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Caring babies: Concern for others in distress during infancy

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Abstract

Concern for distressed others is a highly valued human capacity, but little is known about its early ontogeny. Theoretical accounts of empathy development have emphasized stages, but this has been called into question. This study sheds new light on four key issues: onset, consistency, development, and predictive power of early manifestations of concern for others. Three-month-old Israei infants (*N* = 165) were followed longitudinally at ages 6, 12, and 18 months, and their observed responses to others' distress were assessed. Concern for distressed others was seen early in the first year of life, long before previous theories assumed. Empathic concern was moderately consistent across both situation and age, from as early as 3 months. Concern for others grew only modestly with age, plateauing during the second year, whereas prosocial behavior increased rapidly during the second year. Early individual differences in concern for others predicted later prosocial behavior on behalf of distressed others. Findings underscore the early roots of caring, and appear to refute assumptions of prior stage theories of empathy development, by showing that concern for others develops much earlier and more gradually than previously assumed.

KEYWORDS
concern for others, development, empathic concern, empathy, infancy, prosocial behavior

1 | INTRODUCTION

Concern for distressed others is a central attribute of human nature. Yet, little is known about its early ontogeny. The goal of this study was to shed light on key issues regarding the capacity for concern in infancy.

1.1 | Empathy and Concern for Others

Humans, like several other species (Decety, Bartal, Uzefovsky, & Knafo-Noam, 2016; MacLean, 1985; de Waal, 2008), are prewired to experience emotional arousal in response to emotional states of conspecifics. This basic mechanism of empathic arousal (also known as emotion contagion or affective resonance) can lead to concern for others (Batson, 1991, 2009). The literature differentiates between three components of concern for others: affective, cognitive, and behavioral (e.g. Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008; Zahn-Waxler et al., 2018).

The affective component is *empathic concern* (also known as affective empathy or sympathy). This other-oriented, emotional response denotes feeling worried for or caring about a hurting or needy other. In young children, this is manifested by orienting toward the other, stopping any play or other activity, combined with a concerned facial expression (e.g. sobering), and often accompanied by other-oriented gestures or sympathetic vocalizations (Roth-Hanania, Davidov, & Zahn-Waxler, 2011). Empathic concern is possible when the observer is able to regulate the arousal generated by the others' distress. If over-arousal ensues, then a different affective response results: self-distress (or personal distress). Here, the observer experiences self-focused, anxious feelings reflecting concern for one's own well-being (Batson, 1991).

The cognitive component, referred to as *cognitive empathy*, denotes the ability to comprehend the other's feelings and experiences. In young children, it is also seen as attempts to comprehend the other's distress, inquiring or exploring another's distress (also called 'hypothesis testing'; Zahn-Waxler, Radke-Yarrow, Radke-Yarrow, Wagner, & Chapman, 1992; Zahn-Waxler, Robinson, Robinson, & Emde, 1992) because such exploration is essential for gaining better understanding of the other's situation and emotional state. Cognitive and emotional components of concern for others are partially tied through both genetic and environmental factors, as often reflected in moderate intercorrelations (Knafo et al., 2008).

The behavioral component of concern for others is prosocial behavior, that is, acting to aid or benefit others (Eisenberg et al., 2015), such as helping, comforting, sharing, etc. Empathic concern promotes prosocial behavior in children and adults, within the same situation and longitudinally (Batson, 1991; Eisenberg et al., 2015). When one feels concern, one has a stake in another's welfare, a powerful motive for action (Batson, 1991), albeit other motives also exist (Davidov, Vaish, Knafo-Noam, & Hastings, 2016; Eisenberg, VanSchyndel, & Spinrad, 2016). Empathic concern does not always translate into prosocial action (e.g. the child may be physically unable, or not know what to do). Thus, the causal link is meaningful, but only partial.

1.2 | Early Development of Concern for Others: Theory and Research

Conceptions of empathy development have been dominated by a stage view. Thus, both Piagetian and Psychoanalytic theories, through different hypothesized mechanisms, held that young children were too immature – cognitively or emotionally – to experience concern for others (Zahn-Waxler, 1998). Later, Hoffman's theory of empathy development posited a substantially earlier onset of concern for others – the second year of life (Hoffman, 1975, 1984, 2001). But this theory too emphasized a stage conceptualization of development, which was entrenched in developmental thinking of the time. Hoffman posited that empathy progresses in qualitative shifts, driven by developmental advances in children's cognitive abilities. This conceptualization, which has been dominant, assumed that cognitive achievements, taken largely from Piagetian theory, transform the quality of children's emotional experiences of affective empathy. Interestingly, there has been little consideration of whether such application of stages was appropriate for characterizing motivational and emotional processes, like caring and concern. Moreover, although much research over the past decades has shown that classic Piagetian theory underestimated the cognitive abilities of infants and young children (e.g. Gopnik, 1996), Hoffman's theory of empathy development was not amended to reflect this more sophisticated understanding.

Specifically, according to this theory (Hoffman, 1975, 1984, 2001), the first stage, roughly spanning the first year of life, consists of empathic arousal, as seen in contagious crying or self-distress, but not

Research highlights

- This is the first study to show the early onset of concern for others, from 3 months of age – a much younger age than previously assumed.
- Infants' expressions of empathic concern for distressed others (through face, voice, and body) are moderately consistent across situations, from as early as 3 months.
- Infants showing more empathic concern for distressed others at an early age also show greater concern at later ages, from 3 to 18 months, reflecting trait-like consistency.
- Expressions of empathy at 3–6 months predict greater attempts to help another in distress at 18 months, reflecting the early motivational role of concern for others.

other-oriented concern. Infants' capacity for contagious distress was first observed in newborns who cried in response to the cries of other infants, and more so than when exposed to other equally loud, aversive sounds (e.g. Sagi & Hoffman, 1976; Simner, 1971;cf. Ruffman, Lorimer, & Scarf, 2017). During the first year, infants were viewed as incapable of other-oriented empathy, due to their inability to distinguish between the other's distress and their own. Explicit self-other differentiation, as reflected in mirror self-recognition, was considered a prerequisite for concern for others. Only once this relatively advanced cognitive milestone is achieved, toward the middle of the second year (Butterworth, 1992), were infants thought to shift to the second stage, marked by the ability to experience and express true concern for another (Bischof-Köhler, 1991; Hoffman, 2001). Consequently, studies of early concern for others typically began in the second year of life (Knafo et al., 2008; Zahn-Waxler, Radke-Yarrow, & King, 1979; Zahn-Waxler, Radke-Yarrow, et al., 1992).

Hoffman's theory has been challenged by studies showing young infants' responding was not limited to self-distress, but included other-oriented responses as well (Davidov, Zahn-Waxler, Roth-Hanania, & Knafo, 2013). This was observed in 6-month-old (Hay, Nash, & Pedersen, 1981) and 8-month-old infants' (Liddle, Bradley, & Mcgrath, 2015) responses to peers' distress. Infants often direct their gaze toward the distressed peer, and show socially communicative behaviors. However, both samples were small, and Hay et al. did not directly assess concern for others. Roth-Hanania et al. (2011) found affective concern (reflected by facial expressions, vocalizations, and gestures) and cognitive empathy (attempts to explore and comprehend the other's distress) among 8- and 10-month olds. This is consistent with Darwin's observation of his son's empathic reaction at 6 months, when his nurse pretended to cry (Darwin, 1872, p. 359). Moreover, Roth-Hanania, et al. found that early expressions of concern predicted prosocial behavior toward distressed others several months later, but again with a small sample.

Consequently, Davidov et al. (2013) proposed an alternative theory of early empathy development. In their view, empathy does not

develop in a stage-like manner, and the ability to experience concern is not dependent on emerging cognitive capacities. Rather, concern for others, both affective and cognitive, is already present during the first year of life (see also Uzefovsky, Paz, & Davidov, 2019; Zahn-Waxler et al., 2018). Concerned reactions do not require the cognitive ability of explicit self-knowledge, but rather the more basic ability of *implicit* self-other differentiation (Davidov et al., 2013). Such implicit ability has been shown to already be present in young infants and newborns (Dondi, Simion, & Caltran, 1999; Rochat & Hespos, 1997; see also Davidov et al., 2013) and possibly even prenatally (Castiello et al., 2010).

Thus, rather than self-distress emerging first and later developing into empathic concern in the second year, the alternative theory posits that young infants, in addition to self-distress, can already respond to others' distress with affective and cognitive concern (see also Zahn-Waxler et al., 2018). As with older children and adults, whether self-distress or concern for others will be shown in a particular situation is determined by regulatory processes, that is, the ability to effectively regulate emotional arousal, and thus remain focused on the other (Davidov et al., 2013; see also Abramson, Paz, & Knafo-Noam, 2019).

This alternative theory still awaits systematic examination. Important gaps in knowledge exist regarding concern for others in infancy, particularly regarding the onset, consistency, development, and predictive power of early affective and cognitive concern for others. The present study addressed these gaps.

1.3 | The Present Study

A large sample of infants was followed from 3 to 18 months, and their observed responses to others' distress were assessed. The following research questions were examined:

1. *Onset:* How early are affective and cognitive empathy for others in distress seen? Based on prior studies with small samples (Hay et al., 1981; Liddle et al., 2015; Roth-Hanania et al., 2011), we expected that 6-month-old infants would show modest but clear levels of empathic concern and exploration of the other's distress (viewed as a marker of cognitive empathy), whereas self-distress responses would be less common. Extrapolating from prior work, we also expected that some 3-month olds would already show concern for others. These predictions are in stark contrast to Hoffman's theory of empathy development.
2. *Consistency:* Are individual differences in concern stable across situations and over time? Based on work showing trait-like consistency of concern for others during the second and third years of life (Knafo et al., 2008), we hypothesized that some consistency in concerned responses would already be shown during the first year of life, both across situations and over time.
3. *Development:* How do the different responses to distress change with age? Distinct developmental trajectories were expected for different aspects of concern for others (Roth-Hanania et al., 2011). Reflecting our theoretical view of early empathy development,

we expected a modest and gradual increase in empathic concern from 3 to 18 months (rather than the stage-like, abrupt shift proposed in Hoffman's theory). Relatedly, we expected self-distress to be low across all ages. In contrast, because cognitive empathy has been shown in prior work to increase more markedly with age than affective empathy (see Davidov et al., 2013), we expected a steeper slope, yet still gradual, for cognitive empathy compared to empathic concern. Finally, we expected a steep and later emergence of prosocial behavior (comforting, helping), which is less likely to be seen prior to the second year (Roth-Hanania et al., 2011).
4. *Prediction:* Do early markers of concern for others predict later prosocial action? Roth-Hanania et al. (2011) showed such prediction from 8 to 12 months, and from 10 to 14 months. Additionally, infants' sensitivity to facial expressions of fear at 7 months has been linked to their subsequent prosociality at 14 months (Grossmann, Missana, & Krol, 2018). We sought to extend these findings, by examining predictive links from 3 to 18 months. We hypothesized that early affective and cognitive concern for others in the first year would predict prosocial behavior in the second year.

