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Positively Biased Processing of Mother's Emotions Predicts Children's Social and Emotional Functioning

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Abstract

Risk for internalizing problems and social skills deficits likely emerges in early childhood when emotion processing and social competencies are developing. Positively biased processing of social information is typical during early childhood and may be protective against poorer psychosocial outcomes. We tested the hypothesis that young children with relatively less positively biased attention to, interpretations of, and attributions for their mother's emotions would exhibit poorer prosocial skills and more internalizing problems. A sample of 4- to 6-year-old children ($N=82$) observed their mothers express happiness, sadness and anger during a simulated emotional phone conversation. Children's attention to their mother when she expressed each emotion was rated from video. Immediately following the phone conversation, children were asked questions about the conversation to assess their interpretations of the intensity of mother's emotions and misattributions of personal responsibility for her emotions. Children's prosocial skills and internalizing problems were assessed using mother-report rating scales. Interpretations of mother's positive emotions as relatively less intense than her negative emotions, misattributions of personal responsibility for her negative emotions, and lack of misattributions of personal responsibility for her positive emotions were associated with poorer prosocial skills. Children who attended relatively less to mother's positive than her negative emotions had higher levels of internalizing problems. These findings suggest that children's attention to, interpretations of, and attributions for their mother's emotions may be important targets of early interventions for preventing prosocial skills deficits and internalizing problems.

Keywords

emotion processing; positivity bias; prosocial skills; internalizing problems; mother-child relationship

Young children typically exhibit positivity biases, meaning that they acquire and maintain positively biased views of the self and others by selectively attending to, processing, and interpreting positive over negative information (Boseovski, 2010; Mezulis, Abramson, Hyde,

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& Hankin, 2004). This positivity bias is most pronounced during early to middle childhood (Boseovski & Lee, 2006; Harter & Pike, 1984) and diminishes during late childhood and adolescence (Mezulis et al., 2004). Although aspects of young children's emotional development, such as their emotion knowledge and emotion regulation skills, have been associated with their academic success and social and emotional functioning in classroom settings (Denham et al., 2012; Garner & Waajid, 2012), researchers have not yet studied whether individual differences in young children's positivity biases are associated with their social and emotional functioning. Lower positive attributional style biases have been associated with depression and anxiety in older children and adolescents (Meyer, Dyck, & Petrinack, 1989; Mezulis et al., 2004; Tems, Stewart, Skinner, Hughes, & Emslie, 1993), and determining whether this association is present in early childhood may provide an important clue about processes that contribute to social and emotional functioning in this developmental period.

Early childhood is a critical developmental stage for the acquisition of emotion processing and interpersonal skills (Herba, Landau, Russell, Ecker, & Phillips, 2006; Thompson & Lagattuta, 2006), and mothers' expressions of emotions are an important context for children's emotion learning (Denham & Grout, 1992). Although risk for impaired prosocial functioning and internalizing psychopathology is thought to be emerging during early childhood (Hay, Payne, & Chadwick, 2004; Luby, Belden, Pautsch, Si, & Spitznagel, 2009), mechanisms of risk at such young ages are not well understood. Negatively biased processing of emotional stimuli has support as a correlate of impaired interpersonal functioning and depression and anxiety during adulthood, adolescence, and late childhood (Riskind, Alloy, & Iacoviello, 2010; Rudolph, Hammen, & Burge, 1997). However, as young children tend to exhibit positivity biases when processing social information, relatively less positively biased, rather than negatively biased, emotion processing may be particularly relevant to risk for poorer social and emotional functioning during early childhood.

Emotion Processing Risks for Internalizing Problems in Children

Studies have found links between emotion processing biases, including attention, interpretation, and attribution biases, and internalizing problems in older children and adolescents. The majority of this research has focused on relations between negatively biased processing of static, non-personal emotional stimuli and internalizing problems. Attention biases toward strangers' negative facial expressions have been found in youth with elevated anxiety and anxiety disorders (Roy et al., 2008) and daughters of depressed mothers (Joormann, Talbot, & Gotlib, 2007). Negatively biased interpretations of the intensity of others' emotions have also been linked to depression; studies have shown that depressed youth interpret low-intensity angry faces as more intensely angry than children with low depression (van Beek & Dubas, 2008) and sons of depressed mothers identify sad facial expressions at lower intensities than low-risk children (Lopez-Duran, Kuhlman, George, & Kovacs, 2013). Children's misattributions of personal responsibility for others' negative emotions have also been linked to internalizing problems. Depressed children were found to perceive overly hostile intentions in others and to misattribute themselves as the cause of the hostility (Quiggle, Garber, Panak, & Dodge, 1992), and in the context of parental

depression, children who misattributed personal responsibility for their parent's negative emotions had higher levels of internalizing problems (Goodman, Tully, Connell, Hartman, & Huh, 2011). Although these studies are cross-sectional, studies demonstrating negatively biased processing in children of depressed parents who are at risk for depression but do not yet have clinically significant symptoms (e.g., Joorman et. al, 2007) and research on cognitive vulnerabilities more broadly (Jacobs, Reinecke, Gollan, & Kane, 2008) suggest that these biases are precursors of internalizing problems, although cognitive biases and internalizing problems likely have bidirectional influence (Masten & Cicchetti, 2010).

