Infants help singers of familiar songs

Laura K. Cirelli and Sandra E. Trehub

Abstract
Infants are highly selective in their help to unfamiliar individuals. For example, they offer more help to partners who move synchronously with them rather than asynchronously and to partners who interact with them in a “nice” rather than “mean” manner. Infant-directed song and speech may also encourage infant helping by signaling caregiver quality. In the present study, we investigated the effect of infant-directed song and recitation on 14-month-old infants’ subsequent helpfulness and proximity-seeking in relation to unfamiliar performers. During a 2.5-minute exposure phase, infants sat on their caregiver’s lap opposite an experimenter who sang “The Ants Go Marching” (song condition), recited the lyrics (recitation condition), or remained silent while parents read them a book (baseline condition). After the exposure phase, infants participated in a series of helping tasks that necessitated the return of objects dropped “accidentally”. Infants in the song and recitation conditions helped more than those in the baseline condition, but their helping of singers was moderated by song familiarity. Specifically, the extent of help directed to singers correlated positively with song familiarity. Singing (and to some extent, recitation) also encouraged infants to seek proximity with the experimenter. The findings indicate that rhythmic song and recitation by an unfamiliar adult foster infant affiliative behavior, but familiar songs may have special social importance.

Keywords
Infants, prosocial, singing, social development, speech

Submission date: 27 July 2017; Acceptance date: 6 February 2018
For 18-month-old infants, helping rates are comparable in the presence or absence of the intended recipient, which indicates that social recognition and reputation building are not necessary for early helping behavior (Hepach, Harber, Lambert, & Tomassello, 2017). Instead, early helping may be intrinsically motivated. In fact, extrinsic rewards reduce helping rates in 20-month-olds (Warneken & Tomasello, 2008). By 24 months of age, toddlers help an experimenter regardless of parental presence or encouragement and even when helping necessitates interrupting an exciting game or climbing over a barrier (Warneken & Tomasello, 2013). When infants witness an experimenter in need of help, their arousal levels, as measured by pupil dilation, increase until help is forthcoming, whether by their own actions or those of a third party (Hepach, 2016; Hepach, Vaish, & Tomasello, 2013). Taken together, these findings corroborate infants’ concern for the welfare of others.

Interestingly, infants who experience greater arousal in response to an experimenter’s distress are faster to offer help than those with lesser arousal (Hepach et al., 2013). Such individual differences may be partly attributable to socialization processes that build on our biological predispositions for prosociality (Brownell, 2016; Warneken, 2016). For example, parents’ use of praise and encouragement at home is linked to parent-rated infant helpfulness (Dahl, 2015). In the laboratory, parental scaffolding during a clean-up task predicts 18-month-olds’ helpfulness toward an experimenter (Brownell, Svetlova, Anderson, Nichols, & Drummond, 2013; Hammond & Carpendale, 2015).

Infants direct their help selectively rather than indiscriminately. For example, 14-month-olds are more helpful to a woman who previously engaged with them in synchronous rather than asynchronous movement (Cirelli, 2018; Cirelli, Einarson, & Trainor, 2014; Cirelli, Wan, Spinelli, & Trainor, 2017; Cirelli, Wan, & Trainor, 2014, 2016). Interpersonal synchrony, a common component of musical engagement (e.g., joint music-making, dancing), involves the temporal alignment of body movements among two or more individuals. In the aforementioned studies involving interpersonal synchrony, an assistant bounced infants gently while instrumental music or nature sounds played in the background. The experimenter faced the bouncing partner during the movement and helping phase revealed no evidence of differential behavior or bias (Cirelli, Einarson, & Trainor, 2014; Cirelli, Wan, & Trainor, 2014; Cirelli et al., 2017; Cirelli et al., 2016). Infants’ selective helping supports the “partner choice” model of prosociality (Kuhlmeier et al., 2014), which suggests that helpfulness directed toward “better” partners is socially adaptive because “better” partners are more likely to reciprocate such favors in the future.

Older toddlers engage in selective helping in other contexts. For example, two-year-olds extend more help to an experimenter who participated in reciprocal play—rolling a ball and handing a toy ring back and forth between partners—rather than parallel play (Cortes Barragan & Dweck, 2014). As with interpersonal synchrony, reciprocal play involves responsive and contingent interaction, which may underlie the enhancement in helpfulness.

Infants also offer more help to social partners who are “nice” rather than “mean”. For example, 20-month-olds offer a preferred toy to a prosocial puppet who previously helped another puppet achieve a goal, but not to an antisocial puppet who hindered another puppet from achieving a goal (Van de Vondervoort, Aknin, Kushnir, & Hamlin, in press). When 21-month-olds are given the choice of helping an experimenter who previously tried but failed to provide a toy or one who purposely kept the toy for herself, they selectively help the well-intentioned experimenter (Dunfield & Kuhlmeier, 2010).

