I help when I feel, I feel when I help: Investigating the role of young children's emotion in relation to different types of prosocial behavior

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This study examined children's emotion both preceding and following prosocial behavior in 215 children aged 16-28 months in three prosocial tasks (helping, sharing, and comforting). The study employed a novel emotion measure to capture children's positive and negative emotion holistically and continuously. The study aimed to (1) determine to what extent negative emotion precedes and either motivates or inhibits early prosocial behavior, and to what extent positive emotion follows and possibly reinforces prosocial behavior; (2) whether these patterns vary by age or prosocial task; (3) whether children's temperamental positivity or negativity account for relations between children's emotion and prosocial behavior.

Results revealed first that, contrary to theoretical predictions, children were neither intensely negative nor highly positive, either preceding or following prosocial behavior. Rather, children's emotion varied from mildly positive to more positive. This introduces the important theoretical possibility that very early prosocial behavior arises within and is governed by positive rather than negative emotional contexts. Second, older children were more prosocial and also more positive both preceding and following prosocial behavior, and positivity during prosocial tasks explained age differences in prosocial behavior. However, nuanced findings emerged regarding age- and task-specific effects in relation to children's emotion preceding and following prosocial behavior. Third, children who were more temperamentally positive were more prosocial and were more positive preceding and following a prosocial act. Critically, controlling children's

temperamental emotionality reduced or eliminated the effects of positivity on prosocial behavior and changed previously found relations between age and prosocial task. However, controlling temperamental emotionality did not affect age differences in prosocial behavior; older children were still more prosocial than younger children.

These novel findings suggest that children's emotion in prosocial situations is partly a function of their temperamental emotionality and that neither negative nor positive emotion can independently explain children's nascent prosocial acts. In sum, prosocial behavior may arise in positive emotional contexts, with a limited role for negative emotion in motivating very early prosociality, and young children's emotional responses in prosocial situations are likely driven in part by their temperament rather than being inherent to the prosocial act itself.

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Preface

While a dissertation is an independent scholarly milestone, the completion of this dissertation is also a testament to the support, advice, and love I have received from dear mentors, friends, and family members in the past six years. I could not have done this alone.

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Finally, I dedicate this dissertation to my late grandfathers, Dimitar and Venko. Thank you for your unconditional belief in me. I think of you often.

1.0 Introduction

Prosocial behavior describes voluntary actions that benefit another individual (Eisenberg & Fabes, 1998). Nascent prosocial behavior in 1-3-year-old children include picking up dropped pencils or clothespins, opening cabinet doors (Dahl et al., 2017; Newton, Goodman, & Thompson, 2014); sharing treats, toys, or food (Aknin, et al., 2012; Wu, Zhang, Guo, & Gros-Louis, 2017); and attempting to comfort someone who is distressed or sad (Nichols, Svetlova, & Brownell, 2014; Spinrad & Stifter, 2006; Svetlova, Nichols, & Brownell, 2010). Developmental psychologists have long demonstrated a marked interest in studying prosocial behavior during toddlerhood and in mapping out the developmental trajectory of emerging prosocial behavior during the first years of childhood (Warneken & Tomasello, 2007; Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992).

Early prosocial acts describe a fascinating developmental phenomenon: while 1-3-year-old children often bite, scratch, and take toys away from others, they can also engage in a range of rudimentary prosocial acts (Brownell, 2016). Emerging helping, comforting, and sharing attempts draw attention to young children's responses to the emotions and needs of others, but also to children's own emotion in prosocial contexts. Does children's own emotion motivate prosocial behavior, or does it interfere? Does helping another in need give even very young children the same feeling of a "warm glow" that it gives adults? To date, there has been no systematic empirical study of 1-3-year-old children's emotional responses in relation to emerging prosocial behavior that takes into account emotion of positive and negative valence in the same study. This limits both the empirical and theoretical picture of young children's emotion in relation to prosocial behavior.

This study addressed two theoretical proposals about the roles of young children's negative and positive emotion in emerging prosocial behavior: (1) in response to someone else's distress, young children show negative emotion before comforting someone else, thus suggesting that children's negative emotion motivates early prosocial behavior (e.g., Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992), and (2) young children are more positive after sharing treats or toys, which suggests that children's positivity reinforces and sustains prosocial behavior, i.e., children may continue to behave prosocially because it "feels good" to do so (Aknin et al., 2012). However, these have not been studied in the same children on the same tasks.

Moreover, we do not know how young children's temperamental emotionality, i.e., how positive or negative children are overall, relates to their emotion during prosocial tasks. This is important because it is possible that differences in children's temperamental positivity or negativity underlie associations between children's emotion and prosocial behavior in the moment. For example, more positive children might be generally more prosocial, experience less negative emotion in response to the need of another, or respond with more positive emotion after engaging in prosocial behavior. Further, 1-3-year old children's emotion in relation to prosocial behavior, whether of negative or positive valence, has not often been compared across age, especially their emotion following a prosocial act. Nor have different types of prosocial behavior (e.g., helping by picking something up that was dropped versus comforting someone in distress) been compared with respect to how children respond emotionally. Not only do various types of prosocial behavior make different behavioral demands on children, but they also make different emotional demands. As a result of these empirical limitations, our understanding of the potentially distinct functions of positive and negative emotion in early prosocial behavior remains limited.

With the intention of providing a fuller understanding of the role of emotion in prosocial behavior during the period when it is first emerging, this study addressed four main aims: (1) to examine children's emotion preceding prosocial behavior; (2) following prosocial behavior; (3) as a function of age (16, 24, or 28 months) and prosocial task (helping, sharing, or comforting); and (4) in relation to temperamental positivity/negativity. Using data from four independent studies of early prosocial behavior, I measured 1-2.5-year-old children's emotional valence and intensity during prosocial tasks and their temperamental emotionality (i.e., positivity/negativity during relaxed free play).

In what follows, I review two separate lines of research that motivated this study: on negative emotion preceding (and possibly motivating) prosocial behavior and on positive emotion following (and possibly reinforcing) prosocial behavior during early childhood. I also discuss the roles of age and type of prosocial task in relation to children's emotion and nascent prosociality. In addition, I review what we know about children's temperamental positivity and negativity in emerging prosocial behavior. Finally, because studying emotion in laboratory settings poses unique measurement challenges, I highlight issues of conceptualizing and measuring emotion in young children and introduce a novel method for assessing young children's emotion to help resolve some of these issues.

1.1 Negative emotion and prosocial behavior

Interest in studying the relationship between negative emotion and prosocial behavior in childhood originates from seminal theoretical and empirical work linking negative emotion with helping, caring, and compassionate behavior in adults. In 1987, Batson, Fultz, and Schoenrade

proposed that adults' prosociality is motivated by the experience of "emotional empathy," i.e., feelings of negative emotion (distress, sadness) on someone else's behalf (concern for another), serve to promote a prosocial act. In prosocial contexts, personal distress manifests in alarm, distress, and worry, triggered by witnessing the plight of another; whereas empathy reflects true understanding of the situation of another and results in feelings of compassion, kindness, and softheartedness along with concern for the other's well-being (Batson, Fultz, & Schoenrade, 1987).

While in some cases both personal distress and empathy can promote prosocial behavior, the motivational mechanisms that are recruited to produce a prosocial act differ. Personal distress induces "egoistic" prosocial behavior, i.e., helping someone else alleviates one's own experience of negative emotion. Importantly, since other types of behavior can also reduce one's own distress (e.g., avoidance of or distraction from the needy other, leaving the situation), the experience of personal distress does not necessitate engaging in prosocial behavior. In contrast, feelings of empathy are associated with "altruistic" prosocial behavior, that is helping someone else to alleviate their distress rather than one's own, motivated by feelings of compassion and concern for the other (Batson et al., 1987).

Initial empirical evidence supports this theory: in seven empirical studies, Batson reported that adults who experienced greater personal distress were less prosocial than adults who experienced greater empathy, especially when avoiding or leaving the prosocial situation was possible (studies reviewed in Batson et al., 1987). In subsequent decades, theoretical and empirical work has revealed a more sophisticated pattern of relations between personal distress, empathy, and prosocial behavior in adults. In response to the need of someone else, adults experience both personal distress and empathy. Empathy recruits higher-order cognition, while personal distress likely occurs because of affective contagion and is, therefore, more likely to be entirely emotion-

based. Since personal distress is both arousing and self-focused, too much personal distress can interfere with prosocial behavior, even when one also feels empathetic (Eisenberg et al., 1994; Eisenberg & Miller, 1987). Indeed, in a sample of college-aged adults, perspective taking (a key aspect of empathy) positively predicted volunteering when personal distress was low. In adults who reported moderate to high levels of personal distress, however, perspective taking did not consistently predict volunteering (Carlo et al., 1999). Of course, adults can usually regulate their negative emotions sufficiently well to permit them to help someone else even when they are themselves upset (Batson et al., 1987). Moreover, adults have advanced social and emotional understanding competencies that help them figure out what someone else needs and how they can effectively intervene on another's behalf.

Importantly, the experience of negative emotion in response to the need of another has been conceptualized as a developmental process (Eisenberg & Fabes, 1992; Hoffman, 1990). Just like in adults, children's negative emotion is proposed to motivate them to engage in prosocial behavior, either to help the other person, to alleviate one's own discomfort and distress, or both (Eisenberg et al., 1989; Eisenberg & Fabes, 1990). However, this develops over the first two years of life. Seminal theory argues that, from birth, infants share the affective states of others through emotional contagion (Hoffman, 1975, 2000). Contagious responding in infancy can be in response to the distress of another (e.g., crying when another baby cries) or the positivity of another (e.g., infants begin to reciprocate their parents' smiles around two months of age, referred to as "social smiling"). Thus, the mechanism for experiencing distress in response to another's distress appears early in life. However, this is insufficient to motivate prosocial responding. During the second year, children begin to distinguish between self and other and, simultaneously, they start to develop emotion regulatory skills (Zahn-Waxler et al., 1992). It is young children's growing social and

emotional understanding, paired with their maturing emotion regulation, that permits them to intervene prosocially in response to the distress of another in need.

Specifically, with age toddlers come to distinguish between their own (contagious) distress and others' emotions, and can represent and reason about them independently (Hoffman, 2007). This permits them to begin to understand others' needs and distress, including the causes and what might alleviate them. Ample empirical evidence shows that, indeed, by 24 months of age, children are sometimes able to comfort an adult in distress with a pat or a hug or bringing the adult a comfort object like a blanket or a toy (e.g., Brownell, Svetlova, & Nichols, 2009; Nichols et al., 2009; Spinrad & Stifter, 2006; Zahn-Waxler et al., 1992).

For this to occur, however, children must also be able to regulate their own emotions sufficiently well to permit them to act on their social and emotional understanding. For example, Liew et al. (2011) found that, among 18-28-month-old children, those who experienced higher levels of fearfulness, negative emotion, and sought parental comfort were less likely to help an adult who accidentally hurt herself. Recent findings by Waugh and Brownell (2017) also support this: 18- and 28-month-old children who did not engage in prosocial behavior when an adult was distressed showed more wariness and sought more comfort from their parents than did children who helped. Thus, whether children's own distress is a response to another's distress or is a result of situational wariness or behavioral inhibition, they must be able to control it well enough to be able to recruit and use their social and emotional understanding to reason about the situation, and must be willing to approach the person in distress in an attempt to help.

Research on the development of emotion regulation, i.e., one's ability to manage emotional arousal, shows that emotion regulation undergoes significant development in the second year of life, becoming more autonomous and more effective. During infancy and toddlerhood, children

begin to transition from relying on caregivers' attempts to soothe and regulate their aversive emotional states to gradually being able to self-regulate (Dollar & Calkins, 2014). Improvements in young children's emotion regulation abilities occur relatively rapidly and correlate with a range of positive behavioral outcomes throughout childhood, including prosocial behavior (Dollar & Calkins, 2014; Eisenberg, 2000). These developments in emotion regulation permit children to engage in prosocial behavior, either to further reduce their own negative emotion or out of concern for the other's well-being (Eisenberg et al., 1989; Hoffman, 1981).

The proposed relations between negative emotion in toddlers (e.g., crying, freezing, seeking comfort and proximity to their parent, showing concern or distress) and prosocial behavior were first studied by Zahn-Waxler and Eisenberg (Eisenberg et al., 1989; Zahn-Waxler et al., 1992). The earliest studies linking children's negative emotion and prosocial behavior were conducted as home assessments in which parents enacted physical pain and distress. Subsequent laboratory-based studies followed similar paradigms and, under more controlled conditions, examined children's reactions to the distress, sadness, or pain of a parent, experimenter, or an infant peer[1] (Newton et al., 2014; Bandstra, Chambers, McGrath, & Moore, 2011; Brownell, Svetlova, & Nichols, 2009; Nichols et al., 2014; Spinrad & Stifter, 2006, Zahn-Waxler et al., 1992). This research has shown that young children's negative emotion, whether in the form of personal distress or in the form of empathic concern for another's distress, is an essential aspect of emerging prosociality. Thus, prosocial children are likely to experience negative emotion in the prosocial situation, but at less intense levels than children who do not respond prosocially. Based

[1] The manipulation in which a parent or an experimenter enacts pain after "accidentally" hurting herself (e.g., dropping a toy on her foot) is now widely established. Upon accidentally hurting herself, the adult then shows negative facial expressions and vocalizations (e.g., "Ouch! My toe hurts!") and body movements consistent with pain and distress (e.g., rocking, rubbing the injury), while awaiting the child's help (Dunfield et al., 2011; Eisenberg et al., 2016; Zahn-Waxler et al., 1992). In similarly-structured paradigms, a smaller number of studies examine children's prosocial responses towards an experimenter who is cold or sad (e.g., Drummond, Paul, Waugh, Hammond, & Brownell, 2014) or towards a realistic-looking crying baby doll (e.g., Nichols, Svetlova, & Brownell, 2009; Nichols et al., 2014; Spinrad & Stifter, 2006).

on theory and past empirical findings, *the current study hypothesized that children who were less negative during prosocial tasks would be more likely to engage in prosocial behavior.*

However, measurement of negative emotion in toddlers presents important challenges. It has been inconsistent across studies of very early prosocial behavior, and there are seldom validating criteria provided. For example, individual discrete indicators of negative emotion (e.g., crying, pouting, eyebrow furrowing, freezing, etc.) have not been useful in predicting young children's prosocial behavior, rather these have been lumped together to describe the larger construct of personal distress (Petkova & Brownell, 2020). This is because, individually, these indicators of children's experience of negative emotion cannot be reliably and consistently detected in this age group, in part because such behaviors occur with relatively low frequency, and in part because very young children's facial expressions are not reliably linked to the emotion context (Camras et al., 2002). As a result, most studies examine only some indicators, without particular theoretical justifications and without assessing the construct validity or measurement reliability of either the individual measures or their composites. Therefore, current measures of young children's negative emotion preceding prosocial behavior fail to capture the full expression and intensity of their emotion, possibly weakening, or even invalidating, findings and conclusions. *In the proposed study, children's negative emotion is assessed holistically – by measuring emotional valence (positive/negative) and intensity (continuously) as demonstrated across multiple modalities, including facial, bodily, verbal, vocal, and postural indicators.*

1.2 Positive emotion and prosocial behavior

To be considered truly prosocial, actions must be undertaken out of concern for another and to promote another's welfare (Batson, O'Quin, Fultz, & Vanderplas, 1983; Batson & Shaw, 1991). Social psychology research provides strong support for the role of positive emotion in motivating and sustaining prosociality in adulthood. In adults, volunteering, caring for a loved one, or spending money on someone else have been associated with subsequent positive emotion (Aknin, Whillans, Norton, & Dunn, 2019; Dunn, Aknin, & Norton, 2014; Dillard, Schiavone, & Brown, 2008; Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006). Researchers have proposed that positive emotion sustains prosocial behavior in adults by providing feelings of "warm glow," i.e., joy, warmth, and connectedness after performing a prosocial act (Aknin et al., 2012).

However, both theory and empirical research on prosocial behavior with young children has disproportionately focused on their negative emotion as a motivator of prosocial behavior. Yet, a small emerging work in developmental psychology has begun to describe a "warm glow" pattern in young children as well: Aknin et al. (2012) reported that 22-month-old children were happier after complying with an instruction to share treats with a "hungry" puppet than they were before sharing; Hepach and colleagues showed that 29-31-month-old children showed increased happiness and signs of pride after helping an adult (Hepach, Vaish, & Tomasello, 2017); and Wu et al. (2017) showed that 33-60-month-old children were happier after spontaneous, but not obligatory, sharing with an imaginary child. Together, these results provide initial evidence for the possibly unique role of positive emotion in relation to emerging prosocial behavior, that is, that "warm glow" effects occur in early development as well as in adulthood.

We do not know whether the earliest instances of prosocial behavior bring about positive emotion as they do in older children and adults, or whether young children's positive emotion may be due to other factors unique to the very young. That is, early in childhood positive emotion following prosocial acts may not be due to an altruistic "warm glow" from reducing another's need or distress, but instead arise from more basic motives such as increased social connection, mastery, pride, or receiving social approval. Nevertheless, the results by Hepach et al. (2017) and Aknin et al. (2012) raise the possibility that, perhaps by the second year of life, children's prosociality is linked not only with distress in response to the need of others, but potentially with positive emotion as well.

Further work is needed to understand children's positive emotion in relation to their prosocial behavior, especially in relation to age and type of prosocial behavior. Younger children need to be studied since prosocial behavior is evident as early as 14 months of age (Warneken & Tomasello, 2007), whereas the youngest age group typically studied for their positive emotional response is a year or older. Accordingly, the youngest age group in the current study was 16 months of age, when children have begun to demonstrate simple prosocial acts. In keeping with existing empirical work with young children, and the presumed function of positive emotion in this age group, *I hypothesized that children would be more positive following prosocial behavior*.

Of note is that the few studies reporting a positive association between prosocial behavior and subsequent positivity are methodologically constrained in relation to assessment of children's emotion. For example, both Aknin et al. (2012) and Wu et al. (2017) relied on 7-point Likert-scales (1 – not at all happy; 7 – very happy) to detect change in children's positivity following their prosocial behavior, thus assigning a single value indicating valence for children's emotion before and after their prosocial behavior. Importantly, this Likert-scale approach assumes that children's

emotion would be of neutral to positive valence and, thus, does measure children's negativity. In addition, in these two studies, only children who were prosocial were included in analyses, which limits our understanding of the emotion of children who did not engage in prosocial behavior.

We do not know, therefore, whether children who were not prosocial were also positive at the end of the task, whether they showed negativity when faced with a situation that required prosocial intervention, or what other emotion-relevant behavior they may have displayed. Additionally, Hepach et al. (2017) included a measure of children's posture, relating increases in postural change to feelings of "warm glow" and pride following helping; yet we do not know with certainty whether postural change alone is a reliable predictor of positivity in very early childhood. While Hepach et al. (2017) also measured the occurrence of smiling, smiles occurred with relatively low frequency and, again, the approach confines children's expression of emotion to a single discrete behavior. Other indices of positivity (or negativity), including vocalizations, approach/avoidance, gestures, and so on were not assessed. Finally, the indices of positive emotion in these studies are very different from those for negative emotion preceding prosocial behavior, making it impossible to compare and integrate the two. To overcome these methodological constraints, the current study examined young children's emotional positivity following prosocial behavior using the same holistic, continuous rating of emotional valence and intensity as for negative emotion preceding prosocial behavior.

1.3 Age in relation to emotion and prosocial behavior

Early in development, children's emotion in relation to prosocial behavior changes (Eisenberg et al., 1989; Wu et al., 2017) as a function of their growing social and emotional

understanding and emotion regulation abilities (Ensor & Hughes, 2005; Hoffman, 2007; Reschke, Walle, & Dukes, 2017). To date, theory and empirical work have largely focused on examining age effects in relation to children's negative emotion preceding prosocial behavior. The role of age in associations between children's positive emotion following prosocial behavior remains understudied, yet emerging work suggests that age likely plays a role in these associations, too.

1.3.1 Age and negative emotion preceding prosocial behavior

As children grow older, their more advanced emotion and social understanding permit them to better understand why another is upset, to regulate their negative emotion when exposed to the need or distress of another, and, as a result, to respond prosocially (Eisenberg, 2000; Hoffman, 1990). Within the span of only a year, children's prosocial behavior undergoes marked changes. Fourteen- to 16-month-old children can pick up and return an object that an adult dropped (Svetlova et al., 2010; Warneken & Tomasello, 2007), demonstrating understanding of others' immediate goals, but they seldom share (Brownell, Iesue, Nichols, & Svetlova, 2012; Brownell et al., 2009) or comfort (Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011) which require more advanced understanding of others' internal emotional states and desires; by 24 months of age, children can sometimes comfort someone who is distressed or sad (Nichols et al., 2014), and by 30 months of age this ability has become more robust and general in concert with relevant advances in understanding of others' intentions, desires, and emotions (Brownell, Nichols & Svetlova, 2013; Svetlova, et al, 2010).

At the same time, children's growing emotion regulation plays an equally important role. As early as the first half of the second year in life, just like in older children and adults, toddlers show signs of negative emotions in situations that call for prosocial intervention (Liew et al., 2011;

Nichols et al., 2014; Spinrad & Stifter, 2006). However, excessive negative emotion can interfere with prosocial behavior at any age. This might be especially likely in younger children whose emotion regulation skills are still developing and may not yet be very effective. Indeed, high levels of negative emotion have been associated with lower levels of prosocial behavior in 1-2-year-old children (Eisenberg, 2000; Eisenberg et al., 1989). In contrast, second and third grade children who showed distress in response to the need of another demonstrated significantly higher rates of prosocial behavior in a variety of situations than did much younger children (Eisenberg et al., 2016). This is presumably because they were able to better regulate their own negative emotion, which enabled them to intervene prosocially. As Eisenberg (2000) argues, effective emotion regulation permits more other-oriented concern and behavior toward others.

Given the role of emotion understanding and emotion regulation in prosocial behavior among older children, and what we know about their development during the period when prosocial behavior is emerging, the current study aimed to examine relations between negative emotion and prosocial behavior in three age groups: 16, 24, and 28 months. Specifically, *I expected age-related differences in both prosocial behavior and emotion preceding prosocial acts, such that older children would be more prosocial than younger children and would also be less negative preceding a prosocial act. Furthermore, the current study examined whether emotional positivity/negativity preceding prosocial behavior mediated age-related differences in prosocial behavior, which is as yet unexamined in toddlers.*

1.3.2 Age and positive emotion following prosocial behavior

Unlike studies on negative emotion and prosocial behavior, the limited number of empirical studies in this age range have been conducted with children of 22 months or older. Considered

across studies, there is some evidence of age differences in positive emotion in relation to prosocial behavior in 22-24-month- versus 33-60-month-old children. Younger children's positive emotion followed prosocial behavior that had been explicitly requested (Aknin et al., 2012) or that occurred in a structured paradigm and was instrumental in nature (Hepach et al., 2017). By 3 – 5 years, children experienced positive emotion after sharing spontaneously and in a more cognitively and emotionally demanding situation, i.e., sharing with an imaginary child and without the benefit of directly perceived, overt emotion in the recipient of the prosocial behavior (Wu et al., 2017).

These results suggest that, with age, children's positive emotion following prosocial behavior might be due to an increased awareness of the needs of others and being able to assist others with their needs (Carpendale, Kettner, & Audet, 2015; Hammond & Brownell, 2018). Correspondingly, younger children might be less positive following prosocial behavior if they do not yet fully understand others' needs or their own role in meeting them. In addition, because the earliest prosocial acts may be less about relieving another's needs or distress, given limitations in one-year-old children's social and emotional understanding (discussed above), and more about relieving one's own distress, we might expect to see lower levels of positive emotion following prosocial behavior at the youngest ages. The current study included 16-, 24-, and 28-month-old children to examine whether relations between prosocial behavior and positive emotion were moderated by age. *I hypothesized that older children would be more positive than younger children following prosocial behavior*.

1.4 Emotion in diverse prosocial tasks

Prosocial tasks, generally designed to resemble realistic social situations, vary in the type of need that children witness and in the emotional interpretations required of the child (Dunfield et al., 2011). Most of what we know about 1-3-year-old children's emotion and prosocial behavior in early childhood stems from studies that examined children's emotional and behavioral reactions towards the distress of another, i.e., in comforting situations, and immediately preceding prosocial behavior. As a result, we do not know whether children show negative emotion preceding prosocial behavior in other situations with a demonstrated need (e.g., sharing with a hungry other, or in instrumental helping tasks when the needy other's emotion is neutral). In addition, newer research on positive emotion following prosocial behavior has been limited to sharing and instrumental helping; no research has examined whether young children exhibit positive emotion after comforting someone in distress. It is therefore unknown to what extent negative emotion motivates (or inhibits) early prosocial behavior across multiple types of prosocial situations, as well as to what extent positive emotion similarly follows all types of prosocial behavior.

In the simplest prosocial tasks, administered to children as young as 12-14 months of age, children provide instrumental help such as picking up someone's dropped pencils, handing over an out-of-reach clothespin needed for the clothesline, or opening a cabinet door for someone whose hands are full (Newton et al., 2014; Warneken & Tomasello, 2007). Such instrumental helping tasks pose few emotion recognition or understanding demands on children (Dunfield et al., 2011; Svetlova et al., 2010) since the recipient remains emotionally neutral; the child relies instead on simple goal understanding. Yet children's *own* emotion in these tasks remains relatively understudied. We do not know whether children are likely to experience negative emotion preceding instrumental help, when they perceive that someone's goal has been blocked or can't be

attained, like they do in the more widely studied comforting tasks. As for children's emotion following helping, results suggest that young children cheerfully help adults achieve instrumental goals in household chores (Hammond & Brownell, 2018; Hepach et al., 2017; Rheingold, 1982), and are positive following either helping or sharing in laboratory tasks (Aknin et al., 2012; Hepach et al., 2017). However, it remains unclear how general positive emotion follows prosocial behavior since no research has included both sharing and helping in the same study, and the tasks used in different studies are not parallel. Moreover, no study has addressed whether young children's positive emotion increases after comforting someone who is distressed.