Studies of older children and adolescents have also demonstrated that positively biased emotion processing is associated with low levels of internalizing problems (e.g., Boseovski, 2010). For example, studies have found biased attention toward positive stimuli in children and adolescents with low levels of depression (Jacobs et al., 2008; Ladouceur et al., 2005) and daughters of non-depressed mothers (Joormann et al., 2007). Moreover, non-depressed children and adolescents have been found to misclassify negative facial expressions as happy (Jenness, Hankin, Young, & Gibb, 2015; Schepman, Taylor, Collishaw, & Fombonne, 2012). On the other hand, depressed adolescents interpreted low-intensity happy faces as less intensely happy than adolescents with low depression (van Beek & Dubas, 2008). Depressed youth have also been found to have greater impairments in recalling positive information, including fewer positive personal memories, than non-depressed children (Drummond, Dritschel, Astell, O'Carroll, & Dalgleish, 2006; Whitman & Leitenberg, 1990), and among depressed adults, greater recall of self-referential positive words uniquely predicted a decrease in symptoms nine months later (Johnson, Joormann, & Gotlib, 2007). This research underscores that not only negatively biased, but also less positively biased processing of emotions are associated with internalizing problems.

Whereas most of the studies of positivity biases have samples with age ranges that span middle childhood to middle adolescence, early childhood is a particularly critical stage for studying emotion processing biases given that emotion discernment skills, including skills for discerning negative emotions and low-intensity emotional displays, are still developing (Herba et al., 2008, 2006; Vicari, Reilly, Pasqualetti, Vizzotto, & Caltagirone, 2000). Very little attention has been given to emotion processing biases in early childhood, although a few studies have found support for associations between biased attention toward negative emotional facial expressions and internalizing problems in young children. Specifically, behavioral inhibition in toddlerhood predicted social withdrawal at age five in children with biased attention toward angry faces but not in children without this negative attention bias (Pérez-Edgar et al., 2011), and 5-to 7-year-old daughters of depressed mothers exhibited biased attention toward sad faces (Kujawa et al., 2011). Studies have not examined relations between young children's less positively biased processing and their internalizing problems. Moreover, this research has focused on attention to strangers' static negative emotions in photographs; our study utilized a paradigm in which mothers simulated emotions *in vivo*, which provides a more developmentally relevant context for studying young children's emotion processing biases.

Emotion Processing and Social Functioning

Emotion processing biases may be associated not only with young children's internalizing problems but also with their social functioning. Indeed, accurate understanding of another's emotions and needs is a critical component of selecting an appropriate social response (Saarni, 1992), and biased processing of others' emotions may interfere with a child's ability to interact effectively with others, for example by impeding accurate recognition of others' needs, empathy and prosocial actions. Prosocial actions are voluntary social behaviors that are helpful, supportive, and intended to benefit another (Eisenberg & Fabes, 1998).

Acquiring skills for acting prosocially is important for developing social competence during early childhood, when expanding social networks that include school contexts require more sophisticated prosocial skills (Vandell, Nenide, & Van Winkle, 2006). As young children learn social rules and become increasingly sensitive to situations in which prosocial behaviors are needed and desired, their prosocial behaviors become increasingly selective; for example, they are more likely to behave prosocially toward friends and their own mothers than unfamiliar peers and adults (Hay & Cook, 2007). Moreover, individual differences in young children's prosocial skills are predictive of later prosocial tendencies (Eisenberg et al., 1999).

Research has largely focused on how biased emotion processing is related to children's negative social behaviors; indeed, four- to five-year-old children who misidentified anger in others displayed more aggression and hostility in the classroom (Barth & Bastiani, 1997; Schultz, Izard, & Ackerman, 2000). Yet, emotion processing biases are thought to be associated not only with children's negative social behaviors but also their positive social behaviors; for example, interpreting social cues as friendly may facilitate social approach, and misidentifying sadness and anger in others may inhibit positive social interactions and prosocial behaviors. Surprisingly little research has focused on this topic, although one study found that adolescents who exhibited negatively biased processing by attributing greater hostile intent to others in ambiguous vignettes engaged in fewer altruistic prosocial behaviors (Laible, Murphy, & Augustine, 2014). We expected that young children's less positively biased emotion processing would be similarly related to their poorer prosocial functioning.

