Cognition 211 (2021) 104630

Contents lists available at ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/cognit

# The power of allies: Infants' expectations of social obligations during intergroup conflict

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ARTICLE INFO

*Keywords:*
Social allegiance
Social obligations
Social cognitive development
Infants
Social cognition

ABSTRACT

Many species of animals form social allegiances to enhance survival. Across disciplines, researchers have suggested that allegiances form to facilitate within group cooperation and defend each other against rival groups. Here, we explore humans' reasoning about social allegiances and obligations beginning in infancy, long before they have experience with intergroup conflict. In Experiments 1 and 2, we demonstrate that infants (17–19 months, and 9–13 months, respectively) expect a social ally to intervene and provide aid during an episode of intergroup conflict. Experiment 3 conceptually replicated the results of Experiments 1 and 2. Together, this set of experiments reveals that humans' understanding of social obligation and loyalty may be innate, and supported by infants' naïve sociology.

## 1. Introduction

To aid survival, cognitive adaptations have evolved to support the formation and participation in social allegiances (Cheney & Seyfarth, 1986; De Waal & Waal, 2007; Harcourt & de Waal, 1992; Tomasello, 2014; Wilson & Wrangham, 2003). Work in the social sciences has begun investigating the psychological underpinnings of such an alliance detection system: a neurocognitive system that is attune to cues and categories that are likely to be indicative of a cooperative social allegiance. This cognitive capacity serves to help individuals detect, track, store and retrieve relevant social information across various contexts (Kurzban, Tooby, & Cosmides, 2001; Sidanius and Pratto, 2001; Harcourt & de Waal, 1992; Perry, Barrett, & Manson, 2004; Pietraszewski, Cosmides, & Tooby, 2014). In addition, research has suggested that representations of social allegiances constrain expectations about the social group's identity, roles and moral obligations (Haidt & Craig, 2008; Hauser, 2006; Pietraszewski, 2016; Pietraszewski et al., 2014; Pietraszewski & Shaw, 2015; Rhodes, 2012; Rhodes, 2013; Rhodes & Brickman, 2011). For example, a critical component of social allegiances is the expectation that when one member is threatened by an opposing group, members of the same group should come to their aid (Cheney & Seyfarth, 1986; Fiske, 2004; Harcourt & de Waal, 1992; Kurzban et al., 2001; Perry et al., 2004; Pietraszewski et al., 2014; Rai & Fiske, 2011; Wilson & Wrangham, 2003). Thus, knowing who is willing to help or hinder you, or whom to align with or avoid, is critical for safely navigating the social world.

To begin exploring the developmental origins of reasoning about social allegiances, Pun, Birch, and Baron (2016) investigated whether infants, like non-human primates, use numerical group size to predict the outcome of a conflict between two agents. The results revealed that 6–12 month old infants expected an agent from a numerically smaller group to submit, and defer to an agent from a numerically larger group. Such a finding is consistent with evidence from non-human animals and suggestive of a foundational capacity to reason about social allegiances (Fiske, 2004; Harcourt & de Waal, 1992; Lanchester, 1956; Mech, Adams, Meier, Burch, & Dale, 1998; Perry et al., 2004; Pietraszewski & German, 2013; Pietraszewski & Shaw, 2015; Rai & Fiske, 2011; Rhodes, 2012; Sidanius and Pratto, 2001; Wilson & Wrangham, 2003). This result was particularly intriguing in light of the fact that a) both competing agents were identical in physical size and b) social group members only observed the conflict, and did not intervene. This finding raises the question of *why* infants expected an agent from a numerically larger group to win against an agent from a numerically smaller group. More specifically, do infants view social groups as *social allegiances,* such that the larger group entails more allies that would be able to intervene and provide aid during the conflict? Currently, this is just speculation, as Pun et al. (2016) did not directly test infants' expectations of whether a social group member would intervene. The goal of the present research is to investigate whether infants view social groups as *social allegiances,* and consequently, expect ingroup members to provide support to one

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https://doi.org/10.1016/j.cognition.2021.104630
Received 14 October 2019; Received in revised form 6 February 2021; Accepted 10 February 2021

another during intergroup conflict.

