

Toddlers show heightened attention to selective distributors

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ABSTRACT

We investigated whether Norwegian 21-month-olds ($N = 176$) hold expectations about agents' dominance based on their distributive fairness (data collected during 2021–2024). Toddlers were presented with two agents who first distributed resources, one acting evenly/fairly and the other selectively/unfairly. Then the agents engaged in territorial competition (Experiment 1). Toddlers looked longer when the unfair, selective agent prevailed and gained center-stage visibility. Experiment 2 ruled out the influence of low-level non-social factors. In Experiments 3 and 4, toddlers watched distributive events like in Experiment 1, but unlike earlier experiments, the test phase did not include competition. Toddlers again looked longer at the selective distributor when it gained center-stage visibility. Overall, these results suggest that toddlers pay special attention to unfair, selective distributors at large, also in the absence of dominance conflict or a clear violation event during the test phase.

Concerns about resource distribution and power are central to human social life and likely played a key role in shaping our social nature (Boehm, 1999; Cheng, 2020; Sheehy-Skeffington & Thomsen, 2020; Zeng et al., 2022). Consistent with the proposal that evolution has endowed humans with early-emerging, domain-specific learning mechanisms that enable even very young children to rapidly make sense of relational interactions (Laurence & Margolis, 2024; Thomsen & Carey, 2013), research has documented sophisticated competencies in infants and toddlers. Crucially, these include the capacity to represent distributive actions and fairness—illustrated, for example, by findings that 19-month-olds look longer at unequal than equal distributions of resources, suggesting a default expectation that others adhere to a principle of fairness (Sloane et al., 2012; see also Buyukozur Dawkins et al., 2019; Meristo et al., 2016; Sommerville & Enright, 2018; Surian & Margoni, 2020; for a review see Surian et al., 2025)—as well as the capacity to represent dominance relations and predict conflict outcomes based on formidability cues such as physical size (Thomsen et al., 2011), voice depth (Filesi et al., 2025), agility (Meng et al., 2025), number of allies (Pun et al., 2016, see also Fonn et al., 2026), and prior win-lose conflict outcomes (Bas & Sebastian-Galles, 2021; Enright et al., 2017; Mascaro & Csibra, 2012; for a review see Thomsen, 2020). The current study builds on this prior work by addressing two novel questions. First, we ask whether young toddlers expect those who create and perpetuate resource inequality to be formidable, dominant agents. Second, we ask whether toddlers *generally* show heightened attention to uneven distributors, and selectively attend to them even in the absence of any clear expectancy

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violation during the test phase.

Research done within the framework of the social dominance theory (Ho et al., 2025; Sidanius et al., 2004; Sidanius & Pratto, 1999) supports the claim that human political psychology links inequality and dominance. *Social dominance orientation* (SDO) captures individual motives that favor society being organized into between-group hierarchy and is one of the most robust psychological predictors of political ideology and support for redistributive policies (Sidanius & Pratto, 1999; for recent review see Ho et al., 2025). SDO is also positively correlated with intergroup and interpersonal aggressive attitudes and expectations (Aiello et al., 2013; Ho et al., 2012, Ho et al., 2015, Ho et al., 2025; Kunst et al., 2017; Pratto et al., 2000), with justification of the hierarchical status quo, and with opposition to redistributive resource transfer (Pratto et al., 1994; Sheehy-Skeffington & Thomsen, 2020; Sibley & Duckitt, 2010). In sum, individual expectations and endorsement of social dominance, inequality, and resource monopolization tend to converge as a behavioral syndrome, and these links may arise early in development or even infancy (for reviews see Ho et al., 2025; Kleppetø et al., 2019; Sheehy-Skeffington & Thomsen, 2020). For instance, sensitivity to unfair resource distributions covaries with infants' willingness to incur a personal cost, such that infants who are unwilling to give up their own favorite toy to an unknown experimenter also show reduced sensitivity to unfairness (Sommerville et al., 2013; Ziv & Sommerville, 2017).

Furthermore, the infant literature suggests that infants may perceive unfair distributors as generally antisocial (Margoni & Surian, 2018; Margoni & Tan, 2026), as infants have been shown to generalize sociomoral dispositions. First, 14-month-olds are not surprised if a hinderer distributes resources unevenly, but they are surprised if a helper does so (Surian et al., 2018; see also Gill & Sommerville, 2023). Second, 17-month-olds expect protectors to distribute resources evenly and, in some cases, expect aggressors to distribute resources unevenly (Zeng et al., 2026). Third, 25-month-olds are not surprised if a harmer, or an agent who does not support their group, distributes resources unevenly, but they are surprised if a harmful agent acts selflessly when distributing resources (Ting & Baillargeon, 2021). Infants and toddlers thus appear to link cooperative dispositions to acts of third-party resource distribution.