Young Children's Processing of Mothers' Emotions

Investigating children's attention to, interpretations of, and attributions for their mother's emotions may offer developmentally salient information about early emotion processing biases given that the mother-child relationship is an important context in which children first learn to process emotions and develop prosocial skills. Exposure to mothers' emotional expressivity implicitly teaches children about emotions, including their expression, causes, and eliciting situations, which is, in turn, knowledge that may foster social skills (Denham, Zoller, & Couchoud, 1994). Studies have found that mothers' low positive and high negative emotional expressivity are associated with social skills deficits and internalizing problems in young children (Eisenberg et al., 2001; Valiente et al., 2006); thus, individual differences in children's exposure to their mother's emotions are related to their psychosocial outcomes. Individual differences in how children process their mother's positive and negative emotions

may be as important as mother's actual expressivity and may be associated with these social and emotional impairments; for example, perceiving their mother's emotional expressions as less positive may also be associated with children's social skills deficits. The design of the current study, which standardizes children's exposure to their mother's emotional expressivity by exposing all children to the same emotional event, allows for examination of whether individual differences in children's positively biased processing of their mother's emotions are related to their negative social and emotional outcomes.

Early in development, mothers' emotions are particularly significant to children. Children are especially attentive to vocalizations and facial expressions demonstrated by their mother compared to unfamiliar adults (e.g., Montague & Walker-Andrews, 2002). Moreover, by two years of age, children are more empathic toward their mother's emotions than an unfamiliar adult's emotions (van der Mark, van IJzendoorn, & Bakermans-Kranenburg, 2002; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992). Mothers' emotional expressions may also be particularly prone to processing biases. Young children tend to be more inaccurate when discerning facial expressions on familiar faces, including those of their mother, than unfamiliar faces (Herba et al., 2008). Furthermore, although children can give plausible explanations for others' emotions by about age four (Dunn & Hughes, 1998), five- and six-year-old children tend to overattribute themselves as the cause of their mother's emotions, especially her happiness and anger (Covell & Abramovitch, 1987); however, around 45% of the children reported other causes of their mother's happiness and anger, such as another family member, suggesting variability in children's processing of their mother's emotions. Children who were particularly prone to misattribute personal responsibility for their mother's negative emotions at age two produced more guilt themes in laboratory assessments at age seven (Cummings, Hollenbeck, Ianotti, Radke-Yarrow, & Zahn-Waxler, 1986). Together, this research suggests the salience of a mother's emotions during early childhood, the tendency for children to process their mother's emotions in a biased manner, and the potential for these biases to result in poor prosocial skills and internalizing problems.

Simulated Emotional Phone Call and Study Hypotheses

In summary, early childhood is an important period for studying children's biased processing of their mother's emotions and their link to children's poorer prosocial skills and internalizing problems. We continued this line of research by studying children as they witnessed their mother simulate happiness, sadness and anger during a pretend phone conversation that was adapted from the Simulated Phone Argument Task (SPAT; Davies, Cummings, & Winter, 2004). Following the phone call, children rated how intensely their mother felt each emotion and reported whether they were personally responsible for each of their mother's emotions. Researchers also rated from video the percentage of time children were attending to their mother when she expressed each emotion.

The purpose of the study was to test the central hypothesis that children with less of a positivity bias when processing their mother's emotions have poorer prosocial skills and greater internalizing problems. More specifically, we tested two hypotheses. First, we hypothesized that poorer prosocial skills would be associated with children's (a) less positive *attention biases*, which we operationalized as smaller ratios of time children spent

attending to their mother's positive emotions relative to the time they spent attending to her negative emotions, (b) less positive *interpretation biases*, which we defined as smaller ratios of children's ratings of the intensity of their mother's positive emotions relative to her negative emotions, and (c) *misattributions of personal responsibility* for their mother's negative emotions and lack of misattributions of personal responsibility for her positive emotions. Second, we hypothesized that greater internalizing problems would be associated with children's (a) less positive *attention biases*, (b) less positive *interpretation biases*, and (c) *misattributions of personal responsibility* for their mother's negative emotions and not her positive emotions.

Method

Participants

Four- to six-year-old children and their mothers ($N = 82$; $M_{\text{age}} = 4.96$ years; 52.4 % girls) were recruited from a) a list of potential research participants for university studies ($n = 79$) and b) a large local health maintenance organization ($n = 11$). The sample was primarily Caucasian (80.5%), with 7.3% African-American, 3.7% Hispanic, 3.7% Asian and 4.9% other races. English was the primary language spoken by all families. Mothers were well educated (92.7% had at least a college degree) and had an average family income in the range of \$100,000–109,000.