Relative to helping, comforting and sharing are more challenging because they require recognition and understanding of an internal emotional need rather than a simple, directly perceivable goal. In comforting tasks, the child has to recognize and understand the overt negative emotion of another, as well as understand what is causing the negative emotion, and must both wish to and know how to alleviate the need or distress (Dunfield et al., 2011; Svetlova et al., 2010). In sharing tasks, children also need to understand the other's material need as the source of emotional distress, as well as one's ownership of resources and that giving over one's own resources can alleviate the distress of another (Brownell et al., 2013). These inferences are difficult for 1-3-year-old children who may not yet be able to differentiate fully their own emotions and needs from others', and who find it difficult to connect an emotion expression to its cause (Russell, 1990). Moreover, comforting and sharing may place additional regulatory demands on young children. Therefore, in comparison with prosocial tasks of instrumental nature, it is possible that children would show more negativity prior to sharing or comforting, and that younger children would be more negative than older children.

In addition, it is possible that children who engage in comforting and sharing would show stronger positivity following these more emotionally demanding types of prosocial behavior than following helping in an emotionally neutral context. This might be especially true for older children who possess more advanced socio-emotional capacities and can regulate their negative emotion better which, in turn, would permit better understanding of their own role in alleviating another's emotion and, thus, greater positivity upon doing so.

To address these gaps in the literature the current study compared children's emotion preceding and following three different types of prosocial behavior: helping an adult who accidentally dropped pencils out of reach; comforting an adult who was cold; and sharing with a hungry "bunny." *In relation to emotion preceding prosocial behavior, I hypothesized that children would be more negative preceding comforting and sharing than helping, and further, that this would be moderated by age such that this pattern would be stronger for younger children. In relation to emotion following prosocial behavior, I hypothesized that children would be more positive following comforting and sharing than following helping, and that this pattern would be stronger for older children.*

1.5 Temperamental positivity/negativity and prosocial behavior

Adding complexity to understanding the emotional mechanisms underlying emerging prosocial behavior is that young children's temperamental emotionality affects their behavior as temperament stabilizes during the first few years of childhood (Rothbart, Ahadi, Hershey, & Fisher, 2001). Zentner and Bates (2008) describe positive and negative emotionality as higher order, central aspects of temperament in early childhood. In addition, Rothbart et al. (2001) showed

that relatively early in childhood stable individual differences relating to children's emotional reactivity and self-regulation abilities can be reliably detected (Rothbart et al., 2001). These findings pose questions about the role of young children's temperament in emerging prosocial behavior.

Young children's negative and positive affective predispositions are important to consider in relation to nascent prosocial behavior since young children's emotion within the prosocial situation (and associated prosocial behavior) might be at least in part accounted for by their overall positivity or negativity. For example, adults and children alike who are high in negative affectivity are generally likely to experience more intense distress and negative emotion, even in the absence of overt stressors (Watson & Clark, 1984). Children who are higher in negative affectivity tend to experience more frequent aversive emotional states (anger, fear, sadness), which, in turn, affects their ability to engage in a large array of behaviors, including prosocial behavior (Watson & Clark, 1984). On the other hand, more positive children, possibly driven by their eagerness to engage with others, reward sensitivity, and their less frequent experience of negative emotion (Rothbart, Bates, Demon, & Lerner, 2006) might not only be more frequent helpers, but also happier after prosocial behavior.

Indeed, empirical work shows that, beginning in the second and third years of childhood, individual differences in children's positivity and negativity correlate with children's prosocial behavior (Liew et al., 2011; Sallquist et al., 2009; Young, Fox, & Zahn-Xaxler, 1999; Zahn-Waxler et al., 1992). For example, Liew et al. (2011) showed that 18-30-month-old children who were less temperamentally fearful were more likely to comfort an adult who got accidentally hurt. Volbrecht, et al., (2007) found a positive association between infants' temperamental positivity at 12 and 22 months and their later helping behavior toward their mothers at 19-33 months. Yet the majority of

studies documenting relations between young children's negative emotion preceding prosocial behavior have not accounted for temperamental effects and none of the studies of positive emotion following prosocial behavior has done so (Petkova & Brownell, 2020). In summary, without examining children's temperamental emotionality in relation to their emotion preceding and following prosocial action, strong inferences cannot be drawn about the role of children's immediate, situational emotions in governing their prosociality. *I therefore examined whether children who were more temperamentally positive/negative were also more positive/negative preceding and following prosocial behavior.*

The roles of age and type of prosocial behavior are also relevant in considering whether and how temperamental emotionality might relate to children's emotions in prosocial situations. The effect of temperamental predispositions on children's behavior tends to decline with age (Sallquist et al., 2009), and older children's behavior is likely to be better tuned to the needs, wants, and expectations of others. *Accordingly, I hypothesized that relations between children's temperamental emotionality and their emotional valence during prosocial tasks would be influenced by age, such that older children's temperamental emotionality would be less likely to explain their emotion both preceding and following prosocial behavior.*

With respect to task effects, in some prosocial tasks (e.g., comforting someone who is upset) children witness the overt distress or emotional need of another, while other tasks are less emotional in nature (e.g., retrieving something another has dropped out of reach); it is possible that children's temperamental emotionality, at least in part, accounts for children's emotional reactions during more emotionally demanding prosocial tasks. *Therefore, I hypothesized that in the more emotionally demanding prosocial tasks requiring comforting and sharing, children's emotional*

positivity/negativity would be more influenced by temperamental emotionality than in the emotionally neutral instrumental helping task.

1.6 Measuring emotion

Emotion researchers have long recognized the difficulties of conceptualizing and measuring emotions objectively (Ekman & Rosenberg, 2005; Ekman, 1992). Studying young children's emotion, even in controlled laboratory settings, remains a particularly challenging task for developmental researchers (Camras et al., 2002). Studies that have coded emotion in relation to young children's prosocial behavior have varied in how children's emotions were defined and measured, without attention to either the frequency of such indices or the reliable detection of individual indices (Petkova & Brownell, 2020). This is particularly true for the studies on negative emotion and prosocial behavior in which a large range of potential negative emotion indices have been coded: gaze aversion and avoidance of the experimenter in 30-month-old children (Drummond, Hammond, Satlof-Bedrick, Waugh, & Brownell, 2016); freezing, crying, appearing wary, looking for parent in 18-24-month-old children (Nichols et al., 2014; Spinrad & Stifter, 2006); and expressions of distress accompanied by physiological change (Liew et al., 2011).

However, discrete indices of emotion occur with relatively low frequency in prosocial tasks (Petkova & Brownell, 2020). Moreover, very young children tend to show generalized, rather than specific facial expressions of emotions and their facial expressions often do not coincide with the emotion context; for example, they might exhibit facial disgust in a fear-inducing context, or might blend sadness and fear (Camras et al., 1998). Therefore, coding discrete expressions is likely to be less productive than coding emotions more holistically (Camras et al., 2002). Further,

operationalizing emotion exclusively with respect to discrete indices confines children's emotion to singular time-points (e.g., a smile) or expressions. Importantly, expressed emotion is conveyed across multiple bodily dimensions (posture, voice, face) over time and at varying levels of intensity. Because of such challenges, it makes more sense to measure emotion holistically, in terms of valence (positive/negative) and intensity rather than to focus on discrete behaviors, especially in very young children.

Finally, studies of emotion in relation to prosocial behavior in very young children have measured either positive emotion or negative emotion. No study has assessed both. Thus, it is possible that along with the low frequency and intensity of negative emotion as typically reported in toddler prosocial studies, toddlers also exhibit positive emotion. We have no way to know this from the current empirical work. Likewise, following prosocial behavior toddlers may not only exhibit positive emotion, but also negative emotion. For example, perhaps they are pleased at the social approval they receive upon sharing, but displeased about losing a prized possession. Again, current empirical work has not addressed this possibility. Thus, it is important to examine the full range of positive and negative emotion both preceding and following prosocial behavior to obtain a complete and accurate picture of how emotion functions to motivate or sustain early prosociality.

The use of continuous ratings of emotional valence and intensity has been adopted in adult studies on emotion and interpersonal relationships as a more accurate way of capturing how positivity and negativity change over short periods of time (Girard, 2014). This technique, however, has not been used in previous studies on young children's emotion and prosocial behavior. *The proposed study utilized continuous ratings of the valence and intensity of children's emotional behavior, thus capturing all dimensions of emotion expression holistically and*

continuously over time. As a result, this study also contributes methodologically to the study of 1-3-year-old children's emotion in the context of their emerging prosocial behavior.

2.0 The current study

The current study bridged two heretofore disparate bodies of theory and research: one on negative emotion before prosocial behavior and one on positive emotion after prosocial behavior. I examined young children's emotional valence both preceding and following prosocial behavior at three ages and in three prosocial tasks, each requiring intervention by the child on behalf of an adult in need or distress. Two commonly hypothesized emotional motivators of prosocial behavior, including in its earliest manifestations, are: 1) negative emotion preceding a prosocial act that induces the child to alleviate someone else's need or distress; and 2) positive emotion following a prosocial act that reinforces or maintains prosocial behavior. No previous study has examined both of these potential motivators in the same sample of children. No previous study has examined positive emotion following prosocial behavior in children as young as 16 months, or across multiple prosocial situations that vary in their emotional demands. Thus, the current study has the potential to add significantly to our understanding of how very young children's emotion relates to their prosocial behavior.

Empirical research has mostly studied the effects of children's negative emotion in response to witnessing the distress, pain, or sadness of another, with results showing that children as young as 16-18 months show negativity in response to the need of someone else. For very young children, whose emotion understanding and regulation abilities are just emerging, the experience of intense negativity might prevent them from engaging in prosocial behavior. Yet, as children's socio-emotional skills mature rapidly during the first few years of development, children become better able to understand others' emotions, to regulate their own negative emotion in response to others and to recognize what action is needed to alleviate the distress of another. *Thus, children*

who are less emotionally negative or more emotionally positive in the prosocial situation may be more likely to enact prosocial behavior than less positive children, and older children may be more positive than younger children, hence more prosocial.

Recent empirical work and theory from adult social psychology raise the possibility that even very young children's prosociality is linked not only with distress in response to the need of others, but potentially with positive emotion as well. With development in understanding others' emotions and increasing awareness of ones' own ability to reduce another's distress, children may come to experience positive emotion following prosocial action. *Thus, prosocial action might be likely to increase positivity among children, and to do so more strongly or consistently among older children.*

Because of their limited social understanding and emotion regulation abilities, young children's more general temperamental positivity or negativity may govern their actions and emotions in the prosocial situation as much or more than the immediate emotional demands of the situation itself, meaning that their emotions preceding and/or following prosocial behavior may not be specific to prosocial action. *Thus, young children's temperamental positivity or negativity may predict the likelihood of enacting prosocial behavior as well as their emotion preceding or following prosocial action; temperamental emotionality would be expected to exert less effect on older children's prosocial behavior as well as on their emotion preceding and following prosocial behavior.*

All of these patterns may differ depending on the nature of the prosocial task itself; *effects may be more evident in more emotionally demanding prosocial tasks,* such as comforting an adult in distress or sharing with a needy other, and because older children are more generally more

skilled in prosocial action and the underlying competencies, *task is likely to interact with age such that effects of task are more pronounced among younger children.*

Additionally, since children's emotion, of both negative and positive valence, appears to be an important factor in emerging prosocial behavior (Sallquist et al., 2009; Zahn-Waxler et al., 1992; Eisenberg et al., 1989), an objective and precise evaluation of children's emotion is crucial. To date, existing empirical studies have not assessed young children's emotion continuously and for the full duration of tasks requiring prosocial intervention, nor have studies assessed both positive and negative emotion in the same task. Confining measurement of emotion to single discrete behaviors during narrow intervals of time limits our understanding of how the valence and intensity of children's emotion relate to their prosocial behavior. The current study introduced a novel continuous measure of emotion to better understand children's emotion preceding and following their prosocial acts, thus expanding what we know about the role of emotion in several types of early-emerging prosocial behavior.

The current study, therefore, had four main aims. Aim 1 examined how children's emotion during prosocial tasks predicted prosocial behavior, as well as how predictions differed as a function of age and prosocial task. Aim 2 examined helpers' emotion immediately following prosocial behavior, also in relation to age and type of prosocial task. Aim 3 examined associations between children's temperamental emotionality and their emotion preceding and following prosocial behavior, again as influenced by age and type of prosocial task. Finally, Aim 4 re-examined relations between emotion preceding and following prosocial behavior after accounting for effects of temperamental emotionality.

3.0 Aims and specific hypotheses

3.1 Aim 1: Emotion preceding prosocial behavior

The first aim addresses questions related to the role of children's emotion preceding a prosocial act in predicting prosocial behavior. Children's emotion preceding prosocial behavior is examined as a predictor of prosocial behavior, as well as a mediator of the relationship between age and prosocial behavior. In addition, I examine whether type of prosocial task moderated relations between age and emotional valence during prosocial tasks (see Figure 1).

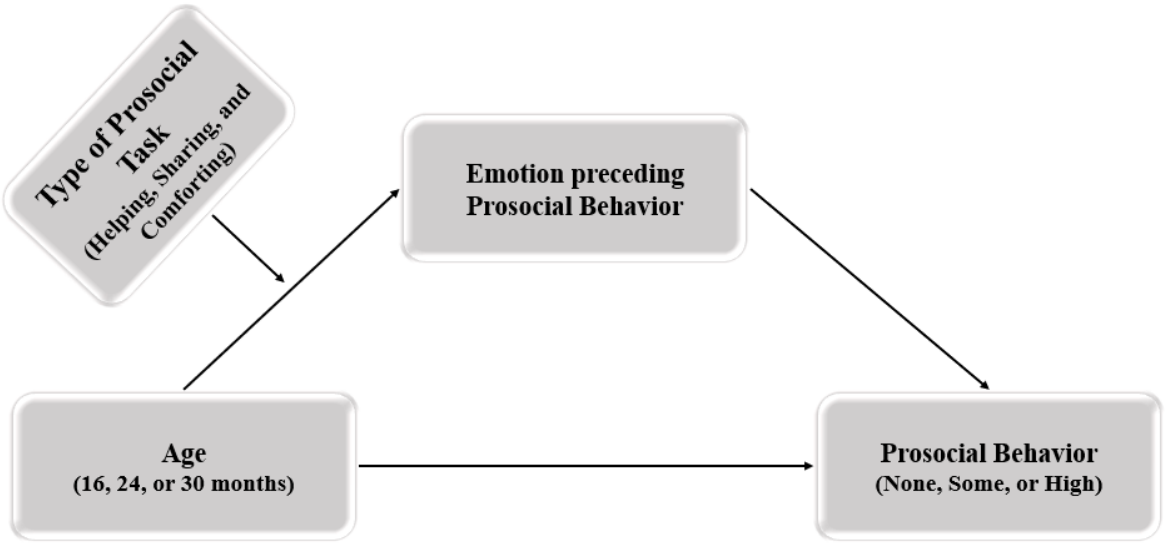


Figure 1. Aim 1 Descriptive Model

3.1.1 Hypothesis 1: Emotion preceding prosocial behavior will predict engagement in prosocial behavior

Across age and prosocial tasks, children who are less negative/more positive will be more likely to engage in higher rates of prosocial behavior.

3.1.2 Hypothesis 2: Age will predict (1) engagement in prosocial behavior and (2) emotion preceding prosocial behavior

Across prosocial tasks, older children will be (1) more prosocial and (2) less negative/more positive preceding prosocial behavior than will younger children.

3.1.3 Hypothesis 3: Emotion preceding prosocial tasks will mediate the relationship between age and engagement in prosocial behavior

Across prosocial tasks, the effect of age on prosocial engagement will be accounted for by children's emotion during prosocial tasks.

3.1.4 Hypothesis 4: Age and type of prosocial task will interact to predict emotion preceding prosocial behavior

Older children will be less negative/more positive preceding prosocial behavior than younger children in the emotionally demanding sharing and comforting tasks but not in the emotionally neutral helping task.

3.2 Aim 2: Emotion following prosocial behavior

This aim examines hypotheses related to children's emotion following prosocial behavior. Of necessity, the proposed hypotheses are specific to children who behaved prosocially in at least one prosocial task (for task-specific analyses) and two or three tasks (for analyses that collapse across tasks; see Table 2 for a breakdown). First, I examine whether positivity increased following prosocial behavior, then whether this effect differs by age. Next, I examine the role of age and type of prosocial task together in explaining children's positivity following prosocial behavior.

3.2.1 Hypothesis 1: Across age and prosocial tasks, children will be more positive following prosocial behavior than preceding prosocial behavior

Across age and prosocial tasks, children will be more positive following prosocial behavior than they were preceding prosocial behavior. If this hypothesis is confirmed, I will also test whether positivity increased following prosocial behavior separately in each of the three prosocial tasks.

3.2.2 Hypothesis 2: Across prosocial tasks, age will predict emotion following prosocial behavior

Across prosocial tasks, older children will be more positive following prosocial behavior than will younger children.

3.2.3 Hypothesis 3: Age and type of prosocial task will interact to predict emotion following prosocial behavior

Older children will be more positive than will younger children following prosocial behavior in the emotionally demanding sharing and comforting tasks but not in the emotionally neutral instrumental helping task.

3.3 Aim 3: Temperamental emotionality in relation to emotion preceding and following prosocial behavior

First, I examine whether children's temperamental positivity/negativity accounts for their emotion preceding and following prosocial behavior. Second, I examine whether age and prosocial task moderate these relations.

3.3.1 Hypothesis 1: Temperamental emotionality will predict emotion preceding and following prosocial behavior

Across ages and prosocial tasks, children who are temperamentally more positive will be more positive both preceding prosocial behavior and following prosocial behavior. If this hypothesis is confirmed, I will also test whether temperamental emotionality predicts children's emotion preceding and following each individual prosocial task.

3.3.2 Hypothesis 2: Temperamental emotionality and age will interact to predict emotion preceding and following prosocial behavior

Older children's temperamental emotionality will be less strongly associated with their emotion both preceding and following prosocial behavior.

3.3.3 Hypothesis 3: Temperamental emotionality and prosocial task will interact to predict emotion preceding and following prosocial behavior

In the more emotionally demanding prosocial tasks (comforting and sharing) children's emotion preceding and following prosocial behavior will be more influenced by their temperamental emotionality than in the emotionally neutral instrumental helping task.

3.4 Aim 4: Controlling for temperamental emotionality in relations between emotion and prosocial behavior

If children's temperamental emotionality predicts children's emotional valence preceding or following prosocial behavior, I will re-test relevant hypotheses from Aims 1 and 2 after controlling for temperamental emotionality

4.0 Methods

4.1 Participants

The proposed study included data from four previously completed laboratory play-based studies on early prosocial behavior (Drummond et al., 2016; Gross et al., 2015; Petkova et al. 2017, 2018; Hutchinson et al., 2017). Data from 215 children[2], aged 15-32 months, were included (*M* = 20.16 months; *SD* = 5.29; 106 girls) and each child only took part in one study. Study 1 included 65 16-month-olds (*M* = 16.37; *SD* = 1.35, 34 girls); Study 2 included 72 16-month-olds (*M* = 16.75; *SD* = 2.14, 36 girls); Study 3 included 31 24-month-olds (*M* = 23.94; *SD* = 1.39, 14 girls), and Study 4 included 47 28-month-olds (*M* = 28.13; *SD* = 2.49, 22 girls).

Families were recruited from the city of Pittsburgh and the greater Pittsburgh area via phone, email, and mail. Overall, 82.30% of the participating children were White/Caucasian and 17.70% were non-White (including African American, Asian, Latino/Hispanic, and biracial/multiracial). Participating children were full-term and typically developing, per parent report during initial phone screen and behavioral observations during laboratory visit. All children received a book for their participation. University IRB approval was obtained for all studies, as well as written and verbal consent from parents.

[2] Five children were excluded due to concern for developmental delay or distress that led to not completing the study.

4.2 Procedure

All studies were conducted in the same large playroom (3 x 4 m) and video recorded from behind a one-way mirror. Prior to entering the main playroom, children engaged in warm-up play in a separate room so that they became familiar with the setting and the two adult experimenters (subsequently referred to as E1 – lead experimenter and E2 – assistant experimenter). The parent completed informed consent during this period. The child, parent, and E1 and E2 then moved to the main playroom where prosocial tasks were administered. Additional tasks as part of the larger studies (e.g., imitation of an array of behaviors, accidentally breaking E's favorite toy) were also administered, but are not discussed here. Periods of free-play, and sometimes snacks and water, were interspersed between tasks to maintain children's interest and prevent fatigue. Parents remained in the playroom during the entire visit. They were asked not to coach or interfere with their children, and given questionnaires to fill out. A typical visit took approximately 45 minutes.

4.3 Prosocial tasks

Three types of prosocial tasks (instrumental helping, comforting, and sharing) were selected for inclusion. Two of these tasks, instrumental helping (for brevity, referred to as "helping") and comforting, were standard tasks and have been widely used by researchers who study prosocial behavior in young children. The sharing task was newly developed for Studies 2 and 3 but was modeled on previous research in this lab (Brownell et al., 2013). The three tasks varied in the type of need that E1 demonstrated and, consequently, in the type of help that children

could provide. Children had the opportunity to participate in two (Studies 1, 2, and 4) or three (Study 3) prosocial tasks (see Table 1 below).

Table 1. Number of Children in Prosocial Tasks by Age

Study	Age (months)	Helping	Comforting	Sharing	Two or Three Prosocial Tasks Completed
1	16	64	63	N/A	62
2	16	68	N/A	63	59
3	24	28	29	30	31
4	28	46	47	N/A	46
Total		211	145	90	198

Note. N/A denotes that the prosocial task was not administered.

4.3.1 Helping task

The helping task was administered in all included studies. In this task, E1 accidentally dropped several sticks and needed help picking them up as they had fallen out of reach (adapted from Over & Carpenter, 2009 and Warneken & Tomasello, 2007). E1 maintained a neutral facial expression and gave up to four increasingly specific cues every 10 seconds, culminating in an overt request for the sticks. Once children helped, the cues were discontinued, and the child was invited to join free-play with E1 and E2. Children were scored for whether they helped (yes/no), where helping meant that the child picked up at least one stick and handed it to E1.

4.3.2 Comforting task

The comforting task (adapted from Svetlova, Nichols, & Brownell, 2010) was administered in Studies 1 (16 months), 3 (24 months), and 4 (28 months). During free play, E1 feigned being cold by shivering and rubbing his/her arms and saying "I'm cold" after getting the child's attention. E1 showed the child that putting on a blanket made him/her feel warm. Later in the session E1 again feigned being cold, but E1's blanket had been placed on a table out of E1's reach. E1 provided up to four increasingly specific cues every 10 seconds, culminating in an overt request for the blanket. Once children handed the blanket to E1, the cues were discontinued, and the child was invited to join free-play with E1 and E2. Children were scored for whether they brought the blanket (yes/no).

4.3.3 Sharing task

The sharing task was designed for Studies 3 (16 months) and 4 (24 months). During free play, E1 and E2 introduced the child to their "bunny" (Furby™, a robotic interactive toy that resembles a small furry animal). E1 and E2 showed the child that feeding bunny with Cheerios™ made the hungry bunny feel better. Once fed, the bunny made noises indicating he/she (matched to child's gender) was content and no longer hungry. During the sharing task, an empty bowl was placed in front of bunny; the child, but not E1 or E2, had access to Cheerios™. E1 and E2 provided a series of open-ended cues, culminating in a final overt request for the child to feed bunny. Once children fed the bunny, the cues were discontinued, and the child was invited to join free-play with E1 and E2. Children were scored for whether they fed the bunny (yes/no). where successful feeding

was defined by placing at least one Cheerio™ in bunny's bowl without taking it back or by putting at least one Cheerio™ in bunny's mouth.

4.4 Measures

4.4.1 Prosocial behavior

Children had been previously scored for whether they were prosocial or not in each task (yes = 1/no = 0) for a total possible prosocial behavior score of 0 – 3 (see Table 2 for a breakdown of number of children who were prosocial by task and age). Children with a score of one or higher (i.e., who were prosocial on at least one task) were included in task-specific analyses that were restricted to prosocial children.

Table 2. Number of Children who Enacted Prosocial Behavior in Each Task by Age

		Helping		**Comforting**		**Sharing**	
Study	**Age (months)**	*Prosocial*	*Not Prosocial*	*Prosocial*	*Not Prosocial*	*Prosocial*	*Not Prosocial*
1	16	35	29	15	48	N/A	N/A
2	16	39	29	N/A	N/A	18	45
3	24	21	7	22	7	23	7
4	28	42	4	37	10	N/A	N/A
Total		137	69	74	65	41	52

Note. N/A denotes that the prosocial task was not administered in that study.

Additionally, to address hypotheses predicting overall prosociality (i.e., across prosocial tasks), an average prosocial score was computed for children who completed two or three prosocial tasks (prosocial behavior score (0-3) / number of tasks completed). Children who completed only one task did not receive an average prosocial score (n = 17). Since average prosocial scores were not continuously distributed, they were re-coded into a categorical variable indicating level of *prosocial engagement* (following Schachner, Newton, Thompson, & Goodman-Wilson, 2018)*:* *none* (for average prosocial scores of 0), *some* (for average prosocial scores between .33 - .50), and *high* (for average prosocial scores between .67 – 1). Overall, 51 (23.7%) children were in the *none* category; 64 (29.8%) were in the *some* category, 83 (38.6%) were in the *high* category, and 17 (7.9%) were excluded from the *prosocial engagement* score calculation.