Infant-directed (ID) vocalizations may also signal partner quality (Schachner & Hannon, 2011). In their face-to-face interactions with awake, alert infants, adults typically adopt a distinctive style of speech or song that features higher fundamental frequency (F0), greater temporal regularity, slower tempo, and enhanced positive affect relative to adult-directed (AD) speech and adult- or self-directed song (Fernald, 1992; Nakata & Trehub, 2011; Papoušek, 1992; Trainor, Austin, & Desjardins, 2000; Trehub, Plantinga, & Russo, 2016; Trehub, Unyk, & Trainor, 1993a). Such differences are evident regardless of gender, language, or culture (Fernald et al., 1989; Trehub et al., 1997; Trehub, Unyk, & Trainor, 1993b).

When infants hear audio recordings of speech or song with unfamiliar voices, they exhibit greater attention to ID over AD versions (e.g., Cooper & Aslin, 1990; Fernald, 1985; Masataka, 1999; Trainor, 1996). In general, attention is comparable for lively audio renditions of ID speech and song (Corbeil, Trehub, & Peretz, 2013; Costa-Giomi, 2014; Trehub et al., 2016; but see Tsang, Falk, & Hessel, 2017, who report greater attention to ID song over ID speech). By contrast, infants exhibit greater attention to audiovisual recordings of ID singing relative to those of ID speech (Costa-Giomi, 2014; Nakata & Trehub, 2004), which suggests an important role for the visual gestures that accompany singing. In fact, infants are more attentive to silent video displays of ID singing than to comparable displays of ID speech, the former typically featuring more smiling (Trehub et al., 2016).

Not surprisingly, live renditions of ID speech and song have more potent consequences than recordings. Moreover,
live maternal singing is more effective at relieving infant distress than is live maternal speech (Trehub, Ghazban, & Corbeil, 2015). Although audio-only recordings of ID speech and singing are equally effective at capturing infant attention (Corbeil et al., 2013), the recordings of singing are more effective than those of speech at sustaining infant attention or composure and delaying the onset of infant distress (Corbeil, Trehub, & Peretz, 2016). Specifically, infants’ latency to distress was more than twice as long when listening to an ID version of a Turkish children’s song (9 min) than to an ID recitation of the song lyrics (4 min).

Our principal interest in the present investigation was in infants’ social behavior toward unfamiliar adults as a function of their vocal behavior. In previous research, five-month-olds exhibited a visual preference for an adult who had previously produced ID rather than AD speech (Schachner & Hannon, 2011). The ID speech style may embody the sense of a familiar language (Kinzler et al., 2007) by signaling some vocal similarity between a social partner and the primary caregiver. Infant-directed song may signal comparable social information. When five-month-olds are exposed to videos of two smiling women, they look longer at the woman who previously sang a familiar, parent-taught melody rather than an unfamiliar melody (Mehr, Song, & Spelke, 2016). Moreover, 11-month-olds are more likely to select an object endorsed by a person who sang a familiar melody than one who sang an unfamiliar melody (Mehr & Spelke, 2017). These findings highlight the social relevance of ID song, song familiarity, and the source of such familiarity.

In the present study, we investigated how ID singing and recitation influence 14-month-old infants’ helpfulness toward unfamiliar adults. During an exposure phase, infants sat on their caregiver’s lap while the experimenter sang “The Ants Go Marching” (song condition), recited the lyrics of the song (recitation condition), or remained silent while caregivers interacted with infants (baseline condition). In the test phase, infants were given opportunities to retrieve objects “accidentally” dropped by the experimenter (based on tasks by Warneken & Tomasello, 2007, 2008). As noted, ID speech and singing are likely to signal partner quality. Those conditions also featured active social interaction with infants in contrast to the baseline condition with a passive experimenter. Accordingly, ID song and recitation were expected to generate greater infant prosociability than the baseline condition. Moreover, infants in the song condition were expected to help significantly more than infants in the recitation condition based on the emotion regulation advantages for recorded or live ID song over spoken or recited material in younger infants (Corbeil et al., 2016; Trehub et al., 2015). Also of interest were possible effects of song familiarity. “The Ants Go Marching” is rarely cited among songs sung frequently to infants (Trehub et al., 1997). Nevertheless, previously reported effects of song familiarity on younger infants’ social choices (Mehr et al., 2016; Mehr & Spelke, 2017) led to our hypothesis that song familiarity would promote greater infant helpfulness. As an exploratory measure, we also coded infant proximity to the experimenter during trial demonstrations. Because singing in an intimate style is thought to reduce the psychological distance between singer and listener (Pantaleoni, 1985), such singing might lead infants to seek physical closeness with the experimenter. Physical proximity has been used as a proxy for affiliative behavior in children (e.g., Tuncçenç & Cohen, 2016) and adults (e.g., Fay & Maner, 2012) as well as a variety of non-human species (e.g., Paukner, Suomi, Visalberghi, & Ferrari, 2009).