This raises the question if toddlers might also infer individual formidability/dominance from acts of selective resource distribution that are consistent with dominance hierarchy, mirroring the link between personal formidability and general support for dominance hierarchy among adults (e.g., Price et al., 2017; see Ho et al., 2025; Sheehy-Skeffington & Thomsen, 2020; Thomsen, 2020 for further review). Phrased differently, toddlers might expect that agents who violate the principle of fairness (i.e., even distribution between third parties given no discernible reason to do otherwise) will themselves be more aggressive and dominate others.

We address this question in Experiment 1. With no prior information, 21-month-old toddlers were presented with an agent performing an even distribution of strawberries among two recipients (1:1) and an agent distributing unevenly (2:0). They then saw either the unfair, selective agent prevailing in monopolizing a small enclosure at the center of the scene, or the fair agent doing so. According to the violation-of-expectation paradigm (VOE; Margoni et al., 2024), longer looking at one of these outcomes would suggest that toddlers expected the other outcome to occur. Specifically, if toddlers look longer when the *fair* rather than *unfair* agent prevails, this would indicate that this scenario violated their expectation that agents who distribute resources unevenly between third parties—consistent with a dominance hierarchy—will be more dominant and prevail in territorial conflict. More generally, such a finding would suggest that toddlers use cues derived from agents' resource distributions to predict the outcome of other conflicts.

Experiment 2 was conducted to rule out the possibility that toddlers' responses in Experiment 1 were driven by low-level perceptual, non-social factors thereby confirming that toddlers were indeed responding to the sociomoral characterization of the agents. Experiments 3 and 4 tested a further *alternative explanation*, namely that prolonged looking during the test phase at either the unfair/selective or fair/evenly-distributing agent would simply reflect increased *general* attention toward this character. This alternative was proposed after Experiment 1 revealed that toddlers looked reliably longer when the unfair agent, rather than the fair agent, prevailed, raising the possibility that this pattern did not reflect a violation of expectation but might instead be driven by low-level perceptual factors or general heightened attention to selective, uneven distributors.

This alternative account suggests that toddlers' prolonged attention to selective distributors may in part reflect an evolved mechanism for tracking individuals who distribute resources unevenly. In social contexts, this tendency may serve an adaptive function, enabling people to monitor agents who use their control of resources to bias their distribution, possibly helping the perceiver anticipate how to gain favor and access those resources. Consistent with this view, research on adult behavior shows that individuals attend closely to biased or authoritarian leaders and may even set aside moral considerations to gain favor, improve their social standing, or secure access to resources (Appelbaum & Hughes, 1998; De Clercq et al., 2021). Young children have also been found to prefer unequal distributions when these outcomes offer personal advantage (Blake & McAuliffe, 2011; McAuliffe et al., 2017). Evidence from infants and preschoolers further indicates that they expect resources to be allocated preferentially to in-group members, particularly under conditions of scarcity (Bian et al., 2018; Jin & Baillargeon, 2017; Lee et al., 2018), supporting the broader idea that early attention is guided by strategic social considerations.

We test this alternative account in Experiments 3 and 4. Toddlers were first familiarized with the same distributive events used in Experiment 1. Critically, however, the test phase removed any cues of competition. In Experiment 3, only the agent that had been the winner in the corresponding test events of Experiment 1 was shown, with the other agent entirely absent. In Experiment 4, both agents were present, but the former loser remained stationary at the periphery of the scene and did not interact with the other agent. Thus, although the focal agent reproduced the same movement patterns as the winning agent in Experiment 1 (i.e., moving back and forth across the scene and entering and exiting the small enclosure that had served as the contested territory in Experiment 1), the events could no longer be construed as depicting a conflict scenario. These test events were thus perceptually similar to those in Experiment 1, but did not involve any territorial conflict. Finding that toddlers in both experiments look longer at the same agent as in Experiment 1 would suggest that, across experiments, their prolonged looking does not reflect a violation of dominance expectations, but rather *sustained attention* toward one of the agents. Notably, whereas this alternative account can explain both the longer looking times when the unequal agent prevailed in Experiment 1 and the possibility that, in Experiments 3 and 4, toddlers would look longer when the

unfair, selective agent takes center stage, an interpretation based on attributing dominance to either agent cannot.