2 | METHOD

2.1 | Participants

Three-month-old Israeli infants ($N = 165$, 49% females; $M_{age} = 3.35$, $SD = 0.28$) were followed at 6 months ($N = 155$, $M = 6.39$, $SD = 0.36$), 12 months ($N = 151$, $M = 12.53$, $SD = 0.28$), and 18 months ($N = 147$, $M = 18.37$, $SD = 0.58$). One additional infant was excluded from the sample because he was diagnosed with autism at 18 months (his data were transferred, with parental permission, to a study on early empathy as a predictor of autism diagnosis).

Participants were recruited from the Jerusalem metropolitan area. Mothers' mean age was 33.12 ($SD = 4.99$). Table 1 presents the demographic characteristics of the sample. Most mothers were married, and Israeli-born. All families were Jewish, but the sample was diverse with respect to religiosity, income, and family size.

Ethics approval was provided by Hebrew University of Jerusalem IRB and by Hadassah Medical Center Helsinki Committee and Israel's Ministry of Health. Mothers who gave birth at the Hadassah Medical Center were sent a letter about the study, also indicating how to refuse to be contacted (less than 1% elected to refuse). The sample was subsequently recruited by phone. Mothers signed a consent form at the beginning of each visit. They received a gift certificate of 50 NIS (approx. $US 14) and a toy for the child at each visit.

2.2 | Procedure

Data were collected during home visits, conducted by trained female graduate and undergraduate students, and videotaped for

TABLE 1 Demographic characteristics of the sample

Characteristic		n (%)
Family status	Married (or common-law partnership)	148 (89.7)
	Single	5 (3.0)
	Divorced or separated	5 (3.0)
	Did not report	7 (4.2)
Mother's place of birth	Israel	122 (73.9)
	Former Soviet Union	14 (8.5)
	North America	12 (7.3)
	Western Europe or other countries	11 (6.7)
	Did not report	6 (3.6)
Maternal Education	High school	33 (20.0)
	Bachelor's degree	68 (41.2)
	Master's degree or higher	58 (35.1)
	Did not report	6 (3.6)
Number of children	1	43 (26.1)
	2	41 (24.8)
	3	24 (14.5)
	4	26 (15.8)
	5+	25 (15.2)
	Did not report	6 (3.6)
Mother's Religiosity	Secular	46 (27.9)
	Traditional[a]	31 (18.8)
	Religious	53 (32.1)
	Ultra-Orthodox	27 (16.4)
	Did not report	8 (4.8)
Family income (per month)[b]	8,500 NIS or less	41 (24.8)
	8,501–12,500 NIS[c]	44 (26.7)
	12,501–20,000 NIS[d]	54 (32.7)
	20,001 NIS or higher	15 (9.1)
	Did not report	11 (6.7)

Notes: All information was reported by mothers, at the 3-month home visit.

[a]Jewish Israelis who identify as 'traditional' feel close to religion, typically as a family tradition; they observe a few religious customs but do not observe others and, unlike Religious Israelis, are not committed to actively participating in daily religious practices.

[b]Monthly gross family income (before taxes).

[c]Corresponding to the 30th–40th income percentiles (Israel Central Bureau of Statistics, 2017).

[d]Corresponding to the mean monthly family income in Israel at the time, 18,671 NIS, and to the 40th–70th income percentiles (Israel Central Bureau of Statistics, 2017).

subsequent coding. All visits included three distress stimuli: mother simulation, experimenter simulation, and video of a crying infant, and two neutral stimuli (mother and peer video; because of the large number of assessments that had to be completed at each visit, and the young age of the infants, an experimenter neutral episode was not included in the study). See Appendix A for order of the tasks. Because of infants' limited endurance and attention span, two main

considerations guided the ordering of the tasks: (1) interspersing the more stressful (distress) tasks with other tasks and (2) beginning and ending the visit with less demanding tasks. Hence, complete counterbalancing of tasks was not possible. However, mother and experimenter distress simulations were counterbalanced.

2.3 | Measures

2.3.1 | Distress simulations

In the experimenter simulation, the infant was seated on or next to the mother (if able to sit independently). As the experimenter sat down in front of the infant, she pretended to hurt her knee and feigned pain and distress for 60s (the first 30s at a fairly intense level, and the next 30s at a subsiding/lower level). The experimenter avoided making eye contact with the infant, so as not to invite a response, and the mother was instructed not to intervene. The experimenter then stopped crying, made eye contact with the infant, smiled, and said she was feeling well now. The mother's simulation was identical to the experimenter's, except that mothers pretended to hurt their finger while playing with a pounding toy. Mothers were carefully instructed how to perform the simulation. Distress simulations like these have often been used with older infants, toddlers, and young children (Knafo et al., 2008; Roth-Hanania et al., 2011; Zahn-Waxler, Radke-Yarrow, et al., 1992; Zahn-Waxler, Robinson, et al., 1992).

2.3.2 | Crying infant video

Infants observed a 50s video of another infant crying (Geangu, Hauf, Bhardwaj & Bentz, 2011). The video was on a tablet computer in front of the infant, who was on the mother's lap or nearby. Mothers were instructed not to intervene.

2.3.3 | Coding infants' responses to distress

The coding system was based on the coding scheme from the MacArthur Longitudinal Twin Study (Zahn-Waxler, Robinson, et al., 1992). The following dimensions from that coding scheme were used.

Concerned affect
Captures affective expressions of concern for the victim, as seen in facial cues and additional (vocal, gestural-postural) markers. Facial expressions reflecting concern are a necessary component, and include sobering, sad expression with corners of the mouth turned down, or 'sympathy face' with brow furrow (all focused on the victim); vocal cues of concern include a sympathetic or sad intonation; and gestural-postural cues include body alerting, leaning in, approaching, or reaching toward the victim. Coding is based on both duration and intensity of these responses, throughout the episode. Ratings are assigned on

a scale ranging from 0 (= concern absent) to 3 (= strong concern), including half-points for increased sensitivity (as in Light et al., 2009). For the definitions of each scale level, see Appendix B.

Inquiry behavior

Captures the cognitive dimension of empathy at young ages – namely, trying to cognitively comprehend the other's state, as seen in exploration of and efforts to understand the victim's situation (aka 'hypothesis testing', Zahn-Waxler, Radke-Yarrow, et al., 1992). It included intense looking or visual scanning (e.g. looking back and forth from victim's face to 'hurt' body-part or to the toy that hurt mother), social referencing (e.g. alternating gaze between victim and another adult), and vocalizations with questioning intonation (and at later ages, questions or labeling of emotions). The code is given based on duration, intensity, and complexity throughout the episode. Ratings are assigned on a scale between 0 (= absent) to 3 (= strong), with half-points. For the definitions of each scale level, see Appendix B.

Self-distress

Assesses distress that is focused on the self, on a 0–3 scale, with 0 = does not occur; 1 = visible distress manifested non-vocally, through the body (fussiness, irritability, and jerkiness) or through facial expressions (wariness or fear; e.g. eyes wide, mouth open), clearly expressed for several seconds; 2 = whimpering (expressed vocally); 3 = full blown crying. (If infants fully cried, the distress episode was ended).

Prosocial behavior

Reflects attempts to help or comfort the distressed victim, rated on a 0–3 scale, with 0 = none, 1 = brief (e.g. one quick pat, or handing a nearby toy), 2 = moderate (tries to help/comfort for a longer time, e.g. a big hug, or repeated briefer attempts), and 3 = prolonged (assists for a longer duration, and/or with greater effort than for codes 1 and 2). Half points were used as needed. Ratings were based on duration, intensity, and complexity of behaviors, throughout the episode.

Other dimensions

Avoidance: degree to which the child avoided or disengaged from the victim, rated on a 0–4 scale; *Positive affect:* level of positive affect shown during the other's distress (excluding relief at recovery), rated on a 0–4 scale; and *Communicative smiles*, where the infant appeared to try to engage the other by smiling, rated on a 0–3 scale (for more information on these measures, see supplementary information online).

2.3.4 | Reliability

Coders were graduate and undergraduate students, trained by the main researchers, until they reached reliability. For each task at each age there was one main coder, and another coder who rated 20%–30% of the videos for reliability. To avoid carryover effects (as most coders coded more than one task), each task at each age was coded separately (separated over time, and without looking at any prior coding). Inter-rater reliabilities, calculated using Intra-Class Correlations (two-way random, exact agreement), were high for all dimensions at all ages, ranging from 0.85 to 0.94 for concerned affect, 0.84 to 0.94 for inquiry behavior, 0.85 to 0.99 for self-distress, 0.85 to 0.95 for prosocial behavior, and 0.81 to 0.99 for all additional dimensions. Reliabilities were equally high at younger versus older ages (e.g. for empathic concern, ICCs = 0.85 to 0.93 at 3–6 months, and 0.86 to 0.94 at 12–18 months; for inquiry, ICCs = 0.84 to 0.94 at 3–6 months, and 0.88 to 0.93 at 12–18 months).

2.3.5 | Blind coding of concern

Because infants' vocalizations are relevant cues in the coding scheme, the coding could not be blind to the distress stimulus (heard in the background). To ensure that coding of empathic concern was not affected by this knowledge, we conducted two sets of blind coding at age 6 months. A coder viewed videos of infants without knowing whether they responded to a distress stimulus or a neutral stimulus (only the infants' face and body was shown, without audio or any other cues); the coder rated the level of affective concern shown by the infant. In one set, 30 videos in which infants responded to the maternal distress simulation were interspersed with 30 videos in which infants responded to the affectively neutral mother stimulus (reading out loud). In the second set, 30 videos of infants who observed the crying peer video were interspersed with 30 videos of infants who observed the neutral peer video (baby babbling).

