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The effect of emotional communication on infants' distinct prosocial behaviors

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Abstract

Discrete emotions convey distinct relational meanings that inform the response of a social partner, such as how to help. Although prosocial behaviors can take different forms and are observed in a variety of contexts across development, distinct forms of helping are often studied in forced-choice settings in limited emotional contexts. This study examined the prevalence of three prosocial behaviors (instrumental helping, comforting, and indirect helping) by 16-, 19-, and 24-month-old infants in response to situations involving an experimenter reacting emotionally (anger, disgust, fear, sadness, and joy) to an event (a broken toy; an unknown object). Instrumental helping was more prevalent in response to sadness than fear, anger, disgust, and joy, with instrumental helping in joy contexts emerging at 24 months. Conversely, comforting was largely absent in joy and disgust contexts in comparison to the other emotional contexts and increased overall with age. Indirect helping was rarely observed in response to disgust and joy and was most frequent in response to sadness. Furthermore, both 24- and 19-month-olds were more likely to engage in indirect helping compared with 16-month-olds. This study supports the view that infant prosocial behavior is influenced by emotional cues and that distinct forms of helping emerge gradually in infancy.

KEYWORDS
emotion, helping, infancy, prosocial behavior

1 | INTRODUCTION

A hallmark of socio-emotional development is the emergence of prosocial behavior. Prosocial behavior has been defined generally as any behavior intended to benefit another (Dunfield, Kuhlmeier, O'Connell, & Kelley, 2011; Eisenberg, Fabes, & Spinrad, 2006; Padilla-Walker & Carlo, 2014) and is linked to positive adjustment in a variety of domains (see Flynn, Ehrenreich, Beron, & Underwood, 2015). Empirical studies of infant moral development have focused on a range of different behaviors and motivations, including instrumental helping (Warneken & Tomasello, 2006, 2007), comforting (Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992), sympathy (Hepach, Vaish, & Tomasello, 2012; Trommsdorff, Friedlmeier, & Mayer, 2007; Vaish, Carpenter, & Tomasello, 2009), altruism (Svetlova, Nichols, & Brownell, 2010; Thompson & Newton, 2013; Warneken & Tomasello, 2008), and sharing (Brownell, Svetlova, & Nichols, 2009; Dunfield et al., 2011; Schmidt & Sommerville, 2011). These behaviors share a similar goal by the infant to respond to the need, desire, or distress of a social partner (see Dunfield & Kuhlmeier, 2013), and emerge at different points in development (Dahl & Paulus, 2019; Dunfield, 2014; Dunfield & Kuhlmeier, 2013; Svetlova et al., 2010). However, researchers have recently acknowledged the multidimensionality of prosocial behaviors (Padilla-Walker & Carlo, 2014; Paulus, 2017), including their predictors, outcomes, and developmental trajectories (Dahl & Paulus, 2019; Eisenberg & Spinrad, 2014), as well as the role of emotion in identifying and responding to others' needs (see Beier & Dunfield, 2018; Reschke, Walle, & Dukes, 2017; Tunçgenç, 2016). Thus, the emotional cues and strategies used to respond prosocially to others in different contexts can vary widely across development. This investigation used two flexible contexts to explore distinct strategies that infants use to respond prosocially to discrete emotions across the second year of life.

1.1 | The role of emotion in eliciting prosocial behavior

Emotions signal one's relation to the environment on matters of significance and function to regulate the behavior of others (see Saarni, Campos, Camras, & Witherington, 2006). As such, understanding emotion is fundamentally interconnected with understanding others' goals and needs (Reschke, Walle, & Dukes, 2017; see also Ong, Zaki, & Goodman, 2019; Saxe & Houlihan, 2017). For instance, infants can use an agent's prior behavior to anticipate their likely emotional response toward the end of the first year of life (Reschke, Walle, Flom, & Guenther, 2017; Skerry & Spelke, 2014) and use others' emotional communication to differentially respond to objects (e.g., Martin, Maza, McGrath, & Phelps, 2014), potential obstacles (e.g., Sorce, Emde, Campos, & Klinnert, 1985), unfamiliar persons (e.g., Boccia & Campos, 1989), and ambiguous outcomes (e.g., Carpenter, Akhtar, & Tomasello, 1998). Thus, emotional communication provides information relating to a social partner's goals that allows the infant to co-ordinate a response appropriate to the context. A prime example of such adaptive social responding is prosocial behavior.

Infants seem particularly attuned to others' needs and respond prosocially to such contexts in myriad ways (see Davidov, Zahn-Waxler, Roth-Hanania, & Knafo, 2013; Dunfield, 2014). Research studies have commonly elicited infant prosocial responding by placing the infant in a context with a social partner who expresses distress or an instrumental need (for an excellent review, see Brownell, 2013). Interestingly, however, recent research has found that infants respond prosocially to emotions other than distress, as well as when explicit emotional expressions are absent. A study by Walle, Reschke, Camras, and Campos (2017) compared infant behavioral responses across discrete emotion contexts, finding that prosocial behavior was evident in response to an experimenter expressing sadness, fear, anger, disgust, and even joy. However, it is possible that the specific prosocial strategy may vary across emotional contexts—something not examined in the aforementioned study. For example, environments low in immediate threat or harm to the infant, such as sadness or disgust contexts, may result in more direct, instrumental helping or comforting behaviors whereas high arousal situations, such as another person who is fearful or angry, may be more challenging for the infant to cope with (Cummings, Zahn-Waxler, & Radke-Yarrow, 1981) and thus prompt the infant to seek assistance from an available caregiver.

The importance of considering the role of emotion is further highlighted by studies that attempt to eliminate emotion from the prosocial context. Although infants provide instrumental help regardless of whether sadness expressions accompanied instrumental cues (e.g., reaching; Newton, Goodman, & Thompson, 2014) and also help preemptively in anticipation of an agent failing a goal (Warneken, 2013), such studies should not be taken to promote the exclusion of emotional expressions in empirical studies of infant prosocial behavior. Specifically, although infants do help in the absence of overt emotional displays, these studies have used paradigms in which the adult's behavior could be used to infer or anticipate her emotion (e.g., repeated failed reaching communicating goal blockage, thus sadness or frustration), making it unclear whether conditions termed 'neutral' by the researcher are indeed void of affective information (Reschke, Walle, & Dukes, 2017). Moreover, infant helping behavior is typically determined by whether the infant fulfills the goal of the adult. However, such behavior could simply be the infant completing the task, not necessarily responding to the agent's needs (Kärtner, Keller, & Chaudhary, 2010; Kenward & Gredebäck, 2010).

Determining the role of emotion in infant helping necessitates a systematic examination of distinct response strategies that infants use to respond prosocially across discrete emotion contexts in which the instrumental need of the adult is not explicitly communicated.

1.2 | Distinct prosocial response strategies

Examining how infants respond prosocially to discrete emotions necessitates careful consideration of what is categorized as prosocial behavior, as well as the distinct forms that prosocial responding may take. The abundance of developmental research on prosocial responding is nearly equaled by the variability of terms and operationalizations to classify such behavior. Following an extensive, though non-exhaustive, review of the literature, we identified three prosocial strategies[1] that are regularly coded, yet have distinct goals with respect to how individuals respond to others' needs, specifically: instrumental helping, comforting, and indirect helping.