4.4.2 Timing of prosocial behavior

The start of each task was the point in time when E1 first indicated need or distress (i.e., when E1 dropped the sticks, started shivering, or placed the bunny's empty bowl in front of the hungry bunny). If the child helped, shared, or comforted E1 acknowledged the child's act briefly (e.g., "Oh, now I am warm") and discontinued any subsequent cues. If the child did not produce a prosocial act by the last cue, the task was ended by E1. Regardless of whether the child engaged in prosocial behavior or not, E1 verbally marked the end of each task by saying "Ok! Now we will play a new game!" To address hypotheses related to children's emotion preceding and following prosocial behavior, the timing of helpers' prosocial acts was annotated from the video records by the primary author. The point in time when the prosocial act occurred was specified and used to demarcate coding of emotional valence preceding versus following prosocial behavior.

4.4.3 Emotional valence (positivity/negativity) during prosocial tasks

The valence and intensity of children's emotions was rated continuously, on a moment-by-moment basis with CARMA, a user-friendly and freely-available media annotation software program (availbale for download at https://carma.jmgirard.com/; Girard, 2014). This program allows for collecting continuous ratings during audio-visual display on a computer monitor and has gained popularity in adult studies of perceived and experienced emotion (Girard, 2014; Ross et al., 2016). Coders use the arrow keys on a keyboard to indicate emotional valence and intensity continuously during videos (see Figure 2 for an example of CARMA's interface). This approach allowed for collecting many data points describing children's emotional valence as it occurred and changed during prosocial tasks (unlike, for example, coding children's happiness by assigning a single score; Aknin et al., 2012).

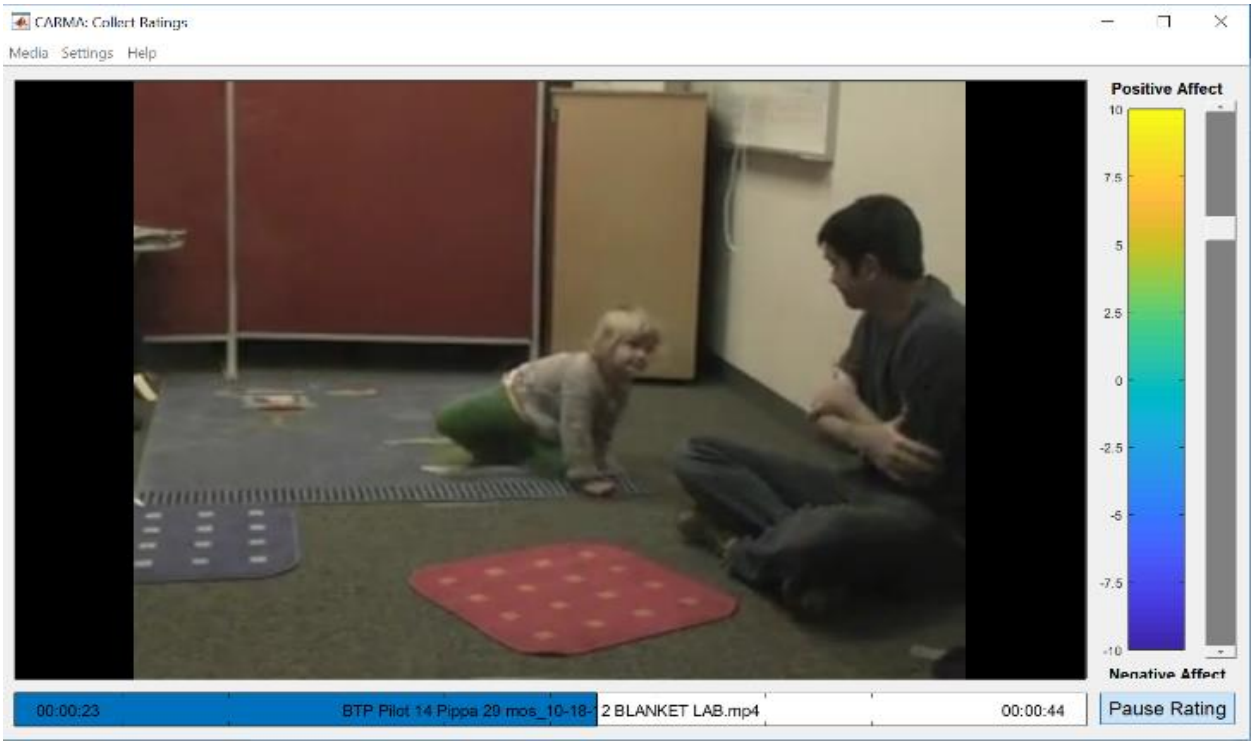


Figure 2. Example of Coding with CARMA

For the purposes of this study, CARMA's rating scale was calibrated from -10 (most negative) to 10 (most positive), where 0 indicated neutral. Coders naïve to the hypotheses of this study were trained to rate positivity and negativity by observing gross dynamic and static indicators (e.g., smiling or crying, posture and postural change, movement direction and quality, positive and negative verbalizations and vocalizations such as whining, laughing). No videos were excluded from coding unless the child's back was completely turned to the camera and there were no other indices of positivity/negativity (i.e., posture, movement, vocalizations, verbalizations). For each video, representing one task from a single child, there was a rating between -10 and 10 for each second of that video. For each video, these second-by-second ratings were averaged to obtain a task-specific *emotional valence* score.

Children had separate emotional valence scores for the helping, sharing, and comforting tasks and received up to four emotional valence scores per task: (1) all children were scored for emotional valence *during* the full duration of the task (i.e., from start of task until E1 ended the task as described above), (2) those who produced a prosocial act in a task also received emotional valence scores *preceding* prosocial behavior, *following* prosocial behavior, and (3) a *difference* score (emotional valence following – emotional valence preceding prosocial behavior). These scores were used in relevant task-specific analyses.

Additionally, for children who were prosocial in two or three tasks, average emotional valence scores preceding and following prosocial behavior, as well as average difference scores were computed (average emotional valence following prosocial act – average emotional valence preceding prosocial act). These were used for analyses that collapsed across prosocial tasks. *Emotional valence difference* scores were used in analyses that included multiple ages and prosocial tasks.

4.4.4 Baseline emotionality

Children's temperamental emotionality (i.e., how positive or negative children were outside of the prosocial tasks) was indexed by children's baseline positivity/negativity as assessed during relaxed free play. Episodes of free-play were interspersed between prosocial and other tasks. During these episodes, E1 and/or E2 played together with the child with a variety of interesting toys. For each child, three 40-second episodes of free-play from the main session (after the initial warm-up) were selected for coding (beginning, middle, and end of session), yielding two minutes of coded free play spanning the full session. Emotion during free-play was coded with CARMA, following an identical approach to coding children's emotional valence during prosocial tasks. The same scale was used: from -10 (most negative) to 10 (most positive), where 0 indicated neutral emotion. Children's emotional valence ratings from the three free-play episodes were averaged to obtain a baseline emotionality score (Table 25 in Appendix C shows the number of children with three free-play episodes by age and study).

4.4.5 Spontaneous, prompted, and requested prosocial behavior

In each prosocial task, children received a series of cues, starting with a non-verbal indication of need (e.g., shivering with cold). Children who were prosocial following this cue were categorized as *spontaneously* prosocial. Children who were prosocial following one of the subsequent cues before an overt request were categorized as *prompted* prosocial. Children who were prosocial following the final cue, an explicit request for help, were categorized as *requested* prosocial (see also Section 4.3 in Methods). A series of exploratory supplemental analyses were

conducted that assessed baseline emotionality and emotional valence based on cue type and age. Because few unique effects emerged, these are reported in Appendix C.

4.4.6 Smiling

To add another index of positivity and to partially validate the coding of emotional valence with CARMA, occurrence of smiles during prosocial tasks was coded with ELAN (Version 4.8 for Windows and available for download at http://tla.mpi.nl/tools/tla-tools/elan; Brugman & Russel, 2004). ELAN allows for coding and annotating behavior from videos on a second-by-second basis (Brugman & Russell, 2004). A smile was coded when a child's cheeks were raised, the muscles around the eyes were contracted to describe smiling/laughing lines, or the child's mouth was open and his/her eyes were wide (i.e., laughter) (Ekman, Friesen, & Hager, 2002). The intention was to produce an *average smiling* score (number of seconds during which the child smiled / the total number of seconds for the task). However, the video records did not permit reliable coding because of frequent partial or full obstruction of children's faces (recording was from a single camera and children's backs or sides were frequently turned toward the camera); when facial expressions were unobstructed, smiling occurred with low frequency. Therefore, no analysis of smiling was possible. See Appendix A for details.

4.5 Coding and reliability

Coding was completed by the author, who served as the primary coder, and four secondary coders naïve to the hypotheses of the proposed study. During training, secondary coders double

coded training videos with the primary coder until they met a threshold of at least 80% agreement. Following this, secondary coders and the primary coder coded 20% of all study videos to establish reliability on study data. Discrepancies were discussed and resolved.

To determine inter-observer reliability for coding of children's positivity/negativity during prosocial tasks and free-play, intraclass correlations (ICC; Koo & Li, 2016; Shrout & Fleiss, 1979) were calculated between the secondary and primary coder for each video. In randomly assigned double-coded videos, an ICC value of at least .80 was required. Videos with lower agreement were either discussed and resolved or were re-coded by the primary coder and reviewed with the secondary coders. Excellent reliability was achieved (see Table 14; Appendix B). For all remaining videos after training, secondary coders and the primary coder double coded a randomly selected number of videos each week (~10% of total videos assigned weekly) to prevent drift; any videos with less than 80% agreement were discussed and resolved with the primary coder.

5.0 Preliminary analyses

See Tables 3 and 4 for means and standard deviations for the primary measures. Preliminary analyses verified that the four datasets did not differ in demographic make-up. Differences in children's baseline emotionality and emotional valence during prosocial tasks in relation to ethnicity, parent education, and parent income were examined. Few differences were found. Given the inconsistent pattern in these differences, ethnicity, parent income, and parent education were not controlled in subsequent analyses (see Tables 15 - 22, Appendix C).

Table 3. Means and Standard Deviations for Baseline and Emotional Valence (Positivity/Negativity) by Age and Prosocial Task

		Baseline Emotionality		**Emotional Valence Helping**		**Emotional Valence Comforting**		**Emotional Valence Sharing**		**Prosocial Tasks (valence averaged)**	
Study	**Age (months)**	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1	16	3.05	1.10	2.69	1.55	1.35	1.75	N/A	N/A	2.03	1.29
2	16	2.59	1.65	2.21	1.90	N/A	N/A	2.33	1.65	2.17	1.46
3	24	3.03	1.23	1.86	1.93	2.18	2.00	2.12	1.35	2.00	1.31
4	28	4.47	0.84	3.57	1.38	2.64	1.97	N/A	N/A	3.11	1.49
Full sample		3.20	1.46	2.61	1.78	1.96	1.95	2.27	1.56`	2.32	1.45
Range		-2.57 – 6.31		-2.38 – 6.10		-2.22 – 6.78		-2.71 – 5.72		-1.93 – 5.83	

Notes. N/A denotes that the prosocial task was not administered in that study. Reported statistics are for all children who completed at least one prosocial task.

Table 4. Means and Standard Deviations for Emotional Valence (Positivity/Negativity) Preceding and Following Prosocial Behavior for Prosocial Children by Age and Prosocial Task

	Emotional Valence Helping		**Emotional Valence Comforting**		**Emotional Valence Sharing**		**Prosocial Tasks (valence averaged)***	
Study	*Preceding M (SD)*	*Following M (SD)*	*Preceding M (SD)*	*Following M (SD)*	*Preceding M (SD)*	*Following M (SD)*	*Preceding M (SD)*	*Following M (SD)*
1	2.83 (1.23)	3.80 (1.40)	1.82 (1.82)	1.28 (.66)	N/A	N/A	2.39 (1.35)	2.40 (.66)
2	2.49 (1.26)	3.34 (1.44)	N/A	N/A	2.08 (1.39)	2.69 (1.58)	2.56 (.96)	3.49 (1.09)
3	2.24 (1.44)	3.15 (1.58)	2.90 (1.29)	3.00 (1.25)	2.18 (.74)	2.99 (.62)	2.43 (.84)	3.00 (.79)
4	3.30 (1.27)	4.43 (1.17)	2.71 (1.78)	4.02 (1.86)	N/A	N/A	3.08 (1.23)	4.34 (1.29)
Full sample	2.79 (1.33)	3.76 (1.44)	2.59 (1.69)	3.16 (1.83)	2.14 (1.10)	2.86 (1.13)	2.72 (1.14)	3.55 (1.28)
Range	-1.82 – 5.71	-.37 – 6.84	-1.64 – 6.49	-.29 – 7.21	-1.00 – 3.72	-1.34 – 4.90	-.45 – 5.48	.80 – 6.67

Notes. N/A denotes that the prosocial task was not administered in that study. Reported statistics are for children who enacted prosocial behavior in at least one prosocial task. *Emotional valence, preceding and following, was averaged for children who were prosocial in one or two prosocial tasks.

Few gender differences in either baseline emotionality or emotional valence during prosocial tasks emerged (see Tables 23 and 24, Appendix C). As a result, gender was also not controlled in subsequent analyses. There were no significant differences in children's emotional valence across the three free-play episodes. Accordingly, these ratings were averaged over the three free-play episodes to obtain the baseline emotionality score (see Table 25, Appendix C).

Finally, prior to conducting main analysis, simple bivariate correlations between emotion-related variables were obtained (see Tables 5 and 6 below).

Table 5. Bivariate Correlations between Baseline and Emotional Valence (Positivity/Negativity) during Prosocial Tasks by Age and Prosocial Task

		Prosocial Task		
Study	**Age (months)**	**Helping**	**Comforting**	**Sharing**
1	16	.39**	-.01	N/A
2	16	.39**	N/A	.48**
3	24	.57**	.56**	.49**
4	28	.35*	.49**	N/A
Full sample		.46**	.36**	.47**

Notes. * $p < .05$; ** $p < .01$. Reported correlations are for children who completed at least one prosocial task.

Table 6. Bivariate Correlations between Baseline and Emotional Valence (Positivity/Negativity) Preceding and Following Prosocial Behavior for Prosocial Children by Age and Prosocial Task

			Prosocial Task		
Study	**Age (months)**	**Timing**	**Helping**	**Comforting**	**Sharing**
1	16	*Preceding*	.36*	.46	N/A
		Following	.21	.47*	N/A
2	16	*Preceding*	.26	N/A	.45
		Following	.22	N/A	.43
3	24	*Preceding*	.42	.24	.34
		Following	.51*	-.18	.19
4	28	*Preceding*	.22	.45**	N/A
		Following	.30	.38*	N/A
Full sample (of helpers)		*Preceding*	.37**	.33**	.41**
		Following	.38**	.42**	.37*

Note. * $p < .05$; ** $p < .01$.

6.0 Hypothesis testing

To analyze hypothesized relations between children's emotional valence, age, and prosocial engagement, several analytic techniques were employed, depending on variable types (categorical, ratio/continuous). T-tests or ANOVAs were conducted to compare differences between group means with categorical independent variable(s). Ordinal logistic regression analyses were conducted to examine associations between categorical independent variable(s) and ordinal dependent variables. Ordinary least-squares linear regression analyses examined the effects of continuous independent variable(s) on a continuous dependent variable. To test mediation, a regression-based analysis was conducted using the PROCESS add-on (version 2.15) for IBM SPSS 26.0. Supplemental exploratory analyses were conducted to examine whether children's emotion differed based on the type of prosocial behavior they engaged in (spontaneous, prompted, or requested). These analyses employed chi-square and ANOVA techniques and results are presented in Appendix D.

6.1 Aim 1: Emotion preceding prosocial behavior

To examine this aim, all children who completed prosocial tasks were included in analyses, including those who did not help, share, or comfort. The main findings for this aim showed that children who were more positive during prosocial tasks were more likely to engage in prosocial behavior (helping, sharing, comforting). In addition, older children (24 and 28 months) were more likely to engage in prosocial behavior than were the youngest children (16 months), and the oldest

children (28 months) were also more positive than younger children (16 and 24 months) across prosocial tasks. The age effect on prosocial engagement was accounted for by children's emotional valence during prosocial tasks. Finally, age and prosocial task interacted such that, in the helping task, the oldest children (28 months) were more positive than younger children (16 and 24 months); whereas, in the comforting task, both groups of older children (24 and 28 months) were more positive than the youngest children (16 months). However, in the sharing task older (24 months) and younger (16 months) children did not differ in emotional valence.

6.1.1 Hypothesis 1: Emotion preceding prosocial behavior will predict engagement in prosocial behavior

To address this hypothesis, a cumulative odds ordinal logistic regression was conducted, across ages and prosocial tasks, to determine *relations between emotional valence during prosocial tasks (averaged over tasks) and prosocial engagement (none, some, or high).* Results revealed that for a unit increase in emotional valence, the odds of being high in prosocial engagement increased 2.32 times, 95% CI [1.82, 2.94], Wald χ^2 (1) = 47.70, $p < .01$. That is, children who were more positive during the prosocial tasks were more than twice as likely to engage in prosocial behavior (helping, sharing, comforting).

6.1.2 Hypothesis 2: Age will predict (1) engagement in prosocial behavior and (2) emotion preceding prosocial behavior

(1) To confirm the well-established finding of *relations between age and prosocial behavior* in the current sample, a chi-square goodness-of-fit test was conducted with age (16, 24,

or 28 months) and prosocial engagement (none, some, or high) averaged over prosocial tasks. There was a moderately strong association between age and prosocial engagement, χ^2 (4, N = 198) = 58.72, p < .01 (Cramer's V = .39; Cohen, 1988)[3].

Pairwise z-score comparisons revealed that, in comparison with 24- and 28-month-old children, 16-month-old children were more likely to score in the "none" than the "some" or "high" prosocial categories. Therefore, as expected, age was positively related to higher prosociality, with younger children being less likely to engage in prosocial behavior.

Table 7. Observed and Expected Frequencies of Prosocial Engagement by Age

	Age (months)		
Prosocial Engagement	**16**	**24**	**28**
None	45 $_a$ (31.2)	3 $_b$ (8.0)	3 $_b$ (11.8)
Some	51 $_a$ (39.1)	5 $_b$ (10.0)	8 $_b$ (14.9)
High	25 $_a$ (50.7)	23 $_b$ (13.0)	35 $_b$ (19.3)

Notes. Expected frequencies appear in parentheses below observed frequencies. Subscript letters denote categories whose row proportions differed significantly from each other at the .05 level based on z-score comparisons.

(2) To test the previously unexamined hypothesis that *older children will be more positive than younger children preceding prosocial behavior*, a one-way between-subjects ANOVA was conducted with age (16, 24, or 28 months) as the independent variable and emotional valence during prosocial tasks (averaged over tasks) as the dependent variable. There was a significant

[3] Despite the wide difference in cell size, the assumption of proportional odds was met, as assessed by a full likelihood ratio test comparing the fit of the proportional odds model to a model with varying location parameters, χ^2 (1) = .90, p = .34. The Pearson goodness-of-fit test indicated that the model was a good fit to the observed data, χ^2 (329) = .90, p = .73

effect of age, F (2, 195) = 9.68, $p < .01$, $\eta^2 = .09$. Post-hoc Bonferroni comparisons revealed that 28-month-old children (M = 3.11, SD = 1.49) were more positive than 24-month-old (M = 2.00, SD = 1.31) and 16-month-old (M = 2.10, SD = 1.37) children during prosocial tasks, both *p's* < .01; 24-month-old and 16-month-old children did not differ in emotional valence during prosocial tasks, $p = 1.00$.

Overall, results confirmed that age predicted both prosocial engagement and emotional valence during the prosocial task and this was true for all three prosocial tasks. Specifically, older children (24 and 28 months) were more likely to engage in prosocial behavior than were the youngest children (16 months), and the oldest children (28 months) were also more positive than younger children (16 and 24 months) across prosocial tasks.

6.1.3 Hypothesis 3: Emotion preceding prosocial behavior will mediate the relationship between age and engagement in prosocial behavior

Because both age and emotional valence during prosocial tasks were associated with prosocial behavior, I hypothesized that *emotional valence preceding prosocial behavior will mediate the effect of age on prosocial behavior.* Using the PROCESS add-on (version 2.15) for IBM SPSS 26.0 (Hayes, 2008), I conducted an ordinary least squares regression (OLS) mediation analysis. First, age (16, 24, or 28 months; dummy coded) was regressed on emotional valence during prosocial tasks (Model 1). Second, age and emotional valence during prosocial tasks were regressed on prosocial engagement (none, some, or high) (Model 2). Direct effects were interpreted using standard null hypothesis testing; the indirect effect was interpreted using bias-corrected bootstrap confidence intervals (Hayes, 2008).

Table 8 shows the results from the mediation analysis with unstandardized coefficients. As expected from the previous findings, older children were more positive during prosocial tasks, and more positive children engaged in higher rates of prosocial behavior. A bias-corrected confidence interval based on 10, 000 bootstrap samples showed that the indirect effect (*ab* = .014; see Table 8) was significantly above zero, 95% CI [.005, .023]. Therefore, as hypothesized, emotional valence during prosocial tasks significantly mediated the relationship between age and prosocial engagement. That is, the age effect on prosocial engagement was accounted for by emotional valence during prosocial tasks.

Table 8. OLS Test of Mediation by Emotional Valence of Relations Between Age and Prosocial Engagement

		Model 1				**Model 2**		
		Coeff.	***SE***	***p***		***Coeff.***	***SE***	***p***
Age	*a*	.06	.02	< .01	*c'*	.08	.02	< .01
Emotional Valence		-	-	-	*b*	.23	.03	< .01
Constant	i_1	1.08	.40	< .01	i_2	-.73	.17	< .01
Indirect Effect					*ab*	0.14	.01	N/A
Model Summary	$R^2 = .05$ F (1, 196) = 10.53, $p < .01$				$R^2 = .45$ F (2, 195) = 79.66, $p < .01$			

Note. Unstandardized coefficients are reported.

6.1.4 Hypothesis 4: Age and type of prosocial task will interact to predict emotion preceding prosocial behavior

I expected that *older children would be more positive than younger children preceding prosocial behavior in the emotionally demanding sharing and comforting tasks but not in the emotionally neutral helping task.* Since not all age groups received all prosocial tasks (see Table 1; Section 4.3), this hypothesis was tested with two separate mixed ANOVAs for (1) all children who completed the helping and sharing tasks (16 and 24 months), and (2) all children who completed the helping and comforting tasks (16, 24, 28 months). In both analyses, age and prosocial task were the independent variables and emotional valence during prosocial tasks was the dependent variable.

First, a two-way 2 (age: 16 and 24 months) x 2 (prosocial task: helping and sharing) mixed ANOVA on emotional valence during helping and sharing was conducted. The interaction between age and prosocial task was not significant, F (1, 84) = 1.42, p = .24, η^2 = .02. The main effects of prosocial task, F (1, 84) = 1.85, p = .18, η^2 = .02, and age, F (1, 84) = .12, p = .74, η^2 = .00, were also not significant. Thus, contrary to the hypothesis, 24-month-old children were not more positive than 16-month-old children in the sharing task (see Table 3 for means and standard deviations).

Second, a two-way 3 (age: 16, 24, or 28 months) x 2 (prosocial task: helping and comforting) mixed ANOVA was conducted on emotional valence during helping and comforting. There was a significant interaction between age and prosocial task, F (2, 131) = 9.43, p < .01 (see Figure 3). There was a significant main effect of age, F (2, 131) = 8.29, p < .01, as well as of prosocial task, F (1, 131) = 10.15, p < .01. The significant interaction was followed up with simple main effects analysis by conducting two separate between-subjects ANOVAs with age (16, 24, 28

months) as the independent variable and emotional valence during either helping or comforting as the dependent variable. In the helping task, there was a statistically significant difference in emotional valence among the three age groups, F (2, 131) = 10.54, p < .01, η^2 = .14. Pairwise Bonferroni post-hoc comparisons showed that 28-month-old (M = 3.57; SE = .23) children were more positive than both 24- (M = 1.86; SE = .30) and 16-month-old (M = 2.69; SE = .20) children during the helping task, both p-s < .01; 24- and 16-month old children's emotional valence task did not differ, p = .07.

There was also a statistically significant difference in emotional valence during comforting among the three age groups, F (2, 131) = 6.67, p < .01, η^2 = .09. Pairwise Bonferroni post-hoc comparisons revealed that in the comforting task both 28- (M = 2.64; SE = .27) and 24-month-old (M = 2.18; SE = .35) children were more positive than were 16-month-old (M = 1.35; SE = .24) children; 24- and 28-month old children's emotional valence did not differ, p = .90.