In both blind coding sets, empathic concern ratings were much higher for the distress versus the neutral episodes, even though the coder was unaware of episode type (i.e. distress versus neutral). The means are presented in Table S1 of the supplementary material. Moreover, there was no significant difference between the ratings assigned by the blind and non-blind coders, for any of the episode types (see Table S1). These results lend validity to the main coding, by ruling out the possibility that the main coding (which was not blind) overestimated concerned affect due to knowledge of what children observed.

2.3.6 | Neutral stimuli

Infants also observed two affectively neutral (non-distress) episodes. One was enacted by mothers, who were asked to read out loud segments from an elementary school science textbook. The episode was 60s long, with mothers refraining from making eye contact with the child throughout. The second neutral episode was a 50s video of an infant who was babbling (Geangu, Benga, Stahl, & Striano, 2011), shown on a tablet. The mother neutral episode appeared first (and prior to all distress episodes), to ease the infants and mothers into the study; the neutral peer video appeared last (see Appendix A). Infants' responses to the neutral episodes were coded at 3 and 6 months as the baseline for examining the onset question, that is, whether empathic responses to distress can be

seen at 3–6 months beyond infants' responses to non-distress stimuli. The same coding scheme used for the distress episodes was used for the neutral segments. Inter-rater reliabilities, computed based on 20%–30% of the segments rated independently by a second coder, all ranged from ICCs = 0.81 to 0.99.

2.4 | Data reduction

Principal components factor analyses showed that infants' responses to others' distress converged across the three assessments (mother, experimenter, video) at every age for both concerned affect and inquiry behavior (each analysis yielded a single factor, eigenvalues ranging from 1.26 to 1.62, accounting for 42%–54% of the variance, with all loadings between 0.42 and 0.80). Convergence across episodes was a little weaker for self-distress (perhaps because it was relatively rare), although it was still apparent, with 1–2 of three correlations significant at each age. To reduce the number of analyses, we aggregated scores of each of these dimensions, by averaging across the three assessments at each age.

We also aggregated prosocial behavior scores, but only across mother and experimenter simulations, which converged onto a single factor at both 12 and 18 months (eigenvalues: 1.01 and 1.14 for 12 and 18 months, respectively). Prosocial behavior toward the video was not included; whereas a video can generate feelings of concern for another, it does not foster prosocial action because there is no means for the child to help or comfort (see also Roth-Hanania et al., 2011). Because the majority of children at each age did not show prosocial behavior attempts to help or comfort the distressed other (see below), dichotomous scores were created at each age and used in subsequent analyses; the dichotomous scores reflected whether the child showed any prosocial behavior in at least one simulation (=1) or did not (=0). Inter-rater reliabilities for these scores were also appropriate: Cohen's kappa's ranging from 0.75 to 0.87.

2.5 | Analysis plan

To examine the onset question, that is, whether empathic responses to others' distress can be reliably seen by 3–6 months, we conducted four paired t tests, in which mean scores of concerned affect and inquiry behavior were compared to the mean scores of the same dimensions coded from the neutral stimuli, at 3 and 6 months. The Bonferroni correction was applied to multiple comparisons within age. In addition, differences in self-distress in response to others' distress versus neutral stimuli were also examined.

Consistency across situations and age was assessed using confirmatory factor analysis (CFA), which examined whether at each age, empathic responses all load on a latent factor (with mother, experimenter, and peer video as three indicators), with these four factors in turn converging onto a higher-order empathic concern latent factor. Such a structure would reflect trait-like consistency in empathic

responses, across both situation and age. The models were tested for empathic concern, inquiry behavior, and self-distress.

Development was examined with multilevel growth models, run using HLM (Raudenbush, Bryk, Cheong, & Congdon, 2004). This approach indicates how much variability in infants' observed responses is attributed to individual differences between children (i.e. to the fact that observations are nested within children), as reflected by the ICC parameter. Moreover, it enables assessment of the nature of change with age in responses to others' distress, and specifically whether there is (1) linear growth (change) in infants' responses with age and (2) non-linear change (e.g. whether growth accelerates or decreases with age). The three main analyses examined the development of concerned affect, inquiry behavior, and self-distress. The Level 1 HLM equation reflected variability within children, as a function of age. It took the following form:

$$\Upsilon_{ti} = \pi_{0i} + \pi_{1i}AGE_{ti} + \pi_{2i}AGE_{ti}^2 + \varepsilon_{ti}$$

where the behavior Υ for child i at age t is a function of four components: π_{0i} is an intercept that represents the estimated value of Υ at the first time point (age 3 months); π_{1i} is a slope estimating the linear change per month in behavior Υ between ages 3 and 18 months; π_{2i} reflects the estimated non-linear (quadratic) component in growth of the behavior with age; and ε_{ti} is an individual level error term. The main components of the Level 1 equation were estimated as Level 2 equations, assessing individual differences between infants. This reflects the notion that observations are more likely to be similar when they come from the same infant. Level 2 equations estimate the mean intercept, slope, and quadratic component of the entire sample, as follows:

$$\pi_{0j} = \beta_{00} + r_{0j.}$$

$$\pi_{1j} = \beta_{01} + r_{1j.}$$

$$\pi_{2j} = \beta_{20} + r_{2j.}$$

Prediction of prosociality from earlier empathic responses was examined using four logistic regression models. Each model examined whether multiple responses to distress at one age (3, 6, or 12) predicted the probability of the infant trying to assist a distressed other at 18 months. Concurrent associations with empathy at 18 months were also examined.

3 | RESULTS

3.1 | Descriptive Information

Descriptive statistics for the study's main measures from 3 to 18 months are presented in Table 2 and Figure 1 (see Table S2 for information regarding additional measures). There were no gender differences, with only one exception: Girls showed greater exploration of the other's distress at 18 months compared to boys (respective

TABLE 2 Descriptive information for the study's main measures

		3 months			6 months			12 months			18 months		
		N	M (SD)	Range	N	M (SD)	Range	N	M (SD)	Range	N	M (SD)	Range
Concern	Experimenter	154	0.72 (0.51)	0–2	151	1.13 (0.56)	0–2.5	151	1.24 (0.65)	0–2.5	147	1.33 (0.65)	0–3
	Mother	143	0.65 (0.53)	0–2	140	0.91 (0.59)	0–2.5	147	1.04 (0.75)	0–3	143	1.17 (0.75)	0–3
	Video	156	0.54 (0.49)	0–2	152	1.01 (0.54)	0–2	150	1.00 (0.63)	0–3	147	1.35 (0.69)	0–3
	Total	163	0.63 (0.35)	0–1.5	155	1.02 (0.41)	0–2	151	1.10 (0.48)	0–2.5	147	1.29 (0.51)	0.33–2.5
Inquiry	Experimenter	154	1.43 (0.33)	0–2	151	1.55 (0.34)	0–2	151	1.57 (0.40)	0–2.5	147	1.77 (0.44)	0.50–3
	Mother	143	1.23 (0.47)	0–2	140	1.36 (0.45)	0–2	147	1.54 (0.63)	0–3	143	1.62 (0.64)	0.50–3
	Video	156	1.21 (0.52)	0–2	152	1.66 (0.42)	0.50–2	150	1.89 (0.45)	1–3	147	1.95 (0.45)	1–3
	Total	163	1.29 (0.29)	0.50–2	155	1.53 (0.28)	0.67–2	151	1.67 (0.33)	0.50–2.5	147	1.78 (0.35)	1–2.83
Self-distress	Experimenter	154	0.27 (0.71)	0–3	151	0.17 (0.50)	0–3	151	0.21 (0.56)	0–3	147	0.19 (0.52)	0–3
	Mother	143	0.34 (0.74)	0–3	140	0.29 (0.73)	0–3	147	0.40 (0.87)	0–3	143	0.35 (0.79)	0–3
	Video	156	0.07 (0.32)	0–2	152	0.14 (0.48)	0–2	150	0.27 (0.61)	0–3	147	0.13 (0.38)	0–2
	Total	163	0.23 (0.41)	0–2	155	0.20 (0.37)	0–1.67	151	0.29 (0.46)	0–2	147	0.22 (0.40)	0–2
Prosocial behavior								N	Shown by:	n (%)	N	Shown by:	n (%)
	Experimenter							151		6 (4)	147		15 (10)
	Mother							147		16 (11)	143		53 (37)
	Total							151		21 (14)	147		60 (41)

Notes: Total scores are means averaged across the three episodes (experimenter, mother, and video), except for prosocial behavior total scores which are dichotomous (0 or 1) and do not include the video segment (see Data reduction section). Ranges are the actual ranges observed; possible ranges for all measures are from 0 to 3. Prosocial behavior was not evidenced at all at 3 and 6 months. *N* for total scores at 3 months is 163 (rather than 165), because two infants (both males) did not complete any of the empathy assessments at this age, due to lack of maternal cooperation and infant fussiness/ fatigue.

means = 1.84 versus 1.72, SDs = 0.37 and 0.31, $t(145) = 2.06$, $p = .041$). Also, there were very few links with other demographic variables (see supplementary information). Correlational analysis showed that infants' reactions usually cohered to form a pattern (inter-correlations between different reactions at each age are presented in Table S3). Thus, concerned affect and inquiry behavior were positively intercorrelated at all four ages (rs = 0.53 to 0.62, all ps < 0.001). Moreover, these two manifestations of empathy were often negatively associated with self-distress (see Table S3). Also of interest, empathic responses (concerned affect and inquiry) were never higher toward the mother than toward the experimenter (and at some ages were in fact higher for the experimenter, see Table 3). In contrast, several responses were higher toward the mother than the experimenter at 12 and 18 months: self-distress, prosocial behavior, positive affect, and communicative smiles (see Tables 2 and S2).

3.2 | Onset: how early is concern for distressed others evident?

Table 3 presents the results of the paired t tests. Consistent with prediction, concern for others was already seen at ages 3–6 months, at modest levels. Thus, concerned affect and inquiry behavior were significantly higher in response to distressed others versus to neutral stimuli, at both 3 and 6 months. Moreover, because there was no neutral task for the experimenter, we also compared the neutral stimuli to mean responses from the maternal distress simulation

and crying peer video only, without the experimenter's distress simulation; the results were virtually identical. In contrast, the levels of self-focused distress in response to others' distress were much lower at both 3 and 6 months, and did not differ significantly from the levels of self-distress shown in response to neutral stimuli (see Table 3). Indeed, the majority of infants (67.5% at 3 months, 70.3% at 6 months) did not show self-distress in any of the three episodes. In contrast, only a small portion of infants (4.3% at 3 months, 0.6% at 6 months) showed zero concerned affect in all three episodes (although many showed only brief or weak concern: for example, 39.3% of 3-month olds showed concern at a mean level of 0.5 or lower, on a 0–3 scale; For the full distributions of responses to distress at 3 and 6 months, see Figure S1).