Procedure

Families completed all procedures in a laboratory as part of a larger study. Families first completed informed consent and assent procedures; parents provided written consent, and children provided verbal assent. Then, the mother was trained on the phone call procedure and completed the questionnaires while the child played in another room. The mother listened to an audio recording of the phone conversation, read a written version of the conversation, and practiced repeating the dialogue. Next, the mother joined the child; the two sat at a child-sized table and were left alone. The child was asked to draw a picture with crayons, but no other toys were present. From an adjacent room, the researcher called the mother on her cell phone and played the recording. After the phone call, the mother left the room and the researcher re-entered to ask the child questions about the call.

Measures

The *Child Behavior Checklist* (CBCL/4–18; Achenbach & Edelbrock, 1995) is a 118-item measure used to assess the presence of internalizing symptoms in children during the previous six months. The CBCL has well-established reliability and validity for preschool-aged children. Mothers completed the parent version. Responses are given on a three-point scale, ranging from “Not True” to “Very True.” The 32-item, empirically-derived Internalizing Scale (i.e. depressed, anxious, inhibited) was used for this study ($\alpha = .91$). Scores between 60 and 65 on the CBCL indicate problems in the borderline clinical range, and scores above 65 indicate problems in the clinical range.

The *Social Skills Rating System* (SSRS; Gresham & Elliott, 1990) is a 39-item measure used to assess children's prosocial skills. Mothers completed the parent, preschool version.

Items tap how often children display such skills and are rated as never, sometimes, and often. Higher scores on this measure indicate better social skills. The 10-item cooperation subscale score ($\alpha=.80$) was used for this study as a measure of children's prosocial skills (e.g., "gives compliments to friends"). The manual provides data that support adequate to excellent internal consistency, test-retest reliability and criterion-related validity of the measure.

Simulated Emotional Phone Call Task

Children witnessed live simulations of their mother expressing various emotions during a simulated emotional phone call paradigm adapted from the SPAT (Davies et al., 2004). The SPAT is used to examine children's responses to interparental conflict; we applied a similar method to study young children's responses to mother's positive and negative emotions. The mother and child were alone in a laboratory room when the mother received a phone call. The mother told the child it was a call from a "friend", but a researcher was on the other end of the phone playing an audio recording of an emotional script. The mothers repeated the emotional script using the appropriate affect.

Children can accurately discern happiness, sadness, and anger in others by age four (Russell & Widen, 2002; Widen & Russell, 2003), and children are exposed to both sadness and anger in their mothers. The children thus witnessed these three emotions in their mothers during the phone call. First, the mother used a happy tone while making five statements that either identified her happiness (e.g., "I'm happy to hear that") or were emotionally consistent with happiness (e.g., "wow, that's great"). Next, the mother told her child she was "on hold" to provide greater opportunity for mother-child interaction. This procedure was repeated for mother's sadness, happiness a second time, and then anger: she made five emotional statements and then was "on-hold." She ended the phone call using a neutral tone. Mothers spent equal time (40 seconds) in each emotion phase and each on-hold phase. Thus, children spent equal time witnessing positive and negative emotions, and one positive and one negative phase occurred in each half of the phone conversation. The phone call started with a happy phase to more realistically reflect how a phone conversation with a friend would likely begin. Mothers were asked to use an intensity of emotional expressiveness that they would typically use so that their expressiveness would not seem atypical to some children. Finally, mothers were asked not to look at children during conversation phases to avoid conveying the message that the content was about the children, and to look at children during on-hold phases to encourage interaction.

Children's interpretations of and misattributions for mother's emotions—

Similar to the SPAT (Davies et al., 2004), children were interviewed immediately following the phone call. First, children rated the intensity of their mother's happiness, sadness, and anger on 4-point scales using drawings of faces that increased in emotional intensity. A researcher asked the child, "When your mom was talking on the phone, how happy was she?" Children's ratings of the intensity of mother's sadness and anger were averaged and a ratio of children's ratings of the intensity of their mother's positive emotions to ratings of the intensity of her negative emotions was calculated to provide a measure of children's *interpretation bias*. After the child pointed to a picture depicting the intensity of their

mother's happiness, the researcher asked, "was she happy because of you (pointed to child) or not because of you (shook head)?" Children responded "because of me" or "not because of me." This procedure was repeated for mother's sadness and anger and children's reports of personal responsibility for their mother's sadness and anger were averaged. Children's reports of personal responsibility for mother's positive and negative emotions are *misattributions of personal responsibility*, since the phone conversation, not the child, was the source of mother's emotions.