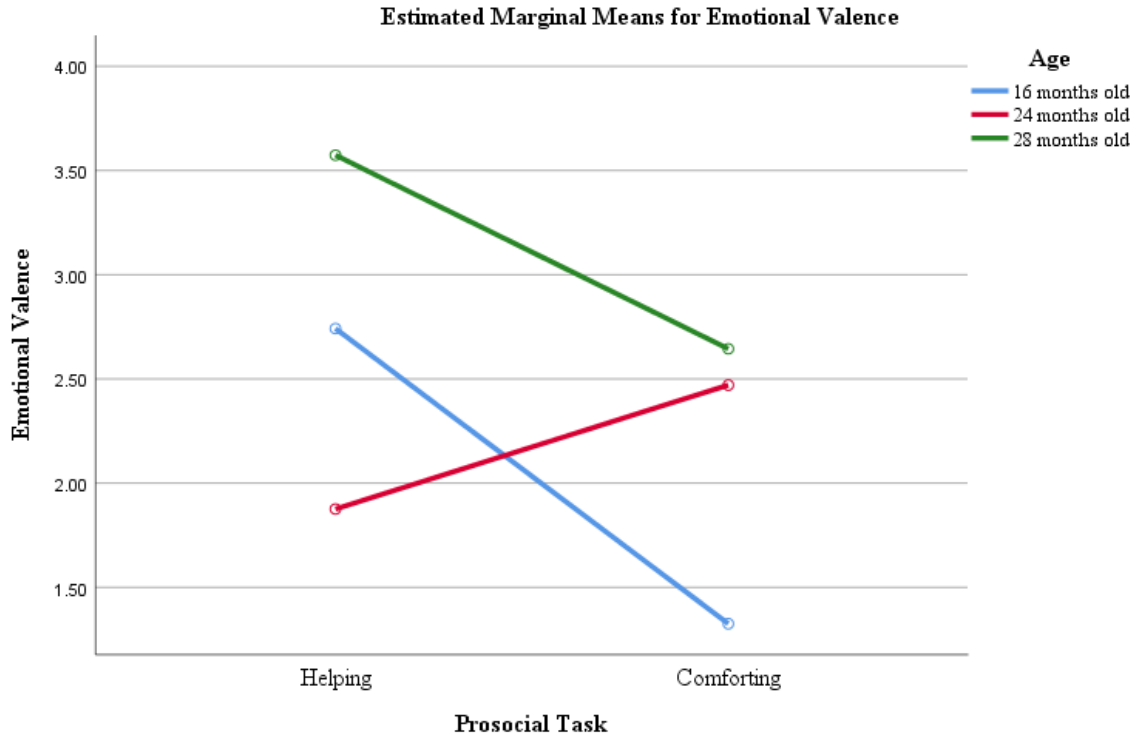


Figure 3. Interaction between Age and Task (Helping; Comforting) for Emotional Valence

In sum, the hypothesis that older children would be more positive than younger children in the emotionally demanding sharing and comforting tasks but not in the emotionally neutral helping task was partially supported. Age and prosocial task interacted such that, in the helping task, the oldest children (28 months) were more positive than younger children (16 and 24 months) during the task; whereas, in the comforting task, both groups of older children (24 and 28 months) were more positive than the youngest children (16 months). However, in the sharing task older (24 months) and younger (16 months) children did not differ in emotional valence.

6.2 Aim 2: Emotion following prosocial behavior

This aim examined whether children become more positive following prosocial behavior and whether this effect differed by age and type of prosocial task. Analyses were specific to prosocial children, i.e., those who helped, shared, or comforted in at least one prosocial task (for task-specific analyses) and in two or three tasks (for analyses that collapsed across tasks).

Results revealed that children were more positive following prosocial behavior across age and prosocial tasks than they were before their prosocial act. Further, this pattern held for each of the three prosocial tasks, including the emotionally demanding comforting and sharing tasks. Age positively predicted children's positive emotion following prosocial behavior: 28-month-old children were more positive than 16- and 24-month-old children. Age and prosocial task also interacted such that the oldest children (28 months) were more positive following comforting than were the two younger age groups (16 and 24 months), whereas there were no age differences in emotional valence following helping. However, there was no age by task interaction for the helping

versus sharing tasks, i.e., 16- and 24-month-old children were equally positive following helping and sharing.

6.2.1 Hypothesis 1: Across age and prosocial tasks, children will be more positive following prosocial behavior than preceding prosocial behavior

A paired-samples t-test compared children's emotional valence scores preceding and following prosocial behavior, averaged across prosocial tasks. Overall, children were significantly more positive following prosocial behavior (M = 3.55, SD = 1.28) than preceding (M = 2.72, SD = 1.14), t (82) = -8.69, $p < .01$ (see Figure 4).

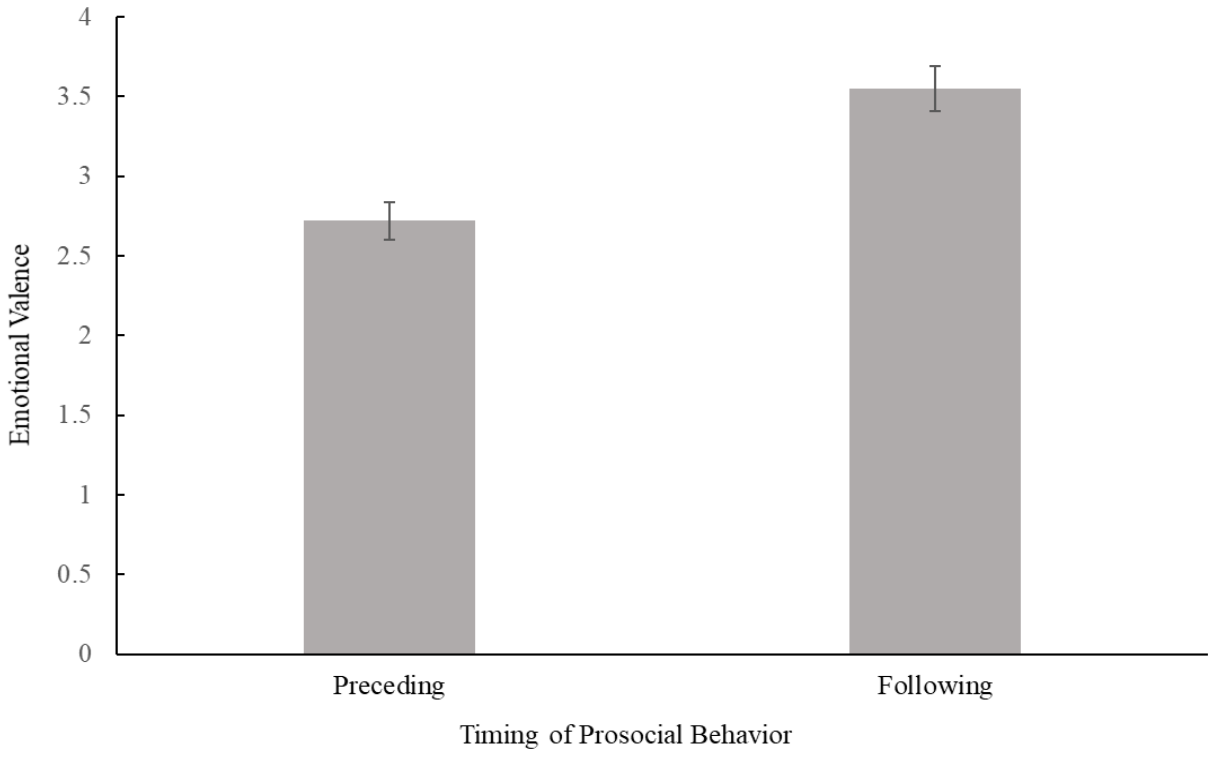


Figure 4. Emotional Valence Preceding and Following Prosocial Behavior Across Tasks

Three additional paired-samples t-tests compared children's emotional valence scores preceding and following prosocial behavior in the individual prosocial tasks. Across ages, children

were more positive following than preceding prosocial behavior in each task: Helping (following: M = 3.76, SD = 1.45; preceding: M = 2.79, SD = 1.33), t (136) = -9.86, $p < .01$; Comforting (following: M = 3.12, SD = 1.83; preceding: M = 2.58, SD = 1.69), t (73) = -3.48, $p < .01$; and Sharing (following: M = 2.86, SD = 1.14; preceding: M = 2.14, SD = 1.06), t (40) = -7.62, $p < .01$.

These results show that, as predicted, children were more positive following prosocial behavior across age and prosocial tasks. This pattern held for each of the three prosocial tasks, including the emotionally demanding comforting and sharing tasks.

6.2.2 Hypothesis 2: Across prosocial tasks, age will predict emotion following prosocial behavior

It was hypothesized that, *following prosocial behavior, older children would be more positive than younger helpers.* To test this hypothesis, a one-way between subjects ANOVA was conducted with age (16, 24, or 28 months) as the independent variable and emotional valence difference scores, averaged across prosocial tasks, as the dependent variable.

There was a significant effect of age on positivity following prosocial behavior, F (2, 80) = 8.50, $p < .01$, η^2 = .18. Post-hoc pairwise Bonferroni comparisons revealed that, following prosocial behavior, 28-month-old children (M = 1.25, SD = .73) were more positive than both 24-month-old (M = .57, SD = .73) and 16-month-old children (M = .48, SD = .95), both p-$s < .01$; 24-month-old and 16-month-old children did not differ in positivity following prosocial behavior.

These findings provide support for the hypothesis that age positively predicted positive emotion following prosocial behavior, complementing the findings above that older children were also more positive preceding prosocial behavior (Aim 1, Hypothesis 2; Section 6.1.2). In both

cases, it was the 28-month-old children who were more positive than were 16- and 24-month-old children.

6.2.3 Hypothesis 3: Age and type of prosocial task will interact to predict emotion following prosocial behavior

I expected that, *following prosocial behavior, older children would be more positive than younger children in the emotionally demanding comforting and sharing tasks but not in the emotionally neutral helping task.* Since not all age groups received all prosocial tasks, this hypothesis was tested with two separate mixed ANOVAs for (1) all children who completed both the helping and sharing tasks (16 and 24 months), and (2) all children who completed both the helping and comforting tasks (16, 24, and 28 months). In both analyses, age and prosocial task were the independent variables and emotional valence difference scores were the dependent variable.

First, a two-way 2 (age: 16 and 24 months) x 2 (prosocial task: helping and sharing) mixed ANOVA with emotional valence difference scores in each task was conducted. The interaction between age and type of prosocial task was not significant, F (1, 28) = .17, p = .69, η^2 = .01. The main effect of age was not significant, F (1, 28) = .01, p = .94, η^2 = .00. However, there was a main effect of prosocial task, such that children were more positive following helping (M = 1.21; SD = 1.39) than following sharing (M = .61; SD = .56); F (1, 28) = 6.50, p = .02, η^2 = .19, regardless of age.

Second, a two-way 2 (age: 16, 24, and 28 months) x 2 (prosocial task: helping and comforting) mixed ANOVA with emotional valence difference scores in each task was conducted. There was a significant interaction between age and prosocial task, F (1, 63) = 6.82, p = .02, η^2 =

.18 (see Figure 5). The main effects of age, F (1, 63) = 13.34, p < .01, η^2 = .30, and prosocial task were also significant, F (1, 63) = 10.89, p = .02, η^2 = .15.

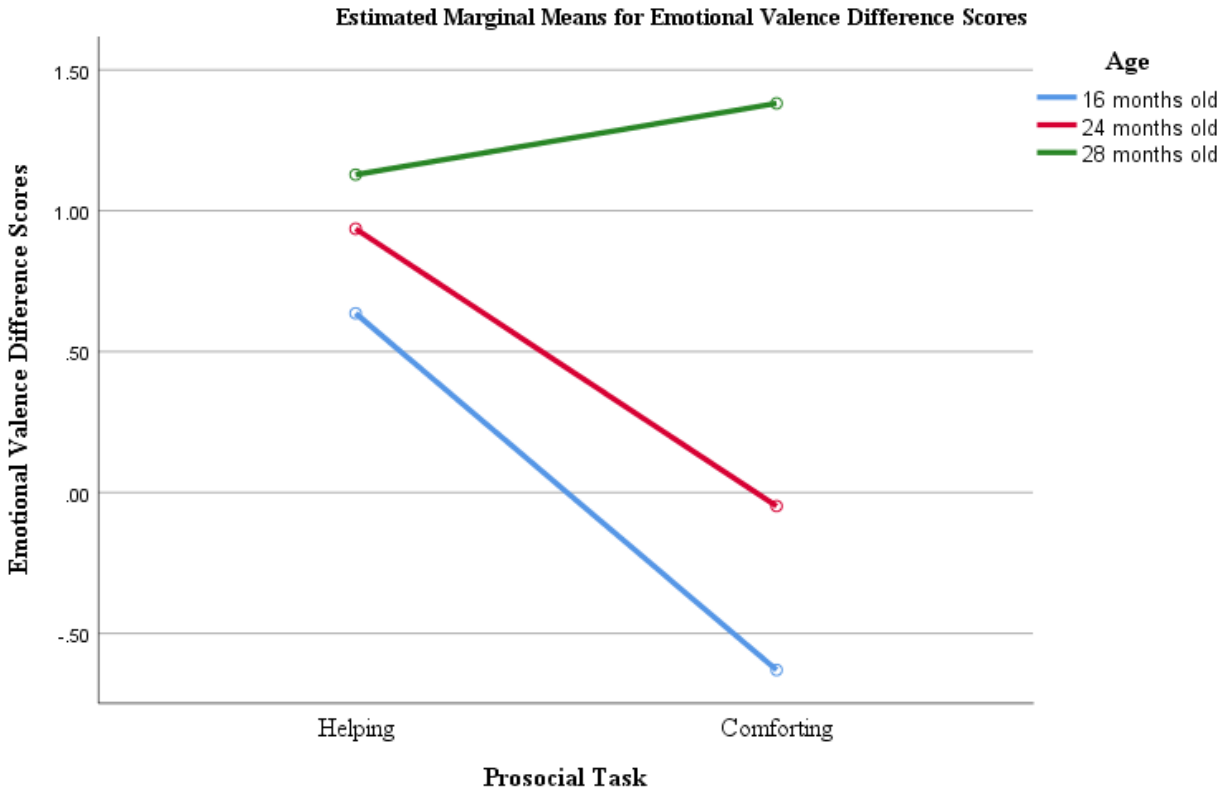


Figure 5. Interaction between Age and Task (Helping; Comforting) for Emotional Valence Difference Scores

The significant interaction was followed up with analyses of simple main effects with two separate between-subjects ANOVA with age (16, 24, or 28 months) as the independent variable and emotional valence difference scores during either helping or comforting as the dependent variable. In the helping task, there were no significant differences in emotional valence difference scores between 16-, 24-, and 28-month-old helpers, F (2, 63) = 1.01, p = .37, η^2 = .03. In the comforting task, however, there was a significant age difference in emotional valence difference scores, F (2, 63) = 18.24, p < .01, η^2 = .37. Pairwise Bonferroni post-hoc comparisons revealed that, in the comforting task, 28-month-old children (M = 1.38; SD = 1.05) were more positive

following comforting behavior than both 24- (M = -.05; SD = .94) and 16-month-old (M = -.63; SD = 1.61) helpers, both p-s < .01, whose emotional valence scores did not differ, p = .52.

In sum, the hypothesis that older children would be more positive than younger children following prosocial behavior in the emotionally demanding sharing and comforting tasks than in the emotionally neutral helping task was partially supported. Age and prosocial task interacted such that, in the comforting task, the oldest children (28 months) were more positive following comforting than were the two younger age groups (16 and 24 months), whereas there were no age differences in emotional valence following helping. However, there was no such interaction for the helping versus sharing tasks, i.e., 16- and 24-month-old children were equally positive following helping versus sharing.

6.3 Aim 3: Temperamental emotionality in relation to emotion preceding and following prosocial behavior

This aim examined hypotheses related to the role of children's temperamental emotionality (i.e., baseline positivity/negativity during free play) in relation to emotion preceding and following prosocial behavior, as well as in relation to age and type of prosocial task. As in Aim 2, analyses were specific to prosocial children (i.e., children who behaved prosocially in at least one prosocial task for task-specific analyses, and children who behaved prosocially in two or three tasks for analyses that collapsed across tasks).

Results revealed that children's baseline emotionality positively predicted their emotion both preceding and following prosocial behavior when averaged over tasks and ages. Baseline emotionality predicted children's emotion within each of the three individual tasks as well. That

is, across ages and tasks, children who were more positive during free play were more positive both preceding and following prosocial behavior. However, baseline emotionality and prosocial task did not interact to predict emotion valence scores either preceding or following prosocial behavior.

6.3.1 Hypothesis 1: Temperamental emotionality will predict emotion preceding and following prosocial behavior

It was hypothesized that, *across ages and prosocial tasks, children who were more positive at baseline would be more positive both preceding and following prosocial behavior.* Two separate OLS linear regressions, in which baseline emotionality was regressed on emotional valence scores preceding or following prosocial behavior (averaged over prosocial tasks), were conducted to examine this hypothesis.

The first regression was significant, F (1, 82) = 20.76, $p < .01$. Approximately 19.4% of the variance in emotional valence *preceding* prosocial behavior was accounted for by baseline emotionality. Children's positivity preceding prosocial behavior increased by .45 for each unit increase in baseline emotionality ($B = .45$, $t = 4.56$, $p < .01$).

The second regression was also significant, F (1, 82) = 22.16, $p < .01$. Approximately 20.5% of the variance in emotional valence *following* prosocial behavior was accounted for by baseline emotionality. Children's positivity following prosocial behavior increased by .52 for each unit increase in baseline emotionality ($B = .52$, $t = 4.71$, $p < .01$).

In addition, since children's baseline emotionality positively predicted their emotion both preceding and following prosocial behavior averaged over tasks and age, a series of simple linear regressions examined whether these relationships held in individual prosocial tasks. For each

prosocial task, baseline emotionality was regressed on children's emotional valence preceding and following helping, sharing, or comforting (a total of six simple linear regressions were tested).

Helping. In the helping task, approximately 13.60% of the variance in emotional valence *preceding* helping was accounted for by baseline emotionality, F (1, 136) = 21.25, $p < .01$. Children's positivity preceding helping increased by .39 for each unit increase in baseline emotionality (B = .39, t = 4.61, $p < 01$). In addition, approximately 14.40% of the variance in emotional valence *following* helping was accounted for by baseline emotionality, F (1, 136) = 22.65, $p < .01$. Children's positivity following helping increased by .44 for each unit increase in baseline emotionality (B = .44, t = 4.76, $p < 01$).

Comforting. In the comforting task, approximately 10.90% of the variance in emotional valence *preceding* comforting was accounted for by baseline emotionality, F (1, 73) = 8.82, $p < .01$. Children's positivity preceding comforting increased by .53 for each unit increase in baseline emotionality (B = .53, t = 2.97, $p < 05$). In addition, approximately 17.60% of the variance in emotional valence *following* comforting was accounted for by baseline emotionality, F (1, 73) = 15.38, $p < .01$. Children's positivity following comforting increased by .73 for each unit increase in baseline emotionality (B = 3.92, t = 3.92, $p < 01$).

Sharing. In the sharing task, approximately 16.60% of the variance in emotional valence *preceding* sharing was accounted for by baseline emotionality, F (1, 40) = 7.78, $p < .01$. Children's positivity preceding sharing increased by .34 for each unit increase in baseline emotionality (B = 2.79, t = 2.79, $p < 05$). In addition, approximately 13.70% of the variance in emotional valence *following* sharing was accounted for by baseline emotionality, F (1, 40) = 6.19, $p < .01$. Children's positivity following sharing increased by .34 for each unit increase in baseline emotionality (B = .34, t = 2.49, $p < 05$).

Overall, these results confirmed the hypothesis that, across ages and prosocial tasks, children who were more positive at baseline were, on average, also more positive both preceding and following prosocial behavior, with baseline emotionality accounting for approximately 20% of the variance in children's emotion in prosocial tasks. These results show that baseline emotionality accounted for children's emotion within each of the three individual tasks as well. That is, children's tendency toward positivity during play predicted how positive they were both preceding and following sharing, helping, and comforting

6.3.2 Hypothesis 2: Temperamental emotionality and age will interact to predict emotion preceding and following prosocial behavior

To test the hypothesis that *older children's baseline emotionality will be less strongly associated with their emotion both preceding and following prosocial behavior (across prosocial tasks) than will younger children's*, two hierarchical multiple regression models were conducted. These models assessed whether, as compared to a main effects model only (Step 1), more of the variance in emotional valence (preceding or following prosocial behavior) was explained with the addition of an interaction term between baseline emotionality and age (Step 2). In both models, baseline emotionality and age (16, 24, 28 months – dummy coded with 16 months as the reference group) were entered as independent variables in the first step and, at step two, the interaction term between baseline emotionality and age was specified. The dependent variables were children's emotional valence preceding or following prosocial behavior scores (averaged over prosocial tasks), respectively.

First, for emotional valence *preceding* prosocial behavior, the regression model was significant at Step 1, F (3, 79) = 6.76, $p < .01$ with an adjusted $R^2 = .174$. Approximately 17.4%

of the variance in children's emotional valence preceding prosocial behavior was explained by baseline emotionality and age. Children' positivity preceding prosocial behavior increased by .45 for each unit increase in baseline emotionality (B = .45, t = 3.59, p < .01). The main effect of age was not significant (24 months: B = -.04, t = -.14, p = .90; 28 months: B = -.01, t = -.03, p = .97). The interaction between baseline emotionality and age was tested at Step 2 and was not significant F_{change} (2, 77) = .27, p = .76, R^2_{change} = .01. This suggested that age did not moderate the effect of baseline emotionality on emotional valence preceding prosocial behavior (see Table 9).

Table 9. Regression Statistics for Emotional Valence Preceding Prosocial Behavior Predicted by Age, Baseline Emotionality, and their Interaction

Model 1		***Coeff.***	***SE***	***t***	***p***	**Lower Bound**	**Upper Bound**
Step 1	**(Constant)**	1.02	.46	2.23	.03	.11	1.93
	Baseline Emotionality	.45	.13	3.59	.00	.20	.70
	Age (24 months)	-.04	.30	-.14	.90	-.64	.55
	Age (28 months)	-.01	.32	-.03	.97	-.65	.62
Step 2	**(Constant)**	1.32	.81	1.64	.11	-.28	2.93
	Baseline Emotionality	.36	.24	1.49	.14	-.12	.83
	Age (24 months)	-.19	-.07	-.17	.86	-2.33	1.95
	Age (28 months)	-.89	1.28	-.69	.49	-3.43	1.66
	24 months x Baseline Emotionality	.04	.32	.14	.89	-.59	.67
	28 months x Baseline Emotionality	.22	.32	.68	.50	-.42	.85

Notes. Unstandardized coefficients are reported. Lower and upper bounds are for 95% coefficient confidence intervals.

Second, for emotional valence *following* prosocial behavior, the regression model was significant at Step 1, F (3, 79) = 11.91, p < .01 with an adjusted R^2 = .285. Approximately 28.5%

of the variance in children's emotional valence following prosocial behavior was explained by baseline emotionality and age. Children's positivity following prosocial behavior increased by .26 for each unit increase in baseline emotionality (B = .26, t = 2.00, p < .05). The main effect for age was not significant for 24-month-old children (B = .04, t = .13, p = .90), but it was significant for 28-month-old children, B = 1.02, t = 3.56, p < .01, suggesting that 28-month-old children were more positive following prosocial behavior than were 16-month-old children (the reference group). However, at step two the interaction between baseline emotionality and age was not significant, F_{change} (2, 77) = 1.15, p = .32, R^2_{change} = .02. This suggests that age did not moderate the effect of baseline emotionality on emotional valence following prosocial behavior. Table 10 shows the regression statistics for Model 2.

Table 10. Regression Statistics for Emotional Valence Following Prosocial Behavior Predicted by Age, Baseline Emotionality, and their Interaction

Model 2		***Coeff.***	***SE***	***t***	***p***	**Lower Bound**	**Upper Bound**
Step 1	**(Constant)**	2.11	.48	4.41	.00	1.18	3.07
	Baseline Emotionality	.26	.13	2.00	.05	.00	.52
	Age (24 months)	.04	.31	.12	.90	-.58	.66
	Age (28 months)	1.02	.33	3.04	.00	.35	1.68
Step 2	**(Constant)**	2.97	.84	3.56	.00	1.31	4.64
	Baseline Emotionality	-.00	.25	-.01	.10	-.49	.49
	Age (24 months)	-.73	1.11	-.66	.51	-2.95	1.49
	Age (28 months)	-.94	1.33	-.71	.48	-3.58	1.71
	24 months x Baseline Emotionality	.24	.33	.72	.48	-.42	.89
	28 months x Baseline Emotionality	.50	.33	1.51	.14	-.16	1.16

Notes. Unstandardized coefficients are reported. Lower and upper bounds are for 95% coefficient confidence intervals.

Overall, results from these analyses showed that age and baseline emotionality did not interact to predict emotional valence scores either preceding or following prosocial behavior. Rather, baseline emotionality positively predicted children's emotional valence both preceding and following prosocial behavior: regardless of age, children who were more positive during free play were more positive both preceding and following prosocial behavior.

6.3.3 Hypothesis 3: Temperamental emotionality and prosocial task will interact to predict emotion preceding and following prosocial behavior

It was hypothesized that, across ages, *in the more emotionally demanding prosocial tasks (comforting and sharing) children's emotion preceding and following prosocial behavior will be more influenced by their baseline emotionality than in the emotionally neutral helping task.* Since not all children received all three prosocial tasks, this hypothesis was tested separately for (1) all children (16 and 24 months) who completed the helping and sharing tasks and (2) all children (16, 24, and 28 months) who completed the helping and comforting tasks.

Four repeated-measures generalized linear models were tested with baseline emotionality and prosocial task (helping versus sharing or helping versus comforting) as the independent variables and emotional valence scores (preceding or following) as the dependent variable. Results for emotional valence *preceding* prosocial behavior are reported first, followed by results for emotional valence *following* prosocial behavior.