Prior research has differentiated each type of prosocial behavior in its coding or as indicators of a more general prosocial/helping code (see Table 1). Although some studies have shown that displays of caring and concern emerge as early as 8–10 months and gradually increase across the second year of life (e.g., Roth-Hanania, Davidov, & Zahn-Waxler, 2011), these studies rarely differentiate among different forms of prosocial behavior. For example, the seminal work by Zahn-Waxler and colleagues included different codes for *instrumental*, *emotional*, and *indirect* helping (Roth-Hanania et al., 2011; Zahn-Waxler, Radke-Yarrow, & King, 1979; Zahn-Waxler, Radke-Yarrow, et al., 1992; Zahn-Waxler, Robinson, & Emde, 1992), and similar distinctions have also been noted by other researchers (e.g., Dunfield et al., 2011; Fabes, Eisenberg, Karbon, Troyer, & Switzer, 1994; Karasewich, Kuhlmeier, Beier, & Dunfield, 2019). However, despite distinguishing between functionally distinct forms of prosocial behavior in their coding, prior research often collapses these behaviors into a more general "helping" behavior, which may obscure important distinctions in how infants help and in what contexts. Although caution is called for when drawing similarities across the studies that may have used distinct conceptualizations of prosocial behavior, integrating commonalities across this research can provide opportunities for furthering our understanding of the unfolding of this construct.

Furthermore, the few studies that have examined distinct forms of infant prosocial behavior have often done so by tailoring a specific context to be addressed (Dunfield, 2014; Dunfield et al., 2011; Karasewich et al., 2019; Svetlova et al., 2010). For example, infant helping when the experimenter has an instrumental need is deemed instrumental helping. Although such studies have contributed to our understanding of contextual influences on prosocial behaviors, no study to our knowledge has examined how infants flexibly deploy distinct helping behaviors within and across different emotional contexts. Specifically, rather than creating an a priori need of the experimenter, it remains to be tested how infants can infer the needs of the adult as a function of the discrete emotion communicated and thus differentially deploy distinct prosocial strategies across emotional contexts.

TABLE 1 Non-exhaustive review of relevant prosocial/helping behaviors coded in prior research

Prosocial behaviors	Operational definition	Study	Participant age range (mos.)	Prosocial/helping behavior	Description
Instrumental helping	Addressing a physical/objective need	Dunfield and Kuhlmeier (2013)	24–54	Helping	Retrieving the required object and returning to the experimenter. (p. 1769)
	Examples: attempting to fix or remove the emotion target, offering a different object to the experimenter, or distracting the experimenter's attention away from the situation	Dunfield et al. (2011)	18–24	Helping	Retrieving the toy from the ground and placing it in the experimenter's hand. (p. 236)
		Eisenberg-Berg and Hand (1979)	48–63	Helping	The child attempts to alleviate the another's non-emotional needs; for example, assists another by giving information, helps another with a task, or offers an object not previously in giver's possession. (p. 357)
		Fabes et al. (1994)	67–108	Direct problem solving	Efforts to change the problem situation by changing the other child's environment. Actions that provide assistance or help to the other child (e.g., "go over and help the child get another toy" or "offer to include the child in what your child is doing"). (p. 1683)
		Johnson (1982)	18–24	Direct intervention	Child helps/shares specific actions designed to help/comfort or relieve the other's distress (e.g., helping someone get up after they have fallen, or sharing object or food). (p. 384)
		Newton et al. (2014)	18–21	Prosocial behavior	The child instrumentally helped the experimenter achieve her goal. (p. 220)
		Paulus, Kühn-Popp, Licata, Sodian, and Meinhardt (2013)	18	Instrumental helping	Returning the object (i.e., clothespin, pen) to the experimenter. (p. 525)
		Svetlova et al. (2010)	18–30	Helping	Child hands the target object to experimenter. (p. 1819)
		Vaish et al. (2009)	17–27	Helps/shares	Child provides a balloon to the experimenter. (p. 538)
		Warneken and Tomasello (2009)	[Review]	Instrumental Helping	Acting on behalf of others' goals. (p. 458)

(Continues)

TABLE 1 (Continued)

Prosocial behaviors	Operational definition	Study	Participant age range (mos.)	Prosocial/helping behavior	Description
		Zahn-Waxler et al. (1979)	15–20	Providing objects	For example, food, toys, bandages. (p. 322)
				Giving physical assistance	(p. 322)
		Zahn-Waxler, Radke-Yarrow, et al. (1992)	13–25	Helping	For example, puts on a bandage, gives bottle to crying baby, and brings shawl to shivering person. (p. 129)
				Sharing	For example, gives food to sister. (p. 129)
				Distraction	For example, closes picture book that makes mother sad. (p. 129)
		Zahn-Waxler, Robinson, et al. (1992)	14–20	Prosocial acts	Efforts to help victim (e.g., gets Band-Aid). (p. 1040)
Comforting	Helping or comforting the victim emotionally	Dunfield and Kuhlmeier (2013)	24–54	Comforting	Positive verbal (e.g., "It's okay", "Put a band-aid on it", or "Rub it!"), or physical interventions (e.g., rebuilding the tower or kissing or hugging the experimenter). (p. 1770)
	Examples: patting or hugging the experimenter, or making comforting statements toward the experimenter (e.g., "It's okay", "All better")	Dunfield et al. (2011)	18–24	Comforting (other-oriented)	Approaching the experimenter (e.g., patting, hugging, and kissing), or concerned vocalizations (e.g., asking about the experimenter's welfare "you okay?"). (p. 236)
		Eisenberg-Berg and Hand (1979)	48–63	Offers comfort	The child attempts to alleviate the emotional needs of another; for example, tries to make the other feel better when in distress. (p. 357)
		Johnson (1982)	18–24	Direct Intervention	Child provides physical comfort (pats, hugs, and kisses) or verbal comfort. (p. 384)
		Roth-Hanania et al. (2011)	8–16	Prosocial behavior	Attempts to help or comfort the victim. [4-point scale based on duration of behavior] (p. 451)
		Vaish et al. (2009)	17–27	Helps/shares	Child comforts, hugs, or pats experimenter. (p. 538)
		Warneken and Tomasello (2009)	[Review]	Comforting	Providing emotional support to others. (p. 458)

(Continues)

TABLE 1 (Continued)

Prosocial behaviors	Operational definition	Study	Participant age range (mos.)	Prosocial/helping behavior	Description
		Young, Fox, and Zahn-Waxler (1999)	24	Prosocial behavior	Behavioral expressions of concern for others reflected in attempts to alleviate the victim's distress (e.g., sharing a toy, kissing, or rubbing the injury, and verbal sympathy). (p. 1192)
		Zahn-Waxler, Radke-Yarrow, et al. (1992)	13–25	Physical comfort	For example, hugs, pats, and kisses. (p. 129)
				Verbal comfort	For example, "You be okay", "Are you okay?" (p. 129)
		Zahn-Waxler et al. (1979)	15–20	Verbal sympathy	For example, "All better now?" (p. 322)
				Physical sympathy	For example, hugs victim. (p. 322)
		Zahn-Waxler, Robinson, et al. (1992)	14–20	Prosocial acts	Efforts to comfort victim (e.g., pats victim). (p. 1,020)
Indirect helping	Soliciting help from the caregiver or experimenter to remedy the situation	Bischof-Köhler (1991)	16–24	Blocked Helping	Child tried to draw their mothers' attention to the accident by continuously verbalizing about the event and pointing at the playmate.
	Examples: asking the caregiver or the experimenter for help or bringing the target object to the caregiver for assistance	Johnson (1982)	18–24	Indirect Intervention	Child actively attempts to get another person to help distressed other (e.g., gets mother and brings to distressed other). (p. 383)
		Karasewich et al. (2019)	38–48	Indirect Helping	Child requested that another adult help the experimenter by communicating verbally (e.g., "Can you get it?") or nonverbally (e.g., pointing between the experimenter and the needed object).
		Paulus et al. (2017)	18–36	Involving Caregiver	Child tried to contact her caregiver and to establish eye contact with caregiver while alternating her gaze between caregiver and helpee (or the object the helpee was longing for). Additionally, this alternating gaze needed to be accompanied by either a pointing gesture to the helpee or the object, a verbal utterance, or a direct verbal request for help. (p. 654)