Coding of children's attention to mother's emotions—The mother and child were video recorded during the phone conversation, and the focus of children's attention during each emotional phase of the phone call was coded based primarily on children's eye gaze, similar to coding systems used by Zahn-Waxler and colleagues (e.g., Zahn-Waxler, Cole, Welsh, & Fox, 1995). Three trained behavioral coders who were blind to the purpose of the study used mutually exclusive codes to indicate whether the child was focused on the task (i.e., drawing), focused on their mother, or not focused on the task or mother. A change in attentional focus was recorded when the child's focus shifted from one of these codes to another for at least 2 seconds, and the percent of the emotional phase that the child spent in each code was calculated. The percentage of time the child focused on the mother was used to test the hypothesis in this study. The percentage of time the child focused on the mother during the sadness and anger phases were averaged and a ratio of the percent of time children were focused on the mother during her positive emotions relative to the percent of time they were focused on the mother during her negative emotions was calculated to provide a measure of children's *attention bias*. At least 25% of the participants coded by each coder were coded by a master coder. Inter-rater reliability (interclass correlation coefficients, ICCs) were calculated and ranged from .78 to .94 for the average of the sad and angry phases ($M = .84$) and .76 to .94 for the average of the two happy phases ($M = .83$), all considered in the excellent range (Cicchetti, 1994).

Ratings of children's prosocial behaviors—Two additional raters rated children's prosocial behaviors from video. This variable was used to control for the possibility that children reported that they were responsible for mother's happiness during the paradigm because they used prosocial behaviors, and thus their reports of responsibility for mother's happiness are not misattributions. Children's prosocial behaviors were rated during each of the emotional phases using a 4-point continuous scale (1 = *none*; 2 = *minimal*; 3 = *moderate*; 4 = *strong*) and an average prosocial rating across phases was used for this study. Examples of children's prosocial behaviors include children's behavioral attempts to help or comfort the mother, such as using statements of affection or attempting to share their drawing with the mother. Twenty-five percent of the participants were rated by both coders. The inter-rater reliability for the average prosocial rating was strong, ICC = .76.

Ratings of mother's emotional expressiveness—The mother's emotional expressiveness during each of the emotional phases of the phone call was rated from video by three additional raters using a 5-point rating scale (1 = *flat affect*; 2 = *mild affect*; 3 = *moderate affect*; 4 = *clear/strong affect*; 5 = *extreme affect*) to be used as a statistical control in the analyses. Higher ratings indicate intense and persistent expressiveness and lower

ratings indicate subtle and brief expressiveness. Internal consistency reliabilities were calculated on 25% of the videos, and average inter-rater reliabilities (Cohen's Kappas) across raters were .90 and .92 for the two happy phases, .89 for sadness, and .84 for anger. Correlations among the four ratings of mother's emotions were all strong and significant ($r_{mean} = .60$) and thus the scores were averaged to create one score reflecting mother's level of expressiveness during the phone call (Cronbach's $\alpha = .81$).

Results

Preliminary Analyses

Chi-square and *t* tests revealed no significant differences in levels of study variables by child's gender, age, or race, and no differences in child's age or ethnicity by child's gender. Correlations among study variables are reported in Table 1 and descriptive statistics are reported in Table 2. The mean level of children's internalizing problems in this sample is fairly typical compared to the normative sample, although the range includes scores in the clinically significant range (range = 29 to 76). Mean ratings of children's prosocial behaviors during the phone call paradigm ranged from 1 (*none*) to 2.13 (*minimal*) across children, with a sample mean rating of 1.16, indicating that children displayed few prosocial behaviors during the paradigm. Nevertheless, younger age of children was associated with higher rated prosocial behaviors during the paradigm. Average ratings of mothers' emotional expressiveness (a statistical control) ranged from 2 (*mild affect*) to 5 (*extreme affect*) with sample averages in the *moderate affect* to *clear/strong affect* range.

On average, children spent a significantly smaller percentage of the positive emotion phases ($M = 6\%$; range = 0% – 43%) than the negative emotion phases ($M = 18\%$; range = 0% – 71%) attending to their mother, $t(81) = -5.94, p < .001$. Correspondingly, the mean ratio of the percentage of time children focused on their mother's positive relative to negative emotions was .87, which is significantly lower than 1, $t(81) = -5.87, p < .001$, and indicates that children exhibited a negative attention bias rather than a positive attention bias. However, this ratio ranged from .45 to 1.39, indicating that some children spent a larger percentage of time attending to their mother's negative emotions, whereas other children spent a larger percentage of time attending to their mother's positive emotions.

Children's ratings (i.e., interpretations) of the intensity of mother's emotions on the 4-point pictorial scale range from 1 to 4 for mother's happiness ($M = 2.27$; $SD = 1.27$), sadness ($M = 2.14$; $SD = 1.21$), and anger ($M = 2.64$; $SD = 1.65$). Thus, children used the full range of possible ratings. The mean ratio of children's interpretations of the intensity of their mother's positive to negative emotions was 1.30, which is significantly greater than 1, $t(81) = -5.87, p < .001$. This value indicates that overall children rated their mother's positive emotions as significantly more intense than her negative emotions, and thus exhibited a positive interpretation bias. The mean ratio ranged from .25 to 4.00, indicating that some individual children rated their mother's positive emotions as more intense than her negative emotions, whereas other children rated their mother's negative emotions as more intense than her positive emotions.