Emotional valence preceding helping vs. sharing. The interaction between baseline emotionality and prosocial task was not significant, F (1, 28) = 2.73, p = .11, η^2 = .09. The effect

of baseline emotionality was not significant, F (1, 28) = 2.39, nor was the effect of prosocial task, F (1, 28) = 2.17, p = .15, η^2 = .07. Children's emotional valence scores preceding prosocial behavior in the helping (M = 2.46; SD = 1.41) and sharing (M = 2.37; SD = .92) tasks did not differ significantly regardless of whether they were more or less positive in baseline emotionality. In other words, baseline emotionality did not differentially influence children's emotional valence preceding helping versus sharing.

Emotional valence preceding helping vs. comforting. The interaction between baseline emotionality and prosocial task was not significant, F (1, 64) = .25, p = .62, η^2 = .00. The effect of baseline emotionality was not significant, F (1, 64) = .70, p = .41, η^2 = .01. The effect of prosocial task was also not significant F (1, 64) = .67, p = .41, η^2 = .01. Children's emotional valence scores preceding prosocial behavior in the helping (M = 3.03; SD = 1.33) and comforting tasks (M = 2.67; SD = 1.66) did not differ significantly regardless of whether they were more or less positive in baseline emotionality. In other words, baseline emotionality did not differentially influence emotional valence preceding children's helping versus comforting.

Emotional valence following helping vs. sharing. The interaction between baseline emotionality and prosocial task was not significant, F (1, 28) = 3.26, p = .08, η^2 = .10. The effect of baseline emotionality was not significant, F (1, 28) = .94, p = .15, η^2 = .07. The effect of prosocial task was also not significant F (1, 28) = .94, p = .34, η^2 = .03. Children's emotional valence scores preceding prosocial behavior in the helping (M = 3.67; SD = 1.39) and sharing tasks (M = 2.98; SD = 1.08) did not differ significantly regardless of whether they were more or less positive in baseline emotionality. In other words, baseline emotionality did not differentially influence emotional valence following children's helping versus sharing.

Emotional valence following helping vs. comforting. The interaction between baseline emotionality and prosocial task was not significant, F (1, 64) = 2.92, p = .09, η^2 = .04. The effect of baseline emotionality was significant, F (1, 64) = 24.45, p < .01, η^2 = .28, i.e., children who were higher in baseline emotionality were more positive following prosocial behavior in both the helping and comforting tasks (r = .38 and .42, respectively, both p-s < .01). The effect of prosocial task was also significant, F (1, 64) = 6.29, p < .05, η^2 = .09. A pairwise Bonferroni post-hoc comparison showed that, across levels of baseline emotionality, children were more positive following prosocial behavior in the helping (M = 4.00; SE = .15) than in the comforting task (M = 3.27; SE= .20), p < .01. In other words, although baseline emotionality and task both predicted emotional valence following helping and comforting, baseline emotionality did not differentially influence emotional valence following children's prosocial acts in the helping versus comforting tasks.

In summary, baseline emotionality and prosocial task did not interact to predict emotion valence scores either preceding or following prosocial behavior for any comparison of prosocial tasks.

6.4 Aim 4: Controlling for temperamental emotionality in relations between emotion and prosocial behavior

Since baseline emotionality was shown above to positively predict children's emotional valence preceding and following prosocial behavior across tasks and age, relevant hypotheses from Aim 1 (emotional valence preceding prosocial behavior) and Aim 2 (emotional valence following prosocial behavior) were re-tested including baseline emotionality as a control variable. The goal

of these analyses was to examine whether children's positivity in prosocial tasks was specific to prosocial behavior or, rather, was at least in part explained by children's baseline emotionality.

Findings showed that whereas the prior results revealed that children who were more positive during prosocial tasks were more likely to behave prosocially, this effect was reduced once baseline emotionality was controlled, suggesting that children's temperamental positivity was in part responsible for the initial finding that positive emotion predicted prosocial behavior. Controlling baseline emotionality produced a somewhat more complex picture for age effects in prosocial behavior and related emotions. First, age continued to predict children's engagement in prosocial behavior with baseline emotionality controlled. However, the earlier finding that older children were more positive during prosocial tasks than were younger children was no longer significant when baseline emotionality was accounted for, nor were older children more positive during the comforting versus helping tasks, suggesting that baseline emotionality is a stronger predictor of children's emotional valence during prosocial tasks than age, especially for tasks with more advanced emotional demands.

For positive emotion following prosocial behavior, once children's baseline emotionality was controlled, they were no longer more positive following prosocial behavior than preceding it. However, this held only for the emotionally demanding comforting and sharing tasks; in the emotionally neutral instrumental helping task children remained more positive following prosocial behavior even with baseline emotionality controlled. Additionally, age effects on children's positivity following prosocial behavior were maintained with baseline emotionality controlled, with older children more positive than younger children, including following comforting versus helping. Thus, baseline emotionality accounted for children's increased positivity following prosocial behavior in the more emotionally demanding situations, but it did not account for the

previously found age differences in positivity following prosocial behavior; older children remained more positive following prosocial behavior than were younger children even with baseline emotionality controlled.

6.4.1 Temperamental emotionality effects in Aim 1: Emotion preceding prosocial behavior

Hypothesis 1: Emotion preceding prosocial behavior will predict engagement in prosocial behavior. Previous results confirmed that children who were more positive during prosocial tasks were more likely to engage in prosocial behavior (Aim 1, Hypothesis 1, Section 6.1.1). To examine whether this relationship still held with baseline emotionality controlled, a cumulative odds ordinal logistic regression with proportional odds was run to determine the effect of emotional valence during prosocial tasks and baseline emotionality on prosocial engagement (none, some, high).

The effects of emotional valence during prosocial tasks and baseline emotionality were both significant. The odds of being high in prosocial engagement increased by 1.97 times, 95% CI [1.52, 2.54], Wald χ^2 (1) = 26.92, $p < .01$, for a unit increase in emotional valence during prosocial tasks; and by 1.55 times, 95% CI [1.19, 2.02], Wald χ^2 (1) = 10.64, $p < .01$, for a unit increase in baseline emotionality. While emotional valence remained a significant predictor of prosocial engagement, even after including baseline emotionality in the model, the strength of emotional valence as a predictor decreased. Specifically, without baseline emotionality included (Section 6.1.1), the odds of being high in prosocial engagement increased by 2.32 times vs. 1.97 times in the current model with baseline emotionality controlled. These results suggest that, while children's positivity predicted greater engagement in prosocial behavior, this association was in part influenced by children's baseline emotionality.

Hypothesis 2: Age will predict (1) engagement in prosocial behavior and (2) emotion preceding prosocial behavior. The first part of this hypothesis confirmed a well-established relationship between age and prosocial behavior: older children were more likely than younger children to engage in higher rates of prosocial behavior (Aim 1, Hypothesis 2, Section 6.1.2). To examine whether this relationship held when baseline emotionality was included (because older children were higher in baseline emotionality), a cumulative odds ordinal logistic regression with proportional odds was conducted to determine the effect of age (16 months – comparison group, 24, or 28 months) and baseline emotionality on prosocial engagement (none, some, or high).

Prosocial behavior. With baseline emotionality in the model, age continued to have a significant effect on the likelihood of a child being high in prosocial engagement, Wald χ^2 (2) = 35.89, $p < .01$. The odds of 16-month-old children scoring high in prosocial engagement were .19 times, 95% CI [.08, .44], lower than those of 28-month-old children, Wald χ^2 (1) = 15.02, $p < .01$. The odds of scoring high in prosocial engagement did not differ for 24- and 28-month-old children (odds ratio of 2.09, CI [.67, 6.53]), Wald χ^2 (1) = 1.62, $p = .20$. An increase in baseline emotionality, with age in the model, was also associated with an increase in the odds of scoring high in prosocial engagement, with an odds ratio of 1.83, 95% CI [1.40, 2.39], Wald χ^2 (1) = 19.98, $p < .01$. In other words, the youngest children were less likely to engage in high rates of prosocial behavior, regardless of their baseline emotionality, and children who were more positive at baseline were more likely to engage in more prosocial behavior regardless of their age. These results complement the prior findings by confirming that age and baseline emotionality both positively predicted prosocial engagement.

Emotional valence. Second, to examine whether older children remained more positive than younger children during prosocial tasks (Aim 1, Hypothesis 2, section 6.1.2) after controlling

for baseline emotionality, an analysis of covariance (ANCOVA) was conducted with age (16, 24, or 28 months) and baseline emotionality as independent variables and children's emotional valence scores, averaged across prosocial tasks, as the dependent variable. After controlling for baseline emotionality, there was no longer a significant effect of age on emotional valence during prosocial tasks, F (2, 194) = .43, p = .65, η^2 = .00 (see Table 11). In other words, the previous age differences in children's positivity during prosocial tasks (Aim 1) did not hold when children's baseline emotionality was controlled.

Table 11. Adjusted and Unadjusted Means for Emotional Valence during Prosocial Tasks by Age (with Baseline Emotionality as a Covariate)

		Unadjusted		**Adjusted**	
Age (months)	***N***	***M***	***SD***	***M***	***SE***
16	121	2.10	1.37	2.32	.12
24	31	2.00	1.31	2.16	.22
28	46	2.32	1.45	2.44	.20

Notes. *N* = number of children, *M* = Mean, *SD* = Standard Deviation, *SE* = Standard Error.

To sum up, age remained a positive predictor of children's engagement in prosocial behavior, with older children more likely to be more prosocial, even when baseline emotionality was controlled. However, the earlier finding that older children were more positive during prosocial tasks than were younger children was no longer significant when baseline emotionality was accounted for, suggesting that baseline emotionality, rather than age, predicts children's emotional valence during prosocial tasks. In other words, while controlling for baseline emotionality did not alter the relationship between age and prosocial behavior, it did alter the relationship between age and emotional valence preceding prosocial behavior.

Hypothesis 4: Age and type of prosocial task will interact to predict children's emotion preceding prosocial behavior. In Aim 1 (section 6.1.4) I expected that older children would be more positive than younger children in the emotionally demanding sharing and comforting tasks but not in the emotionally neutral helping task. Age and prosocial task were indeed found to interact such that, in the helping task, 28-month-old children were more positive than 16- and 24-month-old children; and, in the comforting task, both 24- and 28-month-old children were more positive than the youngest children (16 months). As a result, this moderation analysis was re-tested controlling for baseline emotionality in the comparison of emotional valence in the helping and comforting tasks only.

A two-way mixed analysis of covariance (ANCOVA) was conducted. Age (16, 24, or 28 months) was a between-subjects independent variable, prosocial task (helping; comforting) was a within-subjects independent variable, baseline emotionality was a covariate, and emotional valance during prosocial tasks was the dependent variable. With baseline emotionality as a covariate, there was still a significant interaction between age and prosocial task, F (2, 130) = 9.71, $p < .01$, $\eta^2 = .13$. The significant interaction was followed-up by examining simple main effects with adjusted means. Two separate between-subjects ANCOVAs were conducted, with age (16, 24, 28 months) as the independent variable, baseline emotionality as a covariate, and emotional valence during either helping or comforting as the dependent variable. The effect of age was not significant, F (2, 137) = 4.29, $p = .02$, $\eta^2 = .06$. This indicates that, after accounting for baseline emotionality, there were no longer age-related differences in children's emotional valence during the helping task (16-month-old children: $M = 3.01$, $SE = .19$; 24-month-old children: $M = 2.09$, $SE = .28$; 28-month-old children: $M = 2.99$, $SE = .25$). In the comforting task, the effect of age was not significant, F (2, 137) = 2.66, $p = .07$, $\eta^2 = .04$. This indicates that, after accounting for baseline

emotionality, there were no longer age-related differences in children's emotional valence in the comforting task (16-month-old children: M = 1.58, SE = .24; 24-month-old children: M = 2.44, SE = .35; 28-month-old children: M = 2.17, SE = .30).

In sum, these results revealed that, when baseline emotionality was accounted for, the previously found age differences in children's emotional valence scores in the helping versus comforting tasks (Aim 1, Hypothesis 4, section 6.1.4) disappeared; older children were no longer more positive than younger children preceding either helping or comforting. This suggests that baseline emotionality is a stronger predictor than age of children's emotional valence preceding prosocial behavior in tasks that differ in their emotional demands.

6.4.2 Temperamental emotionality effects in Aim 2: Emotion following prosocial behavior

Hypothesis 1: Across age and prosocial tasks, children will be more positive following than preceding prosocial behavior. Results from the initial test of this hypothesis (section 6.2.1) suggested that, across age and prosocial tasks, children were more positive following than preceding prosocial behavior. This hypothesis was re-tested by including baseline emotionality as a control variable in a repeated-measures ANCOVA with repeated measures on time (preceding, following prosocial behavior) and emotional valence as the dependent variable.

Considered across age and tasks, once baseline emotionality was controlled, emotional valence scores preceding and following prosocial behavior did not differ significantly, F (1, 81) = 2.75, p = .10, η^2 = .03. To parallel the additional task-specific analyses that were included in the original test of Aim 2, three repeated-measures ANCOVAs valence were conducted, one for each prosocial task, with baseline emotionality as a control variable, repeated measures on time (preceding, following prosocial behavior), and emotional valence as the dependent variable.

Significant differences between children's emotion following and preceding prosocial behavior were interpreted with adjusted means.

Helping. There was a significant effect of time (preceding vs. following prosocial behavior) on emotional valence in the helping task, F (1, 135) = 7.13, $p < .05$, $\eta^2 = .05$. A post hoc Bonferroni pairwise comparison revealed that, after accounting for baseline emotionality, children were more positive following (M = 3.76; SE = .12) than preceding helping (M = 2.79; SE = .11).

Comforting. The effect of time was not significant, F (1, 72) = .12, $p = .74$, $\eta^2 = .00$, when baseline emotionality was controlled, showing that baseline emotionality accounted for the previous finding that emotional valence following comforting was greater than preceding it.

Sharing. The effect of time was not significant, F (1, 39) = 8.60, $p < .05$, $\eta^2 = .18$, when baseline emotionality was controlled, showing that baseline emotionality accounted for the previous finding that emotional valence following sharing was greater than preceding sharing.

Overall, these results indicated that when children's baseline emotionality was controlled, they were not more positive following prosocial behavior than preceding it. However, this held only for the emotionally demanding comforting and sharing tasks; in the emotionally neutral helping task children remained more positive following prosocial behavior even with baseline emotionality controlled.

Hypothesis 2: Age will predict emotion following prosocial behavior. To test whether older children would remain more positive following a prosocial act after controlling for baseline emotionality (section 6.2.2), an analysis of covariance (ANCOVA) was tested with age (16, 24, or 28 months) as the independent variable, baseline emotionality as the covariate, and emotional valence difference scores as the dependent variable.

After controlling for baseline emotionality, there was a signifcant main effect of age, F (2, 79) = 10.30, $p < .01$, $\eta^2 = .21$. Post-hoc pairwise Bonferroni comparisons using adjusted means revealed that with baseline emotionality controlled, 28-month-old children were more positive following prosocial behavior than both 24-month-old and 16-month-old children both *p-s* < .01; 24-month-old and 16-month-old children did not differ (see Table 12 for adjusted means and standard errors). Therefore, these results suggest that, even after controlling for baseline emotionality, older children were more positive following prosocial behavior than were younger children.

Table 12. Adjusted and Unadjusted Means for Prosocial Children's Emotional Valence Difference Scores (with Baseline Emotionality as Covariate)

		Unadjusted		**Adjusted**	
Age (months)	***N***	***M***	***SD***	***M***	***SE***
16	25	.48	.96	.38	.17
24	23	.57	.73	.46	.17
28	35	1.26	.73	1.40	.15

Note. N = number of children, *M* = Mean, *SD* = Standard Deviation, *SE* = Standard Error. Note that, as in Aim 2, emotional valence difference scores that collapsed across tasks were for children who helped on two or three prosocial tasks.

Hypothesis 3: Age and type of prosocial task will interact to predict emotion following prosocial behavior. I expected that older children would be more positive than younger children following prosocial behavior in the emotionally demanding sharing and comforting tasks but not in the emotionally neutral helping task. Results from Aim 2 (section 6.2.3) revealed a significant age by task interaction only for the helping versus comforting prosocial tasks. As a result, this moderation analysis was reconducted only for those two tasks.

A mixed two-way analysis of covariance (ANCOVA) with age (16, 24, or 28 months) as a between-subjects variable, baseline emotionality as a covariate, and repeated measures on task (helping and comforting) was conducted with emotional valence difference scores as the dependent measure. The interaction between prosocial task and age was significant, F (2, 62) = 7.45, $p < .01$, $\eta^2 = .18$. The significant interaction was followed up with analyses of simple main effects by conducting two between-subjects ANCOVAs with age (16, 24, or 28 months) as the independent variable, baseline emotionality as the covariate, and emotional valence difference scores as the dependent variable, separately for the helping and comforting tasks. In the helping task, the effect of age was not significant, F (1, 62) = 1.04, $p = .36$, $\eta^2 = .03$. In the comforting task, however, there was a significant effect of age, F (1, 62) = 19.08, $p < .01$, $\eta^2 = .38$. Post-hoc Bonferroni pairwise comparisons with adjusted means revealed that, after accounting for baseline emotionality, 28-month-old children (M = 1.58; SE = .21) were more positive than 24- (M = -.25; SE = .26) and 16-month-old children (M = -.88; SE = .34) following comforting behavior, both p-$s < .01$; 16- and 24-month-old children did not differ, $p = .40$. Thus, in parallel with the original findings from Hypothesis 3 (Aim 2; section 6.1.2.3), these re-analyses showed that after accounting for baseline emotionality, older children were no longer more positive after helping; however, older children remained more positive than younger children following comforting.

All together, these results suggest that children's positivity in prosocial tasks was not entirely specific to prosocial behavior. Their baseline emotionality accounted in part for their greater positivity *preceding* a prosocial act, and it fully accounted for age differences in positivity preceding prosocial behavior. Baseline emotionality also accounted for children's greater positivity *following* prosocial behavior, but only after sharing and comforting, not helping. Baseline emotionality accounted for age differences in positivity following helping, but not

comforting, with older children continuing to exhibit greater positivity following comforting even with baseline emotionality controlled.

7.0 Discussion

The goal of this study was to extend and clarify a growing body of theoretical and empirical work that has found evidence of relations between emotion and prosocial behavior in the first few years of development. This study used data from 215 children, aged 16 – 28 months, who participated in helping, comforting, or sharing prosocial tasks. By utilizing a novel, continuous measurement of children's emotional valence, the current study examined the extent to which children's emotion preceding prosocial tasks predicted (and possibly motivated or inhibited) prosociality, and whether children were more emotionally positive following (and possibly reinforcing) prosocial behavior. These associations between emotion and prosocial behavior were examined in three types of tasks that varied in their emotional demands and at three ages across the toddler period to determine if either of these factors moderated the primary findings. Importantly, a measure of children's baseline emotionality (i.e., positivity/negativity during free play) was included to assess possible temperament-related effects underlying associations between young children's emotional valence and prosocial behavior.

In what follows, I discuss the main findings, with attention to novel contributions to what we know about emerging prosocial behavior related to (1) children's positivity/negativity during prosocial tasks, and (2) baseline emotionality, respectively. Then, I discuss specific results from Aims 1 (emotion preceding prosocial behavior), 2 (emotion following prosocial behavior), and 3 and 4 (baseline emotionality) in order to highlight possible mechanisms that might govern discovered relations between emotional valence and prosocial behavior. Finally, limitations, future directions, and implications of the findings are addressed.

7.1 Main findings and contributions

Primary goals of the current study were to examine very young children's emotion preceding prosocial behavior as a predictor of their prosocial behavior; whether children's prosocial behavior generated greater positivity following a prosocial act; and whether associations between emotional valence and prosocial behavior held with temperamental (baseline positivity/negativity) emotionality controlled. A secondary goal was to introduce a novel measure of emotion based on continuous coding of emotional valence and intensity (highly negative to highly positive), using a holistic approach to measure emotion rather than using discrete emotion measures which have unique limitations in young children.

The current study also included three prosocial tasks – one of which, the comforting task, employed a well-established distress paradigm and the other two (helping and sharing), more recent paradigms, communicated either an instrumental or an emotionally demanding need to the child. This allowed for examining whether the theory that negative emotion precedes and possibly motivates early prosocial behavior applies to different types of nascent prosocial acts, and whether positive emotion follows different early-emerging prosocial attempts. From a developmental perspective, it is also important to know whether any of the potential patterns varied by age since prosocial behavior is just beginning to emerge in the first half of the second year, and undergoes significant change over the ensuing year, becoming more general, more quickly and autonomously initiated, and more norm-governed (Dahl et al., 2017; Svetlova et al., 2010). Thus, three ages were included to span this important developmental period.

Results showed first, and somewhat surprisingly given existing theory (Hoffmann 2000; 1975; Eisenberg et al., 1989), that children did not appear distressed in response to a needy other and seldom evidenced either strongly negative or strongly positive emotion before or after

prosocial behavior. Instead, children's emotion preceding prosocial behavior varied from neutral/mildly positive to moderately positive, on average, and it was the change in emotional valence that predicted prosocial behavior; likewise, following prosocial behavior children were not highly positive but became more somewhat more positive than they had been preceding the prosocial act. This finding is important, first, because discrete positive and negative emotion signs have appeared with low frequency among young children in existing studies, thus limiting the kinds of conclusions that can be confidently drawn. Second, it is important because theory stipulates that positive and negative emotion function differently in emerging prosocial behavior (Petkova & Brownell, 2020). The current findings suggest that while this may be true in older children and adults, it may be less true for very young children who are just becoming prosocial; that is, it may be that more or less intense positivity, rather than more or less intense negativity, is the key to explaining early-appearing prosocial behavior. A brief summary of the main findings is presented below, with detailed discussion of the most important results following.

Children who were more positive during the prosocial tasks were also more like to enact prosocial behavior, both across the prosocial tasks (helping, comforting, and sharing) and within each task. Confirming well-established findings on age differences in prosocial behavior, older children were more prosocial (Brownell, Svetlova, Anderson, Nichols, & Drummond, 2013; Zahn-Waxler et al., 1992). Newly reported here, older children were also more positive preceding and following prosocial behavior, and this was true regardless of the type of prosocial task. This is the first study to examine age differences in positivity both preceding and following prosocial behavior in this age period.

Moreover, children's positivity preceding a prosocial act accounted for the age differences in their prosociality, also a new finding that contributes to our understanding of potential

mechanisms underlying age differences in early prosocial behavior. In addition, although I expected older children to be more positive than younger children in the emotionally demanding sharing and comforting tasks but not in the emotionally neutral helping task, the findings were more complex. Consistent with expectations, older children (24, 28 months) were more positive preceding comforting than were the youngest children (16 months). But contrary to expectation, older children (24 months; 28-month-olds did not receive this task) were not more positive preceding sharing than were younger children (16-months). Also contrary to expectations, the oldest children (28 months) were more positive than younger children (16, 24 months) preceding helping. These findings provide a more nuanced picture of what we know about children's emotion in relation to different types of prosocial behavior in the first few years of development.

Children who were more positive at baseline were also more positive both preceding and following prosocial behavior. Once baseline emotionality was controlled, the previous associations between emotion and prosocial behavior became quite different. For emotion preceding prosocial behavior, controlling baseline emotionality reduced the effects of emotional positivity on children's prosociality; that is, baseline positivity partly explained the association between children's positivity in the prosocial situation and the likelihood of enacting prosocial behavior. In addition, older children were no longer more positive than younger children preceding prosocial behavior when their baseline emotionality was controlled.

For emotion following prosocial behavior, there were also effects of controlling baseline emotionality, but they were fewer. On the one hand, children across ages were no longer more positive following sharing and comforting when baseline emotionality was controlled; however, they were still more positive following helping. Older children also continued to be more positive than younger children following prosocial behavior even with baseline emotionality controlled.

Overall, these novel findings lend support to the idea that temperament may play a central role in young children's emotional responses in prosocial situations. That is, children's positivity in prosocial situations, including following a prosocial act, might be partly a function of their baseline positivity rather than being inherent to the prosocial act itself, providing important nuance for recent claims about the generality of the "warm glow" effect in very young children (Aknin et al., 2012l; Hepach et al., 2017).

Taken together, these findings show that, early in development, children's emotional responses in different types of prosocial situation are intricate and influenced by age, type of prosocial tasks and baseline emotionality. Importantly, the fact that children were neither intensely positive nor intensely negative in relation to prosocial acts of varying emotional demands (i.e., helping, sharing, or comforting), much like they were during relaxed free play, raises the possibility that children's emotional responses during prosocial tasks are influenced by larger developmental factors, such as their temperamental predisposition, mood, and socialization (e.g., parent scaffolding and encouragement of prosocial behavior; Hammond & Carpendale, 2015). Although children's immediate emotional responses during prosocial tasks have been hypothesized to have a primary influence on children's emerging prosocial behavior (Eisenberg, 2000), the current results highlight the need to integrate larger developmental factors in existing theory on emotion and emerging prosocial behavior.

7.2 Emotional valence preceding prosocial behavior (Aim 1)

Theory has proposed that young children's negative emotion in response to another's distress, unless too intense, serves as a motivator of prosocial behavior. That is, early on children

help or comfort someone else to reduce their own distress and, as their emotion regulation and understanding skills improve, they do so to alleviate the need and distress of another rather than their own negativity (Eisenberg & Miller, 1987; Eisenberg et al., 1989). However, existing studies have adopted a fragmented approach to measuring children's negative emotion by focusing on (1) negative emotion expressions that appeared with low frequency (e.g., crying, frowning, freezing) and (2) generally disregarding the possibility that, in the very young, some of these expressions might reflect wariness, shyness, or confusion, rather than negativity, distress, or concern (Waugh & Brownell, 2017).