(Continues)

TABLE 1 (Continued)

Prosocial behaviors	Operational definition	Study	Participant age range (mos.)	Prosocial/helping behavior	Description
		Vaish et al. (2009)	17–27	Helps/shares	Child describes the situation to parent: verbal or gestural descriptions about the situation (e.g.,"The balloon is gone") directed to the parent in an effort to draw the parent's attention to the situation. (p. 538)
		Zahn-Waxler et al. (1979)	15–20	Finding someone else to help	(p. 322)
		Zahn-Waxler, Radke-Yarrow, et al. (1992)	13–25	Indirect helping	For example, gets mother to retrieve others' object. (p. 129)

Note: When possible, the prosocial/helping behavior and description are presented verbatim with page numbers in parentheses corresponding to the original research article.

Moreover, infant use of these prosocial strategies may demonstrate developmental differences due to the level of complexity of the organizing behavior. Prosocial behavior emerges gradually in development (see Brownell, 2013; Hay & Cook, 2007; Warneken, 2015). As such, instrumental helping, comforting, and indirect helping vary in their emergence and use in the second year of life. For example, comforting, which functions to address another's distressed state, emerges later than instrumental helping, which involves goal-directed completion of others' actions (Dahl & Paulus, 2019; Svetlova et al., 2010). Likewise, indirect forms of helping (e.g., soliciting help from a caregiver) are less prevalent in younger infants (Paulus, Jung, O'Driscoll, & Moore, 2017), possibly due to the interpersonal skills required to make such social bids. Thus, just as prosocial behavior emerges gradually, so too can it be expected that specific prosocial strategies may vary in prevalence across infancy and emotional contexts.

1.3 | The present study

To address some of the above limitations, this study examined the effect of emotional communication on infants' helping behaviors (instrumental helping, comforting, indirect helping) in two ambiguous situations (unknown object, damaged toy). We utilized a corpus of videos (Walle et al., 2017) in which 16-, 19-, and 24-month-old infants were previously coded as responding with prosocial behavior to an adult's emotional communication (sadness, fear, anger, disgust, or joy). Unique to the present study, infant prosocial behavior(s) were further delineated and operationalized based on prior research (see Table 1). Specifically, infant prosocial behaviors were classified as *instrumental helping*: addressing a physical/objective need (e.g., Eisenberg et al., 1999; Fabes et al., 1994); *comforting*: helping the victim emotionally (e.g., Dunfield et al., 2011; Roth-Hanania et al., 2011); and *indirect helping*: soliciting help from another individual to remedy the situation (e.g., Bischof-Köhler, 1991; Zahn-Waxler, Radke-Yarrow, et al., 1992).

The rationale for including five discrete emotions was twofold. Firstly, including multiple discrete negative emotions allowed for comparison of infant responses to distinct emotional contexts that may call for functionally distinct response behaviors (e.g., it may be more appropriate to instrumentally help a sad individual, but to solicit help from the parent when confronted with someone who is angry). Secondly, the inclusion of a positive emotion was used to further explore the possibility that early infant helping may be motivated more by social participation than responding to a need (Dahl, 2015).

Of particular interest to the present study was how infants of different ages helped in distinct emotion contexts. Firstly, we predicted that infant deployment of specific forms of prosocial behaviors would differ across age groups (Dahl & Paulus, 2019). Specifically, we hypothesized that instrumental helping would be demonstrated by all age groups, as this prosocial behavior has been observed in prior research of infant helping early in the second year of life (e.g., Sommerville, Schmidt, Yun, & Burns, 2013). Conversely, we predicted that comforting and indirect helping would be more prevalent in the older age groups, and that these behaviors would become more prevalent between 19 and 24 months of age.

Secondly, we predicted that infants' use of each form of helping would vary as a function of the discrete emotion communicated by the experimenter. Previous research indicates that infant prosocial behaviors can be elicited by different contexts (e.g., Dahl, 2015; Svetlova et al., 2010). We predicted that infants would be more likely to respond with comforting when the experimenter expressed sadness compared with the other emotion conditions, as sadness signals a need for nurturance (e.g., Saarni et al., 2006; Zahn-Waxler, Radke-Yarrow, et al., 1992). Additionally, we hypothesized that infants would respond with instrumental helping more in the disgust conditions compared with other emotions because disgust communicates a need to avoid or remove a contaminated object (e.g., Walle & Campos, 2012) and is a context in which the infant would likely be competent to address the needs of the adult. We also predicted that infants would be more likely to engage in indirect helping

(i.e., eliciting help from another) when responding to an adult expressing anger or fear compared with other emotions. Addressing the adult's needs in these contexts may necessitate co-operative support from the caregiver (see Walle & Campos, 2012), as anger signals a dominant role that may decrease direct interaction with the emoter (Strayer, 1980) or seeking of co-operative engagement with another individual to address the anger context (e.g., Dunn & Munn, 1985; Walle et al., 2017) and fear functions to signal threat and the need for security (e.g., Klinnert, 1984). No a priori hypotheses were made for the joy emotion.

Thirdly, we anticipated that infants in each age group would vary in their responding between discrete emotions (i.e., the Age × Emotion interaction). Thus, we explored whether infants' prosocial behavior varied (a) in response to a specific discrete emotion across age groups, and (b) across discrete emotions within a particular age group. For example, infants' use of indirect helping in response to an angry adult might be most prevalent by 24-month-old infants, an age group previously found to demonstrate more differentiated behavioral responses to this emotion than younger infants (see Walle et al., 2017). However, we refrained from making specific hypotheses for each possible comparison given the exploratory nature of the analyses.

2 | METHOD

2.1 | Participants

Participants were 16-, 19-, and 24-month-old infants (N = 296) recruited from an urban and suburban area in Northern California. The 16-month-old sample included 88 infants (46 female) with a mean age of 16.04 months (SD = 0.60, range = 14.96–17.29). The racial composition consisted of 2% Black, 5% Asian, 7% Hispanic, 2% Native Hawaiian or Other Pacific Islander, and 54% non-Hispanic White, and 30% 'Other'. The 19-month-old sample included 102 infants (52 female) with a mean age of 19.15 months (SD = 0.61, range = 18.05–20.28). The racial composition was 4% Black, 22% Asian, 18% Hispanic, 28% non-Hispanic White, and 28% "Other". The 24-month-old sample included 106 infants (54 female) with a mean age of 24.15 months (SD = 0.67, range = 23.08–25.25). The racial composition was 3% Black, 3% Asian, 13% Hispanic, 53% non-Hispanic White, and 28% 'Other'. Information regarding the ethnicity and racial composition of participants was missing for 69 of 296 infants. All of the data for 36 additional infants and part of the data of 111 infants were not included in the final sample because of experimenter error (n^2 = 36), infant fussiness (n = 50), infant inattention (n = 69), parental interference (n = 12), equipment failure (n = 4), and infant physical disability (n = 4). Descriptive information regarding the number of observations for each age group, emotion condition, and paradigm is provided in Table 2.