Method

Participants

Participants in the final sample consisted of 54 infants (27 girls; Mean age = 14.6 months; SD = 0.3 months) from middle-class families in a Canadian suburban community. An additional infant who completed the task was excluded because of fussiness during the exposure and test phases. All infants were capable of walking without assistance (required for the test phase) and were exposed to English at home at least 50% of the time. The University of Toronto Research Ethics Board approved all experimental procedures, and informed consent was obtained from all caregivers.

Sample size (n = 18 per condition) was determined by a priori power analyses (G*Power2) based on effect sizes from previous studies of selective infant helping with this age group (Cohen’s d = 1.01 in Cirelli, Wan, & Trainor, 2014; d = 1.31 in Cirelli et al., 2016; and d = 0.98 in Cirelli et al., 2017), power of 0.80 and alpha level of .05. These estimates were calculated for a planned one-way ANOVA with three groups. With the lowest effect size estimate (d = 0.98), a sample size of n = 15 per condition was recommended. We chose to increase sample size to n = 18 per condition to ensure power and to balance the order of helping tasks. With 18 infants per condition, power estimates based on these effect sizes range from 0.90 to 0.99.

Equipment

The entire procedure took place in a child-friendly area approximately 2.5 m by 1.5 m, with infants seated on their caregiver’s lap during the exposure phase and infants free to move about during the test phase. Two camcorders (Sony Exmor R) were positioned to maximize infant and experimenter visibility throughout the experiment.

Procedure

Before the experiment began, an assistant interacted with the infants, encouraging them to handle the objects (paper ball, clothespin, marker) to be used in the subsequent helping tasks while the experimenter explained the procedures.
to the caregiver and obtained consent. The experiment consisted of an exposure phase of about 2.5 min followed by a prosocial test phase. Infants were randomly assigned to one of three conditions of exposure. For each condition, infants sat on the caregiver’s lap while the experimenter stood facing them approximately 1 m away. In the song condition, the experimenter sang “The Ants Go Marching” in a lively ID manner with hand and marching gestures corresponding to the lyrics. In the recitation condition, the experimenter recited the song lyrics in a lively and rhythmic ID manner with the same hand and marching gestures. For the song and recitation conditions, parents listened to music over sound-masking headphones (Vic Firth Isolation Headphones) to prevent them from hearing what infants were hearing. If infants looked away from the song or recitation display, the experimenter regained their attention by exaggerating her hand gestures. In the baseline condition, caregivers were asked to entertain infants on their lap with a designated picture book while the experimenter silently read her own book. Toys were also available in case infants were uninterested in the book. If infants in the baseline condition initiated eye contact with the experimenter, she met their gaze and smiled, but then returned attention to her book. Sample video excerpts of the familiarization conditions are provided in the supplementary material online.

The prosocial test phase consisted of three tasks – a paper ball game, a clothespin game, and a marker game – developed by Warneken and Tomasello (2007, 2008) and used previously by Cirelli and colleagues (Cirelli, Einarson, & Trainor, 2014; Cirelli et al., 2017; Cirelli, Wan, & Trainor, 2014; Cirelli et al., 2016). Parents were instructed to remain neutral during this task, to work silently on the questionnaires provided, and to refrain from directing infants’ behavior in any way. Parents were also blind to the study hypotheses. For each trial, the experimenter first demonstrated successful completion of a goal (throwing a paper ball into a bucket, using a clothespin to pin a dishcloth on a clothesline, or using a marker to draw a picture), then “accidentally” dropped the target item on three test trials per task, resulting in nine opportunities for infant helping across the three tasks. During each test trial, the experimenter reached for the dropped object for 30 s. In the initial 10 s of reaching, she focused her gaze exclusively on the object, reaching for it, and vocalizing mild distress. During the next 10 s, she added gaze alternation between infant and object. In the final 10 s, she continued with gaze alternation and distress vocalization, but also named the infant and object. In the final 10 s, she continued with gaze alternation and distress vocalization, but also named the infant and object. During the next 10 s, she added gaze alternation between infant and object. In the final 10 s, she continued with gaze alternation and distress vocalization, but also named the infant and object.

