfort in response to their children's disappointment would have children who were less prosocial. Receiving physical comfort from their mothers after opening a disappointing gift likely emphasized children's focus on their negative emotions, as opposed to alternative strategies that could actively reduce or change negative thoughts about the least preferred prize (Spinrad et al., 2004). We did, however, find support for our hypothesis that RSA regulation would moderate the association between maternal physical comfort and children's prosocial behavior. Children exhibited lower levels of prosocial behavior when their mothers provided more physical comfort, but this was true only for children who also demonstrated less effective physiological regulation. Even though the disappointment task was designed to elicit mild distress, well-regulated children may not have been particularly upset by receiving the least preferred prize, and an active regulatory response would not necessarily be needed. Therefore, mothers may have engaged in hugging, patting, cuddling, and other physical gestures to provide their children with emotional support, but not explicit information about emotion regulation. It is also possible that mothers of less well-regulated children may have compensated for children's regulatory difficulties by opting for an ES strategy that would relieve children's immediate personal negative arousal, but would limit children's opportunities to practice strategies that support other-oriented responses. Regardless, results are consistent with the idea that mothers' use of physical comfort at age 3.5 did not promote prosocial behavior, potentially because using this strategy in the context of a mild, uncontrollable disappointment would undermine children's ability to actively regulate their own negative arousal and focus attention elsewhere (e.g., toward others in need).

Contrary to our hypothesis, mothers' observed use of expressive encouragement was not related to children's prosocial behavior. Previous research has suggested that emphasizing

the expression of negative emotions may exacerbate distress, depending on children's initial level of arousal (Eisenberg et al., 1996c; Roberts & Strayer, 1987). Encouraging children that "It's ok to feel sad" or probing "Tell me how you feel" in contexts where children are experiencing only mild distress, as in the current study, may not have interfered with prosocial behavior because the distress was not intense enough to overwhelm children's self-regulatory responses. Encouragement to focus on and express intense distress, on the other hand, would potentially preclude children from engaging in regulation of their negative feelings, and this could interfere with their ability to attend to the needs of others. A promising direction for future studies would therefore be to examine mothers' observed ES strategies in response to children's varying levels of distress and children's emerging prosocial behavior.

In terms of mothers' observed use of behavioral distraction, we found trending support for our hypothesis that mothers who used more behavioral distraction strategies would have children who were more prosocial. This aligns with previous literature showing that mothers who involved their upset children in some other activity successfully re-directed children's attention away from the source of distress (Bariola et al., 2011, 2012; Davis et al., 2010; Perry et al., 2012), and this would potentially allow children to attend to others in need. While we did not find support for RSA regulation as a moderator, mothers' observed use of behavioral distraction at age 3.5 did moderate the association between mothers' report of problem-focused reactions at age 2 and children's prosocial behavior at age 4. Children were more prosocial at age 4 as mothers' reported use of problem-focused reactions at age 2 increased, but the association was stronger when mothers engaged in lower levels of behavioral distraction during the age 3.5 disappointment task. Thus, use of behavioral distraction in this uncontrollable disappointment context did relate to prosocial behavior, but primarily in conjunction with mothers' problem-focused reactions. In other emotional contexts (e.g., in which anger or fear is elicited), behavioral distraction may be more directly associated with prosocial behavior.

Again, it is important to highlight the context of the current study in interpreting our pattern of findings—we examined mothers' ES strategies and children's RSA regulation in response to an uncontrollable event, meaning that children could not behaviorally solve the problem causing their disappointment. Emerging research has shown that children modify their use of regulatory strategies to fit the characteristics of specific emotional situations (Davis et al., 2010). More specifically, in response to uncontrollable situations such as experiencing sadness and fear, children change their thoughts more often than they take action to fix a problem (Davis et al., 2010). Therefore, it may be more beneficial for mothers to suggest cognitive ES strategies that enable children to change their thoughts to help them regulate negative emotions when the problem is out of their control. Future work should consider these possibilities and continue to explore the effects of context, as well as children's emotion regulation repertoires for managing discrete negative emotions.

No support was found for our hypotheses that mothers' use of cognitive distraction would be positively related to children's prosocial behavior or that children's RSA would moderate the association between maternal cognitive distraction and children's age 4 prosocial behavior. But, mothers' observed use of cognitive distraction at age 3.5 moderated the

association between mothers' report of problem-focused reactions at age 2 and children's prosocial behavior at age 4. When mothers reported high levels of problem focused reactions at age 2 and used more cognitive distraction at age 3.5, children were more prosocial at age 4. Thus, mothers' use of cognitive distraction to help children divert thoughts away from the disappointment was an effective strategy for promoting prosocial behavior.