TABLE 2 Number of observations sorted by age, paradigm, and emotion

	24-month-olds			19-month-olds			16-month-olds		
Condition	Box	Toy	Total	Box	Toy	Total	Box	Toy	Total
Sadness	17	17	34	13	16	29	13	17	30
Fear	17	18	35	15	18	33	14	16	30
Anger	18	20	38	13	18	31	13	12	25
Disgust	17	20	37	21	17	38	11	13	24
Joy	15	18	33	18	16	34	15	15	30
Total	84	93	177	80	85	165	66	73	139

TABLE 3 Descriptions of procedures

	Paradigm	
	box	**Toy**
Stimulus	Opaque box (6″ × 6″ × 6″) with an ambiguous rubbery toy with various knobs and protrusions inside	Plush bunny toy with a torn leg and stuffing spilling out
Long phrase	"There's a fobble in the box. I can't believe there's a fobble in the box"	"Look what happened to the bunny. I can't believe that happened to the bunny"
Contingent phrase	"There's a fobble in the box"	"Look what happened to the bunny"

Note: For each paradigm, the experimenter expressed an emotion (Sadness, Fear, Anger, Disgust, or joy) vocally, facially, and posturally towards the stimulus using the Long Phrase. After the Long Phrase, the experimenter continued to express the emotion facially and vocally and said the Contingent Phrase up to two times if the infant looked at the experimenter. The word "fobble" was used in the Box paradigm to provide a novel label for the contents of the container.

2.2 | Procedure

In each paradigm a distinct experimenter communicated a single emotion (sadness, fear, anger, disgust, or joy) through the face, posture, and voice toward a stimulus (novel object inside box or broken toy), followed by one long phrase and up to two contingent phrases if the infant looked at the experimenter in the response phase (see Table 3 for stimuli and phrase descriptions). The experimenter was trained to express each discrete emotion based on prior research to ensure differentiation across emotions in the face (e.g., Ekman & Friesen, 1976), voice (e.g., Scherer, 1995), and posture (e.g., de Gelder & Van den Stock, 2011), which included distinct gesturing for each emotion (e.g., anger = firm point; sadness = flaccid point; fear = retracting point). Detailed descriptions of how the emotions were communicated by the experimenter and the manipulation check used to ensure that experimenter emotional expressions were well-executed are provided in Walle et al. (2017). Importantly, the experimenter was explicitly instructed to not direct the emotion at the child.

Infants participated in both paradigms in a fixed order, Box then Toy paradigm. Within each paradigm, infants were randomly assigned to an emotion condition, with the exception that no infants were assigned to the same emotion condition across both paradigms. Each paradigm took place in a distinct, comfortably furnished room. The infant and the experimenter were positioned across from one another. Experimenters were instructed to kneel across from the infant who was standing at the start of the procedure. The parent, occupied by completing a questionnaire, and a toy basket were situated behind the infant in opposite corners of the room.

For the box paradigm, the experimenter removed the lid from an opaque box, looked inside, expressed the assigned emotion, tilted the box toward the infant, and then replaced the lid and set the box within reach of the infant. For the toy paradigm, the experimenter took the toy out of a box, indicated that it had been broken into two pieces by holding one piece in each hand, expressed the assigned emotion, and then set the two pieces on the floor within reach of the infant.

Following the experimenter's emotional expression, infants' behavioral responses to the emotional context were recorded for 40 s, during which the infant could freely respond. Infants' behaviors were captured using three video camcorders: one camera facing the infant located behind the experimenter, and two additional cameras located in opposite corners of the room behind the infant to ensure that the child remained in frame if s/he moved away from the experimenter. These videos were later synchronized using Adobe Premiere video editing software to facilitate coding (see below).

All procedures were approved by the Committee for the Protection of Human Subjects at the University of California, Berkeley.

2.3 | Coding

Infant responses were first coded for general prosocial behavior, operationalized as the infant intending "to help the experimenter or relieve her condition in some way" (κ = .70) as part of a separate study examining infant goal-directed behaviors (reported in Walle et al., 2017). This initial coding was designed to capture the function of the infant's behavioral response rather than a specific manifestation (see Walle & Campos, 2012).

Unique to the current study, of the infants (N = 296) included in the initial investigation by Walle et al. (2017), infants previously identified as having demonstrated "prosocial responding" (n = 126) were further examined for distinct prosocial behaviors using a novel coding scheme. A trained researcher naïve to the study hypotheses coded for the presence of three distinct helping behaviors (see Table 1). Infants could demonstrate multiple helping behaviors during the 40s response period. Reliability was assessed by a second coder who coded 20% of the recordings. Interrater reliability for each code was substantial, which Landis and Koch (1977) identified as a Cohen's κ = .61, or higher. Helping behaviors and corresponding Cohen's κ values were as follows:

2.3.1 | Instrumental helping (κ = .79)

Infant behaviors attempting to address a physical/objective need (e.g., Eisenberg et al., 1999; Fabes et al., 1994). Behaviors included attempting to fix or remove the emotion target, offering a different object to the experimenter, or distracting the experimenter's attention away from the situation.

2.3.2 | Comforting (κ = .61)

Instances in which the infant attempted to help the victim emotionally (e.g., Dunfield et al., 2011; Roth-Hanania et al., 2011). Behaviors included patting or hugging the experimenter, or making comforting statements toward the experimenter (e.g., "It's okay", "All better"), but were independent of the infant's own affective expression.

2.3.3 | Indirect helping (κ = .72)

Attempts by the infant to solicit help from the caregiver or experimenter to remedy the situation (e.g., Bischof-Köhler, 1991; Paulus et al., 2017). Behaviors included the infant asking the caregiver or the experimenter for help or bringing the target object to the caregiver for assistance.

The above behaviors were operationalized by their underlying goal-directed function, not their surface-level manifestation. Thus, behaviors that were perceptually similar but whose functions were distinct (e.g., moving to the parent to solicit help versus obtain security; giving the experimenter a toy to alleviate her distress versus obliviously playing with the experimenter) were separated such that only the helping behaviors of interest were coded (see Walle & Campos, 2012).

2.4 | Analytic strategy

Overall infant prosocial behavior, instrumental helping, comforting, and indirect helping were each analyzed with separate generalized linear mixed models using the GENLINMIXED tool in SPSS. The statistical models were specified with a binomial distribution, a logit link function, and a compound symmetry covariance matrix and used Restricted Maximum Likelihood (REML) and Satterthwaite approximation for degrees of freedom (see Wilcox, 1987). Each model included paradigm (box, toy) and emotion (sadness, fear, anger, disgust, and joy) as within-subjects factors, and age (24, 19, and 16) as a between-subjects factor, as well as the Age × Emotion interaction term. Paradigm was included as a variable in all models to explore whether it moderated the effects of age, emotion, and the Age × Emotion interaction.[3] For the sake of completeness, each model also included the Paradigm × Age, Paradigm × Emotion, and Paradigm × Age × Emotion interaction terms. However, given that effects of paradigm were not of central interest to the present study, related pairwise comparisons for these interactions are presented in the Supporting Informations. All models reached convergence using the initial iteration values. Preliminary analyses of overall infant prosocial behavior revealed no significant effect of infant gender, $p = .98$, and thus this variable was not considered in subsequent analyses.

Below we report the results of all omnibus tests. Our primary interest was examining differences in infant prosocial behaviors as a function of emotional context and age. Thus, we have restricted our reporting of pairwise comparisons to significant effects and interactions of emotion and age. The estimated marginal means and pairwise comparisons of each model are displayed in Table 4. The data that support the findings of this study are available from the corresponding author upon reasonable request.

