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Twelve months old infants' evaluation of observed comforting behavior using a choice paradigm: The role of animacy cues and self-distress

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Abstract

Comforting is a prosocial behavior that children start to engage in around their second year of life. There is much less known about their ability to evaluate comforting behavior of others. The current study examined whether 12 months old infants, after having watched animated abstract characters comfort or ignore a third party in distress, would show a preference for the comforting character. Using a manual choice paradigm, we found that infants were more likely to choose the comforting character than the ignoring character (Experiment 1). When the characters however lacked human surface features (eyes) infants did not show a preference (Experiment 2). Furthermore, infants self-distress during the watching of the animations did not prevent infants to evaluate the behavior of the observed characters. These findings support the idea of an early presence of "moral sense" in infancy.

1 | INTRODUCTION

There is a large body of evidence suggesting that infants around their second year of life start to produce pro-social behaviors, behaviors that aim to benefit others, such as helping, sharing or comforting (e.g., Brownell et al., 2009; Dunfield et al., 2011; Vaish & Tomasello, 2014; Warneken & Tomasello, 2009). The underlying mechanisms responsible for the development of these behaviors, particularly whether there are distinct developmental trajectories for the ability to produce specific prosocial behaviors in terms of age of onset, cognitive and motivational prerequisites and neural correlates, are highly

debated in the literature (Bloom, 2010; Decety & Howard, 2014; Dunfield, 2014; Hamlin, 2013; Jin et al., 2018; Paulus et al., 2013; Thompson & Newton, 2013). Individual differences in terms of parenting, cultural practices and dispositional factors have also been widely investigated in relation to the emergence of prosocial and moral behavior (Biro et al., 2015, 2021; Hobson et al., 2009; Johnson et al., 2007, 2010; Kärtner et al., 2010; Laible et al., 2014; Smimizu et al., 2018; Spinrad & Stifter, 2006; Travis et al., 2001; Yagmurlu & Sanson, 2009).

Comforting behavior has often been found to be the type of prosocial behavior that emerges the latest (e.g., Dunfield & Kuhlmeier, 2013; Roth-Hananiaa, Davidov, Zahn-Waxler, 2011; Zahn-Waxler et al., 1992). It has been long proposed that infants need to be able to transform their self-distress, which is their initial reaction to others' discomfort, into empathic concern and constructive, other-oriented responses (Decety & Meyer, 2008; Hoffman, 2000; Moore, 2007). Therefore both the ability to deal with negative arousal and to infer the ways in which others' affective states can be altered is thought to be crucial for engaging in comforting behavior.

Several studies have also shown that well before infants can actually produce prosocial behaviors they are already able to distinguish between prosocial and antisocial behaviors of others, make nuanced expectations about prosocial acts in third-party interactions and have a preference for characters who show prosocial behaviors (e.g., Burns & Sommerville, 2014; Geraci & Surian, 2011; Hamlin & Wynn, 2011; Hamlin et al., 2007; Kanakogi et al., 2017; Salvadori et al., 2015; Sloane et al., 2012). Most of the research has so far focused on infants' expectations and preferences concerning instrumental helping and sharing resources and much less is known about the early evaluation of observed comforting behavior of others (see Margoni & Surian, 2018).

Recent studies investigating infants' expectations about comforting behavior have revealed somewhat mixed results and no research has been done so far to test whether infants would prefer someone who shows comforting behavior over someone who shows ignoring behavior. Jin et al. (2018) using the violation of expectation method found that 12 and even 4 months old infants expect to see comforting as opposed to ignoring behavior toward a distressed baby. Johnson et al. (2007, 2010; see also Biro et al., 2015 for related findings) however showed that such expectations cannot be found in 12 months infants overall, only in infants who are classified as securely attached to their primary caregivers. These latter studies thus point to individual differences related to quality of parenting and infants' interactive experiences in the emergence of infants' expectations about comforting. There were however considerable differences between these studies. While for example, Jin et al. showed infants movies depicting a real adult female figure, the Johnson et al. studies showed abstract animations of interacting geometric figures. This however could not, by itself, explain the different findings, as infants from at least 6 months have been shown to be able to make expectations about the behavior of abstract figures when other prosocial and antisocial acts such as helping versus hindering scenarios (see e.g., Hamlin Wynn & Bloom, 2007), or attacking an aggressor versus attacking a victim (Kanakogi et al., 2017) are contrasted. There is also no evidence that securely attached infants are better at interpreting abstract figures.