During the helping tasks, parents worked on a background questionnaire (including rating infants’ familiarity with the song) and two subscales (smiling and approach) of the Infant Behavior Questionnaire (IBQ; Rothbart, 1981). At times, these subscales of the IBQ have correlated with infant helpfulness (Cirelli, Einarson, & Trainor, 2014; Cirelli, Wan, & Trainor, 2014).

**Results**

We attest to reporting all measures, conditions, data exclusions, and the manner of determining sample size for this experiment. First, we present data on infant and experimenter behavior in the exposure phase, then adult behavior in the test phase and, finally, infant response data on helping trials and proximity scores on demonstration trials.

**Exposure phase coding**

A rater blind to the hypotheses calculated the percentage of time infants attended to the experimenter during the exposure phase of all conditions, as indicated by visual fixation (inter-rater reliability with secondary coder scoring 20% of the data: \( r = .98, p < .001 \)). The percentage of time attending to the experimenter during exposure did not differ between song, \( M = 69\% , SD = 15\% , 95\% CI = [62\% , 76\% ] \), and recitation conditions, \( M = 70\% , SD = 19\% , 95\% CI = [60\% , 79\% ] \), \( t(34) = -0.10, p = .918 \) (independent samples \( t \)-test). As expected, attention to the experimenter was extremely low during the exposure phase of the baseline condition when caregivers were reading to infants or playing with them, \( M = 12\% , SD = 7\% , 95\% CI = [9\% , 16\% ] \). Also coded were instances of infant attention drifting away from the experimenter (inter-rater reliability with secondary coder scoring 20%: \( r = .97, p < .001 \)) during the exposure phase of the song, \( M = 8.17, SD = 1.01, 95\% CI = [6.04, 10.29] \), and recitation conditions, \( M = 7.67, SD = 0.92, 95\% CI = [5.73, 9.60] \), which did not differ, \( t(34) = 0.367, p = .716 \) (independent samples \( t \)-test).

To ascertain the experimenter’s visual distinctiveness during song and recitation performances, adults naïve to the hypotheses (\( n = 14 \)) watched 22 silent videos (face and body visible) of the first 20 s of the exposure phase – 11 from the song condition and 11 from the recitation condition, in random order – and judged whether the performer was singing or speaking. Although identification significantly exceeded chance levels, \( t(13) = 15.08, p < .001 \), accuracy was relatively modest, \( M = 67\% \) correct, \( SD = 17\% , 95\% CI = [58\% , 77\% ] \) (one-sample \( t \)-test). The relatively low accuracy scores are consistent with the interpretation that visual similarities in gestures and rhythmic pacing across conditions made detection difficult for raters on a third of the trials, on average. In a further examination of the experimenter’s behavior during the exposure phase, a coder blind to the conditions and hypotheses watched silent videos of the experimenter and rated her happiness...
(inter-rater reliability with secondary coder scoring 20%: \( r = .75, p = .001 \)) and engagement with the infant (inter-rater reliability with secondary coder scoring 20%: \( r = .96, p < .001 \)) on seven-point Likert scales (1 = not happy or engaged, 7 = very happy or engaged). Happiness in the song (\( M = 6.5, SD = 0.6, 95\% CI = [6.2, 6.8] \)) and recitation (\( M = 6.3, SD = 0.7, 95\% CI = [5.9, 6.6] \)) conditions did not differ significantly, \( t(29) = 1.33, p = .195 \) (independent samples \( t \)-test). Moreover, experimenter engagement in the song (\( M = 6.8, SD = 0.4, 95\% CI = [6.6, 7.0] \)) and recitation (\( M = 6.6, SD = 0.5, 95\% CI = [6.4, 6.9] \)) conditions did not differ significantly, \( t(29) = 1.13, p = .267 \) (independent analyses \( t \)-test).

**Prosocial test phase**

**Experimenter behavior.** To assess potential experimenter bias in administering the helping tasks, adults (\( n = 14, M \) age = 18.42 years, \( SD = 1.50, 2 \) males) naïve to the hypotheses and conditions rated clips of experimenter behavior during the helping tasks. Details about stimulus creation, procedure, and data processing are included in the supplementary material online. Videos were cropped and trimmed to show only the experimenter during the first 10 s or less (before the onset of helping) of the first marker and paper-ball trials. On 62 trials, participants watched two successive videos and judged (via mouse click) whether the experimenter exhibited greater desire for the dropped object in the first or second video. Each trial always compared two videos from the same task (marker or paper ball) but with different infants, one from the baseline condition and the other from the song or recitation condition.