3 | RESULTS

3.1 | Overall prosocial behavior

Analyses of overall infant prosocial behavior revealed significant main effects of age, $F(2, 408) = 6.65$, $p = .001$, $\eta_p^2 = .03$, emotion, $F(4, 451) = 8.65$, $p < .001$, $\eta_p^2 = .07$, and paradigm, $F(1, 407) = 24.33$, $p < .001$, $\eta_p^2 = .06$, as well as a significant interaction of Age × Emotion, $F(8, 451) = 5.73$, $p < .001$, $\eta_p^2 = .09$.

Pairwise comparisons of the effect of age indicated that 24-month-old infants demonstrated significantly more prosocial behavior than 19-month-old infants, $t(348) = 2.41$, $p = .02$, 95% CI [.02, .23], and 16-month-old infants, $t(334) = 3.64$, $p < .001$, 95% CI [.08, .27].

Pairwise comparisons of the effect of emotion indicated that infants were significantly less likely to be prosocial in joy contexts than contexts of sadness, $t(451) = -5.44$, 95% CI [−.43, −.21], fear, $t(451) = -4.02$, 95% CI [−.33, −.11], and anger, $t(451) = -3.41$, 95% CI [−.29, −.08]. Similarly, infants in the disgust demonstrated significantly less prosocial behavior than in contexts of sadness, $t(418) = -4.60$, 95% CI [−.40, −.16], fear, $t(451) = -3.29$, 95% CI [−.29, −.07], and anger, $t(451) = -2.63$, 95% CI [−.26, −.04].

Pairwise comparisons of the effect of paradigm revealed that infants engaged in significantly more prosocial behavior in the toy paradigm ($M = .33$) than the box paradigm ($M = .14$), $t(351) = 5.19$, $p < .001$, 95% CI [.12, .27].

Pairwise comparisons of the Age × Emotion interaction revealed additional nuance to the findings. Comparison between age group within emotion condition revealed that 16-month-old infants were significantly less prosocial in disgust contexts than 24-months-old infants, $t(388) = -3.97$, $p < .001$, 95% CI [−.46, −.16], and 19-month-old infants, $t(450) = -4.15$, $p < .001$, 95% CI [−.47, −.17]. Additionally, 24-month-olds engaged in significantly more prosocial behavior in the joy condition than 19-month-old infants, $t(390) = 3.58$, $p < .001$, 95% CI [.15, .52], and 16-month-old infants, $t(380) = 2.03$, $p = .04$, 95% CI [.01, .50].

TABLE 4 Proportion of infants demonstrating each prosocial behavior

Behavior	Age	Overall	Sadness	Fear	Anger	Disgust	Joy
Overall prosocial			$.41_{DJ}$	$.31_{DJ}$	$.28_{DJ}$	$.13_{SFA}$	$.09_{SFA}$
	24	$.33_{19,16}$	$.47_{A}$	.31	$.21_{S}$	$.32_{16}$	$.35_{19,16}$
	19	$.20_{24}$	$.35_{J}$	$.31_{J}$	$.40_{J}$	$.33_{J\ 16}$	$.01_{SFAD\ 24}$
	16	$.15_{24}$	$.40_{DJ}$	$.32_{D}$	$.23_{D}$	$.01_{SFA\ 24,19}$	$.12_{S\ 24}$
Instrumental helping			$.34_{FADJ}$	$.19_{SDJ}$	$.19_{SDJ}$	$.06_{SFA}$	$.02_{SFA}$
	24	$.20_{16}$	$.36_{A}$	.15	$.13_{S}$	$.17_{16}$	$.26_{19,16}$
	19	$.15_{16}$	$.32_{J}$	$.21_{J}$	$.32_{J}$	$.19_{J\ 16}$	$.01_{SFAD\ 24}$
	16	$.05_{24,19}$	$.34_{DJ}$	$.22_{DJ}$	.14	$.01_{SF\ 24,19}$	$.004_{SF\ 24}$
Comforting			$.02_{DJ}$	$.01_{J}$	$.02_{DJ}$	$.003_{SAJ}$	$.00_{SFAD}$
	24	$.02_{19,16}$	.08	.06	.003	.08	$.01_{19,16}$
	19	$.003_{24,16}$	$.01_{J}$	$.004_{J}$	.07	.002	$.00_{SF\ 24}$
	16	$.002_{24,19}$	.01	.003	.08	.00	$.00_{24}$
Indirect helping			$.11_{FDJ}$	$.03_{S}$	$.05_{DJ}$	$.01_{SA}$	$.01_{SFA}$
	24	$.05_{16}$	.10	$.003_{DJ\ 19}$	.08	$.11_{F\ 16}$	$.13_{F\ 19,16}$
	19	$.08_{16}$	$.15_{J}$	$.17_{J\ 24}$	$.16_{J\ 16}$	.07	$.01_{SFA\ 24}$
	16	$.01_{19,24}$	.09	.07	$.01_{19}$	$.00_{24}$	$.002_{24}$

Note: Values provided represent estimated marginal means resulting from each mixed linear model. Letters next to a proportion (S = sadness, F = fear, A = anger, D = disgust, J = joy) designate which planned comparisons were significantly different across emotion conditions. For example, infants were significantly more likely to demonstrate instrumental helping in the Sadness condition (.34) than in the Fear (.19), Anger (.19), and Disgust (.06), and Joy (.02) conditions. Numbers next to a proportion (24 = 24-month-olds, 19 = 19-month-olds, 16 = 16-month-olds) designate pairwise comparisons significantly different across age groups. For example, 16-month-old infants were significantly less likely to demonstrate indirect helping (.01) than were 19- (.08) and 24-month-old infants (.05).

Comparisons between emotion conditions within age group indicated that 24-month-olds were significantly more likely to be prosocial in sadness contexts than anger contexts, $t(365) = 2.44$, $p = .02$, 95% CI [.05, .47]. Nineteen-month-old infants were significantly less prosocial in joy contexts than in contexts of sadness, $t(432) = -3.81$, $p < .001$, 95% CI [−.52, −.16], fear, $t(451) = -3.78$, $p < .001$, 95% CI [−.44, −.14], anger, $t(451) = -4.37$, $p < .001$, 95% CI [−.55, −.21], and disgust, $t(451) = -4.20$, $p < .001$, 95% CI [−.47, −.17]. Sixteen-month-old infants were significantly less prosocial in disgust contexts than contexts of sadness, $t(409) = -4.37$, $p < .001$, 95% CI [−.57, −.21], fear, $t(372) = -3.39$, $p = .001$, 95% CI [−.48, .13], and anger, $t(426) = -2.62$, $p = .01$, 95% CI [−.40, .06], and were also significantly less prosocial in joy contexts than sadness contexts, $t(361) = 2.57$, $p = .01$, 95% CI [.07, .50].

3.2 | Instrumental helping

Analyses of instrumental helping indicated significant main effects of age, $F(2, 369) = 11.08$, $p < .001$, $\eta_p^2 = .06$, emotion, $F(4, 451) = 20.31$, $p < .001$, $\eta_p^2 = .15$, and paradigm, $F(1, 355) = 42.57$, $p < .001$, $\eta_p^2 = .11$. Additionally, a significant interaction of Age × Emotion, $F(8, 451) = 8.00$, $p < .001$, $\eta_p^2 = .12$, was present.

Examination of the main effect of infant age indicated that 16-month-olds engaged in significantly less instrumental helping than 24-month-olds, $t(291) = -4.18$, $p < .001$, 95% CI [−.22, −.08], and 19-month-olds, $t(318) = -3.08$, $p = .002$, 95% CI [−.15, −.03].