Recent work demonstrates that toddlers can make predictions about an individual's behavior based on their group membership (Bian, Sloane, & Baillargeon, 2018; Jin & Baillargeon, 2017; Ting, He, & Baillargeon, 2019). For example, in the absence of conflict, 17-month-olds expect ingroup members to provide instrumental support (eg. physically retrieving an object) to another ingroup member. In this context, however, simply delineating group membership (through labeling) did not facilitate infants' expectations about how ingroup members should treat outgroup members, as they were equally surprised when an ingroup member helped or ignored an outgroup member (Jin & Baillargeon, 2017). In addition, Rhodes, Hetherington, Brink, and Wellman (2015) demonstrated that 16-month olds monitor the experiences of individuals from opposing groups to predict how their social partners will behave. They found that toddlers were more surprised when agents from opposing groups (whom had never previously interacted) cooperated, as opposed to conflicted, suggesting that infants expected the initial state of conflict to generalize across social partners. Together, these findings suggest that toddlers' expectations of how an individual will behave towards others is shaped by an understanding of the social relationships among those individuals.

These findings notwithstanding, no studies (to the best of our knowledge) have specifically investigated whether infants expect an agent to intervene during a conflict to help an ingroup member accomplish their goal. This is an important ecologically valid context to study, as allegiances often form to facilitate within group cooperation and defend each other against rival groups (Harcourt & de Waal, 1992; Lanchester, 1956; Mech et al., 1998; Perry et al., 2004; Pietraszewski & German, 2013; Pietraszewski & Shaw, 2015; Tomasello, 2014; Wilson & Wrangham, 2003). As such, our aim was to explore infants' reasoning about within and between group helping (and harm) during an episode of intergroup conflict. More specifically, we investigated whether infants understand that social allies should uphold an obligation to assist an ingroup member during intergroup conflict. Addressing this question can help elucidate the underlying reasons why infants expect numerically larger groups to be socially dominant and provide new insights into the developmental foundations of reasoning about social allegiances.

In Experiment 1, we investigated whether 17–19 month old infants would expect group members to intervene during a conflict and indirectly help an own group member complete their goal. In addition, to begin exploring infants' tolerance for outgroup harm, aiding an ingroup member required performing an antisocial action towards an outgroup member. More specifically, in this violation of expectation paradigm, infants observed third-party interactions between members of two novel social groups. After witnessing a conflict between two opposing group members, infants saw two outcomes: one in which an agent helped an ingroup member accomplish their goal (by hindering an outgroup member), and one in which an agent helped an outgroup member accomplish their goal (by hindering an ingroup member). We reasoned that if infants expect members of a social allegiance to aid a member of their own group, then they should be more surprised and look longer when an agent helps an outgroup member during intergroup conflict.

We chose to conduct this experiment first with 17–19 month-olds, given recent evidence that similar aged infants have some expectations about individuals providing instrumental assistance to ingroup members (Jin & Baillargeon, 2017). In Experiment 2, we sought to investigate the same questions with younger infants (9–13 months). Finally, Experiment 3 was conducted to rule out a potential alternative explanation for the results obtained in Experiments 1 and 2.

## 2. Experiment 1

### 2.1. Method

#### 2.1.1. Participants

36 infants were recruited from our university database. In Experiment 1, we analyzed the data from infants between the ages of 17 and 19 mo (mean age = 18.00 mo, range = 16.92 mo– 19.08 mo, SD = 20 d, 16 females). According to parental report, 55% of infants included in the final sample were classified as Caucasian, 28% as East Asian, and 17% as other ethnicities. An additional 10 participants were excluded from the sample because they did not watch the screen during the critical sequence in which an agent pushed another agent off the platform ($n$ = 3), fussed out ($n$ = 4), or experienced sibling or parental interference ($n$ = 3).

#### 2.1.2. Procedure

For all experiments, the procedure was identical. Each participant was seated on the lap of their caregiver in a sound proof testing room for the duration of the experiment, ~140 cm from the center of a television screen measuring 48″ in diameter. To ensure that caregivers would not influence their child's behavior, they were instructed to either keep their eyes closed or were asked to wear a pair of opaque glasses. Caregivers were also asked to remain silent and to not otherwise direct the child's' attention. The experimenter sat adjacent to the infant and caregiver, separated by a distance of ~4 ft and hidden behind a black curtain. The experimenter remained behind the curtain and out of the infants' line of sight for the duration of the experiment. In all experiments, infants viewed a series of animations that depicted third-party interactions between members of two opposing social groups. A violation of expectation paradigm was implemented, such that infants' looking times to the outcomes of the two test trials were recorded.