As a result, empirical findings have been inconsistent, indices of negative emotion have been infrequent and/or low level, and conclusions have often been weak (Petkova & Brownell, 2020). Therefore, in the current study, it was children's emotional valence (i.e., positivity/negativity) rather than the frequency of individual emotion expressions that was measured and related to prosocial behavior. By doing so, the limitations of relying on discrete negative emotion indices or Likert-scales anchored in discrete emotion signs was overcome and a novel approach to measuring emotion in the context of early prosocial behavior was introduced and tested.

Aim 1 examined children's emotion preceding prosocial behavior in relation to their prosocial engagement, age, and type of prosocial task. As hypothesized, results showed that children who were more positive during the task were more likely to engage in prosocial behavior. This pattern held not only across tasks, but within each one, including the emotionally demanding comforting and sharing tasks. The finding that, on average, children were not in the negative emotional valence range and that it was a relative increase in positivity that predicted prosocial engagement expands our understanding of the role of emotion in early prosocial behavior. Theory

suggests that negative emotion, when it is well-regulated, motivates prosocial behavior while at the same time intense or unregulated negative emotion correlates with reduced prosocial behavior in young children (e.g., Eisenberg et al., 1994). However, the current findings suggest that it is mildly positive emotion, rather than mildly negative (i.e., well-regulated) emotion that is motivating, thus challenging existing and well-established theory on negative emotion.

The current results indicate that it may be more important to examine positive emotion as a predictor of emerging prosociality, especially in emotionally demanding prosocial tasks, during which it has been largely hypothesized that very young children would experience intense levels of distress (Eisenberg, 2000; Zahn-Waxler et al., 1992). It may that children who were more positive during these prosocial tasks were better able to regulate their negative emotion; but it is also possible that children did not experience distress at all, but were instead pleased and happy to be able to engage in helping, sharing, or comforting. This hypothesis has not been routinely examined, although Rheingold proposed it decades ago in her classic study of young children's eager and happy helping with household chores (Rheingold, 1982). Since then, Hammond and his colleagues have reported similar findings regarding toddlers' "cheerful" assistance with household chores based on both parent interviews and observations (Hammond & Brownell, 2018; Hammond & Drummond, 2019).

It is worth noting that it was the use of the continuous measure of emotional valence that permitted discovery of these novel positive emotion findings; future research would benefit from use of this or similar measures of emotion in this age period rather than, or in addition to, discrete emotion indices. Previous studies on negative emotion have generally provided an incomplete picture of negativity by assessing the occurrence of discrete negative emotion expressions (e.g., frowning, crying, freezing, seeking comfort from a parent; Knudsen & Liszkowski, 2013; Spinrad

& Stifter, 2006; Zahn-Waxler et al., 1992) without coding expressions of positivity. Yet, in the current study, children were generally positive and supplemental analyses of emotional valence change over time suggest that children displayed negativity sporadically, while maintaining an overall level of positivity during tasks (see Appendix E). It is therefore possible that the findings of this study do not differ dramatically from previous studies on negative emotion; rather, it appears that the lack of a holistic assessment of children's emotion over time in previous studies only reveals a partial picture of children's emotion. n addition, the current study extends these important findings about the role of positivity to sharing and comforting, in addition to instrumental helping. The larger implication is that although high levels of negative emotion may indeed inhibit prosocial behavior as traditionally theorized (Waugh & Brownell, 2017), it may be positive emotion rather than negative emotion that acts as the primary motivator of prosocial behavior in very young children. Particularly since prosocial behavior is socialized in the context of positive social exchange starting early in life (Brownell et al., 2013; Hammond & Drummond, 2019), it stands to reason that young children's initial attempts at autonomous prosocial behavior would be likewise positive. Overall, the current findings call into question the strength of existing results on negative emotion: without assessing both negativity and positivity concurrently, as in this study, conclusions about the role of negative emotion as a motivator of early prosocial behavior remain constrained and incomplete.

Age differences. Consistent with much prior research, Aim 1 results also showed that older children were more likely to engage in prosocial behavior. The novel finding is that older children were also more positive when they engaged in prosocial behavior. To add to our understanding of age differences in early prosocial behavior, a mediation analyses revealed that the relationship between age and prosocial behavior was accounted for by children's emotional valence, i.e., older

children were more prosocial partly because they were more positive. Many existing studies document age-related differences in prosocial rates without comparing children's emotion (e.g., Dunfield et al., 2011; Warneken & Tomasello, 2007). In the current study, it was the oldest children, 28-months of age, who were more positive than younger children. Theory argues that older children are more helpful because their maturing social and cognitive skills reduce their negative emotion in response to the distress of another and help them understand what can be done to alleviate the other's distress and to act on that understanding (Eisenberg et al., 2016). The current results showing that positivity explained the age differences in prosociality suggests that theory should be expanded to include that age-related changes in positivity, too, may be a result of developing social understanding and emotion regulation, and play at least a complementary role, if not a primary role, in motivating prosocial behavior.

Prosocial task differences. Age differences as a function of prosocial task were examined to assess whether children's emotion varied in situations requiring different social, cognitive, and motivational capacities. It was expected that older children would be more positive than younger children preceding prosocial behavior in the more emotionally demanding tasks (sharing, comforting), but not in the emotionally neutral helping task.

There were no age differences in emotional valence between 16- and 24-month old children in the helping and sharing tasks, even though sharing is presumed to be more emotionally challenging than simple helping. However, 24- and 28-month old children were more positive than 16-month-old children in the comforting task. These findings show that emotion preceding prosocial acts varies as a function of both age and task, and suggest that proposed mechanisms likely operate differently in prosocial situations that place varying emotional demands on children.

However, because the sharing task is a novel introduction in the current study, and because it was not administered to 28-month-old children, it is difficult to draw strong inferences about the lack of age differences in emotion valence between 24- and 16-month-old children's sharing and helping. More generally, in tasks of instrumental nature negative emotions may not be as intense, making it possible that even very young children could regulate their emotion sufficiently to enact prosocial behavior. It is also possible that a need for instrumental help elicits positive emotion in younger children because they have had ample experience with instrumental helping and know well how to do so (Dahl et al., 2017). Comforting requires greater social understanding and children younger than 28 months may have had relatively little experience with it, making them less likely to experience the positive emotion that comes from being able to provide assistance.

Moreover, there are no objective criteria for such emotional demands, so our presumption that sharing is more emotionally demanding than helping may be mistaken. Since children begin sharing, with parents' encouragement, in the first year of life, especially food sharing, the task used in the current study may not be more emotionally demanding than instrumental helping. While the effects of maturing emotion regulation and social understanding might be more important in emotionally demanding tasks, particularly for very young children, for confident conclusions to be drawn future research will need to compare a broader array of such tasks and provide objective standards for gauging relative emotional demands.

Summary. Results from the current study suggest not only that older children were more competent helpers, but also that older children were more positive in prosocial tasks. The finding that it was positivity, as much as age, that contributed to prosocial engagement is novel. Additional novel results from this study show that young children's emotion preceding prosocial behavior varied over tasks as well as age, with some suggestion that this may be due to differences in the

emotional demands of different prosocial situations. More generally, with respect to extant theory, the current results suggest that even in very young children, their positivity, rather than negativity, may play a crucial role in motivating prosocial action.

7.3 Emotional valence following prosocial behavior (Aim 2)

While a handful of researchers (Aknin et al., 2018; Hepach, 2016; Sallquist et al., 2009) have called for studying the links between positive emotion and prosocial behavior in young children, especially following a prosocial act, the number of studies including indices of positive emotion in relation to prosocial behavior during early childhood remains limited. Aim 2 thus had the goal of expanding this small empirical literature by examining multiple tasks in the same study for the first time, as well as multiple ages, including children younger than those in the current research. This is important since the few existing studies documenting that children were more positive following prosocial behavior included only prosocial tasks of instrumental nature (e.g., helping an adult complete a task; Hepach et al., 2017) and only one study included sharing desired food with a hungry other (Aknin et al., 2012). This work also has not studied positivity following a prosocial act in children younger than two years of age, when prosocial behavior is first emerging, nor have multiple ages been compared, thus narrowing the developmental scope of the results. The current study thus aimed to build a more nuanced understanding of young children's positivity following prosocial behavior in relation to age as well as in prosocial tasks varying in difficulty and emotional demand.

Results from Aim 2 showed that, across ages, children were more positive following than preceding prosocial behavior, and that this pattern held both across tasks and within individual

prosocial tasks. Consistent with previous findings documenting increases in positivity following prosocial behavior (Aknin et al., 2012; Hepach et al., 2017; Wu et al., 2017), these results provide further support for the idea that, in early development, prosocial children might experience a "warm glow" both after helping someone achieve their goal (i.e., an instrumentally-oriented prosocial task) and after alleviating a need such as hunger or feeling cold. Since this is the first study on emotion following prosocial behavior that included very young children (16 months) and multiple prosocial tasks, these results strengthen support for the theory that positive emotion sustains and rewards early prosocial acts (but see below and section 7.4 for important caveats).

Age differences. Across prosocial tasks, the oldest children in the sample (28 months) were more positive following prosocial behavior than were younger children (24 and 16 months). This is the first study to examine children as young as 16 months for "warm glow" effects, and to show that these effects were not present in children as young as 16 and 24 months. Consistent with previous studies that only included older children, positivity following prosocial behavior was evident in children by 28 months of age. This finding suggests that positive emotion following prosocial behavior might begin to emerge slightly later in development than prosocial behavior itself and therefore casts doubt over arguments that "warm glow" effects serve to sustain and encourage emerging prosocial behavior (Aknin et al., 2012). Rather, it might be that children with more advanced socio-emotional capacities are the ones for whom positivity follows and maintains prosocial attempts.

Prosocial task differences. In relation to task differences, children were generally more positive following helping than following sharing and comforting. However, interactions between age and prosocial task suggest a more nuanced picture of positivity following prosocial behavior. Specifically, when prosocial tasks were compared, young children were more likely to experience

positivity following helping than comforting or sharing. Therefore, early in development, young children's "warm glow" might be specific to emotionally neutral instrumental contexts (i.e., picking up a dropped object, helping someone achieve a simple goal).

Furthermore, 28-month-old children were more positive following comforting than were 24- and 16-month-olds, but they were not more positive following helping, expanding on the finding above. That is, the youngest children did demonstrate the "warm glow" effect, but in the instrumental context only, whereas the oldest children demonstrated this effect following comforting as well. These findings suggest that age predicts not only increased prosocial competencies but perhaps increased emotional consequences as well. The finding that older children were more positive following the most challenging type of prosocial behavior suggests that, indeed, age-related advances in children's social and emotional competencies likely contribute to their emotional positivity in prosocial situations (Nichols et al., 2009).

Summary. The current results provide evidence that young children experience positivity following prosocial behavior, extending the small corpus of findings with older toddlers and preschoolers (Aknin et al., 2012; Hepach et al., 2017; Wu et al., 2017). However, given the nuanced age- and task-related findings, suggesting that both factors influence the extent to which very young children experience positivity following prosocial behavior, it is important to continue to extend existing empirical work by including multiple age groups and tasks of varying emotional demands, especially in the very young. We do not yet know with certainty that positivity following prosocial behavior is an early, stable, and well-established mechanism through which nascent prosocial attempts are sustained. Moreover, questions remain about the role of children's baseline positivity as a contributing factor to their positivity following prosocial behavior, discussed in the next section.

7.4 Baseline emotionality in relation to emotion in prosocial tasks (Aims 3 and 4)

Previous empirical research suggests that relations exist between young children's temperament and nascent prosocial behavior (Edwards et al., 2015; Liew et al., 2011). For example, temperamentally negative children tend to experience more frequent aversive emotional states (anger, fear, sadness) which, in turn, affects their ability to engage in a large array of behaviors, including prosocial behavior (Watson & Clark, 1984). Others have found that lower temperamental fearfulness or greater temperamental positivity predict toddlers' prosocial behavior concurrently and longitudinally (Sallquist et al., 2009). The current study assessed children's positivity/negativity during free play (i.e., baseline emotionality) and examined its effects in relation to both prosocial behavior and emotional valence in prosocial tasks. Since positivity and negativity are considered higher order, central aspects of temperament in early development (Zentner and Bates, 2008), the baseline emotionality measure was used as a proxy for children's early temperamental predisposition towards positivity or negativity.

Results showed that children were generally moderately positive during free play and that their baseline emotionality positively predicted their prosociality as well as their emotion both preceding and following prosocial behavior. These patterns held across prosocial tasks and within each of the three tasks. Regardless of age, children who were more positive and engaged during free play were more likely to help, share, and comfort, and also tended to be more eager and positive prior to a prosocial act as well as more positive after they behaved prosocially. Indeed, approximately 20% of the variance in children's emotion both preceding and following prosocial behavior was accounted for by their baseline emotionality.

These findings add to the limited empirical work reporting effects of temperament on young children's prosocial behavior by confirming that children's baseline positivity relates to

their emotional responses in prosocial tasks. Given that emotional positivity mediated age effects on prosocial responses (Aim 1 results) and that baseline positivity was then found to predict emotional positivity, it is possible that temperament may influence prosocial behavior in very young children at least as much as age (discussed later).

Importantly, the results also suggest that young children's increased positivity in relation to prosocial behavior may not be specific to prosocial behavior itself insofar as children's emotional responses in the prosocial tasks were, at least in part, accounted for by their baseline positivity. Controlling baseline emotionality reduced the role of positivity in predicting prosocial behavior; fully accounted for the finding that older children were more positive preceding prosocial behavior than were younger children; fully accounted for the finding that children were more positive following sharing and comforting across ages, although not the finding that children were more positive following helping; and did not explain the finding that older children were more positive than younger children following prosocial behavior.

From a theoretical standpoint, these findings call into question the extent to which young children's positive emotion either preceding or following prosocial behavior can be considered a primary mechanism motivating and sustaining early prosociality (Aknin et al., 2012), instead, the mechanisms underlying associations between young children's emotion and prosocial behavior are more multi-faceted and complex, including individual differences in baseline emotionality.

Baseline emotionality and age. Controlling baseline emotionality reduced the role of age in children's emotion preceding but not following prosocial behavior. Specifically, 16-, 24-, and 28-month-old children were equally positive *preceding* prosocial behavior when baseline emotionality was controlled; whereas, without this control, 28-month-old children were more positive than the younger children. *Following* prosocial behavior, 28-month-old children were

more positive than 24- and 16-month-old children, just as they had been without controlling baseline emotionality. Thus, baseline emotionality accounted for 28-month-old children's greater positivity preceding prosocial behavior, but not following it. Age-related differences in children's emotion related to prosocial behavior were weaker with baseline emotionality controlled, but still evident.

These findings are interesting since developments in children's social understanding and emotion regulation over the first few years of life could be expected to reduce the effects of baseline positivity on emotion and prosocial behavior as children become more able to engage and act on their social understanding (Ensor & Hughes, 2005; Sallquist et al., 2009). However, contrary to this expectation, these results suggest that a generally positive temperamental proclivity might be more influential than age in motivating prosocial behavior and positive emotion. Perhaps just as important, baseline positivity did not explain older children's greater positivity following prosocial behavior. This strengthens the possibility that "warm glow" effects are specific to prosocial behavior, but only in the oldest children, and that these effects therefore emerge later in development than prosocial behavior itself. This, in turn, makes such effects less plausible as a mechanism that sustains early-emerging prosocial behavior. Other mechanisms, such as socialization, may be more powerful in encouraging and maintaining the earliest forms of prosociality (Brownell, 2013, 2016).

Summary. On the whole, results for baseline emotionality suggest that 1-2.5-year-old children's predisposition towards positivity predicted their emotion preceding prosocial behavior of different types and did so more strongly than age. Without examining children's baseline emotionality in relation to their emotion preceding prosocial behavior, strong inferences cannot be drawn about the role of children's immediate emotion as a motivator of nascent prosociality.

Similarly, baseline emotionality explained children's greater positivity following sharing and comforting. But it did not account for children's greater positivity after helping, or older children's positivity after comforting, raising intriguing and important questions about when in development "warm glow" effects emerge and what other mechanisms might sustain and encourage prosocial behavior at earlier age points.

7.5 Strengths, limitations, and future directions

Unlike in older children and adults, much less is known about how emotion of positive and negative valence functions in young children who are making their first prosocial attempts. This is likely because, traditionally, two separate bodies of theory and empirical work discuss children's negative emotion preceding and positive emotion following prosocial behavior. The lack of integration between what we know about the role of positive and negative emotion in emerging prosocial behavior highlights a striking gap in the literature that the current study aimed to bridge. This study contributes both conceptually and methodologically to what we know about relations between young children's emotion and emerging prosociality.

Strengths. By including multiple prosocial tasks and age groups, this study extends what we know about children's negativity preceding and positivity following three different types of early prosocial behavior, i.e., helping, sharing, and comforting. This study also extends studying toddlers' positivity following prosocial behavior to a younger age group (i.e., 16 months), when prosocial behavior first emerges. The nuanced task- and age-specific results in relation to children's positivity/negativity during prosocial tasks draws attention to the need to study very young children's emotional responses in multiple prosocial contexts and, importantly, begin to

paint an intricate developmental picture of how children's emotion operates in the first few years of life when prosocial behavior first emerges.

In relation to methodological contributions, the introduction of a novel continuous measure of emotional valence and intensity, not previously used in studying emotion and prosocial behavior in infancy and toddlerhood, is a particular strength of the current study. Children's emotional valence, both during prosocial tasks and free play, was assessed in a large sample at multiple ages. This approach is important because, in this age period, individual expressions of emotion occur with relatively low frequency and, in fact, it was not feasible to code smiling in the current study, highlighting long-recognized challenges in coding discrete emotion in infants and toddlers (Camras et al., 2002) and the utility of continuous measurement of emotion. To facilitate future replication, coding was completed with user-friendly and free software, developed specifically for coding emotional valence during audio-visual recording.

In relation to conceptual and theoretical contributions, two important strengths relate to findings on children's emotional valence during prosocial tasks and to the role of temperamental positivity in associations between emotion and prosocial behavior. First, children appeared neither strongly negative, nor strongly positive, either preceding or following prosocial behavior. Rather, it was the change from neutral/mildly positive to more positive than predicted prosocial behavior. In a similar way, children were not intensely positive following prosocial behavior – they became slightly more positive following helping, sharing, and comforting. This calls into question theory of the role of negative emotion in emerging prosociality, suggesting instead that the earliest forms of prosocial behavior may develop within positive emotion contexts. These results also support initial findings on young children's experience of "warm glow", i.e., positivity, following prosocial behavior. Importantly, however, the current findings revealed an important development in such

"warm glow" effects insofar as they did not appear until 28 months of age following sharing and comforting. This provides further support for the speculation that the earliest emerging instances of prosocial behavior, well before 28 months of age, may be sustained by other positive emotional experiences, for example, during socialization.

Second, baseline positivity predicted emotional valence preceding and following prosocial behavior, as well as engagement in prosocial behavior. While controlling children's baseline positivity in predictive analyses did not entirely account for relations among emotional valence, age, and prosocial behavior, it did eliminate some of them and weaken others. These findings present a serious constraint on arguments that children's emotion in situations that call for assistance is specific to their helping, comforting, or sharing attempts; rather, young children's temperamental predisposition explains at least some of young children's prosociality and emotion preceding and following prosocial behavior. In addition, given that older children were more positive following prosocial behavior, especially comforting, including when baseline positivity was accounted for, "warm glow" effects may appear as individual differences in temperament begin to stabilize. The current results call for measures of temperament to be included in future research as well as in theoretical attempts to integrate theories on positive and negative emotion in relation to prosocial behavior.

Limitations and future directions. While finding from the current study contribute both empirically and conceptually to our understanding of young children's emotion in relation to prosocial behavior, several important limitations exist. Perhaps most impactful was the methodological limitation of prosocial task administration – since data were combined from four distinct studies, independently designed to address other scientific questions, not all children received all three prosocial tasks. As a result, task-specific patterns in emotional valence could not

be fully examined as a function of age and could not be examined in the same model. Therefore, we do not know how the oldest and youngest children's emotion might have differed between the comforting and sharing tasks. This is important since the comforting and sharing tasks placed higher emotional demands on children and developments in emotion preceding and following prosocial behavior may follow distinct developmental courses. Relatedly, the fact that not all children completed all prosocial tasks also led to unequal sample sizes in analyses comparing different tasks. While the analytic approaches employed are relatively robust to sample size violations (Keppel & Wickens, 1991), it is possible that, with larger and more equal sample sizes, stronger effects would have been observed.

Second, analyses of children's emotion preceding prosocial behavior as a predictor of prosocial engagement included both prosocial and non-prosocial children. This was necessary to be able to model how children's emotion related to their prosociality. However, since non-prosocial children had no emotional valence score preceding prosocial behavior (because they did not enact a prosocial response), their emotional valence score for the entire duration of prosocial tasks from the start of the task until it was ended by the experimenter was used. To avoid mixing prosocial children's emotional valence scores preceding prosocial behavior (often based on quite brief durations before they helped) with non-prosocial children's emotional valence scores during prosocial tasks (i.e., for the full duration of tasks) in the same model, all children's emotional valence scores during prosocial tasks were used. This approach also permitted averaging emotional valence scores across tasks for all children, which was necessary for analyses that collapsed across tasks. While this approach is consistent with most other empirical studies that used measurements of children's negativity from throughout the entire duration of tasks to predict prosocial engagement and to speculate about children's emotion preceding prosocial behavior as a motivator

or inhibitor of prosocial behavior (Spinrad & Stifter, 2006; Zahn-Waxler et al., 1992), this choice limits our true understanding of the role of emotion immediately preceding a prosocial act in the very young.

A third limitation of this study relates to the way emotional valence codes, both during prosocial tasks and free play, were used in analyses on children's emotion and prosocial behavior. While coding with CARMA yielded continuous second-by-second ratings of children's emotional valence, these ratings were averaged to produce a single emotional valence score (for each prosocial task and free play episode) that each child completed. This limits our understanding of individual variability in children's emotional responses during prosocial tasks and free play (see Appendix E, Table 32, for illustration of individual differences in this temporal parameter). This is important given that, to an extent, questions about children's emotional responses and baseline emotionality in relation to different types of prosocial behavior are individual differences questions: for example, do different children show different patterns of emotional responses within or across prosocial situations? By averaging emotional valence scores, the current study did not examine how children's emotional responses preceding and following a prosocial act varied within ages and types of prosocial behavior. Given that individual differences in both children's prosocial behavior and socio-emotional competencies have been reported (Gross et al., 2015), it would be important for future research to model change in children's emotion as it evolves during a prosocial task to better understand the already nuanced and complex picture of children's emotion in relation to prosocial behavior. Averaging emotion scores across time periods may also overweight peaks in emotional responses and does not provide a picture of the time course of emotional responsiveness, either of which may be important in relation to prosocial behavior. For example, it is possible that the "warm glow" following a prosocial act actually starts before a prosocial act,

i.e., with the intention to act, as suggested by visual inspection of Table 32 in Appendix E. This is worth exploring not only in young children's emotional responses to prosocial behavior, but also in adults' emotional responses.

Finally, a fourth limitation was that the sharing task was newly developed for Studies 2 (16-month-old children) and 3 (24-month-old children). Children were presented with an interactive furry-looking "bunny" toy. Upon initially meeting "bunny" during warm-up, some children showed wariness and, in some cases, fear. Although all children were eventually fully warmed up to the "bunny," it is possible that children's lower positivity in the sharing task reflected some continuing low-level wariness rather than lower rates of positivity specific to the challenge of sharing one's food. It would also be important to compare whether young children's reactions towards feeding an animal versus a person differed (Barragan, Brooks, & Meltzoff, 2020), especially since Aknin et al. (2012) used a puppet in their sharing task, to determine whether recipient characteristics influence either sharing rates or emotion preceding or following sharing, which we can expect based on differences in children's willingness to comfort their mother versus a stranger in distress (e.g., Spinrad & Stifter, 2006).

Finally, while this study addressed the potential effect of baseline emotionality, no standard measures of temperament were available for inclusion (e.g., Infant Behavior Questionnaire (IBQ); Rothbart, 1981 among others). Such measures typically cover a broader range of contexts and elicitors than the measure of baseline emotionality used in the current study. Thus, whether baseline emotionality reflected temperamental predispositions, as assumed here, or something more transient such as mood, cannot be determined. However, results were consistent with limited past research suggesting that young children's prosocial behavior is influenced by temperamental differences (Kochanska, Murray, Coy, 1997; Sommervile et al 2013). This idea has been largely

overlooked in recent research on children's emotional responses in relation to different types of prosocial behavior, but might be particularly important given that, at least in the current study, children were asked to be prosocial towards an unknown experimenter.

It is reasonable to expect that a more sociable and outgoing child (i.e., more positive at baseline) might be not only more prosocial and willing to approach a stranger, but overall more positive in situations requiring prosocial intervention. Indeed, Hammond and Carpendale (2015) reported that, toddlers' willingness to approach a previously unknown experimenter predicted spontaneous prosocial behavior and overall higher rates of prosociality. For this reason, a measure of children's baseline emotionality, as the one the current study included, might be even more relevant to understanding the role of children's overall positivity in relation to their emotion during prosocial tasks. However, it remains important to validate the current measure of baseline emotionality against well-established measures of temperament, both observational and parent-report.

Summary. The current study integrated existing research and theory on children's positive and negative emotion in relation to prosocial behavior and introduced a novel measure emotion expression in 16-28-month-old children. Overall, the results from the current study elaborate and extend what we know about children's positivity and negativity in relation to early-emerging prosociality and have important implications for existing theories on negative and positive emotion as motivating and sustaining prosociality in this age group. Two of the most important findings of the current study show that, unlike dominant predictions in the field, children were neither intensely negative, nor intensely positive in relation to different types of prosocial behavior, discovered by utilizing a continuous measure of emotional valence and intensity. Instead, they were generally mildly to moderately positive, both preceding and following prosocial behavior.