Three and 6-month-old infants typically exhibited their empathy for the other's distress through concerned facial expressions while focusing on the other, as well as by attempts to explore and comprehend the other's situation. Examples of an infant's concerned responses at the four ages are shown in Video S1 in the supplementary materials online.

3.2.1 | Positive affect in response to others' distress

Another typical response that emerged from the data is positive affect (smiling) in response to others' distress. A majority (69%) of 3-month olds smiled during at least one of the three episodes, as did 75% of 6-month olds, 83% of 12-month olds, and 73.5% of 18-month olds (see also Table S2). While some smiles were only fleeting, others
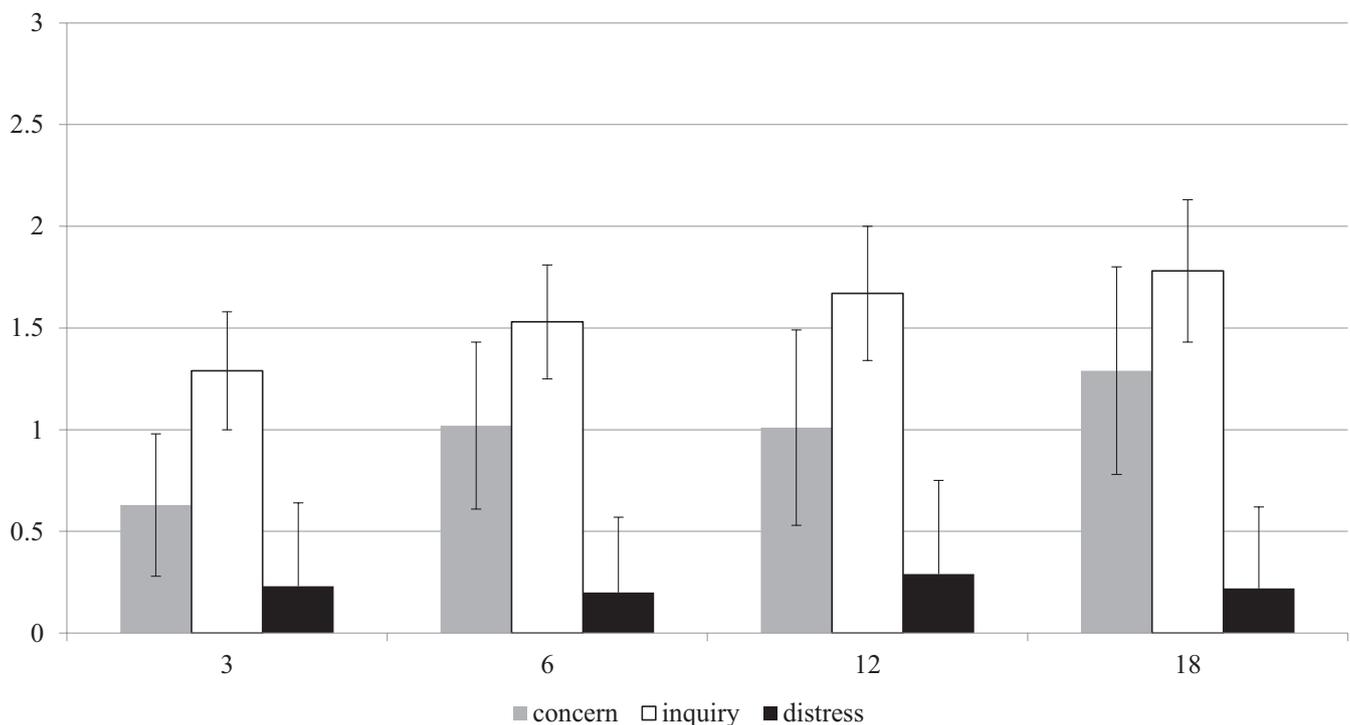

FIGURE 1 The graph presents the means and standard deviations (error bars) of empathic concern, inquiry behavior, and self-distress – all rated on 0–3 scales – from 3 months to 18 months. The scores at each age are averages of the three distress episodes: mother simulation, experimenter simulation, and peer video

TABLE 3 Results of paired *t* tests examining the occurrence of other-oriented and self-focused responses to distress versus neutral stimuli at 3 and 6 months

Age	Score	Distress stimuli Mean (SD)	Neutral stimuli Mean (SD)	t	p value
3m					
	Empathic concern	0.64 (0.35)	0.25 (0.31)	13.33	< 0.001
	Inquiry behavior	1.30 (0.29)	1.04 (0.41)	7.65	< 0.001
	Self-distress	0.23 (0.41)	0.25 (0.51)	−0.49	0.625
6m					
	Empathic concern	1.02 (0.41)	0.27 (0.29)	22.11	< 0.001
	Inquiry behavior	1.53 (0.28)	1.06 (0.39)	13.40	< 0.001
	Self-distress	0.20 (0.37)	0.22 (0.47)	−0.49	0.624

Notes: Distress stimuli means include three episodes (experimenter, mother, video); Neutral stimuli means include two episodes (mother, video). Results were virtually identical when neutral means were compared to distress stimuli means which included only the mother and video episodes. Within each age, the Bonferroni correction was applied to the two comparisons involving other-oriented responses (empathic concern and inquiry behavior).
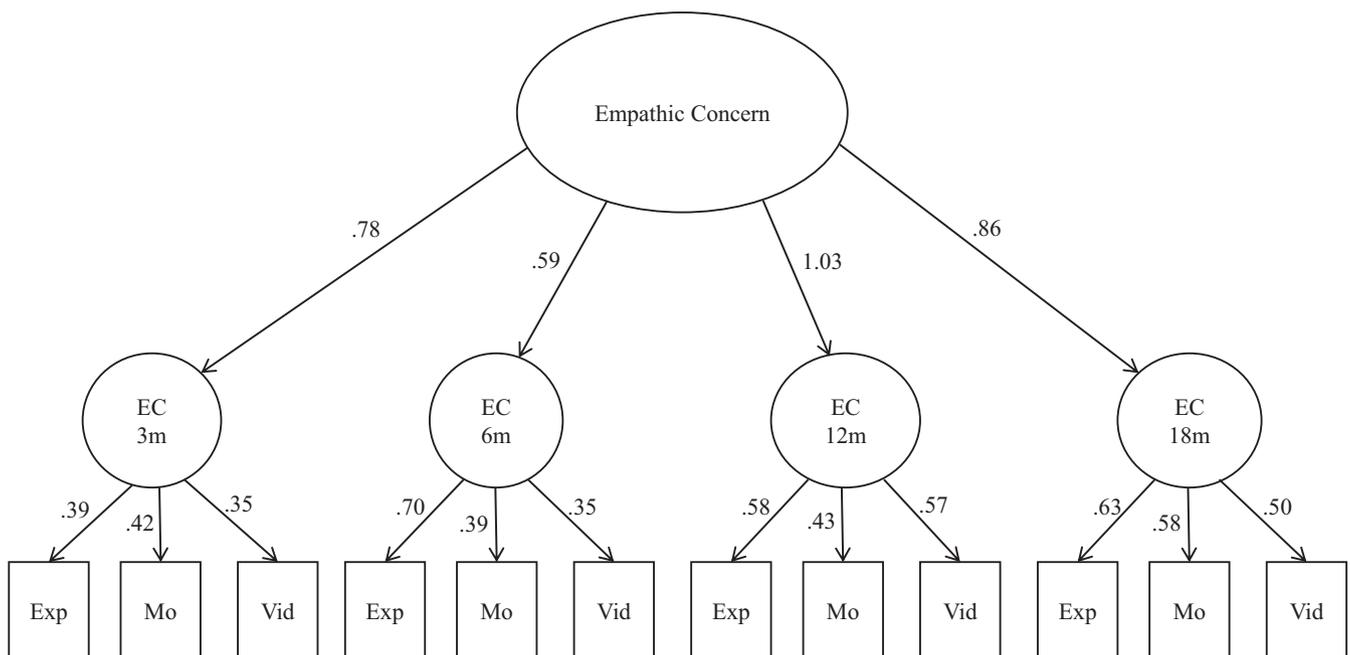

FIGURE 2 Measurement model (Confirmatory Factor Analysis) examining the convergence of empathic concern scores across assessment episodes (Exp = experimenter simulation, Mo = mother simulation, Vid = video episode), and across age. EC = Empathic Concern. Coefficients are standardized maximum likelihood estimates. All coefficients are significant at *p* < .001 (with the exception of the coefficient for Vid at 3m, for which *p* = .002). TLI = .909, CFI = .931, RMSEA = .041.

were broad and repeated. Examination of videos revealed that some smiles appeared to stem from initial confusion or unease, but communicative smiles were also frequent. The latter were directed toward the victim in what seemed to be attempts to generate a cycle of positive interaction (see description in supplementary material). Communicative smiles were fairly common, shown in at least one simulation by 39.5% of the infants at 3 months, 39% at 6 months, 38% at 12 months, and 33% at 18 months. Infants' positive affect responses were either unrelated to or, particularly in the case of communicative smiles, positively associated with the degree of empathic concern and inquiry behavior shown by the infant (see Table S3).

3.3 | Consistency: stability of concern for others across situation and age

Consistency over situations and age was examined using confirmatory factor analysis (using the lavaan *SEM* package in R; Rosseel, 2012). Maximum likelihood method was used for parameter estimation, and full information maximum likelihood imputation (FIML) was applied to treat missing data. The model for empathic concern provided a good fit for the data: $\chi^2(50) = 64.1$, $p = .087$; comparative fit index (CFI) = 0.93, Tucker–Lewis index (TLI) = 0.91, root mean square error of approximation (RMSEA) = 0.04, and standardized root mean

square residual (SRMR) = 0.06 (Hu & Bentler, 1999). The model (in Figure 2) reflects consistency across both situation and age: At each age, infants' empathic concern responses in the three assessments converged onto a latent factor, and these four latent variables, in turn, converged onto a higher-order latent empathic concern factor.