#### 2.1.3. Stimuli and looking time criteria

*2.1.3.1. Group introduction sequence.* All participants were first familiarized to two groups of novel animated characters – one group of blue characters and one group of green characters (similar to the animations designed by Pun et al. (2016)). Similar to the paradigm used by Pun et al. (2016), infants were introduced to two novel social groups that infants did not share similarities with (eg. race and language), thereby eliminating the possibility of infants forming a "like me" or "ingroup" bias (Mahajan & Wynn, 2012; Meltzoff, 2007). Group size was equated, such that there were three members in each group, and each individual was identical in physical size. To introduce these groups, the green characters appeared on the opposite side of the screen from the blue characters, and infants observed each set of characters bounce in synchrony with members of their group for a duration of 3 s. More specifically, all three members of the green group bounced together, followed by the other three members of the blue group (order was counterbalanced across participants).

*2.1.3.2. Goal familiarization (Supplementary Videos 1 and 2).* Following the *group introduction sequence*, participants observed an agent from one of the groups move to the platform (on the bottom of the screen) and proceed to move to the opposite side of the platform (Supplementary Video 1). To ensure that infants understood that the agent had the goal of crossing the platform, this familiarization sequence (19 s) was repeated in its entirety for a minimum of two trials. If an infant looked away during a familiarization trial for a minimum of 1 s, the familiarization sequence was repeated (up to a maximum of four trials). Next, infants observed another familiarization sequence (19 s) in which one agent from the other group performed the same actions, albeit moving across the screen in the opposite direction as the first agent (Supplementary Video 2). Once again, this familiarization sequence was presented for a minimum of two, and maximum of four times. The order of the trials was counterbalanced across participants.

*2.1.3.3. Inter-trial (Supplementary Video 3).* The *inter-trial* (22 s) began with infants viewing the *group introduction sequence*, in which both groups bounced one at a time. After the *group introduction sequence*, one

agent from each group (the same agents viewed in the *goal familiarization* trials) simultaneously moved to the platform. Then, both agents moved across the platform at the same time, albeit in opposing directions. However, when the two agents reached the middle of the platform, they bumped into each other, slightly backed up, and then bumped into each other again (for a total of three times). This *inter-trial* served to establish that when the two agents from opposing groups each pursued their goal of crossing the platform at the same time, a conflict ensued. Therefore, infants were required to view the conflict, depicted by the agents bumping into one another. The inter-trial was only presented once, unless an infant looked away during the conflict. In this case, the inter-trial was presented a second time.

*2.1.3.4. Test trials (Supplementary Videos 4 and 5).* Each infant saw a total of two test trials. The test trials began with the same actions depicted in the *inter-trial*. Infants then witnessed an observing member from one of the groups move down to the middle of the platform and stand between the two competing agents. In one test trial (30 s), this third agent pushed the *outgroup* member off of the platform, thereby allowing their *ingroup* member to achieve their goal of crossing the platform (Expected Outcome) (Supplementary Video 4). In the other test trial (30 s), this third agent pushed their *ingroup* member off the platform, thereby allowing the *outgroup* member to achieve their goal of crossing the platform (Unexpected Outcome) (Supplementary Video 5). After the infant viewed the test event, the animation froze and a static image of the characters remained. Infants' looking times were measured to the static outcomes of the test trials. Therefore, as soon as the animation froze, looking time was recorded until the infant looked away for two consecutive seconds, or until 30 s had elapsed. The order of these two test trials was counterbalanced across participants. Only infants that viewed both the conflict and critical sequence in which the intervening agent pushed another agent off the platform (for each test trial) were included in the final sample. We reasoned that if infants expect members of the same group to be part of a social allegiance, and help each other during a conflict, then infants should be more surprised and look longer when the intervening agent helps an outgroup member (Unexpected Outcome), compared to when they help an ingroup member (Expected Outcome).

#### 2.1.4. Coding

For all experiments, coders used the computer application *jHaB* (Casstevens, 2007) to record the duration of infants' looking times. For all experiments, infants' looking times were recorded by a primary online coder. Data from the primary coder was used in the results. A naive secondary offline coder re-coded 50% of the videos for Experiment 1. For videos that were re-coded, looking times between the two coders were correlated $r = 0.98$ across all trials.

### 2.2. Results and discussion

Across all experiments, looking times from each test trial were first log-transformed. Inferential statistics (eg. model estimates, CIs) were fit to log-transformed looking times (see Csibra, Hernik, Mascaro, Tatone, & Lengyel, 2016). Nevertheless, for ease of communication and interpretation, descriptive statistics (eg. Means, Standard Deviations and Standard Errors) and plots feature raw looking times (in seconds) (eg. similar to Kibbe & Leslie, 2019; Stavans & Baillargeon, 2019).