Regarding misattributions of personal responsibility for mother's emotions, 40% of children reported personal responsibility for their mother's positive emotions whereas only 6% of children reported personal responsibility for her negative emotions, a difference that was statistically significant, $F(1, 81) = 31.69, p < .001$. Thus, children made more misattributions of personal responsibility for their mother's positive than negative emotions. As expected, ratings of children's prosocial behaviors were positively correlated with children's reports of being responsible for their mother's positive emotions but were not significantly correlated with any other study variables.

Children's attention bias had a significant positive correlation with their interpretation bias. The positive correlation was relatively small, suggesting some within person consistency across these two measures of emotion processing but also a distinction between these two measures. Misattributions of personal responsibility for mother's positive emotions also had a significant, small positive correlation with children's greater positive interpretation bias. Misattributions of personal responsibility for mother's negative emotions were not correlated with any other variables, indicating that these misattributions may be distinct from the other emotion processing variables.

Tests of Hypotheses

Multiple linear regression was used to test the hypotheses using IBM® SPSS® Statistics, Version 21 software. Data were first inspected for errors, outliers, and distributional assumptions (Tabachnick & Fidell, 2013); no study variables had outlier data points (i.e., 3 standard deviations above or below the mean) and the children's internalizing problems and prosocial skills were approximately normally distributed. One regression model was used to test the statistical effects of children's attention bias, interpretation bias, and misattributions of personal responsibility for mother's positive and negative emotions on children's prosocial skills. A second regression model was used to test the statistical effects of these variables on children's internalizing problems. The models included four relevant statistical controls in the first step. First, children's age was included as a covariate, given typical emotional development between the ages of 4 to 6 years. Second, children's gender was included given evidence of gender differences in prosocial skills (Eisenberg & Fabes, 1998). Third, an average of the four ratings of mother's emotional expressiveness during the phone call was used to ensure that individual differences in mother's levels of emotional expressiveness were not driving individual differences in children's processing of her emotions. Fourth, ratings of children's prosocial behaviors were also included as covariates to control for the possibility that children's report of personal responsibility for mother's positive emotions reflected their use of prosocial behaviors rather than misattributions of personal responsibility. The second step included the four hypothesized predictors.

Table 3 displays the findings from the first regression model. Children's less positive interpretation biases, misattributions of personal responsibility for their mother's negative emotions, and lack of misattributions of personal responsibility for her positive emotions were significantly associated with children's poorer prosocial skills and explained 6.9%, 4.4%, and 7.2% of the variance in prosocial skills, respectively. Children's attention bias was

not significantly related to their prosocial skills. This model explained 30% of the variance in prosocial skills.

Findings from the second regression model are presented in Table 4. Only children's less positive attention biases were associated with children's greater internalizing problems and explained 4.8% of the variance in internalizing problems. Children's interpretation biases and misattributions of personal responsibility for their mother's positive and negative emotions were not significantly related to children's internalizing problems. The model with all variables explained 14% of the variance in internalizing problems.

Discussion

This study found that young children's emotion processing biases were related to poorer prosocial skills and greater internalizing problems, but distinct biases were differentially related to these poorer outcomes. The two emotion processing variables that evinced positivity biases in our sample – interpretations of and misattributions of personal responsibility for mother's emotions – were associated with children's poorer prosocial skills rather than their internalizing problems, and the emotion processing variable that demonstrated a negativity bias in our sample – attention to mother's emotions – was associated with children's internalizing problems but not their prosocial skills.

Children on average rated their mother's positive emotions as more intense than her negative emotions and a larger percentage of children reported responsibility for their mother's positive than her negative emotions. Thus, children's interpretations of the intensity of their mother's emotions and their misattributions of personal responsibility for her emotions evinced the expected positivity biases in young children. In contrast, children spent a greater percentage of the paradigm attending to their mother's negative than positive emotions, although mothers spent an equal amount of time expressing positive and negative emotions. This indicates that there was a negativity bias rather than a positivity bias in children's attention to their mother's emotions. Studies suggest that family members' displays of anger and sadness are distressing to children in early and middle childhood (Cummings, Vogel, Cummings, & El-Sheikh, 1989). Mothers' anger and sadness may be more salient to young children than her happiness; for instance, mothers' expression of negative emotions may be less common than happiness, thus capturing more attention.

Our hypothesis regarding children's internalizing problems was partially supported in that children in our study who displayed less positive attention biases evinced more internalizing problems; however, contrary to our hypothesis, children's interpretation bias and misattributions of personal responsibility were not related to their internalizing problems. Children who were highly focused on their mother's negative emotions may have had difficulty disengaging from the negative cues, which is a cognitive process that has been linked to emotion regulation difficulties and sustained negative affect (Gotlib & Joorman, 2010). Children who exhibit biased attention toward photos of faces expressing negative emotions in emotional dot probe studies (e.g., Roy et al., 2008) are assumed to also exhibit such biased attention to others' negative emotions during actual interpersonal interactions, which contributes to internalizing problems; our findings extend dot probe research by

demonstrating that children's biased attention toward mothers' negative emotions during an *in vivo*, simulated interpersonal interaction is indeed associated with greater levels of internalizing problems.