Another difference between the studies was the amount of distressing stimulation infants were exposed to. The habituation method used in the Johnson study may have elicited more self-distress, in all, and particularly in insecure infants. In addition, as Jin et al. also pointed it out (2018, p. 4), a confound is present in the interpretation of the looking times in case of stressful stimuli. Relative shorter looking times can reflect expectations of as well as disengagement from the observed events. Thus while ignoring behavior could be unexpected and thus infants would look at it longer than the comforting event, (some) infants might find ignoring more stressful and thus they look at it less long

as part of a defensive strategy. In any case, duration of looking investigating cognitive expectations of scenarios involving distressing or aversive stimuli might be a "noisy" measure as individual differences in regulating negative arousal might interfere with infants' response.

Studies that investigated infants' interpretation of prosocial behavior, such as helping versus hindering, often used a manual task in which infants can choose between two characters, thus infants can express their preference for a character, *after* they watched their behaviors (e.g., Hamlin & Wynn, 2011; Hamlin, Wynn & Bloom, 2007; Salvadori et al., 2015). This measure thus assesses the evaluation of observed behavior and is free from the potential confound when aversive or distressing stimuli are used.

The primary aim of the current study is therefore to assess if 12 months old infants show a preference for a comforting figure compared to a ignoring figure using the choice paradigm after watching the interactions of an abstractly depicted "parent" and a "child" figure. Using a modified version of the animations used in Johnson et al. (2007, 2010) and Biro et al. (2015) studies, infants in the current study were familiarized with a smaller figure who started to cry after getting separated from a larger figure which was followed by the larger figure either coming back and make contact (thus comforting) or going further away from (and thus ignoring) the small figure. After watching the animations infants were offered to choose between one of the two larger figures, who looked different in shape and color.

The secondary aim of the current study is to investigate the role of featural animacy cues in infants' ability to evaluate the abstractly depicted comforting versus ignoring characters. In most of the previous studies that used geometric figures to test infants' preference for prosocial behaviors, the figures exhibited *both* featural cues, such as eyes, and behavioral cues, such as self-propelled and variable movement in order to convey animacy (e.g., Hamlin, Wynn & Bloom, 2007; Kanakogi et al., 2017; Spokes & Spelke, 2016; although see Kanakogi et al., 2013). In the Johnson et al.'s study (2007) however only behavioral cues were present which may have also contributed to the lack of overall expectations for comforting behavior. On the other hand, research on infants' ability to identify agents and to attribute goals, dispositions and mental states to agents indicate the sufficiency, and even the primacy, of behavioral characteristics over featural cues (Biro & Leslie, 2007; Luo & Baillargeon, 2005; Shimizu & Johnson, 2004; Surian & Geraci, 2012; Tauzin & Gergely, 2019). The necessity of human surface features for infants to consider and evaluate the morality of observed behavior, particularly that of a comforting scenario, is therefore, remains unclear. We therefore carried out two experiments, one (Experiment 1) in which the geometric characters had eyes and one (Experiment 2) in which they did not while their behavioral patterns remained the same. By doing so we were able to assess whether eyes are necessary to elicit moral evaluation in terms of a preference, or whether even without the eyes, on the basis of movements characteristic alone, infants are able to assign preference for the characters' behavior.

Finally, our third aim is to assess the potential role of self-distress in infants' ability to evaluate comforting and ignoring behavior. As discussed earlier it has been proposed that producing comforting behavior might be difficult for infants as they cannot easily transfer their own stress caused by the others' distress into other-oriented actions. We hypothesize that such self-distress may also influence the processing of observed behavior and thus might interfere with establishing a preference. To that end we assessed behavioral signs of self-distress to the animations. Using an established scale (Roth-Hanania et al., 2011) we coded infants' distress in terms of facial expression, posture and vocalization while watching the animations.