We ran an ANOVA with a difference score (calculated from infants' transformed looking times to the Unexpected and Expected Outcomes) entered as the dependent variable, and entered two between-subjects factors: trial order (Expected Outcome trial first vs. Unexpected Outcome trial first) and gender. No main effect of trial order was found ($F_{1, 35} = 0.24$, $p = .63$). In addition, no main effect of gender ($F_{1, 35} = 0.27$, $p = .61$) or interaction between trial order and gender ($F_{1, 35} = 0.95$, $p = .34$) was observed. To rule out the possibility of age differences, we ran the same analysis and entered age as a covariate. We found no significant differences due to age ($F_{1,35} = 1.44$, $p = .24$).

As predicted, a paired-samples *t*-test (2-tailed) revealed that 17–19 month olds looked significantly longer to the Unexpected Outcome trial, in which an intervening agent helped an outgroup member ($M = 15.97$ s, $SD = 8.00$) compared with the Expected Outcome trial, in which an intervening agent helped an ingroup member ($M = 12.24$ s, $SD = 8.74$), 95% CI [1.38, 3.12], $t(35) = 2.54$, $p = .016$, $d = 0.55$ (Fig. 1). Similar results are found using the raw data (see Supplementary Material for statistical analyses and plots).

Moreover, during an episode of intergroup conflict, (and in contrast to the absence of conflict as in Jin and Baillargeon (2017)), 17–19-month old infants were more surprised when an ingroup member aided an outgroup member. Our main finding was further supported when the data were examined nonparametrically. Of 36 participants, 27 (75% of the sample) looked longer to the Unexpected Outcome trial in comparison with the Expected Outcome trial: $\chi 2_{(1, 35)} = 9.00$, $p = .003$. Our findings suggest that when groups are in conflict with one another, 17–19-month-old infants expect social allies to exclusively help an ingroup member complete their goal—even if this requires harming an outgroup member (by pushing them out of the way).

## 3. Experiment 2

To further examine the origins of social alliance reasoning, we presented younger infants (9–13-months) with the same stimuli as in Experiment 1.

### 3.1. Method

#### 3.1.1. Participants

60 infants were recruited from our research database. In Experiment 2, we analyzed the data from infants between the ages of 9 and 13 mo (Age groups: 9–9.99 mos; 10–10.99 mos; 11–11.99 mos, 12–12.99 mos (mean age = 11.04 mo, range = 9.00 mo– 12.78 mo, SD = 36 d, 32 females). We set our sample size in order to have a comparable number of infants per each month of age as in Experiment 1. According to parental report, 50% of infants included in the final sample were classified as Caucasian, 32% as East Asian, and 18% as other ethnicities. An additional 17 participants were excluded from the sample because they did not watch the screen during the critical sequence in which an agent pushed another agent off the platform ($n = 5$), fussed out ($n = 9$), or experienced sibling or parental interference ($n = 3$).

#### 3.1.2. Procedure

The procedure for Experiment 2 was identical to Experiment 1. See Sec. 2.1.2.

#### 3.1.3. Stimuli and looking time criteria

The stimuli and looking time criteria for Experiment 2 was identical to Experiment 1. See Sec. 2.1.3

#### 3.1.4. Coding

Coders used the computer application *jHaB* (Casstevens, 2007) to record the duration of infants' looking times. Infants' looking times were recorded by a primary online coder. Data from the primary coder was used in the results. A naive secondary offline coder re-coded 50% of the videos for Experiment 2. For videos that were re-coded, looking times between the two coders were correlated $r = 0.97$ across all trials.

### 3.2. Results and discussion

As in Experiment 1, looking times from each test trial were first log-transformed. Inferential statistics (eg. model estimates, CIs) were fit to log-transformed looking times (see Csibra et al., 2016). Nevertheless, for ease of communication and interpretation, descriptive statistics (eg.