Our hypothesis regarding children's prosocial skills was also partially supported in that children with less positive interpretation biases and less positively biased misattributions of personal responsibility for their mother's emotions had poorer prosocial skills; however, contrary to our hypothesis, children's attention biases were not related to their prosocial skills. These findings are consistent with studies indicating that children who have more highly positive cognitions compared to their peers evince better outcomes (Mezulis et al., 2004) and extend these findings to cognitions about mothers' emotions. Children's less positive interpretations of their mother's emotions likely generalize to maladaptive interpretations of the emotions of other adults and peers, and our findings suggest that this attenuated positive processing is detrimental to children's prosocial functioning. Children's biased processing of mothers' emotions may be related to their poorer prosocial functioning through processes such as social withdrawal and avoidance. Children who interpret their mother's emotions as more negative or misattribute themselves as the cause of their mother's negative emotions may avoid her distress due to beliefs that they would be ineffective in improving her mood or feelings of maladaptive guilt and shame that have been associated with withdrawal in children as young as two (Barrett, Zahn-Waxler, & Cole, 1993). Children who withdraw from their mothers may forego opportunities to learn prosocial skills through her scaffolding. For example, 4-to 6-year-old children who disengaged from their mother's emotions were less empathic to her distress (Tully, Donohue, & Garcia, 2015). Over time, these missed opportunities for social engagement and emotion learning may lead to impaired prosocial functioning beyond the mother-child dyad.

Biased attention to, interpretations of, and attributions for their mother's emotions were associated with distinct psychosocial outcomes in our study. Attentional systems develop early, and are thus prime targets for investigating the early development of internalizing problems (Pine, Helfinstein, Bar-Haim, Nelson, & Fox, 2009). On the other hand, less positively biased interpretations of and misattributions of personal responsibility for mothers' emotions appear to confer risk for poorer prosocial skills rather than internalizing outcomes during early childhood. Indeed, interpretations of social cues are more proximal to social behaviors than is attention to such cues within a Social Information Processing framework (Crick & Dodge, 1994). As interpreting others' emotions involves complex cognitive processes that develop throughout childhood, interpretations of and attributions for mothers' emotions may be associated with internalizing problems later in development. Furthermore, impaired prosocial functioning may be a mechanism through which children develop internalizing problems later in development; indeed, poorer social competence in late childhood has been associated with greater internalizing problems in adolescence and early adulthood (Burt, Obradović, Long, & Masten, 2008). It is important to note that some children likely evince multiple processing biases, rendering them vulnerable to both poor prosocial skills and internalizing problems; indeed, in our study, individual children with less positive attention biases, conferring risk for internalizing problems, also tended to exhibit less positive interpretation biases, conferring risk for poorer prosocial skills.

Limitations

Several limitations of the study design should be described. First, although the simulated phone call provided an opportunity to study individual differences in response to the same event, it may have appeared artificial to some children. Second, a small percentage (7%) of children reported personal responsibility for mother's negative emotions. Replication of this finding using paradigms that capture greater variability in misattributions of personal responsibility for mother's negative emotions is warranted. Third, primarily white, well-educated mothers participated, possibly limiting the generalizability of the findings. Fourth, convenience sampling was used, and children's mean internalizing symptoms scores were in the average range; future studies should examine how children's processing of their mother's emotions relates to their internalizing problems in clinical samples of children. Finally, this cross-sectional study cannot elucidate how children's attention to, interpretations of, and attributions for their mother's emotions are related to their prosocial skills and internalizing problems over time.

Future Research

Researchers should investigate processes that explain how children's processing of their mother's emotions facilitates or impairs prosocial skills and contributes to risk for internalizing symptoms. For example, studies should test maladaptive guilt as a mediator of associations between children's less positively biased processing of their mother's emotions and deficient prosocial skills. Longitudinal studies should determine if prosocial functioning during childhood mediates associations between emotion processing biases in early childhood and internalizing problems later in development. Furthermore, examining attention to, interpretations of, and attributions for their mother's emotions in young children of depressed or anxious mothers during simulated emotional paradigms may be important for understanding intergenerational transmission of risk for internalizing problems. Indeed, although beyond the scope of the current study, future research might utilize this study's novel paradigm to examine the role of maternal health, affect and/or parenting behaviors as well as demographic factors and the affective family environment in associations between children's emotion processing biases and social and emotional outcomes. For instance, children of color and of lower socioeconomic status may be at risk for poorer emotional competence (Trentacosta & Fine, 2011), and lower income families often experience emotional distress (McLoyd, 1990), both of which may influence children's processing of mothers' emotions. Future studies might also utilize variations of paradigm, for example by changing the order of the emotional content or exposing children to just one emotion (e.g., mother's anger), to test other novel questions about children's emotion processing. Finally, our findings suggest possible additional targets for early interventions aimed at improving children's prosocial functioning and reducing their internalizing problems. Researchers may investigate the effectiveness of improving children's control of their attention toward and disengagement from their mother's positive and negative emotions and teaching accurate interpretations of and attributions for mother's emotions. Such research might also inform strategies for teachers and parents to use to help children process others' positive and negative emotions in ways that will support their social, emotional and academic functioning.