2 | EXPERIMENT 1

2.1 | Method

2.1.1 | Participants

Sixty-four infants participated in Experiment 1. An additional 3 infants also participated but were excluded due to technical or procedural errors. The remaining 64 infants (32 male and 32 female) had a mean age of 361 days (SD = 8.35) and were randomly distributed into 8 animation and 2 choice conditions (see Procedure). Infants were recruited via Leiden city council birth records. The present study was conducted according to guidelines laid down in the Declaration of Helsinki, with written informed consent obtained from a parent or guardian for each child before any assessment or data collection. All procedures involving human subjects in this study were approved by the Ethical Committee of the Institute for Education and Child Studies at Leiden University (ECPW-2011/029). On the basis of the meta-analysis of Margoni and Surian (2018), there is a medium effect size in previous studies on infants' preference for pro-social behavior measured by the choice task. In this paper it was also concluded that sample sizes tended to be too small in most of the studies. Based on this theoretically expected medium effect size and our (recommended larger) sample size, the likelihood of observing a significant effect was 80%.

2.1.2 | Procedure

The experiment took place in the Leiden University BabyLab. Caregivers were first fully informed about the procedure then they signed a consent form. Infants then sat on their parents' lap in a curtained booth which had an opening for a monitor. (Note that while an eye-tracking monitor was used, the current study does not involve eye-tracking measures.) Experimenter 1 instructed the caregivers not to interact with the infants and asked the caregivers to close their eyes. Eight animated movies were shown to the infants (see description below). In between the movies, short (2–3 s) animations (such as a jumping duck) with sound (such as a rattle sound) were played to make sure that infants remained interested. With the help of a camera placed above the monitor and another camera mounted behind the baby, a split-screen video recording was made of the baby's face and the stimuli by Experimenter 2. When the animations were over Experimenter 1 opened the curtain of the booth and presented a board in front of the infant on which the two types of "parent" figures (shown in the animations) were placed. Experimenter 1 first hold the board out of the reach of the infants to make sure that infants take a look at both characters. Then moved the board closer to the infants and said to the infants "Look! Which one do you like?" (see e.g., Salvadori et al., 2015 or Hamlin, 2015 for similar procedure). If the baby did not choose for 5 s, experimenter repeated the question and if baby did not make a choice for another 40 s, experimenter retrieved the board. Parents were offered travel expenses and infants were given a diploma and a toy as a gift. Experimenter 1 was not aware of which character was comforting/ignoring in the given condition the infant was assigned to. In addition, Experimenter 1 was instructed to not look at the board to avoid any potential influence.

2.1.3 | Stimuli and material

Animations

All animations showed two geometric figures with eyes, a larger triangle or rectangular figure and a small oval figure (see Figure 1). The two figures moved together until they reached a hill, the larger figure climb it and stayed on middle of the plateau. The little one made two attempts to follow but did