Our hypothesis that mothers' use of cognitive reframing would be positively related to children's prosocial behavior was not supported, but we did find that RSA regulation moderated the association between maternal use of cognitive reframing and children's prosocial behavior. Probing this interaction revealed that mothers' use of cognitive reframing was not significantly associated with prosocial behavior for children who showed either better or worse RSA regulation, but the associations were in different directions. Mothers who are attuned to their children's current ER abilities may choose to provide ES strategies tailored to their child's abilities, or may challenge their children to implement strategies just beyond their current skill level (Grolnick et al., 1998). Even though children can implement cognitive reframing in order to alleviate negative emotions by age 5 (e.g., Davis et al., 2010), there are likely considerable individual differences (e.g., parent socialization practices) that would help explain whether and when children choose to utilize this strategy. An avenue for future research is to examine whether children who are receiving parental socialization scaffolding for cognitive reframing at age five are better able to use it later in childhood.

Although several notable findings emerged, some limitations of this work need to be addressed. First, the study was limited to maternal ES practices, and potential differences in maternal and paternal use of ES strategies and their associations with children's prosocial behavior were not examined. Despite the rich multi-method approach we employed, several key constructs relied solely on maternal report (of her own or her child's characteristics). Even though fathers were not included in the current study, other research has shown that children's developing regulatory skills are influenced more directly by mothers at this age (Bariola et al., 2011, 2012; Fivush, Brotman, Buckner, & Goodman, 2000; McDowell, Kim, O'Neil, & Parke, 2002). We therefore are confident that our study's results add meaningful new insight to our understanding of the interplay of maternal ES strategies and child physiology on children's prosocial development, but encourage researchers to make use of multiple reporters in future studies. Second, few mothers reported using low levels of problem-focused reactions in response to their children's displays of negative affect (i.e., this was a reaction to children's negative emotions that mothers typically endorsed being very likely to use). Even though there was variability in reported use of this strategy, our findings may not generalize to mothers who do not frequently respond to their children's negative emotions with problem-focused reactions. Relatedly, given the sociodemographic homogeneity of our sample, the patterns of findings reported here may not be the same as would be detected with participants from diverse backgrounds. Third, although a strength of our approach was the multi-method assessment of ES, we did not measure children's emotional responding or use of active coping strategies during the disappointment task, which would potentially preclude mothers from engaging with their children in the use of some strategies. Given that all six ES strategies were observed in the lab, mothers apparently

felt compelled to suggest these regulatory behaviors regardless of what their children might already have been doing to regulate disappointment. Fourth, many families' schedules did not permit them to come in for the assessment at age 3.5, so a higher percentage of data was missing at this time point. Analyses showed no differences between those who participated in both assessments and those who participated only in the age 2 assessment, so we are confident that our study's results are robust. Fifth, because observed maternal ES and children's RSA regulation at age 3.5 were measured contemporaneously, we framed RSA regulation as a moderator even though it would have been equally plausible statistically (though not conceptually justified) to examine socialization as the moderator between RSA regulation and children's prosocial behavior. Related to this point, despite the longitudinal design of the study, causal conclusions about the associations among ES, RSA regulation, and prosocial behavior cannot be made. Finally, the study did not take into account heritability estimates of prosocial behavior. Twin studies have typically shown substantial shared environmental and modest genetic influences on prosocial behavior in early childhood (Knafo & Plomin, 2006). Given the complex parent-child socialization and genetic processes underlying children's prosocial behavior, considering both environmental and genetically informed perspectives in future work would contribute to a more holistic understanding of the development of prosocial behavior.

Overall, this study contributes to our understanding of how family-level and individual-level processes of emotion socialization and physiological regulation contribute to the development of prosocial behavior in early childhood. Taking a differentiated approach to emotion socialization strategy use furthers our understanding of socioemotional development by uncovering distinct pathways through which parents can promote children's prosocial behavior. Some maternal emotion socialization strategies appear to be particularly helpful for children when regulating mild, uncontrollable distress, and promote regulatory skills and prosocial engagement. Other strategies may focus children's attention on negative emotions and personal distress, instead of promoting effective emotion regulation, adaptive social interactions, and prosociality. Children's physiological ability to regulate their negative emotions was also shown to be an important factor in positively influencing children's prosocial development. All together, this study supports a new model of children's prosocial development in which mothers' provision and scaffolding of emotion socialization strategies and children's effective physiological regulation independently and jointly predict the development of prosocial behavior in early childhood.