Pairwise comparisons of emotion contexts revealed that infants were more likely to engage in instrumental helping in the sadness condition than the fear, $t(399) = 2.26$, $p = .03$, 95% CI [.02, .27], anger, $t(394) = 2.31$, $p = .02$, 95% CI [.02, .28], disgust, $t(408) = 5.23$, $p < .001$, 95% CI [.17, .38], and joy contexts, $t(396) = 6.21$, $p < .001$, 95% CI [.21, .41]. Additionally, infants engaged in significantly more instrumental helping in the fear condition than the disgust, $t(386) = 2.80$, $p = .01$, 95% CI [.04, .23], and joy conditions, $t(408) = 3.85$, $p < .001$, 95% CI [.08, .26], as well as in anger contexts than disgust contexts, $t(412) = 2.56$, $p = .01$, 95% CI [.03, .22], and joy contexts, $t(394) = 3.56$, $p < .001$, 95% CI [.07, .25].

Pairwise comparisons of the effect of paradigm revealed that infants engaged in significantly more instrumental helping in the toy paradigm ($M = .24$) than the box paradigm ($M = .06$), $t(354) = 5.77$, $p < .001$, 95% CI [.12, .24].

Further analysis of the Age × Emotion interaction demonstrated that 16-month-old infants engaged in significantly less instrumental helping in disgust contexts than 24-months-old infants, $t(389) = -2.56$, $p = .01$, 95% CI [−.30, −.04], and 19-month-old infants, $t(424) = -2.94$, $p = .004$, 95% CI [−.31, −.06]. Additionally, 24-month-olds engaged in significantly more instrumental helping in the joy condition than 19-month-old infants, $t(368) = 2.85$, $p = .01$, 95% CI [.08, .42], and 16-month-old infants, $t(367) = 2.92$, $p = .004$, 95% CI [.08, .43].

Complementary comparisons across ages within emotion conditions revealed that 24-month-olds engaged in significantly less instrumental helping in anger than sadness contexts, $t(420) = 2.35$, $p = .02$, 95% CI [.04, .41]. Nineteen-month-old infants demonstrated significantly less instrumental helping in joy contexts than contexts of sadness, $t(378) = -3.49$, $p = .001$, 95% CI [−.48, −.13], fear, $t(389) = -2.87$, $p = .004$, 95% CI [−.34, −.06], anger, $t(374) = -3.63$, $p < .001$, 95% CI [−.30, −.06], and disgust, $t(432) = -2.91$, $p = .004$, 95% CI [−.30, −.06]. Sixteen-month-old infants displayed significantly more instrumental helping in sadness contexts than contexts of disgust, $t(402) = 3.81$, $p < .001$, 95% CI [.06, .37], and joy, $t(409) = 3.83$, $p < .001$, 95% CI [.16, .50], and significantly more instrumental helping in fear contexts than disgust contexts, $t(388) = 2.69$, $p = .01$, 95% CI [.06, .37], and joy contexts, $t(395) = 2.72$, $p = .01$, 95% CI [.06, .37].

3.3 | Comforting

Analyses of infant comforting indicated significant main effects of age, $F(2, 142) = 37.26$, $p < .001$, $\eta_p^2 = .34$, emotion, $F(4, 190) = 32.64$, $p < .001$, $\eta_p^2 = .41$, and paradigm, $F(1, 150) = 19.22$, $p < .001$, $\eta_p^2 = .04$, and also a significant interaction of Age × Emotion, $F(8, 194) = 12.56$, $p < .001$, $\eta_p^2 = .34$.

Comparisons across infant age groups revealed that 24-month-olds were significantly more likely to engage in comforting than 19-month-olds, $t(100) = 3.74$, $p < .001$, 95% CI [.01, .03], and 16-month-olds, $t(100) = 3.98$, $p < .001$, 95% CI [.01, .03]. Additionally, 19-month-old infants were also significantly more likely to engage in comforting than 16-month-old infants, $t(199) = 2.14$, $p = .03$, 95% CI [.00, .003].

Pairwise comparisons of emotion contexts revealed that infants were significantly less likely to engage in comforting in response to joy than sadness, $t(177) = -2.99$, $p = .003$, 95% CI [−.02, −.01], fear, $t(177) = -2.89$, $p = .004$, 95% CI [−.01, −.003], anger, $t(172) = -2.62$, $p = .01$, 95% CI [−.01, −.003], and disgust, $t(184) = -2.77$, $p = .01$, 95% CI [−.01, −.001]. Additionally, infants were significantly less likely to demonstrate comforting in response to disgust than sadness, $t(177) = -2.35$, $p = .02$, 95% CI [−.02, −.002], and anger, $t(172) = -2.27$, $p = .02$, 95% CI [−.04, −.03].

Pairwise comparisons of the effect of paradigm revealed that infants engaged in significantly more comforting in the toy paradigm ($M = .01$) than the box paradigm ($M = .003$), $t(165) = 3.50$, $p = .001$, 95% CI [.004, .01].

Exploration of the significant Age × Emotion interaction revealed that 24-month-old infants exhibited more comforting in the joy condition than 19-month-old infants, $t(229) = 2.15$, $p = .03$, 95% CI [.001, .02], and 16-month-old infants, $t(229) = 2.15$, $p = .03$, 95% CI [.001, .02].

Additional comparisons between emotion conditions within age group indicated that 19-month-old infants engaged in significantly less comforting in joy contexts than contexts of sadness, $t(198) = -2.04$, $p = .04$, 95% CI [−.01, −.00], and fear, $t(194) = -2.59$ $p = .01$, 95% CI [−.01, −.001].

3.4 | Indirect Helping

Analyses of indirect helping revealed significant effects of age, $F(2, 403) = 27.88$, $p < .001$, $\eta_p^2 = .12$, emotion, $F(4, 451) = 5.95$, $p < .001$, $\eta_p^2 = .05$, and a significant interaction of Age × Emotion, $F(8, 451) = 8.23$, $p < .001$, $\eta_p^2 = .13$. However, the effect of paradigm was not statistically significant, $F(1, 368) = .14$, $p = .71$, $\eta_p^2 = .0003$.

Pairwise comparisons of the effect of age revealed that 16-month-old infants were significantly less likely to respond with indirect helping than 24-month-old infants, $t(288) = -3.12$, $p = .002$, 95% CI [−.08 −.02], and 19-month-old infants, $t(249) = -4.01$, $p < .001$, 95% CI [−.11, −.04].

Comparisons across emotion conditions revealed that infants responding to sadness were significantly more likely to demonstrate indirect helping than infants responding to fear $t(365) = 1.98$, $p = .048$, 95% CI [.001, .16], disgust, $t(35) = 2.80$, $p = .01$, 95% CI [.03, .18], and joy, $t(339) = 2.71$, $p = .01$, 95% CI [.03, .17]. Additionally, infants in anger contexts were significantly more likely to engage in indirect helping than infants in disgust contexts, $t(451) = 2.47$, $p = .01$, 95% CI [.01, .07], and joy contexts, $t(451) = 2.12$, $p = .04$, 95% CI [.002, .06].

Examination of the Age × Emotion interaction revealed that 19-month-old infants were significantly more likely to engage in indirect helping in the fear condition than 24-month-olds, $t(339) = 2.50$, $p = .01$, 95% CI [.04, .31], and were significantly more likely than 16-month-old infants to help indirectly in anger contexts, $t(451) = 2.21$, $p = .03$, 95% CI [.02, .28]. Twenty-four-month-old infants were also significantly more likely to demonstrate indirect helping in disgust contexts than 16-month-old infants, $t(325) = 2.08$, $p = .04$, 95% CI [.01, .21]. Additionally, 24-month-olds in the joy condition were significantly more likely to engage in indirect helping than 19-month-olds, $t(423) = 2.05$, $p = .04$, 95% CI [.01, .25], and 16-month-olds, $t(423) = 2.14$, $p = .03$, 95% CI [.01, .25].