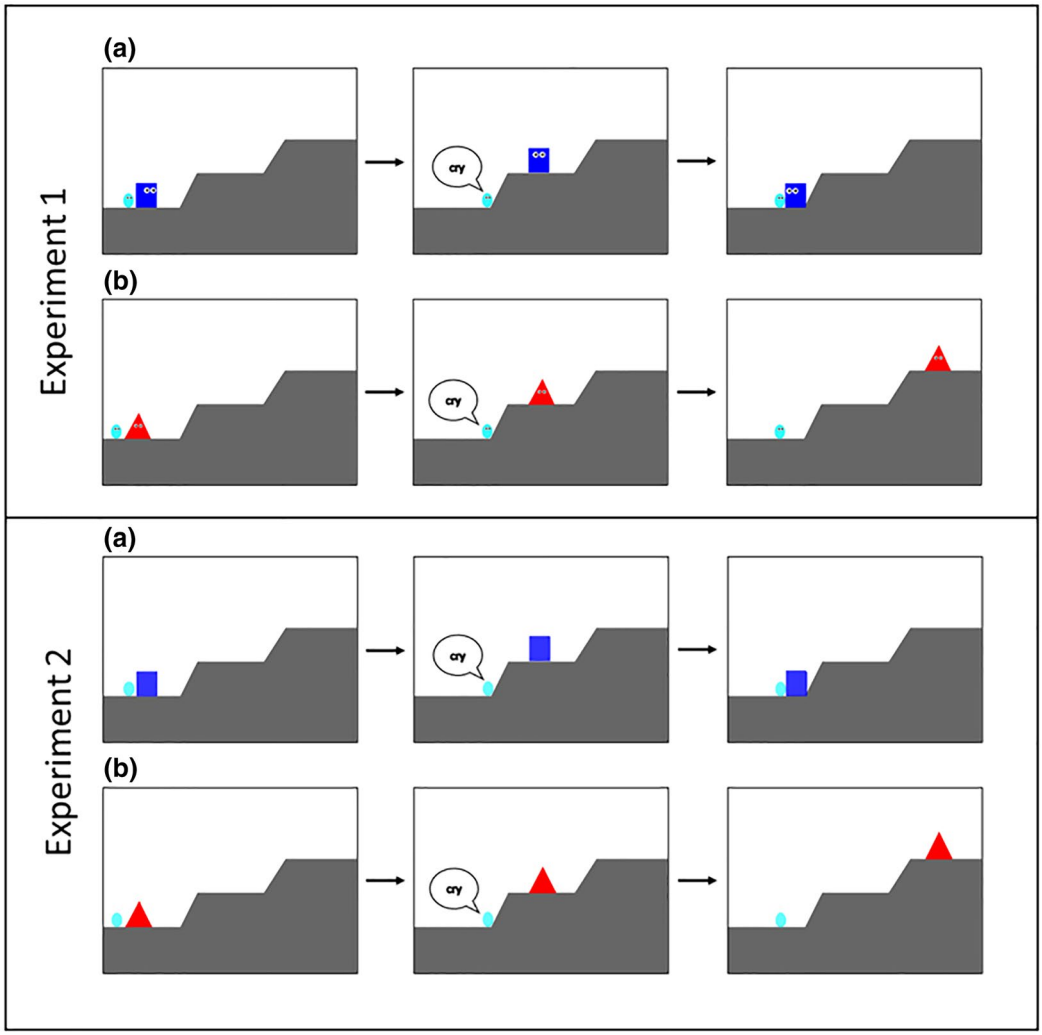

FIGURE 1 Snapshots from the two types of animations: (a) Comforting and (b) Ignoring in Experiment 1 and Experiment 2. Note that the shape and the color of the large figure in the two types of animations were counterbalanced across infants.

not succeed. It started to cry (a real baby crying sound was played while the small figure pulsated – i.e., it expanded and contracted twice together with a slight change in its color – giving the impression that it was the source of the sound). After a period of separation and crying of the small figure, the large figure either climb further up to a second hill (Ignoring movies) or went back and remained in contact with the small character (Comforting movies), with the crying sound stopping (fading away) while the large figure was moving in both types of movies. All movies lasted 20 s, the color of the small figure was light blue and the large figure was either dark blue or red. The color and shape of the large figure in the two types of movies (comforting or ignoring) were always different from each other within-infant (e.g., red rectangular vs. blue triangle or red triangle vs. blue rectangular). The color and the shape and of the large figure were counterbalanced across infants as well as the order in which the animations were played (starting with comforting or with ignoring). Overall infants saw 4 comforting and 4 ignoring movies in alternating order. The counterbalancing resulted in 8 conditions.

Choice test

The board on which the figures were presented was a white magnetic board (30 cm by 40 cm) and the figures were made of wood and painted to the same color as the figures in the animations (8 cm wide by 10 cm tall by 1.5 cm thick). A magnet attached to the back of the wooden objects assured that they do not move on the board when presented. The side placement of the objects was counterbalanced between infants.

2.1.4 | Coding

Overall looking duration: Video recordings were coded offline and a criterion was set up to exclude infants who did not watch at least one ignoring and one comforting movies until the point where the behavior of the parent figures has become clear (by 18 s of the animation). None of the participants had to be excluded. Overall looking duration in the two types of animation was also used to check if infants' choices could be explained by more exposure to (familiarity with) the parent character in the comforting versus ignoring movies.

Choice test: Choice was defined as the first object infants touched, pointed to or grabbed on the board while concurrently looking at it (see e.g., Hamlin & Wynn, 2011). Two coders, naïve to the animation conditions, coded all cases. Coders noted the specific figure that was chosen which was then later checked whether it was the comforting or the ignoring figure. In addition, coders noted when infants made no choice or made a simultaneous choice of both objects (i.e., infants grabbed/touched both objects at the same time). The two coders agreed on all cases except 3 cases which were later resolved. The exclusion of these cases did not change the results therefore it was decided to keep these cases.