This has important implications for our explanations of how early prosocial behavior arises and is maintained, highlighting the potentially central role of positive emotion. Second, children's temperamental positivity explained, at least in part, relations between children's emotion and prosocial behavior, which shows that situation-specific emotion is not necessarily the only or the most central predictor of prosocial engagement in very young children; rather, their own positivity may be as important. It is therefore reasonable to speculate that young children's emotional responses in prosocial situations do not independently promote and sustain prosociality; rather, these likely interact with children's temperament and socialization environment to fully explain the relationship between young children's emotions and their early prosocial attempts.

In addition, children's mild to moderate positivity, both during prosocial tasks and free play, raises questions about the extent to which children had a true prosocial motivation when they helped, shared, and comforted. Emerging prosocial behavior has generally been interpreted as a sign of early altruism, i.e., a deliberate intention to alleviate the plight of another; however, it is possible that, early in development, children's prosocial behavior is due to interest, desire to engage with others, or compliance, rather than due to understanding someone else's emotions and need (Carpendale et al., 2015). Young children's relatively cheerful participation in chores at home (e.g., Hammond & Brownell, 2018; Pettygrove, Hammond, Karahuta, Waugh, & Brownell, 2013), prosocial tasks in lab (e.g., Aknin et al., 2012; Rheingold, 1982; Wu et al., 2017), and relaxed play with adults might evidence the possibility that children's larger socio-emotional developmental factors, above and beyond children's emotion in the moment, contribute to emerging prosociality.

In the current study, age-related results on children's emotion in relation to prosocial behavior also highlight the possibility that very young children's emotional responses might not be specific to prosocial behavior. Only 28-month-old children, but not 16- and 24-month-old

children, showed reduced positivity preceding and increased positivity following comforting (an emotionally demanding type of prosocial behavior) as compared to helping (emotionally neutral). In other words, only the oldest children in the current study showed the pattern of emotion that has been proposed to occur in response to another's emotional need during a prosocial situation. Therefore, it is possible that older children, whose socio-emotional skills are more advanced, are the ones who intervened prosocially out of concern. Younger children's prosocial behavior and corresponding emotion, on the other hand, might have been driven by a desire to engage in social interaction and comply with the requests of an adult. While studying the genuine motivation for emerging prosocial behavior poses a challenging task to developmental researchers, it is, at the minimum, important for research to examine children's emotion during both prosocial and other tasks (e.g., compliance or mastery tasks) with attention to measuring not only emotion, but expressions of interest, compliance, and social approach in both laboratory and naturalistic settings.

In conclusion, in future studies, it will be important to continue to utilize continuous measurement of emotion as a way of overcoming the fact that discrete emotion-related expressions occur with generally low frequency in this age group. It will also be important to continue to examine the role of early temperament in associations between emotion and prosocial behavior. It will be important to continue to include children across the entire range of toddlerhood, from early in the second year until well into the third year, to better understand how potential mechanisms in the emergence and development of prosocial behavior change over this period.

Appendix A Coding smiling

Before beginning coding of children's smiles in the full dataset, feasibility of coding smiles was assessed since children's movements in space often led to obstruction of a full-frontal view of the child's face; this view is optimal for detecting the defining features of a "smile," such as when a child's cheeks are raised, the muscles around the eyes are contracted describing smiling/laughing lines, or the child's mouth is open and his/her eyes were wide (i.e., laughter) (Ekman, Friesen, & Hager, 2002).

Onset and offset of the time (in seconds) during which the child's face was obstructed were coded in 48 randomly selected videos (12 per study, including both free-play and prosocial tasks, representing 22% of the full sample). Specific reasons defined as obstruction of the child's face included (1) the child faced away or a toy/E/parent blocked view of the child's face, (2) the child's face could only be seen partially, and (3) facial features of the child's face were blurry due to poor video quality (video recording was conducting from behind a one-way mirror reducing overall picture quality). The total percentage of uncodable time was obtained by dividing total number of un-codable seconds by the total number of seconds in the video session.

Results revealed that percentage of uncodable time varied from 75% to 96% (see Table 13), rendering coding of smiling unfeasible. In addition, during the times when the child's face was in full-frontal camera view, smiles occurred with very low frequency (see Table 13). Coding occurrence of smiling, therefore, was not implemented in the full sample.

Table 13. Occurrence of Smiles: % Uncodable Time and Smiling Frequency

Study	Age (months)	Total % time un-codable	Number of smiles (during codable time)
1	16	90.84%	0
2	16	74.84%	1
3	24	96.85%	2
4	28	93.41%	2

Notes. A random selection of 12 videos, including free-play episodes and prosocial tasks, was made for each study, resulting in 48 videos assessed for feasibility of coding occurrence of smiling. The total percentage of un-codable time reported for each study is the averaged un-codable time from the 12 respective videos.

Appendix B Reliability

Table 14. Pairwise ICC Values for Emotional Valence Coding by Study and Task

Study	Task	Coders			
		Expert and Coder 1	**Expert and Coder 2**	**Expert and Coder 3**	**Expert and Coder 4**
Study 1	Free play 1	.86	.80	.90	.76
	Free play 2	.83	.82	.83	.82
	Free play 3	.92	.80	.80	N/A
	Helping	.89	.83	N/A	.83
	Comforting	.91	.84	.87	.88
Study 2	Free play 1	.89	.83	N/A	.87
	Free play 2	.82	.80	.81	.83
	Free play 3	.88	N/A	N/A	N/A
	Helping	.93	.85	.92	.89
	Sharing	.88	.80	.84	.85
Study 3	Free play 1	.88	.67	.74	.90
	Free play 2	.91	.83	.90	.74
	Free play 3	.84	.86	.87	N/A
	Helping	.90	N/A	.82	N/A
	Comforting	N/A	N/A	.87	.84
	Sharing	N/A	N/A	N/A	.86
Study 4	Free play 1	.90	.87	.90	.87
	Free play 2	.91	.89	.93	.87
	Free play 3	.92	.80	N/A	.84
	Helping	.82	.87	.83	.86
	Comforting	.90	.88	.80	.85

Notes. Pairwise ICC values are reported for the primary author, i.e., "expert coder" and each of the four research assistant coders. N/A indicates that the research assistant coder did not participate in coding the respective task.

Appendix C Preliminary analyses

Preliminary analyses verified that data from the four included datasets did not differ in demographic make-up (parent income, parent education, and number of siblings), as well as that there were no differences in baseline emotionality and emotional valence during prosocial tasks across studies, in the full sample, or within gender.

First, three chi-square tests of independence examined the relations between *study* (1, 2, 3, and 4) and *parent income* (less than $50, 000, between $50, 000 – 100,000, and more than $100, 000), *parent education* (less than college degree, college degree, and graduate degree), and *number of siblings* (ranging between 0 – 4), respectively. The relation between *study and parent income* was not significant, χ^2 (6, N = 209) = 8.57, p = .20 (see Table 15). The relation between *study and parent education* was not significant, χ^2 (6, N = 210) = 7.91, p = .25 (see Table 16). The relation between *study and number of siblings* was not significant, χ^2 (12, N = 208) = 9.74, p = .64 (see Table 17).

Table 15. Observed and Expected Frequencies for Parent Income by Study

	Parent Income		
Study	**Less than $50, 000**	**$50, 000 – 100, 000**	**More than $100, 000**
1	11 (10.6)	23 (25.5)	31 (28.9)
2	7 (11.2)	28 (27.1)	34 (30.7)
3	4 (4.9)	11 (11.8)	15 (13.3)
4	12 (7.3)	20 (17.7)	13 (20.0)

Notes. Expected frequencies appear in parentheses below observed frequencies. As observed, children were from predominantly middle- and high-income families, and this pattern was consistent across studies.

Table 16. Observed and Expected Frequencies for Parent Education by Study

	Parent Education		
Study	**Less than a college degree**	**College degree**	**Graduate degree**
1	7 (6.8)	12 (12.4)	46 (45.8)
2	5 (7.3)	12 (13.3)	53 (49.3)
3	1 (3.1)	8 (5.7)	21 (21.1)
4	9 (4.7)	8 (8.6)	28 (31.7)

Notes. Expected frequencies appear in parentheses below observed frequencies. As observed, children predominantly came from highly educated families with parents, and this pattern was consistent across studies.

Table 17. Observed and Expected Frequencies for Number of Siblings by Study

	Number of Siblings				
Study	**0**	**1**	**2**	**3**	**4**
1	39 (33.8)	16 (20.0)	6 (6.8)	2 (2.5)	1 (0.9)
2	35 (37.0)	24 (21.9)	9 (7.4)	1 (2.7)	1 (1.0)
3	17 (15.9)	9 (9.4)	2 (3.2)	1 (1.2)	1 (0.4)
4	19 (23.3)	16 (13.8)	5 (4.7)	4 (1.7)	0 (0.6)

Notes. Expected frequencies appear in parentheses below observed frequencies. As observed, the majority of children had either no or one sibling, and this pattern was consistent across studies.

Second, preliminary analyses assessed whether there were differences in *baseline emotionality and emotional valence during prosocial tasks* based on *children's ethnicity* (white or non-white) in each study and in the full sample. No significant differences based on ethnicity emerged for baseline emotionality both within and across studies (all *p-s* > .05; see Table 18) and, for emotional valence, there was only one significant difference in Study 1 (non-white children were more positive than white children; see Table 19). As a result, *ethnicity* was not controlled in main analyses.

Table 18. Baseline Emotionality During Free Play by Ethnicity and Study

Study	Age (months)	White			Non-White			ANOVA Statistics			
		n	*M*	*SD*	*n*	*M*	*SD*	$df_{between}$	df_{within}	*F*	*p*
1	16	50	3.03	1.20	15	3.11	.69	1	63	.07	.80
2	16	62	2.47	1.67	10	3.32	1.34	1	71	2.31	.13
3	24	27	2.97	1.30	4	3.39	.51	1	29	.39	.54
4	28	38	4.44	1.10	9	4.44	1.10	1	45	.02	.90
Full sample		177	3.14	1.52	38	3.51	1.09	1	213	2.06	.15

Note. Five one-way between-subjects analysis of variance (ANOVA) tests examined the effect of children's ethnicity on baseline emotionality (averaged scores from the three free-play episodes for each child) in Studies 1 – 4 and the full sample.

Table 19. Emotional Valence during Prosocial Tasks by Ethnicity and Study

Study	Age (months)	White			Non-White			ANOVA Statistics			
		n	*M*	*SD*	*n*	*M*	*SD*	$df_{between}$	df_{within}	*F*	*p*
1	16	47	1.83	1.25	15	2.68	1.25	1	60	5.22	.03*
2	16	49	2.25	1.50	10	1.80	1.29	1	57	.77	.38

3	24	27	1.84	1.33	4	3.07	.44	1	29	3.27	.08
4	28	37	3.04	1.40	9	3.38	1.89	1	44	.36	.55
Full sample		160	2.23	1.48	38	2.65	1.46	1	196	2.53	.11

Note. Five one-way between-subjects analysis of variance (ANOVA) tests examined the effect of children's ethnicity on emotional valence during prosocial tasks (averaged scores from the prosocial tasks that each child completed) in Studies 1 – 4 and the full sample.

Third, preliminary analyses assessed whether there were differences in *baseline emotionality and emotional valence during prosocial tasks* based on *parent income.* For baseline emotionality, both in Study 2 and the full sample, children with parent income less than $50, 000 were higher in baseline emotionality than children in the two other income groups. However, in both cases, the samples were highly skewed towards higher incomes and few families reported income less than $50, 000 (see Table 20). For emotional valence during prosocial tasks in the full sample, children with parent income between $50, 000 – 100, 000 were more positive than in the other two income groups. However, again, the sample were highly skewed towards higher incomes and few families reported income less than $50, 000 (see Table 21). As a result, *parent income* was not controlled in main analyses.

Table 20. Baseline Emotionality during Free Play by Parent Income and Study

		Parent Income									**ANOVA Statistics**			
		Less than $50, 000			**$50, 000 - $100, 000**			**Above $100, 000**						
Study	**Age**	***n***	***M***	***SD***	***n***	***M***	***SD***	***n***	***M***	***SD***	$df_{between}$	df_{within}	***F***	***p***
1	16	11	3.47	1.09	23	3.06	.83	31	2.89	1.27	2	62	1.12	.33
2	16	7	3.67	.60	28	2.98	1.28	34	2.03	1.91	2	66	4.56	.01*
3	24	4	2.34	1.40	11	2.78	1.56	15	3.35	.89	2	27	1.34	.28

4	28	12	4.37	1.08	20	4.60	.74	13	4.29	.78	2	42	.60	.55
Full sample		34	3.69	1.18	82	3.37	1.29	93	2.85	1.62	2	206	5.47	.01*

Note. Five one-way between-subjects analysis of variance (ANOVA) tests examined the effect of parent income on children's baseline emotionality Studies 1 – 4 and the full sample.

Table 21. Emotional Valence during Prosocial Tasks by Parent Income and Study

		Parent Income												
		Less than $50, 000			**$50, 000 - $100, 000**			**Above $100, 000**			**ANOVA Statistics**			
Study	**Age**	***n***	***M***	***SD***	***n***	***M***	***SD***	***n***	***M***	***SD***	$df_{between}$	df_{within}	***F***	***p***
1	16	10	2.49	1.19	23	2.34	1.26	29	1.64	1.27	2	59	2.81	.07
2	16	5	2.40	1.07	25	2.52	1.35	26	1.90	1.48	2	53	1.27	.29
3	24	4	1.20	2.24	11	2.29	1.20	15	2.00	1.15	2	27	.99	.39
4	28	12	2.72	1.41	19	3.22	1.64	13	3.01	1.28	2	41	.44	.65
Full sample		31	2.40	1.43	78	2.61	1.41	83	1.98	1.45	2	189	3.94	.02*

Note. Five one-way between-subjects analysis of variance (ANOVA) tests examined the effect of parent income (below $50, 000; between $50,000 - $100,000; and above $100,000) on children's emotional valence during prosocial tasks.

Fourth, preliminary analyses assessed whether there were differences in *baseline emotionality and emotional valence during prosocial tasks* based on *parent education.* No difference in baseline emotionality or emotional valence during prosocial tasks emerged based on parent education within and across studies (see Tables 22 and 23). As a result, *parent education* was not controlled in main analyses.

Table 22. Baseline Emotionality during Free Play by Parent Education and Study

Study	Age	Parent Education: Less than College Degree			Parent Education: College Degree			Parent Education: Graduate Degree			ANOVA Statistics			
		n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	$df_{between}$	df_{within}	*F*	*p*
1	16	7	3.33	.98	12	3.58	1.01	46	2.87	1.11	2	62	2.35	.10
2	16	5	3.49	.47	12	2.47	1.46	53	2.55	1.77	2	67	.76	.47
3	24	1	3.47	.00	8	2.80	1.04	21	3.07	1.36	2	27	.19	.83
4	28	9	4.53	.97	8	4.49	1.10	28	4.41	.76	2	42	.74	.93
Full sample		22	3.86	1.00	40	3.27	1.37	148	3.07	1.51	2	207	2.94	.06

Note. Five one-way between-subjects analysis of variance (ANOVA) tests examined the effect of parent education on children's baseline emotionality.

Table 23. Emotional Valence during Prosocial Tasks by Parent Education and Study

Study	Age	Parent Education: Less than College Degree			Parent Education: College Degree			Parent Education: Graduate Degree			ANOVA Statistics			
		n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	$df_{between}$	df_{within}	*F*	*p*
1	16	7	2.92	1.18	12	1.56	1.36	43	2.02	1.24	2	59	2.61	.08
2	16	5	3.15	.33	9	2.37	.84	43	2.09	1.52	2	54	1.40	.26
3	24	1	3.09	.00	8	2.32	1.33	21	1.83	1.35	2	27	.73	.49
4	28	9	2.30	1.96	8	3.80	1.61	27	3.03	1.13	2	41	2.38	.11
Full sample		22	2.73	1.42	37	2.34	1.67	134	2.22	1.38	2	190	1.18	.31

Note. Five one-way between-subjects analysis of variance (ANOVA) tests examined the effect of parent education on children's emotional valence during prosocial tasks.

Finally, in relation to gender, approximately equal number of girls and boys engaged in prosocial behavior in the instrumental helping (χ^2 (1, N = 206) = .29, p = .59), comforting (χ^2 (1, N = 139) = .19, p = .67), and sharing tasks (χ^2 (1, N = 93) = 1.29, p = .26). Preliminary analyses assessed whether there were differences in *baseline emotionality and emotional valence during prosocial tasks* based on *gender.* In Study 1, boys were higher in baseline emotionality than were girls (see Table 24). There were no other differences between boys and girls in baseline emotionality or in emotional valence during prosocial tasks within and across studies (see Table 25). *Gender* was therefore not controlled in main analyses.

Table 24. Baseline Emotionality during Free Play by Gender

		Boys			Girls			ANOVA Statistics			
Study	**Age**	***n***	***M***	***SD***	***n***	***M***	***SD***	***df*** *between*	***df*** *within*	***F***	***p***
1	16	31	3.38	.75	34	2.74	1.28	1	63	6.83	.02*
2	16	36	2.79	1.77	36	2.38	1.52	1	71	1.07	.30
3	24	17	2.87	1.36	14	3.21	1.08	1	29	.59	.45
4	28	25	4.49	.81	22	4.46	.89	1	45	.02	.90
Full sample		109	3.36	1.43	106	3.04	1.48	1	213	2.66	.10

Note. Five one-way between-subjects analysis of variance (ANOVA) tests examined the effect of gender on children's baseline emotionality.

Table 25. Emotional Valence during Prosocial Tasks by Gender

		Boys			Girls			ANOVA Statistics			
Study	**Age**	***n***	***M***	***SD***	***n***	***M***	***SD***	***df*** *between*	***df*** *within*	***F***	***p***
1	16	28	2.34	1.28	34	1.78	1.26	1	61	2.87	.10

2	16	29	2.12	1.56	30	2.23	1.38	1	58	.08	.78
3	24	17	1.91	1.39	14	2.01	1.25	1	29	.16	.69
4	28	25	3.07	1.50	21	3.15	1.51	1	45	.03	.86
Full sample		99	2.39	1.48	99	2.26	1.42	1	196	.40	.53

Note. Five one-way between-subjects analysis of variance (ANOVA) tests examined the effect of gender on children's emotional valence during prosocial tasks.

Additionally, preliminary analyses examined differences in children's positivity/negativity ratings over the three free-play episodes (i.e., baseline emotionality) to determine whether there were systematic change patterns in emotional valence over time (e.g., children becoming more comfortable and positive over time, or more fatigued and negative over time). Paired samples t-tests examined differences between free-play ratings in Studies 1 – 4 and the full sample. In Studies 1 and 3, children had higher ratings in free-play in the first than the second free-play episode, (t (64) = -2.94, p = .01; t (64) = -2.68, p = .01, respectively). In Study 4, children had higher ratings in the second than the first and third free-play episodes, (t (46) = -2.21, p = .03; t (46) = 2.56, p = .01, respectively). No other significant differences emerged and positivity/negativity during individual free-play episodes was not controlled in main analyses.

Table 26. Means and Standard Deviations of Positivity/Negativity during Free Play

			Free-play Episode 1		**Free-play Episode 2**		**Free-play Episode 3**		**Baseline Emotionality**	
Study	**Age (months)**	***n***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
1	16	65	2.65	1.25	3.20	1.24	3.30	2.03	3.05	1.10
2	16	72	2.78	1.95	2.42	2.20	2.56	2.05	2.59	1.65
3	24	31	2.86	1.91	3.09	1.69	3.14	1.59	3.03	1.23

4	28	47	4.49	0.99	4.82	1.00	4.11	1.71	4.47	0.84
Full sample		215	3.12	1.72	3.27	1.86	3.21	1.98	3.20	1.46
Range			-5.46 – 6.21		-2.36 – 6.73		-2. 81 – 6.80		-2.57 – 6.31	

Notes. Rating scale ranged from -10 (most negative) to + 10 (most positive). Baseline emotionality is the average rating of each child's three free-play episodes ratings.

Appendix D Supplemental analyses on types of cues

A series of supplemental exploratory analyses examined whether age, baseline emotionality, and emotional valence differences existed based on the type of cue children received before engaging in helping, comforting, or sharing (see Section 4.4.5 in Methods for how children were categorized by cue type). These analyses are restricted to prosocial children.

Helping. Of the 137 children who were prosocial in the helping task, 54 helped spontaneously, 55 helped following a prompt, and 28 helped following an explicit request. Cue type differences as a function of age were assessed to examine whether older children were more likely to help spontaneously (i.e., with less direction) and whether younger children were more likely to help following a prompt or a request (i.e., with more direction). A chi-square goodness-of-fit test revealed that age (16, 24, or 28 months) was not equally represented across cue type (spontaneous, prompted, or requested), χ^2 (4, N = 137) = 10.68, p < .05. Sixteen-month-old children were more likely to help following a prompt or a request than spontaneously; 28-month-old children were more likely to help spontaneously than following a prompt or a request; and no differences emerged for 24-month-old children (see Table 27).

Table 27. Observed and Expected Frequencies of Cue Type by Age in the Helping Task

	Cue Type		
Age (months)	**Spontaneous**	**Prompted**	**Requested**
16	21 $_{a}$ (29.2)	32 $_{b}$ (29.7)	21 $_{b}$ (15.1)
24	10 $_{a}$ (8.3)	8 $_{a}$ (8.4)	3 $_{a}$ (4.3)

28	23 $_{a}$ (16.6)	15 $_{a, b}$ (16.9)	4 $_{b}$ (8.6)

Notes. Expected frequencies appear in parentheses below observed frequencies. Subscript letters denote categories whose row proportions differed significantly from each other at the .05 level based on z-score comparisons.

Next, to examine whether there were differences in *children's baseline emotionality as a function of cue type*, a one-way between-subjects ANOVA was conducted with cue type (spontaneous, prompted or requested) as the independent variable and baseline emotionality as the dependent variable. There was a significant (but small) effect of cue type, F (2, 136) = 4.71, p < .05, η^2 = .07. Children who helped spontaneously (M = 3.92; SD = .97) were more positive at baseline than children who helped following a prompt (M = 3.62; SD = 1.28) or a request (M = 3.04; SD = 1.55), both p-s > .05; children who helped following a prompt or a request did not differ in baseline emotionality, p > .05.

To examine whether there were differences in *children's emotional valence preceding helping based on cue type*, a one-way between-subjects ANOVA was conducted with cue type (spontaneous, prompted or requested) as the independent variable and emotional valence during the helping task as the dependent variable. There was no significant effect of cue type; i.e., children who helped spontaneously (M = 3.46; SD = 1.24), following a prompt (M = 3.15; SD = 1.42), or following a request (M = 3.10; SD = 1.22) did not differ in emotional valence during the helping task, F (2, 136) = 1.03, p = .36, η^2 = .02.

Finally, to examine whether there were differences in *children's emotional valence following helping based on cue type,* a one-way between-subjects ANOVA was conducted with type of helping (spontaneous, prompted or requested) as the independent variable and emotional valence difference scores during helping as the dependent variable. There was no significant effect of type of cue type, suggesting that children who helped spontaneously (M = .99; SD = 1.04),

following a prompt (M = 1.08; SD = 1.13), or a request (M = .73; SD = 1.40) did not differ in positivity following helping, F (2, 136) = .84, p = .44, η^2 = .01.

In summary, in relation to age, results suggested that 28-month-old children were more likely to help spontaneously than following a prompt or a request. In contrast, 16-month-old children were more likely to help following a prompt or a request, but not spontaneously. Surprisingly, 24-month-old children were equally likely to help across the three cue types. In relation to emotion, cue type differences emerged only for baseline emotionality (such that children who helped spontaneously were more positive at baseline than those who helped following a prompt or a specific request). There were no differences in children's emotional valence during the helping task based on type of cue children received.

Comforting. Of the 74 children who were prosocial in the comforting task, 8 comforted spontaneously, 43 comforted following a prompt, and 23 following a request. Cue type differences as a function of age were assessed to examine whether older children were more likely to comfort following a prompt[4] than a request (i.e., with less direction), and whether the youngest children were more likely to comfort following a request than a prompt (i.e., with more direction). A chi-square goodness-of-fit test revealed that age (16, 24, or 28 months) was not equally represented across cue type (prompted or requested), χ^2 (2, N = 74) = 6.31, p < .05. Both 16- and 28-month-old children were more likely to comfort following a prompt than a request, while 24-month-old children were equally likely to comfort following both prompts and requests.

Table 28. Observed and Expected Frequencies of Cue Type by Age in the Comforting Task

	Cue Type

[4] Only 8 (out of 74) helped spontaneously; therefore, the spontaneous cue type category was merged with the prompted cue type category.

Age (months)	Prompted	Requested
16	7_{a} (10.3)	8_{b} (4.7)
24	14_{a} (15.2)	8_{a} (6.8)
28	30_{a} (25.5)	7_{b} (11.5)

Notes. Expected frequencies appear in parentheses below observed frequencies. Subscript letters denote categories whose row proportions differed significantly from each other at the .05 level based on z-score comparisons.

Next, to examine whether there were differences in *children's baseline emotionality as a function of cue type,* a one-way between-subjects ANOVA was conducted with cue type (prompted or requested) as the independent variable and baseline emotionality as the dependent variable. There was no significant effect of cue type, suggesting that children who comforted following a prompt (M = 4.03; SD = 1.07) or a request (M = 3.82; SD = 1.00) were equally positive at baseline, F (1, 73) = .66, p = .42, η^2 = .01.