In sum, across four experiments, we asked whether toddlers use sociomoral information from resource distributions to predict the outcome of a territorial dominance conflict, or whether their responses—rather than reflecting expectations about who will prevail—are instead driven by a more general enhanced attention toward unfair, selective distributors, potentially reflecting the adaptive value of tracking agents who control and selectively allocate resources.

1. Transparency and Openness

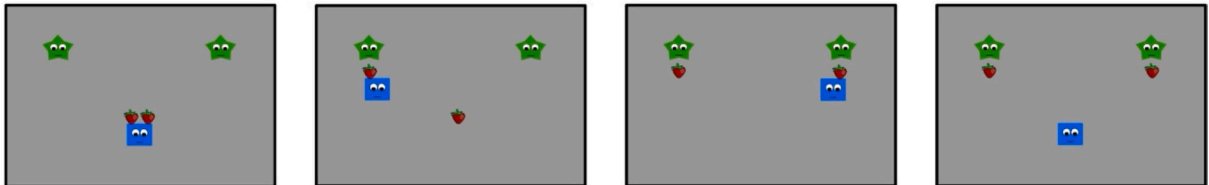
The data and the Supplementary Online Material (SOM) are available on Open Science Framework (OSF): <https://osf.io/84ebg>. Study protocol, predictions, exclusion criteria, and analysis plan were preregistered for Experiments 1 and 2 (see <https://aspredicted.org/4hsd-hrz9.pdf>), and Experiment 4 (see <https://aspredicted.org/y32c-mbyw.pdf>).

2. Experiment 1

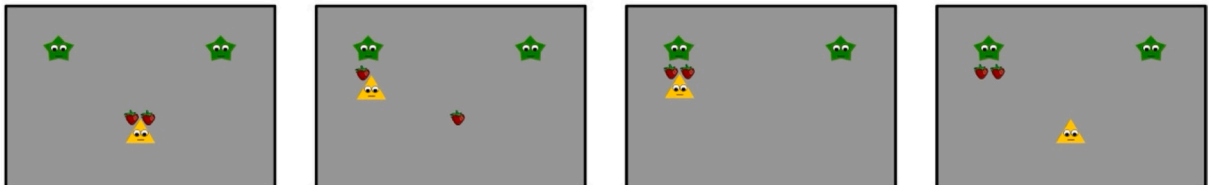
In Experiment 1, we familiarized toddlers to two agents, one performing an even 1:1 distribution between two recipients, and the other performing an uneven 2:0 distribution (see Fig. 1). Next, toddlers saw one test trial where either the fair/even distributor (*fair-win condition*) or unfair/uneven distributor (*unfair-win condition*) won a subsequent territorial conflict, physically prevailing over the