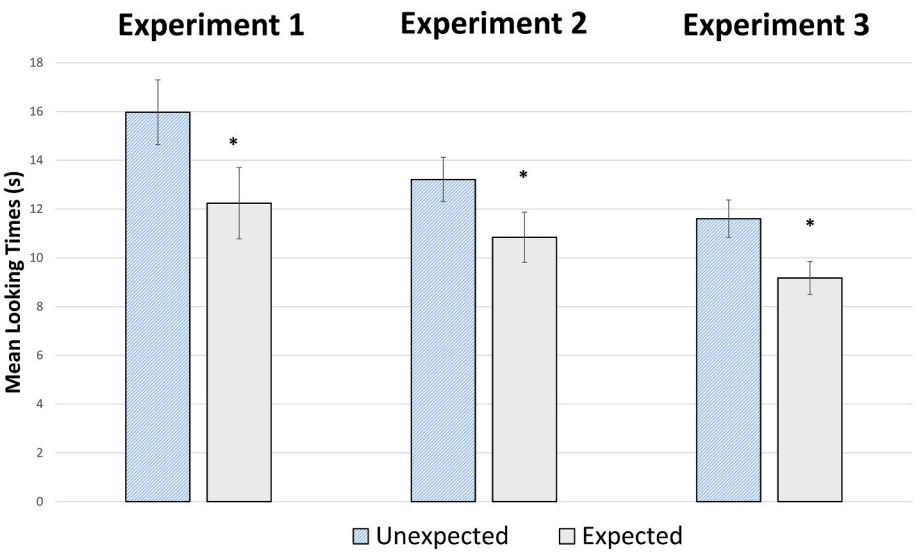


**Fig. 1.** Raw mean looking times to the outcome of test trials in Experiments 1 ($n = 36$), 2 ($n = 60$), and 3 ($n = 88$). Error bars represent SEM, and an asterisk denotes a significant difference between the two events ($p < .05$).

Means, Standard Deviations and Standard Errors) and plots feature raw looking times (in seconds).

We ran an ANOVA with a difference score (calculated from infants' transformed looking times to the Unexpected and Expected Outcomes) entered as the dependent variable, and entered two between -subjects factors: trial order (Expected Outcome trial first vs. Unexpected Outcome trial first) and gender. As with Experiment 1, no main effect of trial order was found ($F_{1, 59} = 0.81$, $p = .37$). In addition, no main effect of gender ($F_{1, 59} = 0.002$, $p = .96$) or interaction between trial order and gender ($F_{1, 59} = 0.20$, $p = .66$) was observed. To rule out the possibility of age differences, we ran the same analysis and entered age as a covariate. We found no significant differences due to age ($F_{1,59} = 0.13$, $p = .72$).

A paired-samples *t*-test (2-tailed) comparing the mean looking times to each trial type revealed that 9–13-month-olds looked significantly longer to the Unexpected Outcome trial, in which the intervening agent helped an outgroup member ($M = 13.21$ s, $SD = 7.05$) compared with the Expected Outcome trial, in which the intervening agent helped their ingroup member ($M = 10.84$ s, $SD = 8.00$), 95% CI [1.20, 2.11], $t(59) = 3.06$, $p = .003$, $d = 0.43$ (Fig. 1). Similar results are found using the raw data (see Supplementary Material for statistical analyses and plots).

Our main finding was further supported when the data were examined nonparametrically. Of 60 participants, 39 (65% of the sample) looked longer to the Unexpected Outcome trial in comparison with the Expected Outcome trial: $\chi 2_{(1, 59)} = 5.40$, $p = .02$, replicating our findings observed with the older sample from Experiment 1.

Younger infants (like older infants in Experiment 1) were more surprised when an intervening agent indirectly helped an outgroup member accomplish their goal during intergroup conflict. Infants' responses suggest that this outcome violated infants' expectation of within-group support. These findings suggest that within the first year of life, infants use social allegiances to predict how individuals within a group are obligated to behave towards one another. More specifically, social group members are expected to intervene during intergroup conflict, and provide aid exclusively to an ingroup member.

## 4. Experiment 3

Infants in the previous experiments looked longer to the trial in which an intervening agent indirectly helped an outgroup member complete their goal (by pushing the ingroup member out of the way), compared to the trial in which an intervening agent indirectly helped an ingroup member complete their goal (by pushing the outgroup member out of the way). Although we interpreted this finding as evidence that infants expect an agent to intervene and provide aid to an ingroup member during a conflict, another lower-level counterhypothesis required consideration. It is possible that infants in Experiments 1 and 2 looked longer to the Unexpected Outcome trial (Supplementary Video 5) because of the manner in which the agents physically engaged with one another. In the *inter-trial* (Supplementary Video 3), collisions between two different colored agents were established to demonstrate a conflict between opposing groups. Therefore, it is possible that infants may have looked longer to the Unexpected Outcome trial in Experiment 1 and 2 because it featured collisions between two same colored agents (ie. two ingroup members).

To address this potential alternative explanation, we presented infants with two new test trials that featured the same collisions as in Experiments 1 and 2. In one test trial, an ingroup member collided with an outgroup member (thereby helping the outgroup member accomplish their goal of crossing the platform). In the other test trial, an ingroup member collided with another ingroup member (thereby helping the ingroup member accomplish their goal of crossing the platform). It is important to highlight that the same collisions that were directed towards an ingroup member in Experiments 1 and 2 (which hindered the ingroup member), directly helped the ingroup member accomplish their goal of crossing the platform in Experiment 3.