A similar model run for inquiry yielded poor fit, with only some of the fit indices in the acceptable range ($\chi^2(50) = 60.64$, $p = .144$; CFI = 0.87, TLI = 0.83, RMSEA = 0.04, SRMR = 0.06). The fit was also poor for self-distress (the model failed to converge).

To shed further light on these results, supplementary correlational analysis showed that inquiry behavior and self-distress responses were both fairly consistent across the three situations, albeit not as strongly as empathic concern (see Table S4 for inter-correlations). Moreover, continuity over time was only modest for inquiry behavior, with two of the six correlations reaching significance (see Table 4), and weak for self-distress, with only one significant association (see Table S5). In contrast, strong evidence of continuity over time emerged for empathic concern, which was correlated between all ages (see Table 4; for correlations over time of additional measures, see Tables S5 and S6).

We also examined stability of individual differences in prosocial behavior, from 12 to 18 months (as expected, prosocial behavior was not present at the earlier ages). The scores were not correlated (Phi = 0.08, $p = .34$).

3.4 | Development: changes with age in infants' responses to distress

Table 5 summarizes results of the HLM analyses of empathic concern, inquiry behavior, and self-distress, and Figure 3 presents the estimated growth curves of these responses (see Table S7 and Figure S2 for models of additional measures). The ICC in the analysis with empathic concern indicates that almost 20% of the variance in observed empathic concern is accounted for by taking into consideration that observations were nested within children. The growth of empathic concern with age (within children) was characterized by a significant positive linear component as well as a significant negative quadratic component. Thus, empathic concern increased with age, but this increase became weaker over time. It was more pronounced at earlier ages (e.g. from 3 to 6 months), and gradually decelerated at later ages (see also Figure 3(a)). This pattern is largely consistent

with our prediction of only a modest increase with age in empathic concern.

For inquiry behavior, the much smaller ICC indicates that only about 4% of the variance was accounted by the fact that multiple observations came from the same child. Within this portion of the variance, the growth pattern was similar to that of empathic concern (see Figure 3(b)). Thus, contrary to our hypothesis, growth with age of inquiry behavior was not steeper than that of empathic concern.

For self-distress, 8% of the variance was nested within individuals. Consistent with prediction, and contrary to Hoffman's theory, there was no change with age in levels of self-distress (see Figure 3(c)).

Prosocial behavior increased substantially with age, with 13.9% of the infants showing prosocial behavior (toward the mother or the experimenter) at 12 months, compared to 40.8% who did so at 18 months (see also Table 2; with no prosocial behavior at 3–6 months, HLM was not relevant).

3.5 | Prediction: links between early empathy and subsequent prosocial behavior

Given the low frequency of prosocial behavior at 12 months, we focused on the prediction of prosociality at 18 months. Toddlers' prosocial attempts included three types of prosocial behavior: Physical comforting (shown by 15.6% of 18-month olds), attempts to recruit help (8.8%), and giving or offering an object to the other (23.1%). Most often (87%), infants showed only one of these forms of prosocial behavior.

Logistic regressions were used for examining if infants' responses to distress at each age predicted whether or not they showed any prosocial behavior at 18 months. Because empathic concern and inquiry behavior scores were highly inter-correlated, and there was no reason to expect they would each independently predict prosocial behavior over and above their shared variance, entering them as separate predictors was impractical. We therefore combined them, by averaging across their standard scores, to yield a total empathy score at each age. This score was used as a predictor, along with two other potentially relevant responses to distress; only when the total empathy score was significant or close to significance, we conducted supplementary regressions with empathic concern or inquiry behavior (in place of total empathy), to clarify whether the total effect was

	Empathic concern				Inquiry behavior			
	3 m	6 m	12 m	18 m	3 m	6 m	12 m	18 m
3 m	–				–			
6 m	0.31***	–			0.14[†]	–		
12 m	0.32***	0.31***	–		0.21**	0.01	–	
18 m	0.29***	0.28***	0.51***	–	0.08	0.10	0.34***	–

TABLE 4 Correlations among Infants' Responses to Distress across Age – Empathic Concern and Inquiry Behavior

Notes: Spearman correlations were used (results with Pearson are virtually identical).

[†]$p < .10$, **$p < .01$, ***$p < .001$ (all two-tailed).

TABLE 5 Results of Multilevel Models (HLM) of Empathic Concern, Inquiry Behavior, and Self-Distress

DV	ICC	Intercept[a]		Age slope		Age-squared (quadratic component)		% Variance explained[b]
		B (SE)	p	B (SE)	p	(SE)	p	
Empathic concern	19.9%	0.70 (0.05)	<.001	0.09 (0.01)	<.001	−0.002 (0.001)	<.001	39.5%
Inquiry behavior	4.1%	1.31 (0.04)	<.001	0.07 (0.01)	<.001	−0.002 (0.000)	<.001	40.2%
Self-distress	8.0%	0.20 (0.06)	<.005	0.01 (0.015)	0.36	−0.000 (0.001)	.43	15.6%

[a]Reflects the estimated level of the dependent variable at the age of 3 months (first time point).

[b]Percent of variance explained by the effects of Age and Age-squared.

predominantly due to one of these aspects, or both (akin to Fisher's least significant difference procedure). The other responses included in the models were self-distress, and communicative smiling (which is other-directed and theoretically relevant to prosociality). Logistic regressions are summarized in Table 6. At 3 months, the total empathy score was close to significance ($p = .063$). Supplementary analysis showed that inquiry behavior was a significant predictor at this age [B (SE) = 1.23(0.62), $p = .048$, Odds Ratio = 3.41]; thus, infants who showed greater exploration of others' distress at 3 months were more than three times more likely to act prosocially towards a distressed other at 18 month. None of the other responses to distress at 3 months were significant predictors. At 6 months, total empathy was a significant predictor, and supplementary analyses showed this effect was stronger for empathic concern [B (SE) = 1.07(0.45), $p = .018$, Odds Ratio = 2.92]. Thus, infants who showed greater concerned affect at 6 months were almost three times more likely to show prosocial behavior at 18 months. None of the responses to distress at 12 months were significant predictors in the logistic regression (although exploratory analysis showed that inquiry behavior alone was a strong predictor: B (SE) = 1.47 (0.57), $p = .009$, Odds Ratio = 4.34). In addition, concurrent links with 18 months empathy were also examined. The total empathy score had a significant association with prosocial behavior (and this effect was due to both empathic concern [B (SE) = 1.27(0.62), $p < .001$, Odds Ratio = 3.56] and inquiry behavior [B (SE) = 2.29 (0.58), $p < .001$, Odds Ratio = 9.86]). Thus, consistent with hypothesis, infants' early empathic responses predicted their subsequent and concurrent prosocial behaviors at 18 months. For descriptive purposes, correlations with the specific forms of prosociality were also examined (presented in Table S8).

4 | DISCUSSION

Concern for distressed others is a highly valued human quality, but little is known about its early ontogeny. By examining infants' responses to distressed others from 3 to 18 months, we provide evidence regarding four key issues: onset, consistency, development, and predictive power of concern for others during infancy.

Infants' responses revealed the early onset of the capacity for other-oriented empathic responses – both concerned affect and exploration of the other's distress – not only at 6 months, but even as early as 3 months. Moreover, self-distress was low at all ages, and

was not elevated when responding to distressed versus affectively neutral others. Taken together, these findings seem to refute the stage theory assumption, that young infants show only self-focused distress in the first year, shifting into other-oriented concern in the second year (Hoffman, 1975, 2001). Rather, they support the view that infants in the first year are capable of both empathic concern and self-distress (Davidov et al., 2013). Multiple factors may determine which of these responses will be shown by the infant, including situational factors such as features of the stimulus (e.g. length, intensity) or infants' fatigue or current mood (Davidov et al., 2013), infant characteristics such as regulatory skills and biologically based temperamental attributes (Abramson et al., 2019; Geangu, Benga, et al., 2011; Young, Fox, & Zahn-Waxler, 1999), and environmental factors such as quality of caregiving (e.g. Leerkes, Blankson, & O'brien, M., 2009). Thus, two separate affective response systems appear to be active from the early months of life when witnessing another's distress (Zahn-Waxler et al., 2018). One system (self-distress) signals *a need for caregiving* when the child becomes dysregulated by another's distress. The other system is other-oriented, and signals potential for *provision of caregiving*. In imaging studies of adults, empathic concern and self-distress show different neural patterns in the brain (Ashar, Andrews-Hanna, Dimidjian, & Wager, 2017), supporting the notion that these responses reflect two distinct biological systems. Consistently, in the present study, the two responses were either unrelated or negatively correlated.

Notably, we employed similar assessment procedures, stimuli and coding, as those used in work with older infants, toddlers, preschool, and older children. Moreover, we ascertained that ratings were not biased by coders' knowledge of what stimulus the infants observed. These features lend confidence to our conclusion that infants' responses indeed reflected concern for the other. The longitudinal links between infants' concerned reactions and later prosocial behavior (discussed below) lend further validity to this interpretation.