Conclusion

This study showed that young children's social and emotional functioning is related to how they selectively attend to, interpret, and attribute their mother's emotions. Children who had less of a positivity bias when interpreting the intensity of their mother's emotional displays and misattributing themselves as the cause of their mother's emotions had poorer prosocial skills, and children who had less of a positivity bias when attending to their mother's emotions had more internalizing problems. These findings suggest that processing of mothers' emotions may contribute to developmental trajectories leading to children's social deficits and internalizing problems and thus may be important targets for early interventions.

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Table 1

Correlations among Study Variables

Variables	1.	2.	3.	4.	5.	6.	7.	8.
1. Age								
2. Mother's Expressiveness during Phone Call	.14							
3. Prosocial Behaviors during Phone Call	-.24*	-.04						
4. Attention Bias	-.01	-.18	.12					
5. Interpretation Bias	.01	-.22*	-.05	.24*				
6. Misattributions of Personal Responsibility for Positive Emotions	-.14	.05	.20	-.10	.21*			
7. Misattributions of Personal Responsibility for Negative Emotions	.12	.02	-.13	.03	.02	.00		
8. Prosocial Skills	.01	-.03	.21	.05	.32**	.34**	-.25**	
9. Internalizing Problems	-.07	-.19	-.14	-.20*	.04	-.11	-.05	-.17

Notes. Attention Bias = ratio of time spent attending to mothers' positive/negative emotions. Interpretation Bias = ratings of the intensity of mother's positive/negative emotions. Misattributions of Personal Responsibility for Mother's Positive and Negative Emotions (0=not responsible; 1=responsible);

* $p < .05$,

** $p < .01$.

Table 2

Means and Standard Deviations of Study Variables

	<i>Mean (SD) or Frequency</i>
Age (months)	59.57 (6.43)
Gender (% female)	52.4%
Mother's Expressiveness during Phone Call	3.45 (.59)
Prosocial Behaviors during Phone Call	1.16 (.25)
Attention Bias	.87 (.20)
Interpretation Bias	1.30 (1.02)
Misattributions of Personal Responsibility for Positive Emotions (% Responsible)	40.2%
Misattributions of Personal Responsibility for Negative Emotions (% Responsible)	6.1%
Prosocial Skills	13.28 (2.83)
Internalizing Problems	48.33 (10.39)

Table 3

Regression Analyses for the Effects of Children's Interpretations of Mother's Emotions on Children's Prosocial Skills

	R^2	p	β	p	sr
Step 1 (Statistical Controls)	.07	.25			
Age			.05	.66	.05
Gender			.15	.19	.15
Mother's Expressiveness during Phone Call			-.03	.19	-.03
Prosocial Behaviors during Phone Call			.23	.05	.23
Step 2 (Hypothesized Predictors)	.24	<.001			
Attention Bias			.02	.88	.02
Interpretation Bias			.29	.01	.26
Misattributions of Personal Responsibility for Positive Emotions			.29	.008	.27
Misattributions of Personal Responsibility for Negative Emotions			-.22	.04	-.21

Notes. Total $R^2 = .30$. sr = semipartial correlation coefficient. Gender (0=male, 1=female). Responsibility for Positive and Negative Emotions (0=not responsible, 1=responsible).

Table 4

Regression Analyses for the Effects of Children's Interpretations of Mother's Emotions on Children's Internalizing Problems

	R^2	p	β	p	sr
Step 1 (Statistical Controls)	.09	.14			
Age			-.09	.44	-.06
Gender			.15	.18	.15
Mother's Expressiveness during Phone Call			-.19	.09	-.19
Prosocial Behaviors during Phone Call			-.16	.15	-.16
Step 2 (Hypothesized Predictors)	.05	.35			
Attention Bias			-.24	.04	-.22
Interpretation Bias			.07	.56	.06
Misattributions of Personal Responsibility for Positive Emotions			-.11	.35	-.10
Misattributions of Personal Responsibility for Negative Emotions			-.02	.84	-.02

Notes. Total $R^2 = .14$. sr = semipartial correlation coefficient. Gender (0=male, 1=female). Responsibility for Positive and Negative Emotions (0=not responsible, 1=responsible).