The proportions of trials on which participants judged greater experimenter desire for the object in the experimental compared to baseline condition were compared to chance levels (0.50) with one-sample \( t \)-tests and Bonferroni-adjusted alpha levels of 0.025 per test (0.5/2). Song/baseline comparisons (\( M = 0.55, SD = 0.12, 95\% CI = [0.48, 0.62] \)) did not differ from chance levels, \( t(13) = 1.59, p = .136 \), nor did recitation/baseline comparisons (\( M = 0.53, SD = 0.10, 95\% CI = [0.47, 0.59] \)). \( t(13) = 1.22, p = .243 \), revealing no evidence of systematic bias in administering the helping tasks.

These ratings were also used to derive a score for each infant representing biased desire by the experimenter for the out-of-reach objects. Linear regressions were used to test the proportion of variance in the helping scores explained by this measure of experimenter bias. Experimenter bias did not account for a significant proportion of variance in overall helping scores, \( R^2 = .01, F(1, 49) = 0.57, p = .455 \), indirectly prompted helping (defined below), \( R^2 < .001, F(1, 49) < 0.001, p = .990 \), or directly prompted helping (defined below), \( R^2 = .02, F(1, 49) = 1.11, p = .297 \), and was therefore not included as a covariate in further analyses.

**Infant helping.** Infant helpfulness was scored by a coder blind to the conditions and hypotheses (inter-rater reliability with secondary coder scoring 20% of the data: \( r = .99, p < .001 \)). Infants received 1 point for handing an object to the experimenter within the 30-second trial window. If infants did not return the object within that window, but returned it during a subsequent trial of the same task, they received 0.5 points (e.g., infants hand marker 1 to experimenter during marker trial 2). On trials in which helping occurred, latency to help (i.e., time from experimenter’s onset of reaching for the dropped object to placement of the object in the experimenter’s hand) was recorded. Recall that during the first 10 s of the helping trials, the experimenter looked only at the dropped object. After the first 10 s, the experimenter looked between object and infant, eventually naming the desired object. Helping latencies of 10 s or less were considered indirectly prompted helping whereas latencies >10 s were considered directly prompted helping. Kruskal–Wallis tests were used to compare mean indirectly prompted, directly prompted, and overall helping rates across condition (because assumptions of homogeneity of variance were violated). Overall helping scores were screened for extreme outliers using the MAD-Median outlier detection rule (Leys, Ley, Klein, Bernard, & Licata, 2013; Wilcoxon, 2011). Two infants in the baseline condition were identified as potential outliers. Sensitivity analyses revealed that results were influenced by the presence of these atypical observations. When these observations were included, the effect of condition on overall helping was marginally significant, \( p = .080 \). When these atypical observations were Winsorized, the effect remained marginally significant, \( p = .062 \). When these observations were excluded, the effect of condition on overall helping was significant, \( H(2) = 8.98, p = .011 \). These two participants were therefore excluded from the analyses on overall helping as well as direct and indirect helping, which are derived from overall helping (see the online supplementary material for complete dataset). With these exclusions, the effect of condition on indirectly prompted helping was also significant, \( H(2) = 8.42, p = .015 \), but that was not the case for directly prompted helping, \( H(2) = 3.07, p = .215 \) (See Figure 1).

For overall helping rates, pairwise comparisons using Mann–Whitney \( U \) tests were conducted with Bonferroni-adjusted alpha levels of .0167 per test (.05/3). Differences between helping in the song condition, \( M = 4.67, SD = 2.83, 95\% CI = [3.26, 6.07] \), and baseline condition, \( M = 2.53, SD = 2.61, 95\% CI = [1.14, 3.92] \), were marginally significant, \( p = .038 \), and differences between helping in the recitation condition, \( M = 5.56, SD = 2.91, 95\% CI = [4.11, 7.00] \), and baseline condition were statistically significant, \( p = .003 \). There were no differences in helping between song and recitation conditions, \( p = .398 \).

Mann–Whitney \( U \) tests with Bonferroni-adjusted alpha levels of .0167 per test (.05/3) were used for pairwise comparisons of indirectly prompted helping rates. Infants in the
recitation condition, $M = 2.83, SD = 2.50, 95\% \text{ CI} = [1.59, 4.08]$, helped more than infants in the baseline condition, $M = 0.56, SD = 0.89, 95\% \text{ CI} = [0.08, 1.04], p = .004$, but no other comparisons reached significance (song vs. baseline, $p = .118$; song vs. recitation, $p = .167$).