Behavioral signs of distress: Based on the scoring system of Roth-Hanania et al. (2011), infants' distress was scored using a 3-point scale (0-2; 0 meaning no self-distress, 1 if the infant expressed facial, vocal or other behavioral signs of distress for a short period, and a score of 2 in case of prolonged signs of fearful expression or distress, whimpering, or crying) at the end of each trial. A mean distress score was calculated for each baby overall and separately for the comforting and ignoring animations. The video recordings were coded by two coders who both coded a subset of 20 cases. On these cases their mean scores were in high agreement with a Cronbach alpha = 0.87 and inter-class correlation of 0.75 (single measure).

2.2 | Results

Preliminary analysis showed that infants had no preference for a color, a shape or for a side in their choice, binominal tests, $p \geq 0.77$, two-tailed. Furthermore gender was not related to the choice infants made, Fisher's Exact test, $p = 0.22$. Out of the 64 infants 47 made a valid choice with 32 infants choosing the Comforting and 15 choosing the Ignoring character, see Figure 2. The difference is significant, binominal test, $p = 0.02$. Infants thus were more likely to choose the comforting figure. Sixteen infants did not make a choice and one chose both figures at the same time. Using binary logistic regression, we found that overall looking duration ($B = -0.04$, SE = 0.02, Wald = 3.01, $p = 0.08$), the difference between looking at Ignoring and Comforting animations ($B = -0.06$, SE = 0.70, Wald = 0.89, $p = 0.35$), or distress ratings ($B = -0.54$, SE = 0.93, Wald = 0.34, $p = 0.59$) did not contribute to the distribution of the two types of choices (ignoring vs. comforting).

In addition, separate repeated measures Anovas with the within-subject variable of type of animation (ignoring, comforting) and with the between-subject variable of making a choice (yes,

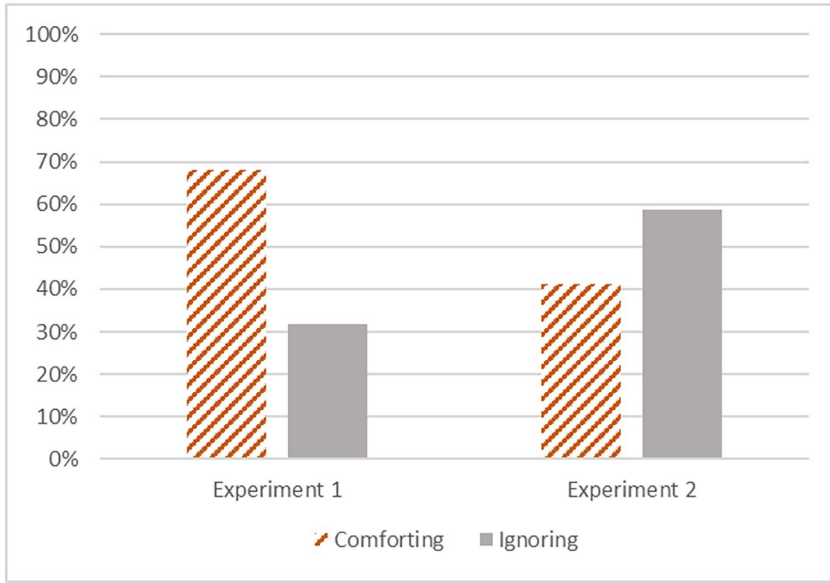

FIGURE 2 Percentage of infants choosing one of the two characters in Experiment 1 and Experiment 2.

TABLE 1 Mean looking durations and distress ratings in Experiment 1 and Experiment 2 for all infants and separately for those who made and did not make a choice during the choice task.