Knafo et al. (2008) showed that an empathic disposition is already present during the second and third years of life, accounted for by environmental and (from 24 months) genetic factors. The current findings suggest that an empathic disposition may be present even earlier, during the first year of life. Thus, individual differences in infants' concern for others were moderately consistent across both situations and age. From as early as 3 months, infants' empathic responses converged across mother, experimenter, and peer video, were significantly associated with the same infants' responses even
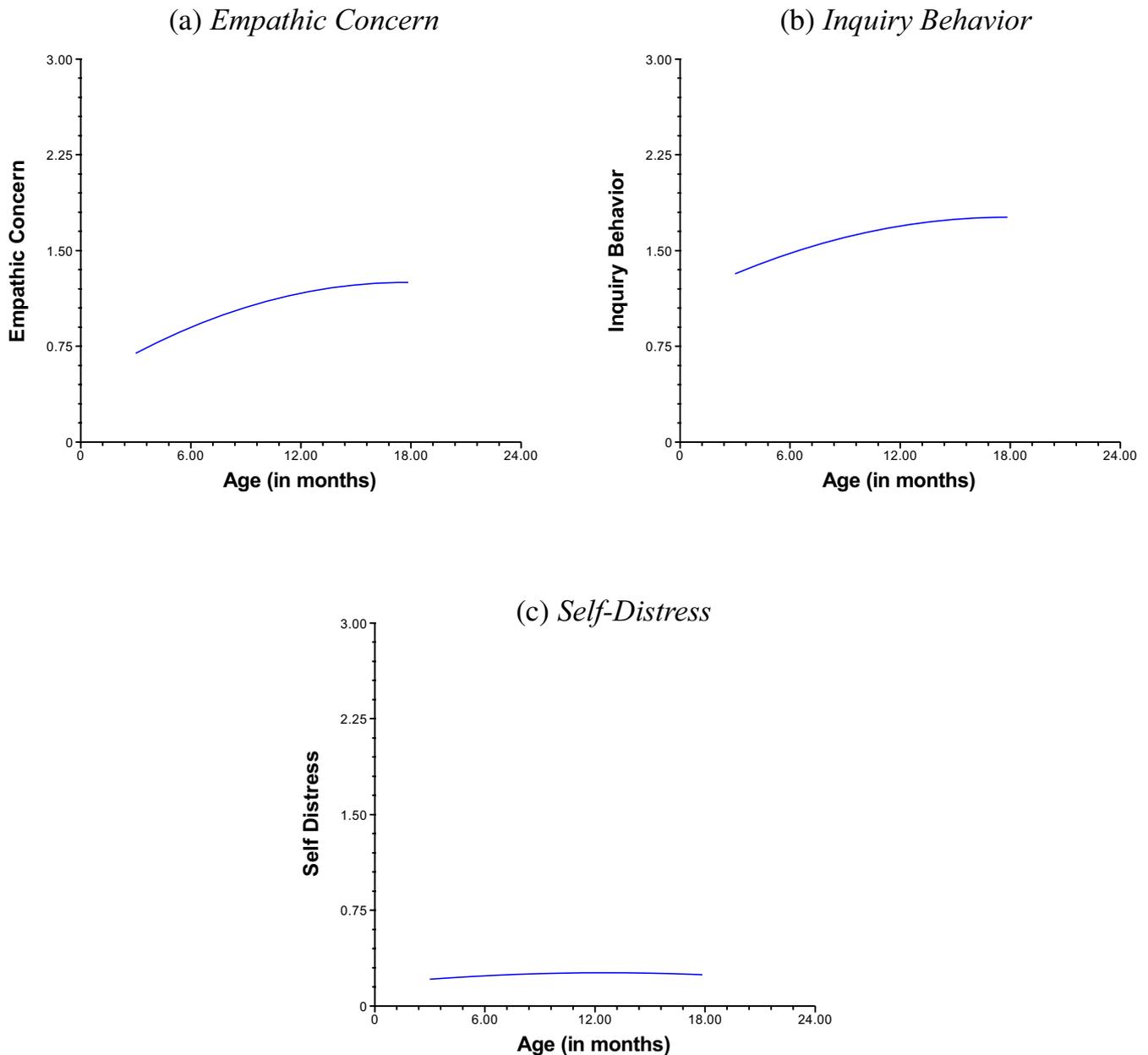
(a) *Empathic Concern*

(b) *Inquiry Behavior*

(c) *Self-Distress*

FIGURE 3   Latent growth curves, for: (a) empathic concern, (b) inquiry behavior ('hypothesis testing'), and (c) self-distress. Models were computed using HLM (Raudenbush et al., 2004), on the average scores across the three distress episodes (mother, experimenter, video) at each age

15 months later, and loaded on a higher-order empathic concern factor. An empathic disposition thus appears to be evident early in the first year of life, alongside situational and age-related variability. Future work is needed in order to determine whether this early trait-like consistency is accounted for by genetic and/or environmental factors.

Notably, convergence across situations shows that empathic responses are not limited to familiar others (the mother); thus, concern is not a relationship-specific response. At the same time, prosocial behavior (but not empathic concern or inquiry) was substantially higher towards the mother. Children's history of experience with the mother can increase prosociality towards her in a number of ways. Children (especially the shyer toddlers) may feel more comfortable

acting upon their concern with their mother, a highly familiar and close other, than with an unfamiliar experimenter (Young et al., 1999). Moreover, because children have likely had opportunities in the past to comfort and assist their mother, they have gained relevant experience as to how to respond prosocially to her. Furthermore, children have likely been socially rewarded by the mother for such behavior in the past (e.g. with smiles, praise, affection), encouraging the repetition of such prosocial responses towards her in other situations (Dahl, 2015).

Interestingly, consistency in individual differences was greater for empathic concern than for cognitive empathy (inquiry) and prosocial behavior. Factors that come online during the first year of life, such as stranger anxiety, motor development, ability to shift

TABLE 6 Summary of logistic regressions predicting prosocial behavior towards another in distress at 18 months from responses to distress at earlier ages, and concurrent associations at 18 months

	3 months			6 months			12 months			18 months		
	B(SE)	p	OR	B(SE)	p	OR	B(SE)	p	OR	B(SE)	p	OR
Empathy (total)[a]	1.16 (0.63)	.063†	3.20	1.41 (0.62)	.023*	4.09	0.72 (0.50)	.153	2.05	1.99 (0.51)	<.001***	7.31
Self-distress	0.45 (0.44)	.303	1.57	−0.12 (0.50)	.81	0.89	0.42 (0.39)	.278	1.52	0.06 (0.47)	.90	1.06
Communicative smiles	−0.18 (0.31)	.56	0.83	−0.59 (0.31)	.058†	0.56	−0.01 (0.33)	.97	0.99	−0.18 (0.39)	.64	0.83

Note: OR, odds ratio.

[a]Total empathy scores = mean scores combining both concerned affect and inquiry behavior (across the three episodes); concern and inquiry scores were standardized and then averaged.

†p < .10, *p < .05, **p < .01 ***p < .001 (all two-tailed).

attention, and social referencing, may influence children's ability and/or motivation to explore the other's predicament at different ages, leading to less continuity. Similarly, carrying out a prosocial act requires motor and cognitive abilities that many infants do not yet possess at 12 months, but develop by 18 months, resulting in inconsistency in prosocial behavior across this period. Conversely, the emotional core of caring about another's suffering may be less influenced by such factors, and hence more stable from very early in development. Of course, this does not mean that infants' predilection for empathic concern cannot be influenced by various factors, such as parenting practices, temperamental characteristics, and more. Indeed, it is quite likely that such variables can have important effects on the disposition for concern, both early and later in development, and these processes merit further investigation.

Hardly any individual differences in concern for others were explained by gender. Gender differences in concern for others can likely emerge later in development, and increase with age, as children come to adopt societal gender role expectations regarding emotional responding and expressivity (Eisenberg et al., 2015; Knafo et al., 2008).

Our hypothesis that affective empathy would increase only modestly with age was largely supported; the pattern of growth was non-linear, with increase in concern plateauing by 18 months. This supports our proposition that the emotional core of concern does not grow substantially with age, and is not aptly characterized by a developmental stages framework. What does increase markedly with age is children's capacity to act upon this motivation (Davidov et al., 2013), as indicated by the emergence of prosocial behavior in the second year, and its considerable increase by 18 months. Caring about the other emotionally therefore appears to emerge much earlier in ontogeny than the understanding of how to assist the distressed other and/or the ability to carry out such goal directed prosocial action. Moreover, the modest growth of concern for others with age was not accompanied by (and thus not accounted by) a parallel decline in self-focused distress, which remained constantly low across the entire period. Of note, other developmental changes in concern for others may still occur at later ages, beyond the first 18 months of life (Knafo et al., 2008). One important change can be a growth in the sophistication and complexity of children's expressions of concern (Vaish, 2016).

Contrary to prediction, inquiry behavior, a commonly used marker of cognitive empathy at young ages ('hypothesis testing'), did not increase markedly with age. Prior work using similar procedures shows that this response does increase later, during the second and third years (Knafo et al., 2008). Two conceptual issues regarding the nature of this variable need to be considered. First, cognitive empathy, as broadly defined, denotes the understanding of another individual's emotion or inner state (Batson, 2009). While inquiry behavior signals that the infant is trying to figure out what is going on with the other, this behavior does not indicate what the infant actually understands. Moreover, attempts to explore and understand, while cognitive in nature, are also largely motivational. It should thus be acknowledged that inquiry behavior is not a direct

or pure assessment of cognitive empathy. Experimental and neurophysiological methods can be useful for elucidating what infants actually understand about others' emotions (e.g. Grossmann, 2010). Second, our measure of inquiry behavior focused on both intensity and complexity of exploration. Whereas less change with age might be expected regarding intensity – young infants can explore vigorously using simple forms of inquiry behavior (e.g. visual scanning) – the complexity of inquiry attempts (how sophisticatedly the infant explores) likely increases more markedly with age (as does the sophistication of expressing concern; Vaish, 2016). As cognitive milestones are achieved, such as joint attention, explicit self-knowledge, language, and so on, children can utilize these abilities to explore and understand the other's situation in more mature ways (although the basic motivation to understand the other's predicament may be present from early on). Accordingly, future work should seek to differentiate between quantity and quality of inquiry behavior ('hypothesis testing').

Early individual differences in concern for others (empathic concern and inquiry behavior), assessed long before prosocial behavior could be shown by infants, prospectively predicted prosocial behavior on behalf of a distressed other at 18 months. These results replicate and extend Roth-Hanania et al. (2011), by showing longitudinal associations at younger ages, across longer periods, and in a much larger sample. Empathy has been shown to promote prosocial action in children and adults (Batson, 1991; Eisenberg et al., 2015). Our findings show this is likewise true of infants. Thus, an early inclination to show affective concern and/or explore the situation of distressed others facilitates taking action to alleviate the other's distress at a later age. Moreover, other social responses, namely, self-distress and positive emotional expressions, did not predict subsequent prosociality towards another in distress; only empathy for the distressed other did. It would be interesting to examine in future work whether early concern predicts other forms of prosociality (e.g. costly versus non-costly behavior). Given the multifaceted nature of prosociality, an early disposition for concern might be more strongly tied to some forms of prosocial behavior than others (Davidov et al., 2016; Eisenberg et al., 2016; Paulus, Müller-Pinzler, Westermann, & Krach, 2013).

Taken together, the present findings support the early ontogeny of concern for others as a motivator of prosocial behavior, which may reflect the evolutionary roots of this motivation. There are different theories regarding the evolution of concern for others in distress. This tendency may have evolved due to its benefits for taking care of the young, because it was a preferred attribute during mate selection processes, or due to its utility for facilitating cooperation in social groups more broadly (Goetz, Keltner, & Simon-Thomas, 2010; Silk & House, 2016). Whatever its ultimate cause may have been across human phylogeny, this motivation appears to be part of the social interaction repertoire of babies – it is early appearing, moderately stable, and promotes later prosociality.