To assess the consistency of these effects across infants, we also analyzed the percentage of infants in each condition who helped at above baseline levels. Previous reports indicate that 14-month-olds’ baseline rate of helping an unfamiliar person on similar tasks (i.e., in the absence of experimental manipulations) is approximately 30% of all helping opportunities (Dahl et al., 2017; Warneken & Tomasello, 2007). Accordingly, we used helping on three or more of the nine trials as the criterion of helping above baseline levels. The number of infants who helped on three or more trials differed significantly across conditions, $\chi^2(1, N = 52) = 12.02, p = .002$, with 78% of infants in the song condition and 83% of the infants in the recitation condition helping on three or more trials, but only 31% of infants in the baseline condition doing so. Post hoc chi-square tests were conducted using Bonferroni-adjusted alpha levels of 0.0167 per test (0.5/3). More infants helped on three or more trials in the song condition than in the baseline condition, $p = .006$, and in the recitation condition than in the baseline condition, $p = .002$, but song and recitation conditions did not differ significantly, $p = .674$.

Pearson correlations between helping (overall, indirectly, and directly prompted) and IBQ scales were used to ascertain whether individual differences in infants’ propensity for smiling or willingness to approach novelty, as rated by parents, predicted helping scores. Because there were no significant correlations for smiling (all $p$s $>.084$, $n = 52$) or willingness to approach novelty (all $p$s $>.325$), these scales were not included as covariates in the above analyses.

According to parents’ reports, which were scored after the completion of testing, 10 of the 18 infants in the song condition were familiar with the target song, “The Ants Go Marching” (five hearing it “rarely”, three “sometimes” and two “often”), and eight were not. Of the 18 infants in the recitation condition, eight were familiar with the song (three hearing it “rarely”, one “sometimes” and four “often”) and 10 were not. Independent samples $t$-tests comparing infants who were familiar with the song to those who were not revealed no group differences in infants’ English-language exposure ($p = .222$) or daily exposure to singing in general ($p = .172$).

We used multiple linear regression to examine how song exposure (an ordinal variable from 0 or never heard to 3 or heard often) and condition (a categorical factor with two levels: song, recitation) were related to overall helping scores. The regression revealed a significant interaction between song exposure and condition, $r(32) = 2.44, p = .02$. Song exposure was positively correlated with helping scores in the song condition, Pearson’s $r = .49, n = 18, p = .041$ (Figure 2a), but the correlation between song exposure and helping did not reach significance in the recitation condition, Pearson’s $r = -.30, n = 18, p = .233$ (Figure 2b). Although song familiarity predicted helpfulness for infants in the song condition, it did not correlate with infant attention during the song exposure phase, Pearson’s $r = .11, p = .676$.

**Proximity-seeking.** Infant proximity to the experimenter during the paper-ball and marker demonstrations was scored by a coder blind to condition (inter-rater reliability with secondary coder scoring 24%: $r = .83, p = .001$). The clothespin tasks were not coded for proximity because the room layout precluded comparable ratings. Proximity was coded for each demonstration, which preceded each helping trial. For example, before throwing each paper ball out of reach, the experimenter successfully threw one into the bucket. Similarly, before dropping each marker, the experimenter used the marker to draw a picture, turning the paper to show the infant her work. If infants remained near their parent during these demonstration trials, they received a score of 0. If they crossed a hypothetical line midway between parent and experimenter (see Figure 3a), they received a score of 1. If they came close to the table behind which the experimenter was located, they received score of 2. Infants received six scores (three for the marker demonstrations and three for the paper-ball demonstrations). The summed scores could therefore range from 0 to 12. Because no outliers were identified with Tukey boxplots, all 54 infants were included in subsequent analyses. Proximity scores correlated modestly with overall helping scores, Pearson’s $R = .39, p = .004$, and indirectly prompted helping scores, Pearson’s $R = .37, p = .006$, but not with directly prompted helping, Pearson’s $R = .12, p = .380$.

Pearson correlations between proximity and IBQ scales were used to ascertain whether individual differences in infants’ propensity for smiling or willingness to approach novelty, as rated by parents, predicted proximity. Because there were no significant correlations (all $p$s $>.19$, $n = 54$),
these scales were not included as covariates in further analyses.