Familiarization Experiment 1, Experiment 3, and Experiment 4

Fair Distribution

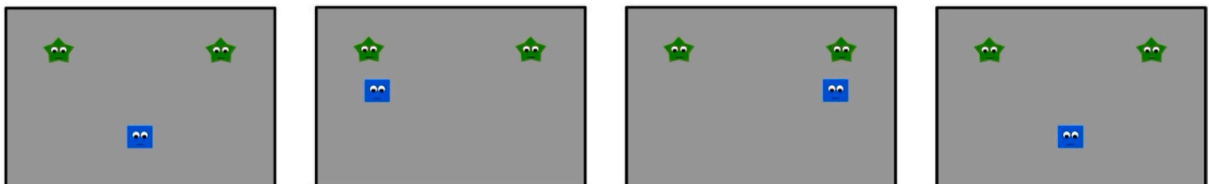


Unfair Distribution



Familiarization Experiment 2

Balanced Movement



Unbalanced Movement

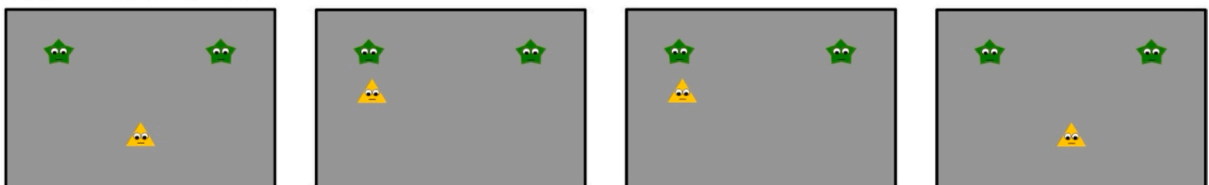


Fig. 1. Schematic Depiction of the Familiarization Trials in Experiments 1 to 4. Note. Familiarization trials in Experiment 1, Experiment 3, and Experiment 4 were identical; toddlers saw a fair distributor (the blue agent in the figure) and an unfair, selective distributor (the yellow agent). In Experiment 2 (bottom), toddlers saw the same scenarios except that the strawberries were removed.

other in occupying a small enclosure at the center of the stage (as in Mascaro & Csibra, 2012) (see Fig. 2). We thus employed a between-subjects design with two conditions. We reasoned that longer looking at the fair-win event than at the unfair-win event would indicate that toddlers expected the unfair, selective agent to prevail.

2.1. Method

2.1.1. Design

Toddlers were presented with three pairs of familiarization trials followed by a test trial. In each pair of familiarization trials, toddlers had to see at least one even and one uneven distribution to be included in the study (events were those used in Meristo & Surian, 2014). In the *fair-familiarization trial*, toddlers saw a 15-s computer-animated event where a distributor (either a blue square with mouth and eyes or a yellow triangle with mouth and eyes) entered the scene from the bottom carrying two strawberries, paused, and approached two green stars (with eyes and mouth) positioned in the upper part of the scene, one on the left and one on the right, giving each of them one strawberry (see Fig. 1 and Movie S1). A drumbeat announced and accompanied the agent's entry, whereas a meow sound was played when each of the stars received a strawberry and jumped as if to express excitement. In the *unfair-familiarization trial*, toddlers saw the same scenario, except that the distributor approached one of the stars twice (see Movie S2).

In the test trial, toddlers saw a 28-s event where a first distributor entered from the right and moved inside a small grey enclosure positioned at the center of the scene, similarly to the event in Mascaro and Csibra (2012)'s Experiment 2. Next, the second distributor entered from the left and a competition to occupy the small enclosure began. The agent who entered from the left pushed repeatedly the other agent outside the enclosure, on the right. The one being pushed tried twice to return to its position, but each time it was pushed away. The event ended with one agent outside the enclosure and one inside (see Fig. 1 and Movies S3-S4). Toddlers in the *fair-win condition* saw the fair distributor prevailing, whereas toddlers in the *unfair-win condition* saw the unfair, selective distributor prevailing.

2.1.2. Participants

Sample size was determined following a preregistered Sequential Bayes Factors approach (Schönbrodt et al., 2017) such that we would continue collecting data until reaching at least positive and moderate Bayesian evidence (cutoff, Bayes Factor ≥ 3 for a Bayesian independent samples *t*-test) in favor of either the alternative hypothesis of a difference in looking times between the two conditions at test or in favor of the null hypothesis that toddlers looked equally long in the two conditions. A Bayes Factor (BF) of 3 is commonly interpreted as providing positive and moderate evidence for one hypothesis over the other and is used as a practical stopping criterion in sequential Bayesian designs (Kass & Raftery, 1995; Schönbrodt & Wagenmakers, 2018). We specified that data would be collected in increments of a full counterbalanced block of 16 participants, and that at least 32 participants would be recruited. Thus, after this minimum sample size, data collection could stop after each additional block of 16 participants if the evidential threshold (BF ≥ 3) was reached. Note that sequential stopping rules can lead to differences in final sample sizes across experiments, because the evidential threshold may be reached more quickly in some experiments than in others. In all cases and for all experiments reported here, data collection stopped only once the threshold of BF ≥ 3 was reached.

For Experiment 1, this strategy resulted in a final sample of 80 healthy toddlers born at full term (41 female; $M_{age} = 21$ months, 12 days; age range = 19 months, 0 days to 23 months, 29 days) from Norwegian-speaking families (see Fig. S1). Forty toddlers participated in the fair-win condition (18 female; $M_{age} = 21$ months, 13 days; age range = 19 months, 0 days to 23 months, 28 days), and 40 in the unfair-win condition (23 female; $M_{age} = 21$ months, 11 days; age range = 19 months, 6 days to 23 months, 29 days). Another 25 toddlers were excluded because they were overly fussy or active (13), distracted in test by objects, food items, external sounds, or people entering in the room (7), or because of experimental errors (2), loss of internet connection during testing (1), parental interference in test (1), and a test looking time that deviated more than three SDs from the condition mean (1). Parents provided oral recorded informed consent, and the procedure used in this research was approved by the Norwegian Centre for Research Data (NSD).