Exp. 1	Mean (SD)	All infants	Making a choice	Not making a choice
	N	64	47	17
	Looking duration comforting animations (sec)	69.25 (14.83)	67.2 (16.45)	74.83 (6.56)
	Looking duration ignoring animations (sec)	70.40 (13.44)	68.7 (14.93)	75.10 (6.21)
	Mean distress rating comforting animation	0.41 (0.42)	0.42 (0.45)	0.40 (0.37)
	Mean distress rating ignoring animation	0.35 (0.44)	0.36 (0.45)	0.31 (0.41)
Exp. 2	**Mean (SD)**	**All infants**	**Making a choice**	**No/both choice**
	N	64	51	13
	Looking duration comforting animations (sec)	64.20 (11.64)	63.51 (12,09)	66.94 (9.64)
	Looking duration ignoring animations (sec)	66.59 (10.41)	65.68 (10.74)	70.21 (8.40)
	Mean distress rating comforting animation	0.66 (0.48)	0.69 (0.47)	0.54 (0.49)
	Mean distress rating ignoring animation	0.65 (0.41)	0.66 (0.48)	0.62 (0.30)

no) showed no significant main or interaction effects for the distress ratings, F (1,62) $\leq$ 3.60, $p \geq 0.06$, or for the duration of looking, F (1,62) $\leq$ 3.29, $p \geq 0.08$. These findings suggest that there was no difference in looking times or in distress ratings between Ignoring and Comforting animations and this was the case for all participating infants as well as separately for those who made or did not make a choice. Table 1 shows the mean duration of looking and distress ratings during the Ignoring and Comforting for all infants and also for infants who made or did not make a choice. Bivariate correlations were also carried out to test if looking durations and distress ratings are related to each other. It was found that higher distress ratings were related to less looking during the Ignoring animations, $r = -0.30$, $p = 0.02$, but not during Comforting animations, $r = -0.18$, $p = 0.15$.

3 | EXPERIMENT 2

3.1 | Method

3.1.1 | Participants

Sixty-four infants were included in Experiment 2. An additional 8 infants also participated but were excluded due to technical or procedural errors (6) and parental interference during object choice (2). The 64 infants (26 male and 38 female) had a mean age of 362 days (SD = 8.32) and were randomly distributed in the 8 animation and 2 object choice conditions (see Procedure). Infants were recruited via Leiden city council birth records and the study was approved by the ethical committee of the Institute for Education and Child Studies, Leiden University (ECPW-2011/029).

3.1.2 | Procedure, stimuli and coding

The procedure, the stimuli and the coding was the same as in Experiment 1 except that the small and large figures in the animations had no eyes. In 2 cases there were disagreements between the coders regarding infants' choices which were later resolved. The exclusion of these cases did not change the results therefore it was decided to keep these.

3.2 | Results

Preliminary analysis showed that there was no color, shape or side preference in infants' choice, binominal tests, $p \geq 0.16$, two-tailed. Furthermore, gender was not related to the choice infants made, Fisher's Exact test, $p = 0.77$. Out of the 64 infants 51 made a valid choice. 21 chose the comforting and 30 chose the ignoring character. The difference is not significant, binominal test, $p = 0.26$. Ten infants did not make a choice and three chose both figures at the same time. Infants thus did not show a preference for the comforting character. Using binary logistic regression, we found that overall looking duration ($B = -0.02$, SE = 0.02, Wald = 1.60, $p = 0.20$), the difference between looking at Ignoring and Comforting animations ($B = -0.02$, SE = 0.04, Wald = 0.30, $p = 0.59$), or distress ratings ($B = -0.14$, SE = 0.68, Wald = 0.04, $p = 0.84$) did not contribute to the distribution of choices (ignoring vs. comforting). In addition, a separate repeated measures Anova with the within-subject variable of type of animation (ignoring, comforting) and the between subject variable of making a choice (yes, no) for the duration of looking showed that overall infants watched the Ignoring animations (Mean = 66.59, SD = 10.41) significantly longer than the Comforting (Mean = 64.20, SD = 11.64) animations, $F(1,62) = 5.02$, $p = 0.03$, $\eta_p^2 = 0.07$. A lack of interaction between animation type and making a choice, $F(1,62) = 0.21$, $p = 0.65$, suggests that this was the case for infants who made and did not make a choice. A similar Anova for distress ratings revealed no main or interaction effects, $F(1,62) \leq 1.54$, $p \geq 0.22$. Bivariate correlations found that distress ratings were not related to looking during either the Ignoring animations, $r = -0.18$, $p = 0.15$, or during Comforting animations, $r = -0.19$ -, $p = 0.12$.