Kruskal–Wallis tests comparing mean proximity scores across condition revealed a significant effect of condition, \( H(2) = 8.24, p = .016 \) (See Figure 3b). Pairwise comparisons with Mann–Whitney \( U \) tests and Bonferroni-adjusted alpha levels of .0167 per test (.05/3) revealed significantly higher proximity scores for infants in the song condition, \( M = 6.00, SD = 2.14, 95\% \text{ CI} = [4.93, 7.07] \), than in the baseline condition, \( M = 3.11, SD = 2.70, 95\% \text{ CI} = [1.77, 4.45] \), \( p = .006 \), marginally higher proximity scores for infants in the recitation condition, \( M = 5.28, SD = 3.61, 95\% \text{ CI} = [3.48, 7.07] \), than in the baseline condition, \( p = .037 \), and no differences in proximity between song and recitation conditions, \( p = .508 \). Multiple linear regression examining the relations among song exposure (an ordinal variable from 0 or “never heard” to 3 or “heard often”), condition (a categorical factor with two levels: song, recitation), and proximity revealed no significant predictors or interactions (\( ps > .333 \)).

**Discussion**

In the present study, 14-month-olds’ provision of help and proximity to an unfamiliar woman were measured after she sang a song (song condition), recited the words of the song (recitation condition), or was present while parents played with infants (baseline condition). Infants were significantly more helpful in the recitation condition than in the baseline condition and marginally more helpful in the song condition.
condition than in the baseline condition. Contrary to our expectation of greater help for singers than for reciters, infant helping in those conditions did not differ significantly. On average, infants in the song and recitation conditions helped on more than half (5–6) of the nine trials, in contrast to infants in the baseline condition, who helped on fewer than a third (< 3) of the trials. Moreover, infants were faster to help in the recitation condition than in the baseline condition, retrieving objects for the reciter before her expressions of dismay included looking at the infant. Helping during this indirectly prompted phase (designated “spontaneous helping” by Carpenter, Uebel, & Tomasello, 2013) may indicate altruistic behavior, in contrast to helping during the directly prompted phase (when the experimenter made eye contact with the infant), which may have more to do with compliance than with prosociality (Cirelli et al., 2016; Carpenter et al., 2013).

Infant proximity-seeking correlated only modestly with helpfulness. Presumably, physical closeness reflected infants’ comfort with the experimenter, but such comfort did not necessarily translate to action (i.e., helping). Nevertheless, infants were significantly more likely to seek proximity in the song condition than in the baseline condition and marginally more likely to seek proximity in the recitation condition than in the baseline condition. Intimate styles of singing are thought to blur psychological boundaries between adult singers and listeners (Pantaleoni, 1985). Feelings of greater psychological closeness for some individuals over others may encourage selective proximity-seeking (Fay & Maner, 2012).

Although elevated infant helpfulness and proximity-seeking could stem from differential mood enhancement across conditions, infants’ mood seemed to be comparable across conditions, as reflected in their positive demeanor throughout the exposure phase. Instead, it is likely that the experimenter’s lively and engaging performance in the song and recitation conditions led infants to consider her a more familiar and more favored social partner than one who refrained from direct engagement in the exposure phase (baseline condition). It is notable, however, that the experimenter in the baseline condition responded to occasional infant bids for attention by smiling pleasantly before looking back to her book. In this case, the experimenter acted much like neutral bystanders encountered in other contexts.

As noted, our hypothesis of greater helping for singing than for recitation, which was based on the favorable emotion-regulatory consequences of ID song relative to ID recitation or speech (Corbeil et al., 2016; Trehub et al., 2015), was not supported. However, the song and recitation conditions were highly similar in featuring rhythmic vocalizations as well as comparable body and facial gestures. As a result, it is difficult to determine which component of these interactions (song and recitation) promoted above-baseline levels of helping, whether these effects are specific to song and recitation, or whether they could be generated by other non-rhythmic or non-vocal interactions. Unlike the baseline condition, the song and recitations conditions featured infant-directed vocalizations, gestures, rhythmic behavior, almost continuous eye contact, and positive facial expression. Infants’ limited attention to the passive experimenter in the baseline condition made her much less familiar than in the other conditions, but it did not lead to avoidance or failure to offer help, merely less help than in the other conditions. Further research is needed to specify the components of infant-directed vocal interactions that promote infant affiliation and prosociality.

Of particular interest was the differential effect of song familiarity on helping in song and recitation conditions. Helping in the recitation condition was no different for infants with prior exposure to “The Ants Go Marching” and those without exposure, raising the possibility that infants failed to recognize the familiar lyrics. For adults, lyrics and melody are recognized more readily when presented together rather than separately (e.g., Crowder, Serafine, & Repp, 1990). By contrast, degree of song familiarity predicted the extent of helping in the song condition, with greater familiarity linked to greater helping. Song melody would seem to exert a greater influence than song lyrics, in line with the effect of familiar sung melodies on the social choices of younger infants (Mehr et al., 2016; Mehr & Spelke, 2017). Note, however, that the sung version in the present study preserved song melody and lyrics, but the recitation preserved lyrics only, making the former closer to the version heard at home. Undoubtedly, the experimenter’s rendition of “The Ants Go Marching” differed substantially from typical maternal renditions, especially with regard to the experimenter’s dramatic visual gestures. Regardless, such differences did not impede infants’ recognition of the song, as reflected in the consequences of song familiarity. “The Ants Go Marching” was the favorite song of only one infant in the present study, and it was heard regularly by very few others. It is possible, then, that highly familiar songs would have more dramatic effects on infants’ prosocial and affiliative behavior.