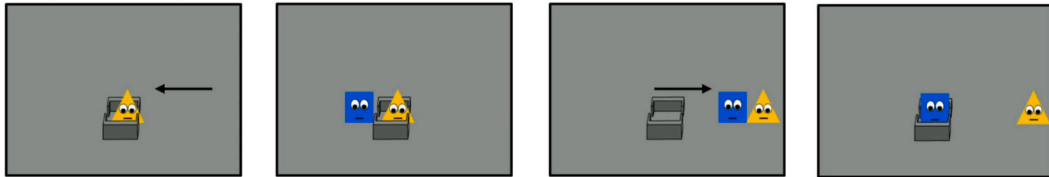
2.1.3. Procedure

Toddlers were tested at home via Zoom (Chuey et al., 2021), which allowed us to remotely present stimuli on the parent's laptop. Stimuli were played with a standard video player on the experimenter's laptop and shared via Zoom, so that the participating toddlers could only see the video being played. Parents were instructed to display the experimenter's shared screen in full-screen mode and to conceal any on-screen windows showing the experimenter's or their own camera feed. Toddlers sat on a parent's lap or a baby chair with their parent next to them. Parents were further instructed to hold their child firmly if on their lap, to refrain from directing the child's attention to the screen or encouraging them to look, and to avoid interfering with the child's spontaneous behavior by keeping their eyes closed while the stimuli were presented. The experimenter remotely assisted the parents in positioning the laptop and any peripheral devices (keyboard or mouse) so that they remained out of the child's reach while keeping the screen fully and properly visible to the child. Parents were also asked to clear the table in front of the child of any objects, close the door, and ensure that no other household members entered the room during the session. Proper lighting conditions were established by asking parents to turn on the lights, and a sound calibration was performed before starting to confirm that the audio was clear and at a comfortable volume.

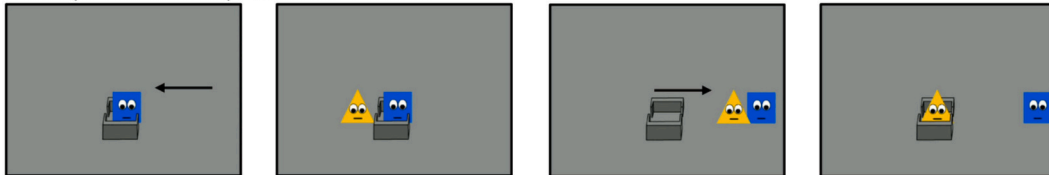
Toddler's looking behavior was monitored and coded on-line using PyHab (Kominsky, 2019), an add-on for PsychoPy (Peirce et al., 2019). On-line coding was done by an experimenter (the first author) who was blind to the experimental condition and the videos' content (a random code associated to the video to play and a piece of cardboard placed over the part of the experimenter's screen where the videos could be visible ensured blindness). The video-call was recorded, and the toddler's face was captured simultaneously with the movies presented. A randomly selected 25% of the total observations (20 participants) were recoded off-line by two independent