If infants find collisions between two same colored agents (ie. two ingroup members) more surprising (independently of the goal they enable), then they should look longer when two same colored agents collide, compared to when two different colored agents collide (ie. ingroup vs outgroup member). However, if infants have expectations that an ingroup member should provide support to another ingroup member during a conflict, then they should be sensitive to whether an agent intervenes to help facilitate the goal of the ingroup member (even if this requires colliding with a same colored agent (ie. ingroup member)). If infants respond in line with our original hypothesis, infants in Experiment 3 should be *less* surprised when two same colored agents collide (ie. two ingroup members), as these collisions directly help the ingroup member accomplish their goal of crossing the platform.

### 4.1. Method

#### 4.1.1. Participants

88 infants were recruited from a local science center and tested in a

soundproof testing room located onsite. Since we did not find significant age differences across our two samples in Experiments 1 and 2 (17–19, and 9–13 mos, respectively), in Experiment 3, we collected and analyzed data from infants aged 9–20 months (mean age = 13.92 mo, range = 9.34 mo – 19.56 mo, SD = 91.25 d, 33 females). According to parental report, 51% of infants included in the final sample were classified as Caucasian, 19% as East Asian, and 30% as other ethnicities. An additional 27 participants were excluded from the sample because they did not watch the screen during the critical sequence in which an agent pushed another agent off the platform ($n = 14$), fussed out ($n = 5$), or because of sibling or parental interference ($n = 3$), or technical error ($n = 5$).

#### 4.1.2. Procedure

The procedure was identical to Experiments 1 and 2. See Sec. 2.1.2.

#### 4.1.3. Stimuli and looking time criteria

In Experiment 3, the actions performed by the agents in the *Group introduction sequence, Goal Familiarization* and *Inter-trial* were identical to those described in Experiments 1 and 2. See sec. 2.1.3.2 and Sec. 2.1.3.3.

*4.1.3.1. Test trials (Supplementary Videos 6 and 7).* The two test trials began with the same actions depicted in the *Inter-trial* of Experiments 1 and 2. See Sec. 2.1.3.3. Then, infants witnessed an observing member from one of the groups come down to the platform and stand next to one of the competing agents. In one test trial (36 s), this intervening agent directly helped their ingroup member complete their goal of crossing the platform (by colliding with and pushing their ingroup member across the platform). Note: this trial featured collisions between two same-colored agents (ie. two ingroup members) (Supplementary Video 6). In line with our original hypothesis, this would be the Expected Outcome trial. In the other test trial (36 s), this intervening agent directly helped the outgroup member complete their goal of crossing the platform (by colliding with and pushing the outgroup member across the platform). Note: this trial featured collisions between two different-colored agents (ie. ingroup and outgroup member) (Supplementary Video 7). In line with our original hypothesis, this would be the Unexpected Outcome trial. After an infant viewed a test trial, the animation froze and a static image of the characters remained. As soon as the animation froze, looking time was recorded until the infant looked away for two consecutive seconds, or until 30 s had elapsed. The order of these two test trials was counterbalanced across participants. Only infants that viewed both the conflict and critical sequence in which the intervening agent pushed another agent off the platform (for each test trial) were included in the final sample.

#### 4.1.4. Coding

Coders used the computer application *jHaB* (Casstevens, 2007) to record the duration of infants' looking times. Infants' looking times were recorded by a primary online coder. Data from the primary coder was used in the results. A naive secondary offline coder re-coded 50% of the videos for Experiment 3. For videos that were re-coded, looking times between the two coders were correlated $r = 0.98$ across all trials.

### 4.2. Results and discussion

As in Experiments 1 and 2, looking times from each test trial were first log-transformed. Inferential statistics (eg. model estimates, CIs) were fit to log-transformed looking times (see Csibra et al., 2016). Nevertheless, for ease of communication and interpretation, descriptive statistics (eg. Means, Standard Deviations and Standard Errors) and plots feature raw looking times (in seconds).

We ran an ANOVA with a difference score (calculated from infants' transformed looking times to the Unexpected and Expected Outcomes) entered as the dependent variable, and entered two between- subjects factors: trial order (Expected Outcome trial first vs. Unexpected Outcome trial first) and gender. No main effect of trial order was found ($F_{1, 87} = 2.88$, $p = .94$). In addition, no main effect of gender ($F_{1, 87} = 0.002$, $p = .97$) or interaction between trial order and gender ($F_{1, 87} = 0.58$, $p = .45$) was observed. To rule out the possibility of age differences, we ran the same analysis and entered age as a covariate. We found no significant differences due to age ($F_{1,87} = 2.68$, $p = .11$).