The observed social consequences of song familiarity may be attributable, wholly or in part, to maternal familiarization. In previous research, five-month-olds directed more visual attention to an unfamiliar woman who sang a familiar song (melody and lyrics) instead of an unfamiliar song (different melody, same lyrics) but only if the source of familiarization was the parent – not someone who sang via live video chat or a toy that emitted the song (Mehr et al., 2016). The implication is that songs acquired in social contexts, especially from the primary caregiver, convey information about caregiving quality or potential group membership and, as a consequence, influence the likelihood of approaching or interacting with unfamiliar persons. Infants’ use of songs to differentiate “in-group” from “out-group” members has its counterpart in children’s, adolescents’ and adults’ use of song knowledge and music
preferences for affiliative purposes. For example, shared musical knowledge or preferences enhance the evaluation of others as potential friends and romantic partners (Rentfrow & Gosling, 2006; Selhout, Branje, ter Bogt, & Meeus, 2009; Soley & Spelke, 2016; Zillmann & Bhatia, 1989).

Manipulations of social interaction increase the potential for experimenter bias. In the present study, the experimenter was blind to song familiarity, but she was not blind to the condition (song, recitation, baseline) or hypotheses. Awareness of condition was unavoidable in a study evaluating the effects of experimenter behavior on subsequent helping directed toward her. From the perspective of the experimenter, however, the most desirable outcome was greater helping following singing than following recitation, which did not occur. Moreover, the baseline condition resulted in helping rates comparable to those observed in other studies with this age group (Dahl et al., 2017; Warneken & Tomasello, 2007). It is also the case that the present experimenter had used the same helping tasks previously with hundreds of infants, resulting in highly standardized administration of test trials. Finally, judgments of experimenter behavior by adults who were blind to the conditions and hypotheses revealed no differences across conditions.

In short, the experimenter’s rhythmic, warmly intoned vocalizations and expansive gestures resulted in engaging sung and recited performances. The lyrics featured repetition, alliteration, and rhyme, like typical sung or recited nursery rhymes. Infants’ prosocial and affiliative behavior, as reflected in their retrieval of dropped objects and proximity to the experimenter, was greater in the song and recitation conditions than in the baseline condition. The findings extend our understanding of the circumstances that promote infant helpfulness and proximity-seeking with unfamiliar adults.

Many questions remain unanswered about the factors that influence infants’ social interactions with singers. Engaging performances seem to promote helpfulness as well as proximity-seeking. Song familiarity also enhances infant helpfulness. Infants who were most familiar with “The Ants Go Marching” were more likely to help than infants who were less familiar or unfamiliar with the song. This finding is consistent with the view that songs acquired in important social contexts have social implications beyond the contexts of initial exposure (Mehr et al., 2016; Mehr & Spelke, 2017). In principle, infant helpfulness toward those who interact in an ID manner could arise from biological predispositions favoring emotive communication, given newborn infants’ preferences for ID over AD speech and singing (Cooper & Aslin, 1990; Masataka, 1999). However, selective helpfulness based on song familiarity is necessarily based on experience, in line with the view that early socialization practices shape infants’ biological predispositions for prosociality (Brownell, 2016; Warneken, 2016).

Acknowledgments
We are grateful to Zuzanna Jurewicz for assistance with data collection and to Leila Baisryymova, Maha Mohamed, Samantha Cottrell, Jovana Miladinovic, Nirma Jbara, Alexandra Kjuseva and Diya Ahmad for video coding. Thanks also to Glenn Schellenberg and two anonymous reviewers for their helpful comments.

Contributorship
Laura K. Cirelli and Sandra E. Trehub contributed to the ideas, analyses, and writing of the manuscript. LC tested the participants.

Declaration of conflicting interests
The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was funded by a grant from the Natural Sciences and Engineering Research Council of Canada to ST and by a postdoctoral fellowship from the Social Sciences and Humanities Research Council of Canada to LC.

ORCID iD
Sandra E. Trehub http://orcid.org/0000-0002-7940-1258

Peer review
Two anonymous reviewers.

Supplementary materials
The supplemental material is available online with the article.

References