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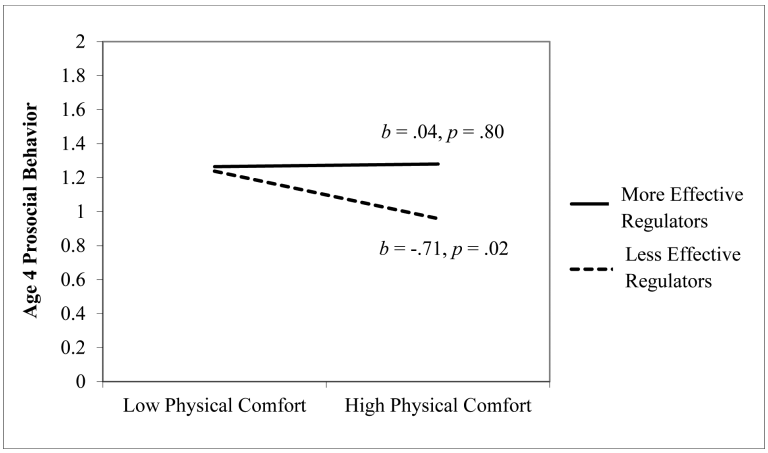

Figure 1.
Mothers' Observed Physical Comforting × RSA Change.

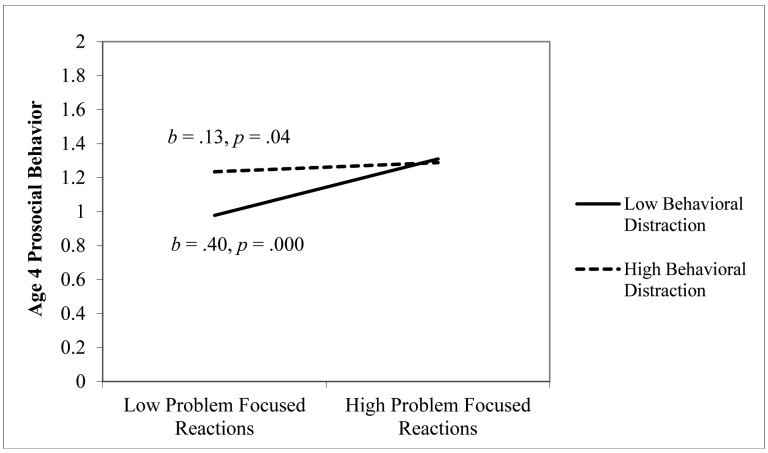

Figure 2.
Mother-Reported Problem Focused Reactions × Mothers' Observed Behavioral Distraction.

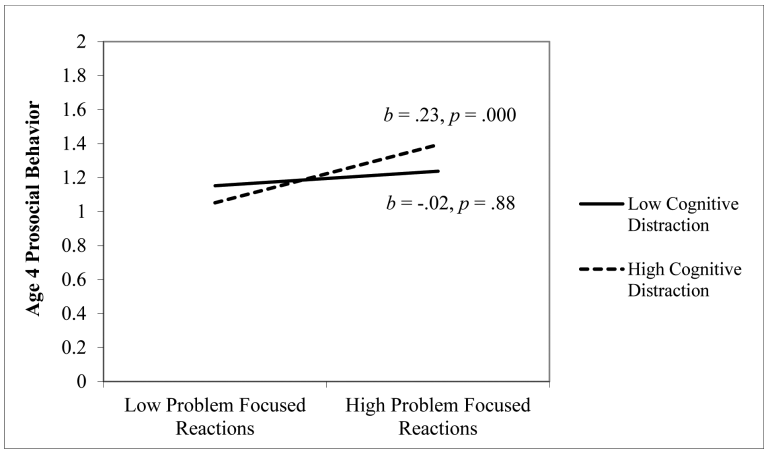

Figure 3.
Mother-Reported Problem Focused Reactions × Mothers' Observed Cognitive Distraction.

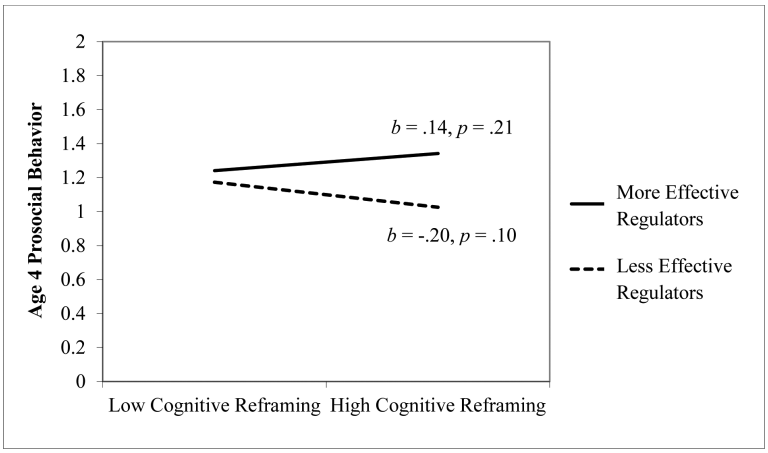

Figure 4.
Mothers' Observed Cognitive Reframing × RSA Change.