An interesting finding was the frequent occurrence of smiling in response to others' distress. One interpretation might be that the infants did not find the distress stimuli arousing. We do not believe

that is the case, however. First, the current study used similar stimuli to prior work, and the level of distress expressed in them was similarly intense. Second, the analysis showed that infants' levels of concerned affect and exploration of the other's situation were elevated compared to a neutral situation, indicating that the stimuli were indeed arousing. And third, smiles do not necessarily reflect joy, but could be due to other reasons (e.g. uncertainty, attempts to engage the other, etc.). Indeed, Liddle at al. (2015) have also found smiling to be a common response when infants reacted to distressed peers. A second interpretation might be that these smiles reflect indifference or even callousness (enjoyment of the others' distress). Once again, the data does not appear to support this explanation. Thus, smiling was not linked to less empathic concern or less exploration of the other's distress at any of the ages. Moreover, infants' smiles frequently appeared as communicative efforts to socially engage the sufferer, and such communicative smiles were often positively associated with greater empathy for the other. Such smiles may be a precursor to the response of 'empathic cheerfulness' exhibited by older children (exuding positive emotion in order to cheer up the sufferer; Light et al., 2009). In the present study, however, communicative smiles did not predict greater prosociality. Additional work is needed in order to clarify whether these smiles subside with age, and their antecedents and subsequent correlates.

The findings suggest additional interesting directions for future research. One is the longitudinal links between early empathy and other child outcomes, associated with variations in empathy in older children (e.g. behavior problems, peer relations; Paz, Orlitsky, Roth-Hanania, & Zahn-Waxler, & Davidov, in press). As well, exceedingly low levels of concern in infancy may be a risk factor (or prodromal sign) for later disorders marked by empathy deficits, like autism or psychopathy (Dadds et al., 2009; Hutman et al., 2010; Rhee et al., 2013; Zahn-Waxler et al., 2018). Antecedents of early individual differences in concern for others are also of interest, including infant temperament, dimensions of parenting, and more (Abramson et al., 2019; Robinson, 1994; Volbrecht, Lemery-Chalfant, Aksan, Zahn-Waxler, & Goldsmith, 2007; Zahn-Waxler et al., 1979).

Every study has limitations. An important one in the current study is that it seeks to assess infants' internal states (concern for others) based on observation of their external behavior. Such observation, as sensitive and reliable as it may be, always entails some level of inference and interpretation. Other limitations are that assessment of infants' responses to affectively neutral others included only mother and video stimuli, without the experimenter, and that the order of the research stimuli was only partly counterbalanced. Moreover, the sample was Israeli-Jewish, and thus replication with diverse samples would be important in order to examine the generalizability of the findings (although we note the results are consistent with prior findings from a US sample; Roth-Hanania et al., 2011). Despite its limitations, the study has notable strengths, including the longitudinal design, multiple observations, and large sample.

In conclusion, the present study supports the position that roots of human caring are found in early infancy. Infants were not

indifferent to the suffering of others, nor did they show only self-focused distress. Concern for others was evident early, and increased only gradually across the transition to the second year, contrary to the qualitative shift hypothesized by Hoffman's stage theory. Thus, the current findings seem to refute the notion that the core experience of caring about another – an affective, motivational experience – develops in qualitative stages during infancy. Rather, the capacity for caring appears to be present from very early on, a manifestation of infants' social nature. There was also substantial variability in the degree to which infants expressed concern for others, and these early individual differences were meaningful: They were consistent across situations and age and predictive of subsequent prosociality. Early signs of concern for others are worth further investigation, to more fully uncover the extent, mechanisms, and implications of the early human capacity to care.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in OSF at http://doi.org/10.17605/OSF.IO/PHMZN, reference ([dataset] Davidov, et al., 2020).

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REFERENCES

Abramson, L., Paz, Y., & Knafo-Noam, A. (2019). From negative reactivity to empathic responding: Infants high in negative reactivity express more empathy later in development, with the help of regulation. *Developmental Science*, *22*(3), 1–17. https://doi.org/10.1111/desc.12766

Ashar, Y. K., Andrews-Hanna, J. R., Dimidjian, S., & Wager, T. D. (2017). Empathic care and distress: Predictive brain markers and dissociable brain systems. *Neuron*, *94*(6), 1263–1273.e4. https://doi.org/10.1016/j.neuron.2017.05.014

Batson, C. D. (1991). *The altruism question: Towards a social-psychological answer*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Batson, C. D. (2009). These things called empathy: Eight related but distinct phenomena. In J. Decety & W. Ickes (Eds.), *The social neuroscience of empathy* (pp. 3–15). Cambridge, MA: MIT Press. https://doi.org/10.7551/mitpress/9780262012973.003.0002

Bischof-Köhler, D. (1991). The development of empathy in infants. In M. E. Lamb & H. Keller (Eds.), *Infant development: Perspectives from German-Speaking Countries* (pp. 245–273). Hillsdale, NJ: Erlbaum.

Butterworth, G. (1992). Origins of self-perception in infancy. *Psychological Inquiry*, *3*, 103–111. https://doi.org/10.1207/s15327965pli0302_1

Castiello, U., Becchio, C., Zoia, S., Nelini, C., Sartori, L., Blason, L., … Gallese, V. (2010). Wired to be social: The ontogeny of human interaction. *PLoS One*, *5*(10), e13199. https://doi.org/10.1371/journal.pone.0013199

Dadds, M. R., Hawes, D. J., Frost, A. D. J., Vassallo, S., Bunn, P., Hunter, K., & Merz, S. (2009). Learning to "talk the talk": The relationship of psychopathic traits to deficits in empathy across childhood. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *50*(5), 599–606. https://doi.org/10.1111/j.1469-7610.2008.02058.x

Dahl, A. (2015). The developing social context of infant helping in two U.S. samples. *Child Development*, *86*(4), 1080–1093. https://doi.org/10.1111/cdev.12361

Darwin, C. (1872). *The expression of the emotions in man and animals*. London, UK: John Marry.

Davidov, M., Vaish, A., Knafo-Noam, A., & Hastings, P. D. (2016). The motivational foundations of prosocial behavior from a developmental perspective – Evolutionary roots and key psychological mechanisms: Introduction to the special section. *Child Development*, *87*(6), 1655–1667. https://doi.org/10.1111/cdev.12639

Davidov, M., Zahn-Waxler, C., Roth-Hanania, R., & Knafo, A. (2013). Concern for others in the first year of life: Theory, evidence, and avenues for research. *Child Development Perspectives*, *7*(2), 126–131. https://doi.org/10.1111/cdep.12028

de Waal, F. B. M. (2008). Putting the altruism back into altruism: The evolution of empathy. *Annual Review of Psychology*, *59*(1), 279–300. https://doi.org/10.1146/annurev.psych.59.103006.093625

Decety, J., Bartal, I. B. A., Uzefovsky, F., & Knafo-Noam, A. (2016). Empathy as a driver of prosocial behaviour: Highly conserved neurobehavioural mechanisms across species. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *371*, 20150077. https://doi.org/10.1098/rstb.2015.0077

Dondi, M., Simion, F., & Caltran, G. (1999). Can newborns discriminate between their own cry and the cry of another newborn infant? *Developmental Psychology*, *35*, 418–426. https://doi.org/10.1037/0012-1649.35.2.418

Eisenberg, N., Spinrad, T.L., & Knafo-Noam, A. (2015). Prosocial development. In M.E. Lamb & R.M. Lerner (Eds.), *Handbook of child psychology and developmental science*, Vol. *3*: Social, emotional and personality development (7th ed., pp. 610–656). New York, NY: Wiley.

Eisenberg, N., VanSchyndel, S. K., & Spinrad, T. L. (2016). Prosocial motivation: Inferences from an opaque body of work. *Child Development*, *87*(6), 1668–1678. https://doi.org/10.1111/cdev.12638

Geangu, E., Benga, O., Stahl, D., & Striano, T. (2011). Individual differences in infants' emotional resonance to a peer in distress: Self–other awareness and emotion regulation. *Social Development*, *20*, 450–470. https://doi.org/10.1111/j.1467-9507.2010.00596.x

Geangu, E., Hauf, P., Bhardwaj, R., & Bentz, W. (2011). Infant pupil diameter changes in response to others' positive and negative emotions. *PLoS ONE*, *6*, e27132. https://doi.org/10.1371/journal.pone.0027132

Goetz, J. L., Keltner, D., & Simon-Thomas, E. (2010). Compassion: An evolutionary analysis and empirical review. *Psychological Bulletin*, *136*(3), 351–374. https://doi.org/10.1037/a0018807

Gopnik, A. (1996). The post-Piaget era. *Psychological Science*, *7*(4), 221–225. https://doi.org/10.1111/j.1467-9280.1996.tb00363.x

Grossmann, T. (2010). The development of emotion perception in face and voice during infancy. *Restorative Neurology and Neuroscience*, *28*(2), 219–236. https://doi.org/10.3233/RNN-2010-0499

Grossmann, T., Missana, M., & Krol, K. M. (2018). The neurodevelopmental precursors of altruistic behavior in infancy. *PLoS Biology*, *16*(9), 1–22. https://doi.org/10.1371/journal.pbio.2005281

Hay, D. F., Nash, A., & Pedersen, J. (1981). Responses of six-month-olds to the distress of their peers. *Child Development*, *52*(3), 1071–1075. https://doi.org/10.1111/j.1467-8624.1981.tb03151.x

Hoffman, M. L. (1975). Developmental synthesis of affect and cognition and its interplay for altruistic motivation. *Developmental Psychology*, *11*, 607–622. https://doi.org/10.1037/0012-1649.11.5.607

Hoffman, M. L. (1984). Interaction of affect and cognition in empathy. In C. Izard, J. Kagan & R. B. Zajonc (Eds.), *Emotions. Cognition*

and behavior (pp. 103–131). Cambridge, MA: Cambridge University Press.