A paired-samples *t*-test (2-tailed) comparing the mean looking times to each trial type revealed that 9–20-month-olds looked significantly longer to the Unexpected Outcome trial in which the intervening agent helped an outgroup member (ie. two different colored agents collided), ($M = 11.60$ s, $SD = 7.21$) compared with the Expected Outcome trial, in which an intervening agent helped their own group member (ie. two same colored agents collided) ($M = 9.17$ s, $SD = 6.39$), 95% CI [1.13, 1.49], $t(87) = 4.30$, $p < .001$, $d = 0.42$ (Fig. 1). Similar results are found using the raw data (see Supplementary Material for statistical analyses and plots).

Our main finding from Experiment 3 was further supported when the data were examined nonparametrically. Of 88 participants, 65 (74% of the sample) looked longer to the Unexpected Outcome trial in comparison with the Expected Outcome trial: $\chi 2_{(1, 87)} = 20.05$, $p < .001$. Taken together, the results of Experiment 3 help to rule out the possibility that infants looked longer in Experiments 1 and 2 because they witnessed two ingroup members (or two same-colored group members) bumping into each other. Importantly, data from all 3 experiments demonstrate that infants are sensitive to whether an agent intervenes to help facilitate the goal of the ingroup member (even if this requires colliding with a same colored agent (ie. ingroup member)). Therefore, Experiment 3 provides additional evidence supporting our original interpretation of the findings: ingroup members should intervene and help an ingroup member during intergroup conflict.

## 5. General discussion

Previous studies with young children and infants have shown that when facing intergroup conflict, an individual that is part of a larger group is expected to win against an individual that is part of a smaller group (Pietraszewski & German, 2013; Pietraszewski & Shaw, 2015; Pun et al., 2016). However, in these studies, it is unclear what kinds of inferences infants make about group members that observed, but did not directly participate in the conflict. Results from our current work offer crucial insight into infants' reasoning about social allegiances, and reveals that infants appear to have an underlying expectation that group members should intervene to aid their allies during intergroup conflict.

Across three experiments, we demonstrated that infants as young as 9 months of age use social allegiances to predict how members of social groups should behave during an episode of intergroup conflict. More specifically, Experiments 1 and 2 investigated whether infants (17–20 mos, and 9–13 mos, respectively) expect a member of a social group to intervene and indirectly help an ingroup member complete their goal of crossing a platform. Infants were introduced to two groups (equal in physical size and number). After viewing a conflict of goals between agents from opposing groups, infants looked significantly longer when an intervening agent indirectly helped an outgroup member complete their goal (by pushing their ingroup member off the platform) compared to when an intervening agent indirectly helped their ingroup member complete their goal (by pushing the outgroup member off the platform). This suggests that infants expect members from the same group to intervene and help an ingroup member accomplish their goal (even if this requires hindering an outgroup member). Experiment 3 provided a conceptual replication of Experiments 1 and 2, and helped to rule out the possibility that infants' looking times at test were primarily driven by lower-level factors, such as whether two same, or different colored agents collided.

Taken together, our results suggest that infants' responses were primarily driven by the expectation that ingroup members should

exclusively support one another during an episode of intergroup conflict. As allegiances often form to defend each other against rival groups (Harcourt & de Waal, 1992; Lanchester, 1956; Mech et al., 1998; Perry et al., 2004; Pietraszewski & German, 2013; Pietraszewski & Shaw, 2015; Tomasello, 2014; Wilson & Wrangham, 2003) harming or hindering the goals of opposing group members may be required. Results from Experiments 1 and 2 revealed that infants expected an intervening agent to hinder an opposing agents' goals in order to help their own group member. Thus, in line with previous work with non-human primates and other social species (Harcourt & de Waal, 1992; Lanchester, 1956; Mech et al., 1998; Wilson & Wrangham, 2003) our work suggests that infants appear to tolerate outgroup harm (ie. hindering an opposing group members' goal), at least during intergroup conflict.