Comparisons across emotion conditions within each age group revealed that 24-month-old infants in the fear condition were significantly less likely to help indirectly than the disgust condition, $t(329) = -2.05$, $p = .04$, 95% CI [−.20, −.004], and joy condition, $t(425) = -2.21$, $p = .03$, 95% CI [−.25, −.01]. Additionally, 19-month-old infants in the joy condition were significantly less likely to demonstrate indirect helping than in the sadness, $t(386) = -1.97$, $p = .049$, 95% CI [−.29, −.00], fear, $t(339) = -2.43$, $p = .02$, 95% CI [−.30, −.03], and anger conditions, $t(322) = -2.20$, $p = .03$, 95% CI [−.28, −.02].

4 | DISCUSSION

Early prosocial behavior sets the foundation for positive social development (see Hastings, Utendale, & Sullivan, 2007). This study highlights important developmental, conceptual, and methodological considerations for research on infant prosocial behavior. Our findings indicate that distinct forms of infant helping behaviors emerge gradually in the second year of life and are used selectively across discrete emotional contexts.

4.1 | Age differences in prosocial response strategies

The second year of life is an important period in the emergence of prosocial behaviors as early orientations toward others' emotions become integrated with perspective taking abilities and a more flexible behavioral repertoire (Zahn-Waxler, Radke-Yarrow, et al., 1992). In the present study, developmental differences

were observed in infants' overall prosocial behavior, instrumental helping, comforting, and indirect helping. Specifically, 24-month-old infants engaged in significantly more prosocial behavior than 19- and 16-month-old infants. Furthermore, overall instrumental helping increased with age, with 24- and 19-month-old infants helping significantly more than 16-month-olds infants. Older infants also demonstrated significantly more overall comforting behaviors than the 19- and 16-month-old infants, though the overall prevalence of this behavior was relatively low. Additionally, 16-month-old infants were less likely to exhibit indirect helping than the two older age groups. Taken together, these results highlight emerging competence in each prosocial strategy across the second year of life.

These age differences are in line with prior research and highlight several differences in infant prosocial behaviors across infant ages. For instance, our finding that instrumental helping increased with age fits with previous research demonstrating that instrumental helping emerges early and increases in the first year of life (Dahl & Paulus, 2019; Warneken & Tomasello, 2007). Furthermore, the finding that 24-month-olds were more likely to engage in comforting than younger infants is consistent with theoretical and empirical work, suggesting that relevant emotional perspective taking skills do not emerge until toddlerhood (Dunfield, 2014; Padilla-Walker & Carlo, 2014; Svetlova et al., 2010), though these results suggest that the overall rates of comforting remain low even in the beginning of the second year of life. The observed differences between infant age groups also complement work by Dunfield and colleagues suggesting an increase in prosocial behaviors between 18 and 24 months of age (Dunfield et al., 2011) and identify specific types of prosocial behaviors that become more prevalent in later infancy, such as indirect helping (see also Paulus et al., 2017). More broadly, the observed development and use of distinct helping behaviors support a view that prosocial behavior develops gradually across infancy and early childhood (see Dahl & Paulus, 2019; Dunfield, 2014).

4.2 | Prosocial responding across discrete emotions

It is generally assumed that prosocial behaviors occur in response to sadness or distress; our findings dispute this notion. This is the first study to knowledge to systematically examine the effect of emotion on infant prosocial responding. Infants' overall prosocial behavior differed across emotion contexts. Specifically, infants engaged in significantly more prosocial behavior in sadness and anger contexts than disgust and joy contexts. Consistent with prior research, the most prevalent type of prosocial behavior observed was instrumental helping (Dunfield, 2014). Interestingly, instrumental helping was most common in response to sadness than the other emotion contexts and occurred less frequently in response to joy than sadness, fear, and anger contexts. Conversely, infants' comforting behaviors occurred most often when the adult was sad or angry and were less frequent in joy and disgust contexts. Finally, infants' overall indirect helping was most prevalent in sadness contexts and least prevalent in disgust and joy contexts.

This underscores the importance of examining helping, as with all emotionally relevant behavior, as a function of the social context (see Dunfield, 2014). For example, observing a child give an object to a sad experimenter is insufficient for deciphering the type of prosocial behavior demonstrated by the child. If the experimenter had broken her object and the child provided a new object to replace that which had broken, the behavior would demonstrate 'instrumental helping'. However, were the child to provide the experimenter with a blanky (a source of emotional comfort), the giving action would demonstrate 'comforting'. Conversely, and contrary to our hypotheses, disgust contexts did not elicit instrumental helping. Again, this points to the importance of specific elements for eliciting particular behaviors in specific contexts. For example, a disgust context featuring a contaminated object (e.g., spoiled food, a dirty diaper) could elicit increased instrumental helping (e.g., stimulus removal). These findings emphasize that conceptualizing helping as only responding to another's distress may miss a broader social function of helping behavior, namely co-operation. Moreover, the results underscore the need to view emotional communication not as the presentation of an emotional expression, but rather as signaling a relational context in

which the emotional expression, the stimulus, and the environmental affordances cohere to influence and inform the behavioral response of a social partner.

4.3 | Age differences in infants' prosocial responses across discrete emotions

Infants utilized specific prosocial strategies selectively across discrete emotion contexts, with some strategies in response to specific emotions differing across age. For example, 16-month-old infants were least likely to engage in prosocial behavior in the disgust condition compared with the other negative emotion conditions whereas 19-month-old infants were least prosocial in the joy condition. Furthermore, 24-month-old infant overall prosocial behaviors were less differentiated across emotions, likely due to their significantly higher prevalence of prosocial behavior in the joy condition compared with the two younger age groups. Additionally, the low prevalence of instrumental helping in joy contexts was representative of 16- and 19-month-old infants, but not 24-month-old infants, who demonstrated greater prevalence of instrumental helping in the joy condition compared with the younger infants. This instrumental helping by the older infants in the joy context may reflect these infants' desire for participation and social engagement (Dahl & Paulus, 2019; Rheingold, 1982) or even alacrity and cheerfulness (Hammond & Brownell, 2018; Rheingold, 1982). This finding also supports prior research, indicating that infants respond with helping behaviors even when the target individual does not express negative affect (e.g., Newton et al., 2014). Infant comforting behavior also demonstrated important nuance across infant age and emotional context, with only 19-month-olds showing differentiated comforting responses across emotions. Conversely, although indirect helping varied across emotions, the pattern of this differentiation varied across age groups. Specifically, 24-month-old infants engaging in significantly more indirect helping in the joy condition compared with fear, 19-month-old infants helping indirectly significantly more in the fear condition than joy, and 16-month-old infants' indirect helping not differing across emotion contexts. Furthermore, indirect helping in response to joy was significantly more prevalent in 24-month-olds than the younger age groups. Taken together, this study indicates that distinct forms of infant prosocial behavior are differentially deployed in emotional contexts across the second year of life.