3.2.1 | Comparison of experiment 1 and 2

The difference between the two conditions in terms of the distribution of infants' choice was significant, $\chi^2 = 7.13$, $p = 0.008$, Fisher's Exact Test $p = 0.009$, thus infants only in Experiment 1 were

more likely to choose the comforting character. Furthermore, infants in Experiment 1 showed lower ratings of distress, $F\,(1,122) = 14.45$, $p < 0.001$, $\eta_p^2 = 0.09$, and longer looking than in Experiment 2, $F\,(1,122) = 6.92$, $p = 0.01$, $\eta_p^2 = 0.05$, regardless of the type of animation.

4 | DISCUSSION

Our primary aim was to test if 12 months old infants show a preference for an abstract character showing comforting behavior over a character who ignores another in distress. We found that it was indeed the case. Infants in Experiment 1 were more likely to choose the comforting character than the ignoring character after watching their behavior. This pattern was not related to how long the infant watched the two types animations, thus more familiarity with comforting characters cannot explain their preference. This finding suggests that at least by 12 months infants overall can evaluate others' behavior in terms of whether it is being an appropriate and preferred response to someone in distress.

In Experiment 2, in which the characters lacked human surface features, such as eyes, we found that no preference for the comforting character was present. The distribution of choices was not different from chance and was not affected by how long the infant watched the two types of animations. This finding addresses our second question regarding the sufficiency of behavioral cues conveying animacy of the interacting characters in infants' evaluation of comforting behavior. One possible explanation for a lack of preference in Experiment 2 is that infants indeed cannot categorize the animated geometrical characters without some sort of human surface feature as animate entities and thus their behaviors are not interpreted within the realm of social interactions and could not be judged on morality (Hamlin, 2014). However given the large body of research in which behavioral cues were proved to be sufficient for infants to attribute goals, intentions, dispositions and even mental states (Biro, 2013; Gergely et al., 1995; Kuhlmeier et al., 2003; Surian & Geraci, 2012), we are cautious to draw such a strong conclusion. Instead, we propose that the facilitating effect of the eyes may have been specific to evaluating comforting behavior per se or to the study design. To establish that the small character was in distress infants needed to couple the crying sound to the small character which may have been more obvious in case of seeing eyes, or infants might have found it ambiguous where the characters headed toward or looked at without eyes. In addition, the manual choice paradigm requires that infants match the 2D display of the geometric characters on the monitor with the real objects on the board that may have also been an easier task having the eyes on. Future research can aim to distinguish between these options. In any case, the finding of Experiment 2 excludes the possibility that infants' preferences in Experiment 1 were based on simply preferring a specific type of spatial movement of the characters, namely, preferring downward movement as opposed to upward movement. Thus Experiment 2 also serves as a control experiment and supports the interpretation that the preference in Experiment 1 indeed reflects social evaluation of the observed behavior. On the other hand, one could argue that the result of Experiment 1 might simply show that infants prefer a character who wants to be in interaction with or close to the other character, regardless of its crying. Note, however that Jin et al. (2018) have previously showed that when a baby laughter was presented and thus the baby could not be considered as being in distress, infants did not have a specific expectations whether the mother would approach the baby or not. In addition, Biro et al. (2015) also found that the type of sound (laughter or crying) during the separation of the large and small characters in similar animations to the current ones influenced infants' monitoring patterns, namely infants focused more on the large character when crying was heard expecting the large character to do something. Both these studies strongly suggest that the presence of crying sound does change infants' interpretation of the type of interaction and it makes it more likely that in Experiment 1 infants indeed interpreted the behavior of the large figure as comforting.

Our third aim was to assess the potential role of self-distress in infants' ability to evaluate the characters' comforting and ignoring behaviors. Behavior signs for distress during the watching of the animations was observable but at a low level, the majority of the infants scored between "no distress, 0" and "slight distress, 1" overall on the 0–2 scale. Importantly, the observed distress level was not linked to the type of choice infants made neither in Experiment 1 nor in Experiment 2. This suggests that negative arousal does not prevent infants from being able to evaluate the characters behavior and assign preferences. In Experiment 1, more stress was however related to less looking in the ignoring movies. Thus the larger the negative arousal was, the more infants looked away, which fits with previous findings that infants can respond to stressful stimuli with disengagement. Since this was most prevalent during the ignoring animations, this finding also suggests that distress-related disengagement was triggered not only by the crying sound per se but also by the specific interaction infants watched. In Experiment 2, infants were more distressed than in Experiment 1 as a group. In the light of our previous argument, it is possible that the crying sound was more upsetting for this group as the lack of human surface cues (aka eyes) may have precluded infants to connect the source of the crying to the small character. Altogether, distress elicited by the stimuli did have an effect on infants' looking times, however it did not interfere with the ability to generate a preference. In other words, infants at this age are able to overcome their self-distress to interpret whether the observed behavior is the appropriate response to alter the negative affective state of someone else.