To further understand infants' representation of social allegiances, future work should explore infants' reactions towards individuals that fail to fulfill social obligations. Indeed, in both human and other social species, failure to provide support for social group members during intergroup conflict is often considered grounds for ostracism and may even invite direct physical punishment or death (Fantina, 2006; Mathew & Boyd, 2011; Wesselmann, Wirth, Pryor, Reeder, & Williams, 2013). Given that 17- month olds expect third-party punishment (in the form of withholding help) for individuals that have harmed an ingroup member (Ting et al., 2019), it is possible that infants will expect an individual that abandons or deserts their group to be punished. This hypothesis could be tested, first, by establishing that an ingroup member chooses to desert an ingroup member during intergroup conflict. Then, infants would be shown one scenario in which this individual is punished, and one in which they do not receive punishment. If infants expect punishment (for disloyalty to the ingroup) to be enforced, then they should be more surprised, and look longer when the deserter is not punished.

Our work also contributes to the ongoing investigation of infants' and toddlers' expectations of whom should (or should not) intervene across different contexts. Thus far, only two studies to date (to our knowledge) have investigated infants' responses to third- party intervention (Kanakogi, Inoue,Matsuda, Butler, Hiraki & Myowa-Yamakoshi, 2017; Stavans & Baillargeon, 2019). More specifically, when group membership is *undefined* (ie. agents were not established as part of the same group) infants do *not* appear to expect a bystander to intervene, but during *within-group conflict* only high status leaders (not members of equal status) are expected to intervene. In our current experiments, all of the individuals were of equal size, and were not differentiated based on status. Therefore, this is the first study to demonstrate that during *intergroup conflict,* infants expect *equally ranked* agents to intervene on behalf of ingroup members. Together, these experiments reveal that the same action (intervention) may be interpreted differently and have different consequences depending on the context and status of social group members. For example, when group members are of equal status, banding together against an outgroup may serve to unite and enhance cooperation between groups during intergroup conflict (Cheney & Seyfarth, 1986; Fiske, 2004; Harcourt & de Waal, 1992; Kurzban et al., 2001; Perry et al., 2004; Pietraszewski et al., 2014; Rai & Fiske, 2011; Wilson & Wrangham, 2003). In contrast, when there is within-group conflict, intervening without the status or authority to do so may create discord and lead to negative social consequences (Stavans & Baillargeon, 2019). Together, these experiments suggest that infants' expectations of whom should intervene may be influenced by various factors, such as whether the individuals are part of the same social group, the status of individuals within a social group, and the type of conflict that occurs (Kanakogi et al., 2017; Stavans & Baillargeon, 2019).

These findings provide further evidence that within the first year of life, infants have an abstract expectation of social group obligation that group members should uphold. Importantly, infants in these experiments are making third-party judgements about social group behavior, that is not influenced by a "like me" or "ingroup" preference or bias (Mahajan & Wynn, 2012; Meltzoff, 2007). Consequently, social allegiance reasoning may have evolved as a part of human's naïve sociology (Rhodes, 2012; Rhodes, 2013). Indeed, some researchers have proposed that relational structures exist across cultures (Fiske, 1991, 1992, 2000; Fiske & Haslam, 2005; Rai & Fiske, 2011) that may serve as the building blocks for reasoning about social allegiances. Consequently, understanding whom is obligated to whom may serve to facilitate expectations about whom will help vs hinder another. For example, Rai and Fiske's moral motive of Unity encompasses social obligations that are expected to be upheld by social allegiances. "Unity is directed toward caring for and supporting the integrity of in-groups through a sense of collective responsibility and common fate. If someone is in need, we must protect and provide for that person; if someone is harmed, the entire group feels transgressed against and must respond…A threat to the group or its integrity, or to any member of it, is felt to be a threat to all" (Rai & Fiske, 2011, p. 61). Given that an expectation of ingroup help appears to emerge within the first year of life, and occurs both in the absence of (Jin & Baillargeon, 2017) and during conflict, these results suggest that ingroup loyalty may be a primary moral motivation that drives human behavior.

## Ethics approval

All research was conducted in accordance with the Behavioral Research Ethics Board guidelines (approval no. H10–00147). The University of British Columbia approved all experiments. A legal guardian provided consent on behalf of each participant.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cognition.2021.104630.

## CRediT authorship contribution statement

**Anthea Pun:** Conceptualization, Formal analysis, Investigation, Writing-Original Draft, Writing-Review & Editing, Visualization. **Susan Birch:** Writing-Review & Editing. **Andrew Baron:** Supervision, Writing-Review & Editing, Project administration, Resources, Funding acquisition.

## Acknowledgments

We would like to thank the Early Development Research Group at the University of British Columbia, the Living Lab at Science World in Vancouver, and the participating parents and children in these studies. This research was funded by the Social Sciences and Humanities Research Council of Canada (Grant #435-2013-0286 and #895-2016-2011 awarded to A.S.B.).

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