Test Experiment 1 and Experiment 2

Fair (or Balanced) Distributor Prevails

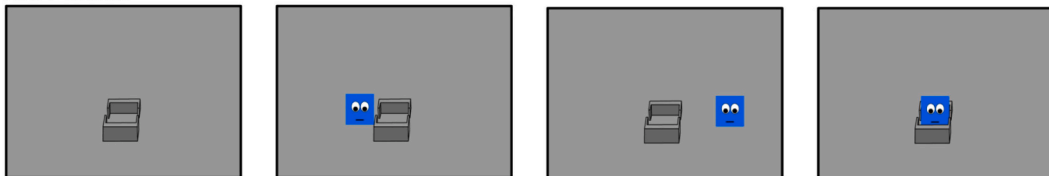


Unfair (or Unbalanced) Distributor Prevails

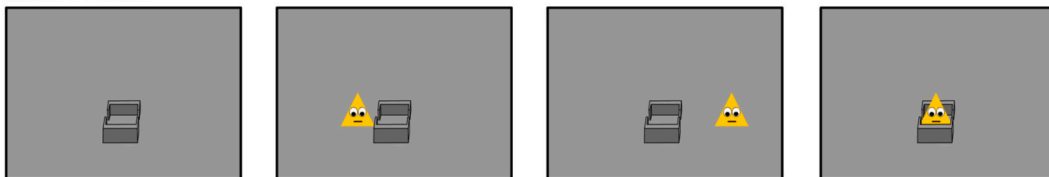


Test Experiment 3

Fair Present

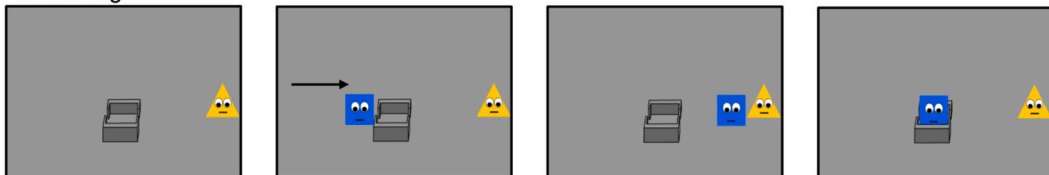


Unfair Present



Test Experiment 4

Fair Moving



Unfair Moving

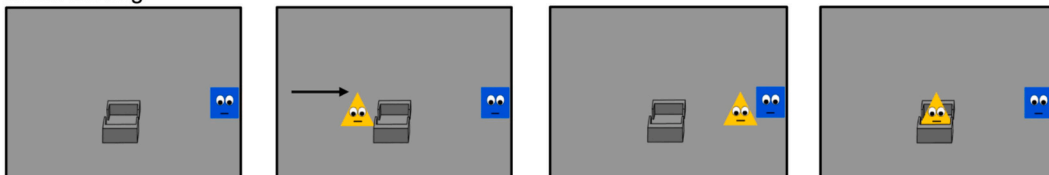


Fig. 2. Schematic Depiction of the Test Trials in Experiments 1 to 4. Note. Test trials in Experiments 1 and 2 (top) were identical; toddlers saw either the fair ('balanced' in Experiment 2) agent prevailing (the blue agent in the figure) or the unfair ('unbalanced' in Experiment 2) agent prevailing (the yellow one). In Experiment 3 (middle), toddlers saw the same scenarios except that the loser was entirely removed from the scene. In Experiment 4 (bottom), toddlers saw the same scenarios used in Experiment 3, except that the second agent was also present, but it stood still in the right corner of the scene.

coders, blind to the condition. Interobserver agreement averaged 98% per trial per toddler.

Toddlers received three pairs of familiarization trials, and one test trial. Each trial began with a bright attention getter showing a baby face. Each familiarization trial ended when toddlers (i) looked away for 2 consecutive seconds after having looked for at least 11 cumulative seconds (the duration of the main part of one event loop) or (ii) when 30 consecutive seconds had elapsed (the duration of two event loops). If the minimum on-time criterion of 11 s was not met, the trial was presented again. Order of familiarization trials (fair-familiarization trial first or unfair-familiarization trial first), color and shape of the distributing agents (a blue square distributing

evenly and a yellow triangle distributing unevenly, or vice versa), and direction of the first movement of the agents (toward the receiver on the left or on the right) were counterbalanced across participants. Looking times during the fair-familiarization trials were averaged and compared to the mean looking time at the unfair-familiarization trials using an ANOVA with familiarization trial type as a within-subjects factor and condition (fair-win, unfair-win) as a between-subjects factor. None of the effects was significant, $p_s \geq .267$ (see Dataset in OSF for the mean looking times). On average, toddlers were attentive during the 30-s familiarization trials, $M = 28.86$.

Next, the test trial had an initial part that lasted for 28 s while the fair and unfair distributor (color and shape counterbalanced across participants) fought for control over the enclosure, after which toddlers were presented with a still picture of the last frame of the event until they (i) looked away for 2 consecutive seconds after having looked at least 3 cumulative seconds or (ii) 60 consecutive seconds had elapsed. The participating toddlers proved very attentive during the initial 28-s part of the test trial; on average, they looked at it for 27.31 s.