Our findings, while cannot resolve the controversy rising from previous studies on infants' expectations of comforting behavior, can add a piece to the puzzle (Jin et al., 2018; Johnson et al., 2007). As we argued earlier the different type and amount of distressing stimuli and the confound that is present in the interpretation of looking time data in case of these distressing stimuli may have been responsible for the mixed results in these previous studies in terms of assessing overall group expectations about comforting behavior at this age. Our finding that higher distress ratings in the ignoring animations were related to less looking in Experiment 1 gives further support to these arguments. Since however we did not assess attachment security in the current study we cannot answer the question whether in insecurely attached infants or in infants with less sensitive parenting self-distress or the relationship between looking and distress would be more prominent.

While the influence of parenting quality is out of the scope of the current paper, it is related to the different types of methods that are used in the literature to assess infants' ability to interpret prosocial behaviors. Studies typically use either looking times measure to assess expectations or manual choice measure to assess preferences, or sometimes use both of these methods within one study and in some cases dissociation between the two measures did occur (see e.g., Hamlin, 2014; Hamlin et al., 2007; Kanakogi et al., 2013). We speculate that while expectations that are based on looking duration or monitoring patterns could be different in securely and insecurely attached infants due to their different experiences, level of self-distress or existing mental representation of similar interactions, their choices that reflect their explicit evaluation/moral judgment on comforting might not differ. There is some preliminary evidence from our lab that while attachment security is reflected in differential monitoring of emotionally charged social interactions, there are no attachment-related differences in infants' preference for the interacting characters (Biro et al., under preparation). Therefore, when individual differences are assessed in the emergence of evaluating prosocial behaviors, using both types of measures could be particularly relevant.

Another methodological issue concerning the manual choice measure is that it seems to be a large variation among studies (12%–40% according to our estimate) in terms of the number of infants who do not make a choice at all. In our studies it was relatively high (23%) but not atypical (see e.g., Kanakogi et al., 2013 or Salvadori et al., 2015). We suspect that the 3D geometrical shapes are less attractive for infants to grab, or it is less obvious for the infants what is expected from them compared

to when for example, puppets are used in similar studies with manual choice measure. We did not find differences in the looking behavior or the distress level between those infants who made a choice and those who did not, therefore less general interest or more distress does not explain infants' lack of choice making.

In summary, we found that 12 months old infants prefer comforting over ignoring behavior and that infants' distress level during the observation of the interactions did not interfere with their ability to make this judgement. Our findings, together with other studies on evaluating comforting (Jin et al., 2018) and related prosocial behaviors, such as preference for a victim over an aggressor (Kanakogi et al., 2013), or preference for a protector of a victim over a bystander (Kanakogi et al., 2017), provide evidence for empathy-related moral evaluation before the end of the first year. Concerning the possible mechanism underlying the emergence of prosocial evaluation, it has been proposed that infants possess a "moral sense" in the form of basic principles which is a product of biological adaption and thus assumed to be innate, universal and unlearned. While most of the evidence supporting this proposal has so far come from studies investigating infants' judgement on instrumental helping versus hindering scenarios, these recent studies suggests that infants' early moral sense may also include principles related to the social-emotional wellbeing of others. Nevertheless, we are most sympathetic to an approach (see Dunfield & Johnson, 2015; Hamlin, 2013; Jin et al., 2018) that emphasizes that while there is a core moral sense, it can be shaped from very early on by infants' experiences, intrinsic and environmental factors as well as by other domain-general neuro-cognitive developmental processes. Future research should thus aim not only to separately discover but to integrate findings on infants' universal abilities and individual differences in early moral cognition and evaluation.

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DATA AVAILABILITY STATEMENT

Processed data that support the findings of this study are available upon request from the corresponding author. The raw data (video recordings) are not publicly available due to privacy and ethical restrictions.

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