Hoffman, M. L. (2001). *Empathy and moral development: Implications for caring and justice*. Cambridge, MA: Cambridge University Press.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1–55. https://doi.org/10.1080/10705 519909540118

Hutman, T., Rozga, A., Delaurentis, A. D., Barnwell, J. M., Sugar, C. A., & Sigman, M. (2010). Response to distress in infants at risk for autism: A prospective longitudinal study. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 51(9), 1010–1020. https://doi.org/10.1111/j.1469-7610.2010.02270.x

Israel Central Bureau of Statistics (2017). *Household income and expenses, data from the 2015 survey of household expenses* (Publication no. 1677, in Hebrew). Jerusalem: Israel: Central Bureau of Statistics.

Knafo, A., Zahn-Waxler, C., Van Hulle, C., Robinson, J. A. L., & Rhee, S. H. (2008). The developmental origins of a disposition toward empathy: Genetic and environmental contributions. *Emotion*, 8(6), 737–752. https://doi.org/10.1037/a0014179

Leerkes, E. M., Blankson, A. N., & O'brien, M. (2009). Differential effects of maternal sensitivity to infant distress and nondistress on social-emotional functionin. *Child Development*, 80(3), 762–775. https://doi.org/10.1111/j.1467-8624.2009.01296.x

Liddle, M. J. E., Bradley, B. S., & Mcgrath, A. (2015). Baby empathy: Infant distress and peer prosocial responses. *Infant Mental Health Journal*, 36(4), 446–458. https://doi.org/10.1002/imhj.21519

Light, S. N., Coan, J. A., Zahn-Waxler, C., Frye, C., Goldsmith, H. H., & Davidson, R. J. (2009). Empathy is associated with dynamic change in prefrontal brain electrical activity during positive emotion in children. *Child Development*, 80(4), 1210–1231. https://doi.org/10.1111/j.1467-8624.2009.01326.x

MacLean, P. D. (1985). Brain evolution relating to family, play, and the separation call. *Archives of General Psychiatry*, 42(4), 405–417. https://doi.org/10.1001/archpsyc.1985.01790270095011

Paulus, F. M., Müller-Pinzler, L., Westermann, S., & Krach, S. (2013). On the distinction of empathic and vicarious emotions. *Frontiers in Human Neuroscience*, 7, 1–5. https://doi.org/10.3389/fnhum.2013.00196

Paz, Y., Orlitsky, T., Roth-Hanania, R., & Zahn-Waxler, C. & Davidov, M. (in press). Predicting externalizing behavior in toddlerhood from early individual differences in empathy. *Journal of Child Psychology and Psychiatry*. https://doi.org/10.1111/jcpp.13247

Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., & Congdon, R. T. Jr (2004). *HLM6: Hierarchical linear and nonlinear modeling*. Lincolnwood, IL: Scientific Software International.

Rhee, S. H., Friedman, N. P., Boeldt, D. L., Corley, R. P., Hewitt, J. K., Knafo, A., ... Zahn-Waxler, C. (2013). Early concern and disregard for others as predictors of antisocial behavior. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 54(2), 157–166. https://doi.org/10.1111/j.1469-7610.2012.02574.x

Robinson, J. A. L. (1994). Patterns of development in early empathic behavior: Environmental and child constitutional influences. *Social Development*, 3(2), 125–146. https://doi.org/10.1111/j.1467-9507.1994.tb00032.x

Rochat, P., & Hespos, S. J. (1997). Differential rooting response by neonates: Evidence for an early sense of self. *Early Development and Parenting*, 6, 105–112. https://doi.org/10.1002/(SICI)1099-0917(199709/12)6:3/4<105:AID-EDP150>3.0.CO;2-U

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, 48(2), 1–36. http://www.jstatsoft.org/v48/i02/ .

Roth-Hanania, R., Davidov, M., & Zahn-Waxler, C. (2011). Empathy development from 8 to 16 months: Early signs of concern for others. *Infant Behavior and Development*, 34(3), 447–458. https://doi.org/10.1016/j.infbeh.2011.04.007

Ruffman, T., Lorimer, B., & Scarf, D. (2017). Do infants really experience emotional contagion? *Child Development Perspectives*, 11(4), 270–274. https://doi.org/10.1111/cdep.12244

Sagi, A., & Hoffman, M. L. (1976). Empathic distress in the newborn. *Developmental Psychology*, 12(2), 175–176. https://doi.org/10.1037/0012-1649.12.2.175

Silk, J. B., & House, B. R. (2016). The evolution of altruistic social preferences in human groups. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 371(1687), https://doi.org/10.1098/rstb.2015.0097

Simner, M. L. (1971). Newborn's response to the cry of another infant. *Developmental Psychology*, 5(1), 136–150. https://doi.org/10.1037/h0031066

Uzefovsky, F., Paz, Y., & Davidov, M. (2019). Young infants are pro-victims, but it depends on the context. *British Journal of Psychology*, 111(2), 322–334. https://doi.org/10.1111/bjop.12402

Vaish, A. (2016). Flexible Concern: The development of multidetermined and context-dependent empathic responding. *Child Development Perspectives*, 10(3), 149–154. https://doi.org/10.1111/cdep.12178

Volbrecht, M. M., Lemery-Chalfant, K., Aksan, N., Zahn-Waxler, C., & Goldsmith, H. H. (2007). Examining the familial link between positive affect and empathy development in the second year. *Journal of Genetic Psychology*, 168(2), 105–129. https://doi.org/10.3200/GNTP.168.2.105-130

Young, S. K., Fox, N. A., & Zahn-Waxler, C. (1999). The relations between temperament and empathy in 2-year-olds. *Developmental Psychology*, 35(5), 1189–1197. https://doi.org/10.1037/0012-1649.35.5.1189

Zahn-Waxler, C. (1998). From the enlightenment to the millennium: Changing conceptions of the moral sentiments. *Developmental Psychologist*, 7, 1–7.

Zahn-Waxler, C., Radke-Yarrow, M., & King, R. A. (1979). Child rearing and children's prosocial initiations toward victims of distress. *Child Development*, 50(2), 319. https://doi.org/10.2307/1129406

Zahn-Waxler, C., Radke-Yarrow, M., Wagner, E., & Chapman, M. (1992). Development of concern for others. *Developmental Psychology*, 28(1), 126–136. https://doi.org/10.1037/0012-1649.28.1.126

Zahn-Waxler, C., Robinson, J. A. L., & Emde, R. N. (1992). The development of empathy in twins. *Developmental Psychology*, 28(6), 1038–1047. https://doi.org/10.1037/0012-1649.28.6.1038

Zahn-Waxler, C., Schoen, A., & Decety, J. (2018). An interdisciplinary perspective on the origins of concern for others: Contributions from psychology, neuroscience, philosophy, and sociobiology. In N. Roughly & T. Schramme (Eds.), *Forms of fellow feeling: Empathy, sympathy, concern and moral agency* (pp. 184–215). Cambridge, UK: Cambridge University Press. https://doi.org/10.1017/9781316271698.008

SUPPORTING INFORMATION

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

APPENDIX A

Order of tasks in home visits

1	Consent form
2	Neutral task (reading) – mother
3	Distress simulation (1) – mother or experimenter[a]
4	Additional task[b]
5	Crying infant video
6	Mother–child interaction[b]
7	Mother interview[b]
8	Distress simulation (2) – mother or experimenter[a]
9	Additional task[b]
10	Neutral infant video
11	Questionnaires[b]

[a]Mother and experimenter distress simulations were counterbalanced.

[b]Task not included in the current report.

In addition, the 18-month home visit included four additional tasks not shown in the above list.

APPENDIX B

Coding scheme of concerned affect and inquiry behavior

Based on the coding scheme from the MacArthur Longitudinal Twin Study (Zahn-Waxler, Robinson, et al., 1992).

a. **Concern for victim:** this code reflects facial, vocal and/or gestural-postural expressions of concern, while looking at the victim. Looking is necessary, even if it is intermittent.

0	Absent
0.5	Very fleeting: facial expression of concern is present (e.g. sobering), but very brief/minimal. (The difference between 0.5 and 1 is duration).
1	Slight concern: slight change in facial expression (usually at a low intensity), including sobering, brow furrow, or sad expression. May also be accompanied by bodily tension (substantial), or brief vocalization of concern toward the victim. Relatively fleeting or slight.
1.5	Somewhat concerned: moderate expression of concern but relatively brief or intermittent.
2	Moderate concern: includes more pronounced sobering of expression or sad expression (compared to a 1), and/or the presence of a sympathy face (eyebrows are drawn down and lips are down-turned). In addition, facial concern may be accompanied by other indicators of concern, including: sympathetic vocal tones, bodily posture (e.g. leaning towards the victim), or gestures (e.g. gesturing towards the victim combined with a concerned facial expression).

	(Duration is the primary distinction between 1 and 2; a 2 usually involves a more intense display of concern compared to a 1, but a 2 always involves a longer duration of concern than what a code of 1 calls for).
2.5	Moderately strong concern: expressed for a long duration, but with moderate intensity; or expressed intensely but somewhat more briefly.
3	Strong concern: evidenced by even fuller recruitment of facial expression in the form of a sympathy face or a clearly sad expression (focused on the other); often accompanied by sympathetic vocal tones, or gestures, or by concern indicated through bodily posture.
	In order for the code of 3 to be warranted, sympathy must be intense at peak and relatively prolonged. The affect displayed must be more intense than what a 2 calls for.

b. **Inquiry behavior ('hypothesis testing'):** this code reflects exploration or other indication that the child is trying to figure out what is happening to the other. Can include active looking and scanning; social referencing; vocalization with questioning intonation; touching own body part analogous to victim; pointing at victim with puzzled look; approaching victim to look at injury; etc. Focus is on effort and intensity of inquiry behavior, as well as complexity.

0	Absent
0.5	Fleeting: looking for a few seconds, focused on victim.
1	Slight: looking intently at victim (for a longer time than in 0.5), and/or looking back and forth from victim's face to hurt body part or to other adult, but relatively briefly.
1.5	Some: like 1, but longer (for at least half the simulation), and may be accompanied by simple vocalizations.
2	Moderate: longer and more active exploration than 1. May be expressed by any of the following: a combination of both non-vocal and vocal inquiry/exploration of the distress; a combination of looking and inquiry gestures; or inquiry behavior may also be expressed here by looking intently or active search, without vocalizations or gestures, but for a long time (at least half the simulation, usually longer).
2.5	Moderately strong: same as 2, but must include something beyond looking, that is, combined exploration (looking + vocal, or looking + gestures).
3	Strong: intense attempts to comprehend the other's distress. Multiple, repeated combined attempts (non-vocal plus vocal, or looking plus gestures).