Table 1

Observed Maternal Emotion Socialization Strategies Coding

Strategy	Definition	Examples
Problem Focused	*Brainstorming ways of taking action* to help children solve the initial problem of being given the wrong gift	Suggesting they ask the primary experimenter what happened, or plan to ask for a different gift
Physical Comfort	Touching/hugging children in order to soothe their distress	A hug, pat on the back, arm rub, or hand holding
Expressive Encouragement	Encouraging children to express/feel emotions	“It’s ok to feel sad” or, “Tell me how you feel”
Behavioral Distraction	Attempts to get children *doing something else*	Pointing out the bow on the present box, getting children involved in some other activity
Cognitive Distraction	Suggesting that children *think about something else* instead of the disappointing gift	“Just think about how much fun you’ll have at the park later” or, “Tell me about all the other games you’ve been playing”
Cognitive Reframing	Suggestions for how children could *think about the disappointing gift in a different way* that would make it less disappointing	“Who do we know who could play with this toy?” or, “Isn’t it still nice that you got a present?”

Table 2

Unstandardized Means, Standard Deviations, and Range for Study Measures

Measure	Mean	SD	Range
2-year assessment			
1. Prosocial behavior	1.07	.38	.20 – 2.00
2. Problem-Focused Reactions	6.32	.55	4.50 – 7.00
3.5-year assessment			
3. Problem Focused	.05	.31	0 – 2.00
4. Physical Comfort	.18	.59	0 – 4.00
5. Expressive Encouragement	.10	.34	0 – 2.00
6. Behavioral Distraction	.33	.80	0 – 5.00
7. Cognitive Distraction	.52	.74	0 – 3.00
8. Cognitive Reframing	.56	1.0	0 – 5.00
9. Total ES Strategies Used	1.74	1.76	0 – 9.00
10. DT RSA change	0.00	1.00	−2.17 – 2.84
4-year assessment			
11. Prosocial behavior	1.19	.34	.35 – 1.95

Note. ES = Emotion socialization. DT RSA = Disappointment task respiratory sinus arrhythmia. Numbers reported here describe raw (non-imputed) data; note that imputation resulted in similar descriptive statistics for all study variables.

Table 3

Bivariate Correlations Among Study Variables

Measure	1	2	3	4	5	6	7	8	9	10
1. Age 2 PSB	--									
2. PFR	.06	--								
3. PF proportion	.12	.08	--							
4. PC proportion	.04	−.05	−.03	--						
5. EE proportion	.02	−.01	.03	−.09	--					
6. BD proportion	−.05	.15	−.11	−.21*	−.04	--				
7. CD proportion	−.03	−.20*	.02	−.13	.06	−.17	--			
8. CR proportion	.07	.02	−.17	−.06	−.28**	−.14	−.44**	--		
9. DT RSA change	.12	.14	−.13	−.14	.16	.28**	−.19*	.09	--	
10. Age 4 PSB	.18*	.31**	.23*	−.003	−.11	.09	−.01	.01	−.19*	--

Note. PSB = Prosocial behavior; PFR = Problem-focused reactions; PF = Problem focused; PC = Physical comfort; EE = Expressive encouragement; BD = Behavioral distraction; CD = Cognitive distraction; CR = Cognitive reframing; DT RSA = Disappointment task respiratory sinus arrhythmia.

* $p < .05$.

** $p < .01$.

Table 4

Regressions predicting age 4 prosocial behavior from age 2 problem-focused reactions, age 3.5 emotion socialization strategy, and children's age 3.5 RSA change