2.2. Results and discussion

Looking times data were log-transformed prior to the analyses conducted in this as well as the other experiments (Csibra et al., 2016). However, for ease of communication, in the paper we report raw looking times. Toddlers looked longer at the unfair-win test event ($M = 22.38$, $SD = 14.36$) than at the fair-win test event ($M = 14.54$, $SD = 8.99$), Hedges' $g = 0.56$, $BF_{10} = 8.60$ (see Fig. 3 and Fig. S1). We analyzed the looking times at test with a linear regression analysis using condition (fair-win, unfair-win) as a predictor.¹ The analysis revealed a significant effect of condition, $F(1,79) = 6.46$, $p = .013$. An additional preregistered robustness check analysis was also conducted confirming the direction of the findings (see the SOM). Last, we checked for possible effects of age (in days), sex, and order of familiarization events (fair first, unfair first) by adding these factors to the model in the linear regression, but none of them reached statistical significance, $p \geq .534$ (see Table S1).

In sum, we found that toddlers looked reliably longer after seeing the unfair, selective agent prevail than after seeing the fair agent prevail. If longer looking reflects surprise or expectancy violation, this pattern might be consistent with a possible hypothesis: that distributing resources evenly between third parties could license inferences of leadership, which in turn might lead to expectations of prevailing in zero-sum conflict. Supporting this possible hypothesis are two interlinked lines of evidence: first, that evenly distributing resources is associated with leadership; second, that leadership is, in turn, linked to preferential rights in zero-sum situations. Evolutionary and psychological models of social hierarchy (Hooper et al., 2010; Spisak et al., 2011; von Rueden & Van Vugt, 2015) propose that leader-follower relations have evolved and are preferred over purely egalitarian relations to facilitate the solution of key challenges of social life, such as the possibility of resource conflict and the problem of free-riding for cooperation. Thus, facilitating even distributions—which reduces conflict among group members—may be associated with leadership in the human mind. These models further posit that leaders receive compensation or preferential rights for their leadership service from followers (Garfield et al., 2019, 2020; Hooper et al., 2010; Price & Van Vugt, 2014; see also Henrich & Gil-White, 2001). Consistent with this reasoning, research on leadership cognition indicates that infants and toddlers expect agents characterized as leaders to rectify fairness violations (Stavans & Baillargeon, 2019) and to be obeyed even in their absence (Margoni et al., 2018; Margoni & Thomsen, 2024). Hence, toddlers might first infer that those who distribute resources evenly are in charge, and subsequently expect these agents to possess preferential rights in zero-sum conflicts.

However, it is also possible that the participating toddlers in Experiment 1 had not attended to sociomoral cues of the fair and unfair distributive acts at all, but might have simply attended to different low-level perceptual non-social factors. In principle, it is possible that toddlers might have looked longer at the unfair-win test event because they were more interested in an agent who always moved to the same side in the familiarization trials (unbalanced movements distributing both strawberries to one agent) than in an agent who moved to both sides (distributing a strawberry to both agents). This possibility is directly addressed and tested in Experiment 2. Instead, Experiments 3 and 4 test a further alternative interpretation of the findings reported in Experiment 1, namely that toddlers' longer looking times at the unfair-win test event do not reflect a violation of dominance expectations, but rather a more general enhancing of attention directed toward unfair, selective distributors.

3. Experiment 2

Experiment 2 was designed to rule out the possibility that toddlers in Experiment 1 responded to low-level perceptual factors rather than to the agents' sociomoral characterization. Toddlers saw the same events used in Experiment 1 except that the strawberries were absent. Removing the strawberries deprived the familiarization events of their sociomoral meaning while maintaining everything else equal to Experiment 1. The agents were no longer distributing resources; they were simply approaching the star(s) (see Fig. 1). Thus, toddlers saw balanced- and unbalanced-familiarization events (empty-handed, the agent is approaching either both stars or one star twice). Next, toddlers received the same test event of Experiment 1 (a balanced- or unbalanced-win test event).

If the longer looking times observed when the unfair distributor prevailed in Experiment 1 reflect responses to unbalanced rather than balanced movements, then toddlers should still show this effect in Experiment 2. Conversely, if the results of Experiment 1 reflect responses to selectively directed resource distribution, then toddlers should no longer show this effect in the present control experiment. Finding that toddlers do not look reliably longer at the unbalanced-test event than at the balanced-test event would thus rule out

¹ We originally preregistered a mixed-effects model analysis, but this was an unsuitable solution given that we limit ourselves to only one test observation per infant.