To examine whether there were differences in *children's emotional valence as a function of cue type*, one-way between-subjects ANOVA was conducted with cue type (prompted or requested) as the independent variable and emotional valence during comforting as the dependent variable. There was no significant effect of cue type, suggesting that children who comforted following a prompt (M = 3.06; SD = 1.71) or a request (M = 2.30; SD = 1.60) were equally positive during the comforting task, F (1, 73) = 3.30, p = .07, η^2 = .01.

Finally, to examine whether there were differences in *children's emotional valence following comforting as a function of cue type*, a one-way between-subjects ANOVA was conducted with cue type (prompted or requested) as the independent variable and emotional valence difference scores as the dependent variable. There was no significant effect of cue type,

suggesting that children who comforted following a prompt (M = .72; SD = 1.37) or a request (M = .26; SD = 1.55) were equally positive following comforting, F (1, 73) = 1.69, p = .20, η^2 = .02.

In summary, in relation to age, 16- and 28-month-old children were more likely to comfort following a prompt than a request, and this difference did not emerge for 24-month-old children. There were no significant baseline emotionality or emotional valence differences based on cue type in the comforting task.

Sharing. Of the 41 children who were prosocial in the sharing task, 0 shared spontaneously, 30 shared following a prompt and 11 following a request. Cue type differences as a function of age were assessed to compare older and younger children in their likelihood to share following a prompt (i.e., with less direction) versus a request (i.e., with more direction). A chi-square goodness-of-fit test revealed that age (24 or 24 months) was not equally represented across cue type (prompted or requested), χ^2 (1, N = 41) = 5.07, p < .05. Both 16- and 24-month-old children were more likely to share following a prompt than a request.

Table 29. Observed and Expected Frequencies of Cue Type by Age in the Sharing Task

	Cue Type	
Age (months)	**Prompted**	**Requested**
16	10 $_{a}$ (13.2)	8 $_{b}$ (4.8)
24	20 $_{a}$ (16.8)	3 $_{b}$ (6.2)

Notes. Expected frequencies appear in parentheses below observed frequencies. Subscript letters denote categories whose row proportions differed significantly from each other at the .05 level based on z-score comparisons.

Next, to examine whether there were differences in *children's baseline emotionality based on cue type,* a one-way between-subjects ANOVA was conducted with type of sharing (prompted

or requested) as the independent variable and baseline emotionality as the dependent variable. There was a significant effect of cue type, suggesting that children who shared following a prompt (M = 3.35; SD = .77) were more positive at baseline than those who shared following a request (M = 2.29; SD = 1.92), F (1, 39) = 6.40, $p < .05$, $\eta^2 = .14$

To examine whether there were differences in *children's emotional valence during the sharing task based on cue type,* a one-way between-subjects ANOVA was conducted with type of sharing (prompted or requested) as the independent variable and emotional valence during sharing as the dependent variable. There was no significant effect of cue type, suggesting that children who shared following a prompt (M = 2.59; SD = .71) or a request (M = 2.03; SD = 1.62) were equally positive during the sharing task, F (1, 39) = 2.39, p = .13, $\eta^2 = .06$.

Finally, to examine whether there were differences in *children's emotional valence following sharing based on cue type,* one-way between-subjects ANOVA was conducted with cue type (prompted or requested) as the independent variable and emotional valence difference scores as the dependent variable. There was a significant effect of type of cue, suggesting that children who shared following a prompt were more positive (M = .85; SD = .60) than children who shared following a request (M = .35; SD = .47), F (1, 39) = 6.36, $p < .05$, $\eta^2 = .14$.

In summary, both 16- and 24-month-old children were more likely to share following a prompt than a request. Children who shared following a prompt were more positive at baseline and following sharing than children who shared following a request. However, there were no significant emotional valence differences preceding sharing based on cue type.

Conclusion. Age differences based on cue type emerged in all three tasks. In the helping task, the oldest children were more likely to help spontaneously (i.e., without direction) than were younger children who, in turn, were more likely to help following a prompt or a request (i.e., with

more direction). In both the comforting and sharing tasks, both younger and older children were more likely to be prosocial following a prompt (i.e., with less direction) than a request (with the exception of 24-month-old children in the comforting task who were equally likely to comfort following both a prompt or a request).

In relation to baseline emotionality, children in the helping and sharing tasks were more positive at baseline when they were prosocial spontaneously (in the helping task) or following a prompt (in the comforting task). That is, children who needed less direction before prosocial behavior were more positive during relaxed free-play. In the comforting task, however, there were no differences in baseline emotionality based on cue type.

Finally, in relation to emotion during prosocial tasks, there were no differences in children's emotional valence based on cue type in the helping and comforting tasks. Only in the sharing task were children more positive following sharing when they shared following a prompt (i.e., with less direction) than following a request.

Because these effects were both few and limited to particular situations, they were not integrated into the primary results or further interpreted.

Appendix E Supplemental analyses on emotion variables

The descriptive statistics and analyses included here aim to provide additional information on children's emotion during prosocial tasks and free play with specific attention to highlighting individual differences.

Table 30. Range of Baseline Emotionality and Emotional Valence Scores during Prosocial Tasks

Study	Age (months)	Baseline Emotionality	Emotional Valence Helping	Emotional Valence Comforting	Emotional Valence Sharing	Prosocial Tasks (valence averaged)
1	16	-.79 – 5.17	-1.49 – 5.23	-2.22 – 5.49	N/A	-1.21 – 5.03
2	16	-2.67 – 4.99	-2.38 – 5.46	N/A	-1.80 – 5.72	-1.90 – 4.14
3	24	-.37 – 4.66	-1.35 – 4.99	-2.19 – 4.93	-2.71 – 3.94	-1.93 – 3.88
4	28	2.44 – 6.31	-1.16 – 6.10	-1.49 – 6.78	N/A	-1.32 – 5.83
Full sample		-2.57 – 6.31	-2.38 – 6.10	-2.22 – 6.78	-2.71 – 5.72	-1.93 – 5.83

Note. N/A indicates that the task was not administered. Reported ranges for emotional valence across prosocial tasks do not reflect ranges for individual tasks due to differences in number of children who completed at least two prosocial tasks. See Table 1 in the main text.

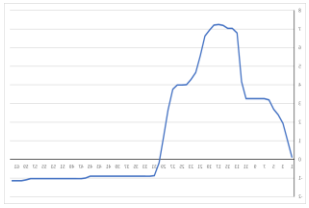
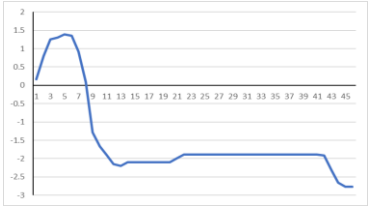
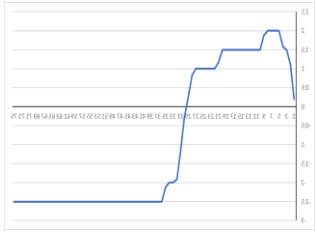
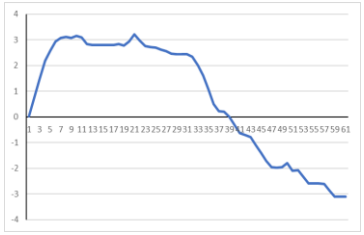
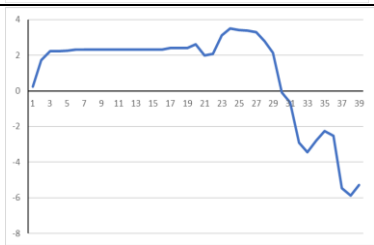
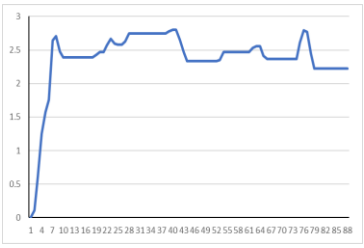
Table 31. Range of Emotional Valence Scores Preceding and Following Prosocial Behavior

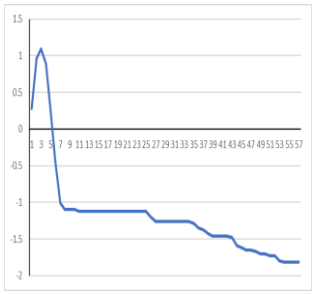
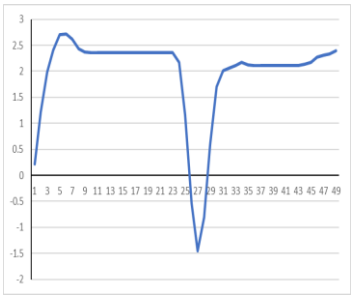
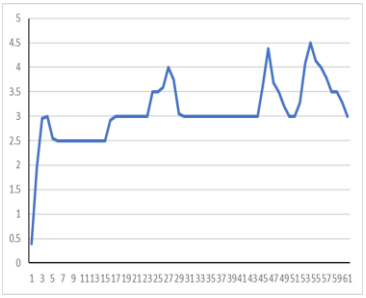
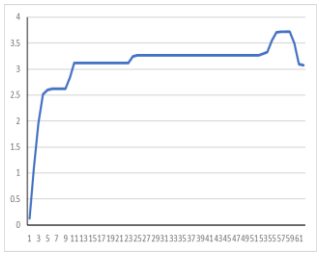
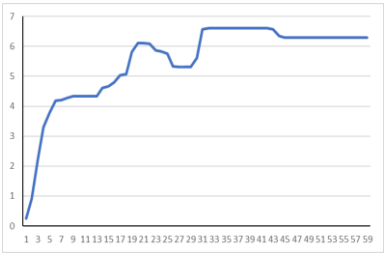
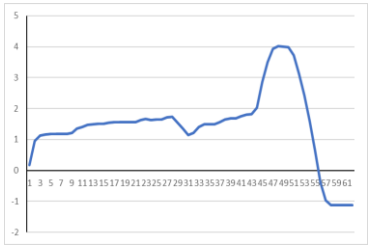
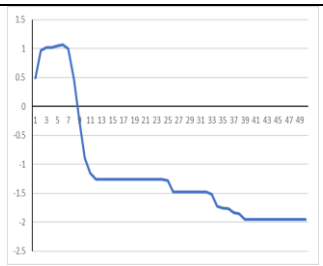
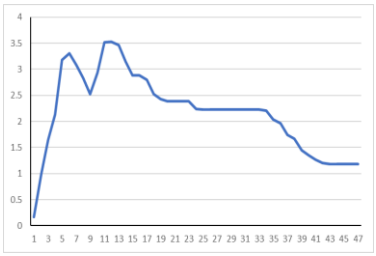
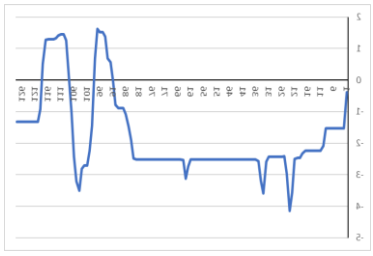
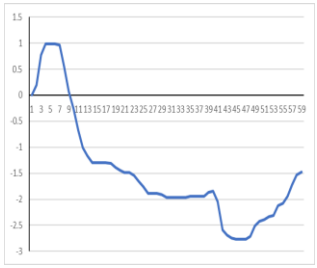
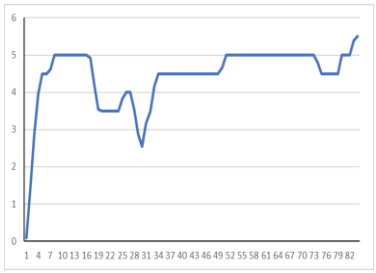
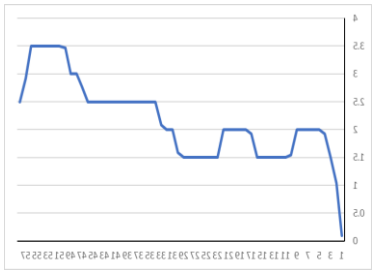
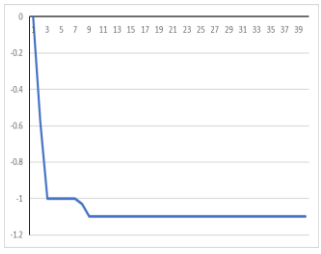
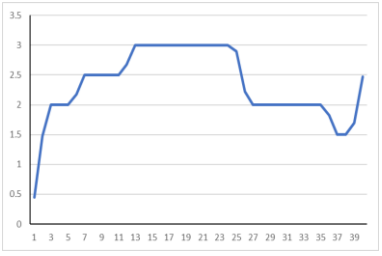
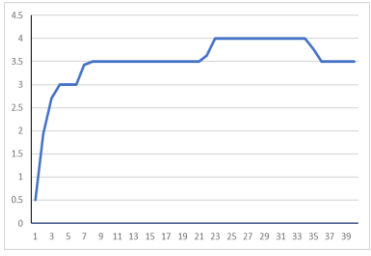
	Emotional Valence Helping		Emotional Valence Comforting		Emotional Valence Sharing		Prosocial Tasks (valence averaged)	
Study	*Preceding*	*Following*	*Preceding*	*Following*	*Preceding*	*Following*	*Preceding*	*Following*
1	-.88 – 5.03	-.37 – 6.09	-1.64 – 5.08	.31 – 5.23	N/A	N/A	-.45 – 4.79	1.15 – 3.61
2	-1.81 – 5.33	.22 – 5.53	N/A	N/A	-1.00 – 3.72	-1.34 – 4.90	.48 – 4.13	.86 – 5.10

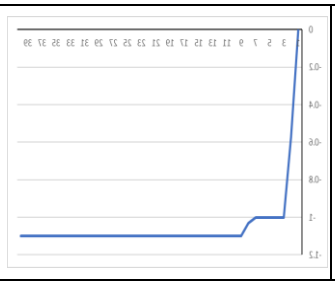
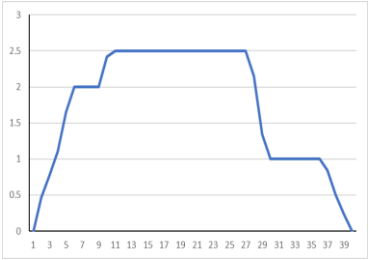
3	-.30 – 4.73	.30 – 5.69	1.10 – 5.09	.50 – 5.33	.25 – 3.66	2.08 – 4.56	.68 – 3.95	.80 – 4.24
4	-.52 – 5.71	.22 – 6.84	-1.33 – 6.49	-.29 – 7.21	N/A	N/A	.54 – 5.48	1.83 - 6.67
Full sample	-1.82 – 5.71	-.37 – 6.84	-1.64 – 6.49	-.29 – 7.21	-1.00 – 3.72	-1.34 – 4.90	-.45 – 5.48	.80 – 6.67

Notes. N/A denotes that the prosocial task was not administered in that study. Reported statistics are for children who enacted prosocial behavior in at least one prosocial task. In addition, reported ranges for emotional valence across prosocial tasks do not reflect ranges for individual tasks due to differences in number of children who completed at least two prosocial tasks. See Table 1 in the main text.

Table 32. Non-Prosocial Children's Emotional Valence (Positivity/Negativity) during Prosocial Tasks as a Function of Time

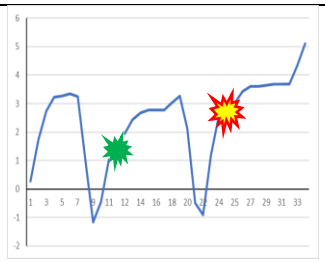
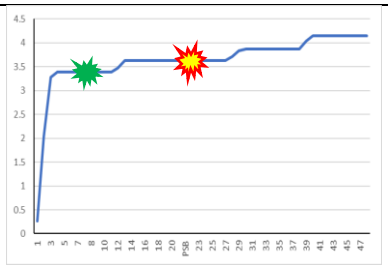
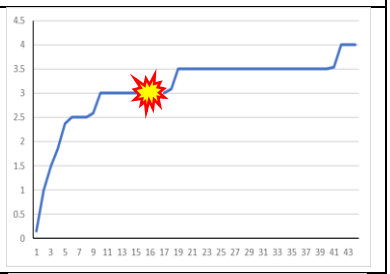
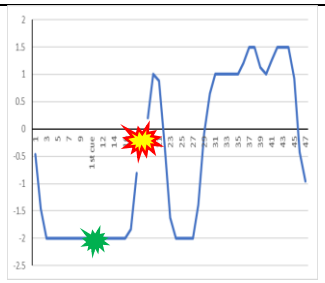
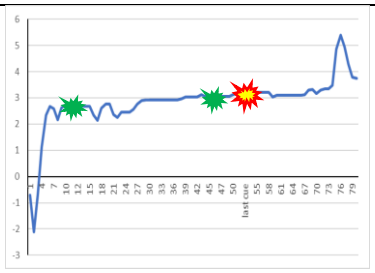
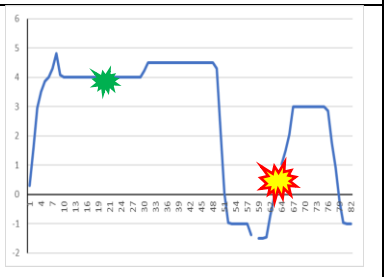
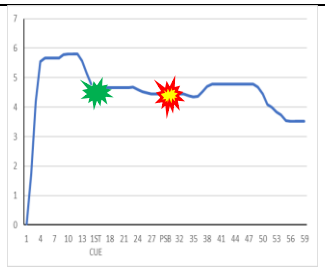
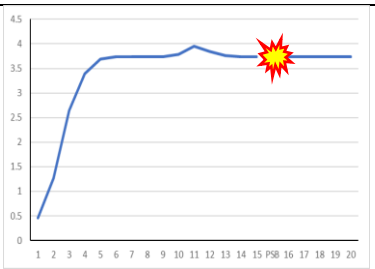
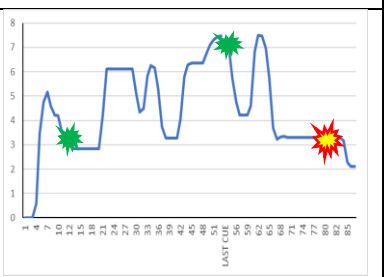
Age	**Helping**		
16			
16			
24			

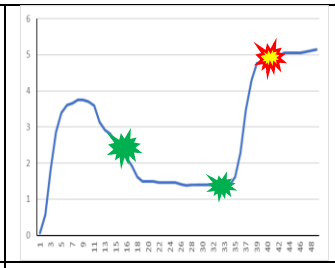
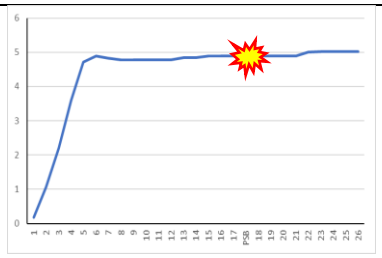
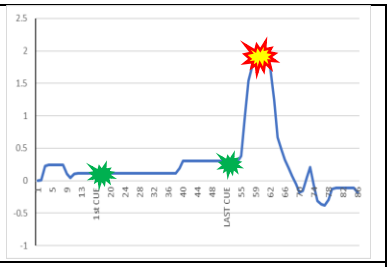
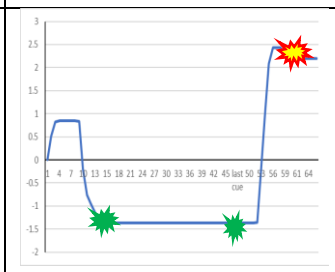
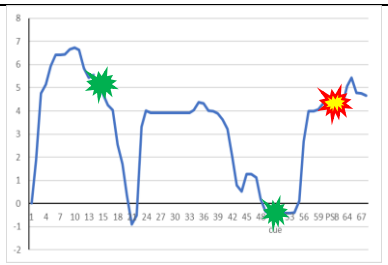
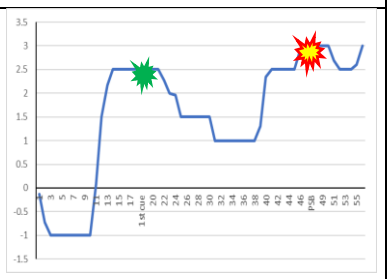
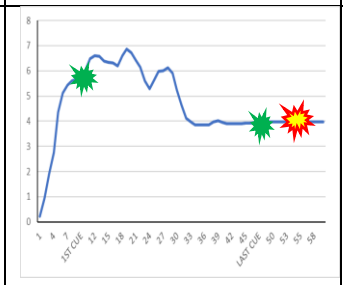
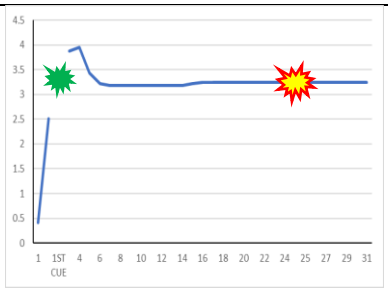
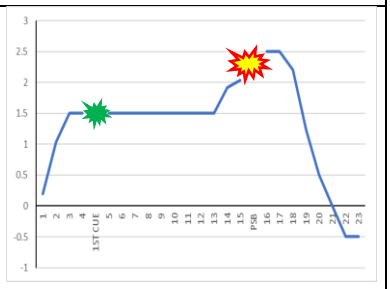
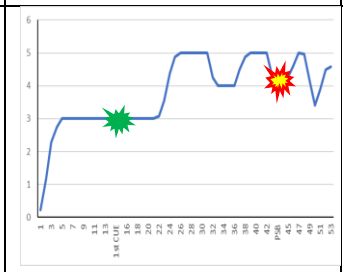
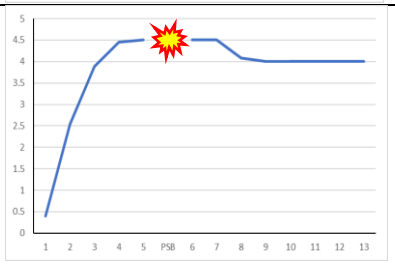
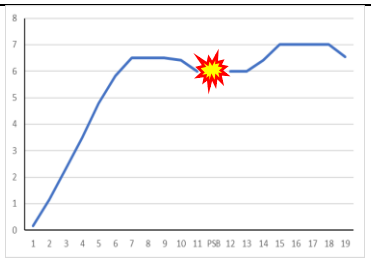
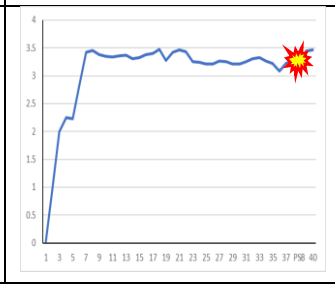
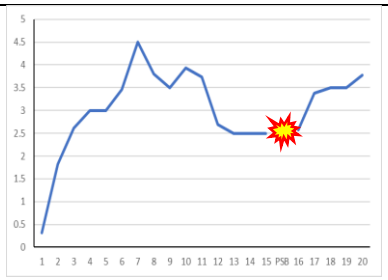
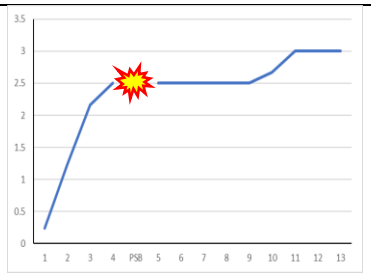
28			
	Comforting		
16			
24			
28			
	Sharing		
16			

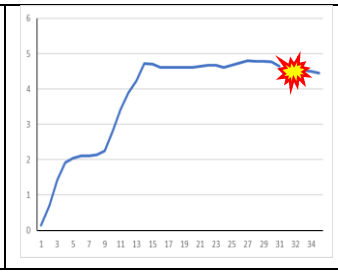
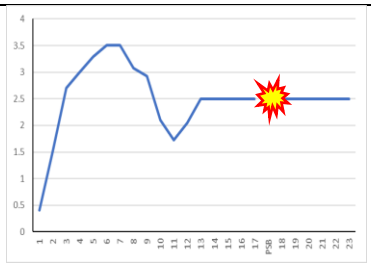
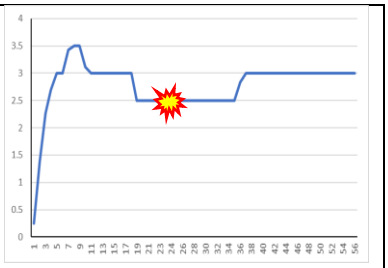
24			

Note. Panels illustrate emotional valence scores for the full duration of prosocial tasks for 27 randomly selected children. For each age, the three panels represent emotional valence scores from three different children who did not engage in prosocial behavior. Therefore, the curves in all panels are from the beginning of the task until the experimenter ended the task. X-axes indicate number of seconds (i.e., duration of the task) and y-axes indicate emotional valence scores (range: -10, most negative, to 10, most positive).

Table 33. Prosocial Children's Emotional Valence (Positivity/Negativity) during Prosocial Tasks as a Function of Time

Age	**Helping**		
16			
16			
24			

28			
	Comforting		
16			
24			
28			
	Sharing		
16			

24			

Note. Panels illustrate emotional valence scores for the full duration of prosocial tasks for 27 randomly selected children who engaged in prosocial behavior. For each age, the three panels represent emotional valence scores from three different children who did engaged in prosocial behavior. X-axes indicate number of seconds (i.e., duration of the task) and y-axes indicate emotional valence scores (range: -10, most negative, to 10, most positive). Green stars mark the occurrence of cues (first and last, when applicable). Yellow stars with red outlines mark the occurrence of prosocial behavior. Note that, 28-month-old children did not receive the sharing task.

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