Variable(s) entered at each step	*B*	S.E.*B*	β	Sig.	Δ R^2	*F*	d.f.
Problem Focused							
1. Prosocial behavior age 2	.11	.07	.13	.14	.03	4.08	(1, 123)
2. Problem Focused Reactions	.18	.05	.31	.00**			
Problem Focused Proportion	.53	.33	.20	.11			
RSA Change	−.07	.03	−.23	.01*	.18	7.85	(4, 120)
3. Problem Focused x Problem Focus	1.16	1.04	.13	.26			
Problem Focused x RSA Change	.03	.04	.06	.49			
Problem Focus x RSA Change	.53	.33	.18	.11	.02	5.02	(7, 117)
4. Problem Focused x Problem Focus x RSA Change	.18	1.05	.02	.86	.00	4.36	(8, 116)
Note. Total R^2 = .24, p < .01.							
Expressive Encouragement							
1. Prosocial behavior age 2	.15	.07	.18	.04*	.03	4.08	(1, 123)
2. Problem Focused Reactions	.17	.06	.29	.00**			
Expressive Enc Proportion	−.24	.20	−.13	.23			
RSA Change	−.07	.03	−.22	.02*	.16	7.06	(4, 120)
3. Problem Focused x Expressive Enc	.32	.59	.07	.59			
Problem Focused x RSA Change	.00	.05	.00	.98			
Expressive Enc x RSA Change	.02	.21	.01	.93	.01	4.26	(7, 117)
4. Problem Focused x Expressive Enc x RSA Change	.33	.39	.10	.40	.01	3.80	(8, 116)
Note. Total R^2 = .24, p < .01.							
Physical Comfort							
1. Prosocial behavior age 2	.18	.07	.22	.01*	.03	4.08	(1, 123)
2. Problem Focused Reactions	.15	.06	.26	.01*			
Physical Comf Proportion	−.34	.17	−.21	.05*			
RSA Change	−.06	.03	−.19	.04*	.16	6.89	(4, 120)
3. Problem Focused x Physical Comf	.86	.45	.28	.06			
Problem Focused x RSA Change	−.01	.05	−.03	.78			
Physical Comf x RSA Change	−.38	.16	−.26	.02*	.03	4.67	(7, 117)

Variable(s) entered at each step	*B*	S.E.*B*	β	Sig.	Δ R^2	*F*	d.f.
4. Problem Focused x Physical Comf x RSA Change	.57	.33	.24	.09	.02	4.52	(8, 116)
Note. Total R^2 = .23, p < .01.							
Behavioral Distraction							
1. Prosocial behavior age 2	.19	.07	.23	.01**	.03	4.08	(1, 123)
2. Problem Focused Reactions	.27	.05	.45	.00**			
Behavioral Dist Proportion	.22	.11	.19	.05*			
RSA Change	−.09	.03	−.28	.01**	.17	7.60	(4, 120)
3. Problem Focused x Behavioral Dist	−.50	.21	−.24	.02*			
Problem Focused x RSA Change	.07	.04	.14	.12			
Behavioral Dist x RSA Change	−.04	.08	−.06	.61	.07	6.09	(7, 117)
4. Problem Focused x Behavioral Dist x RSA Change	−.211	.18	−.11	.24	.01	5.52	(8, 116)
Note. Total R^2 = .28, p < .01.							
Cognitive Distraction							
1. Prosocial behavior age 2	.16	.07	.19	.03*	.03	4.08	(1, 123)
2. Problem Focused Reactions	.10	.08	.17	.18			
Cognitive Dist Proportion	.04	.08	.05	.61			
RSA Change	−.09	.04	−.30	.01*	.15	6.86	(4, 120)
3. Problem Focused x Cognitive Dist	.35	.16	.30	.03*			
Problem Focused x RSA Change	−.01	.07	−.02	.87			
Cognitive Dist x RSA Change	.10	.07	.18	.18	.04	4.74	(7, 117)
4. Problem Focused x Cognitive Dist x RSA Change	.18	.13	.23	.17	.01	4.42	(8, 116)
Note. Total R^2 = .23, p < .01.							
Cognitive Reframing							
1. Prosocial behavior age 2	.12	.07	.14	.09	.03	4.08	(1, 123)
2. Problem Focused Reactions	.18	.07	.31	.01*			
Cognitive Ref Proportion	−.03	.08	−.04	.68			
RSA Change	−.06	.03	−.18	.06	.15	6.86	(4, 120)
3. Problem Focused x Cognitive Ref	.13	.16	.10	.42			
Problem Focused x RSA Change	.01	.05	.01	.92			

Variable(s) entered at each step	*B*	S.E.*B*	β	Sig.	Δ R^2	*F*	d.f.
Cognitive Ref x RSA Change	−.17	.09	−.20	.05*	.03	4.63	(7, 117)
4. Problem Focused x Cognitive Ref x RSA Change	.12	.15	.09	.41	.01	4.12	(8, 116)

Note. Total R^2 = .22, $p < .01$. RSA = Respiratory sinus arrhythmia; Expressive Enc = Expressive encouragement; Physical Comf = Physical comfort; Behavioral Dist = Behavioral distraction; Cognitive Dist = Cognitive distraction; Cognitive Ref = Cognitive reframing

* $p < .05$,

** $p < .01$.