Our findings delineate important nuance regarding how infants at different ages responded to discrete emotion contexts. For example, indirect helping was demonstrated most frequently by older infants, particularly when responding to disgust and joy. Conversely, although all infants demonstrated instrumental helping, 24-month-olds' heightened instrumental helping behavior in response to joy may indicate a specific predilection at this age to help others regardless of emotional context (e.g., Warneken & Tomasello, 2007). Coding additional, functionally distinct, helping behaviors, such as providing useful information (e.g., Liszkowski, Carpenter, Striano, & Tomasello, 2006), preemptively helping (e.g., Knudsen & Liszkowski, 2012), or correcting another's failed behavior (e.g., Buttelmann, Carpenter, & Tomasello, 2009), could further inform our understanding of the development of various prosocial behaviors and their uses across contexts.

4.4 | Limitations and further considerations

Although the present investigation adds to research on the use of prosocial responses across development in infancy, at least three specific limitations warrant consideration for future research.

Firstly, there are myriad ways to code and classify infant helping and prosocial behaviors (see Thompson & Newton, 2013). Indeed, our review of the literature identified a number of definitions and operationalizations with which to code prosocial behavior. Although the three prosocial behaviors selected in the present study seemed most parsimonious and supported based on prior research, other distinct forms of prosocial behavior or further delineation of those used in the present study are undoubtedly possible. Additionally, our decision to

code the presence/absence of helping behaviors may have missed important aspects of infants' behaviors that could be captured by considering duration (e.g., Roth-Hanania et al., 2011), number of instances (e.g., Dunfield & Kuhlmeier, 2013) cues required for the infant to respond (e.g., Svetlova et al., 2010), or level of complexity of the behavior (e.g., Vaish et al., 2009). Although these coding alternatives have their own shortcomings (e.g., defining onset/offset of behavior; differentiating attempts and successful acts when different aged infants vary in motoric competence and dexterity), such considerations could parse meaningful differences between age groups and emotion contexts.

Secondly, although a large number of infants were observed to engage in prosocial responding (n = 126), the behavior was only present in 30% of the total experimental observations (see Walle et al., 2017). While this frequency may at first appear low in comparison to previous studies of infant helping and thus indicative of a flawed paradigm, it may indicate the relative infrequency of helping behaviors in naturalistic, home observations. Infants observed in the home typically help just over once per hour and the majority of helping behaviors (68%) are preceded by adult encouragement (Dahl, 2015). Likewise, laboratory studies typically include explicit instructions at some point in the procedure to elicit infant helping (e.g., Brownell et al., 2013; Karasewich et al., 2019), and some classic studies that did not include such cues observed rates of infant prosocial behavior ranging from 10% to 52% (e.g., Roth-Hanania et al., 2011; Zahn-Waxler, Radke-Yarrow, et al., 1992). Furthermore, as reviewed in the introduction, it is common for studies to specifically tailor the context to elicit prosocial behavior (e.g., Dunfield et al., 2011; Svetlova et al., 2010). In contrast, the present contexts were designed to be ambiguous with regards to need so as to elicit greater flexibility of infant responding and spontaneous prosocial behavior. Thus, the observed frequency of helping in our relatively open-ended experimental context in which no explicit need was communicated nor encouragement to help was provided is fairly consistent with prior research and may reflect rates of infant helping in their everyday emotional life.

Lastly, although the total sample in the present investigation was relatively large (N = 296), the number of age groups, emotion conditions, and paradigms necessitate some caution in interpreting our results. This illustrates the difficult decision faced by researchers in determining how to test and compare specific aspects of infant development. One possible remedy is the emerging emphasis on collaborative and cross-lab studies (e.g., Adolph, Gilmore, Freeman, Sanderson, & Millman, 2012; Frank et al., 2017; VanDam et al., 2016). Pooling resources (e.g., financial, expertise, access to specific populations) can increase analytic power to detect differences between conditions, behaviors, groups, and individuals (see Adolph, Gilmore, & Kennedy, 2017; Frank et al., 2017). Moreover, emphasis of open-source video data (e.g., Databrary, 2012) provides opportunities for previously disparate studies to be amalgamated. Although such collaborative and integrative approaches are not without potential issues (see Frank et al., 2017; Gilmore, Kennedy, & Adolph, 2018), they can complement piecemeal approaches of past research.

4.5 | Considerations for understanding the how, when, and why of infant helping

Our findings indicate an emerging understanding of how and when infants help. However, further examination of underlying mechanisms that facilitate prosocial behavior (i.e., the why) is needed. One mechanism through which such understanding may develop is parental discourse about emotion and interactions with social partners (Carpendale & Lewis, 2004; Dunn, Bretherton, & Munn, 1987). Caregiver discussion of emotion is associated with children's prosocial behavior (Drummond, Paul, Waugh, Hammond, & Brownell, 2014; Laible & Karahuta, 2014) and may be particularly important for highlighting specific aspects relating to emotional contexts (Knothe & Walle, 2018). Parents may emphasize specific helping strategies at different points in development and provide cues about how such behaviors should be directed as a function of another person's emotion. Research examining how socialization and cross-cultural differences influence the development, manifestation, and deployment of distinct helping behaviors (see Kärtner & Keller, 2012) represents an exciting future direction.

Infant cognition, particularly social cognition, also changes dramatically in the second year (see Flavell, 1999) and is closely linked with emotion understanding (see Reschke, Walle, & Dukes, 2017). Although very young infants can discriminate emotional expressions (e.g., Flom & Bahrick, 2007), appreciating others' person-environment relations (e.g., Reschke, Walle, Flom, et al., 2017), mental states (e.g., Buttelmann et al., 2009; Scott, 2017), and the relational significance of discrete emotional communication (Walle et al., 2017) emerges gradually in the second year. Additionally, infants' emerging sense of self is linked with their empathic responding (Bischof-Köhler, 1991; Johnson, 1982). Such development may facilitate infants' use of specific behaviors, such as the increase in comforting between 16 and 24 months. Exploring the interplay of underlying socio-cognitive processes with distinct helping behaviors, particularly with a longitudinal design, would enrich the present findings.

Finally, an important aspect of the multidimensionality of prosocial behavior is the varying targets of prosocial acts (Padilla-Walker, Dyer, Yorgason, Fraser, & Coyne, 2015; Zahn-Waxler, Radke-Yarrow, et al., 1992). Although this work has primarily been conducted with older children and adolescents, children learn who is an appropriate and deserving target of help early in life (see Kuhlmeier, Dunfield, & O'Neill, 2014). While infants in the present study responded to somewhat unfamiliar experimenters, incorporating other targets (e.g., parents, out-group members) is an important consideration for future research (Hastings, Rubin, & DeRose, 2005). Additionally, infants varied their helping behavior across the two paradigms. Although each paradigm was carefully crafted to be open-ended with regards to how an infant would help, it remains important to recognize that contextual factors, such as the eliciting object or event associated with the discrete emotion, are important to consider when evaluating distinct forms of infant prosocial responding (see Dunfield & Kuhlmeier, 2013). Individual differences in infant helping may also be explained by aspects relating to infant dispositional and motivational traits (Eisenberg, VanSchyndel, & Spinrad, 2016; Newton, Thompson, & Goodman, 2016; Paulus, 2014, 2017) and the neural mechanisms involved in subtypes of prosocial behavior (Chakroff & Younger, 2015; Paulus et al., 2013). We encourage future research examining infants' expectations of when and how others demonstrate distinct forms of helping, particularly at ages younger than when the infant may be able to actively demonstrate such behaviors.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTES

[1] We acknowledge that there are likely to be additional distinct prosocial strategies that exist but were not included in the present study.

[2] Note: "*n*" refers to individual cases, not infants.

[3] We thank the Action Editor for suggesting examination of this potential effect on infant prosocial behavior.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

Supplementary Material

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