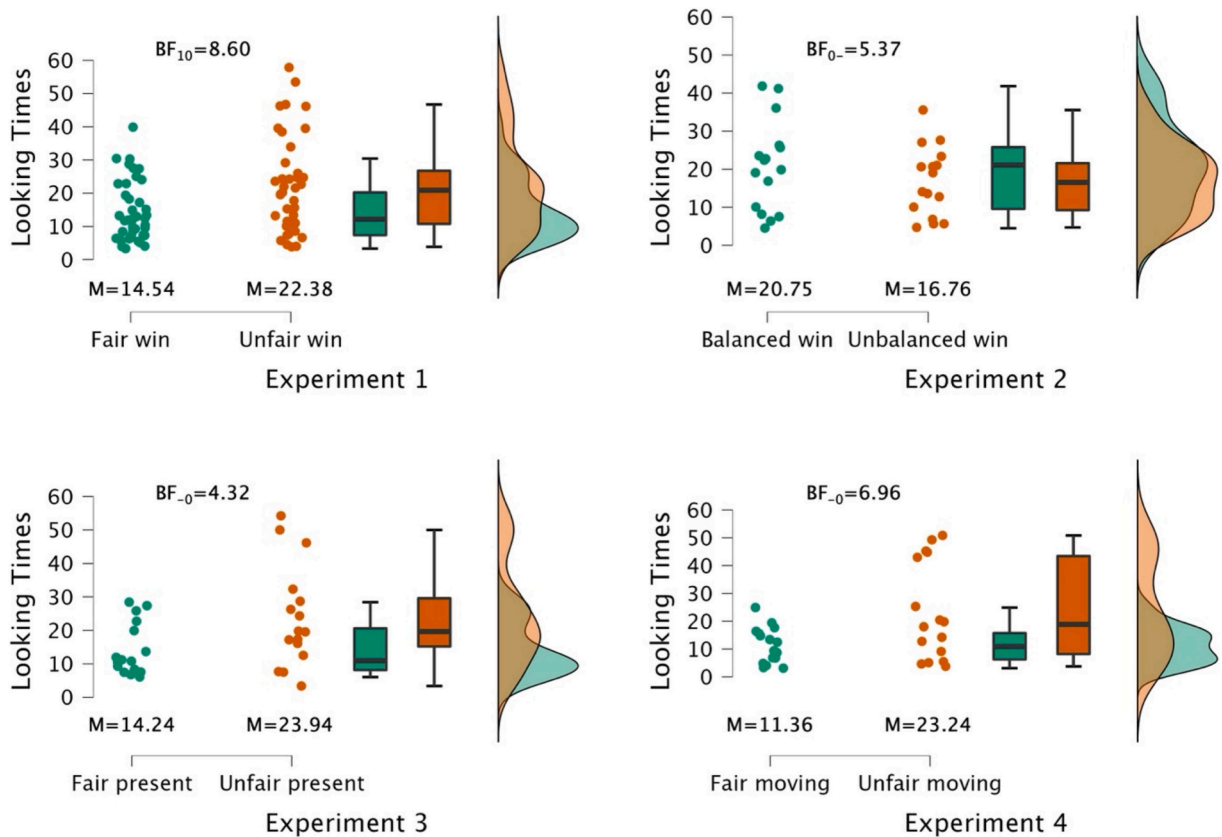


Fig. 3. Results of Experiments 1 to 4. Note. For each experiment, looking times at the test events are displayed with a jitter plot, a box plot, and a density plot. Means are displayed below the jitter plot, Bayes Factor above it.

the counterhypothesis that toddlers in Experiment 1 were not reacting to the sociomoral meaning of the distributing actions.

3.1. Method

3.1.1. Design

Events were identical to those of Experiment 1 except that strawberries were not displayed (see Fig. 1 and Movies S5 and S6).

3.1.2. Participants

Sample size was determined as in Experiment 1. Participants were 32 healthy toddlers born at full term (13 female; $M_{age} = 21$ months, 5 days; age range = 19 months, 2 days to 23 months, 29 days) from Norwegian-speaking families. Sixteen were assigned to the balanced-win condition (7 female; $M_{age} = 21$ months, 25 days; age range = 19 months, 3 days to 23 months, 29 days), and the other 16 to the unbalanced-win condition (6 female; $M_{age} = 20$ months, 19 days; age range = 19 months, 2 days to 23 months, 24 days). Another 4 toddlers were excluded because they were overly fussy or active (3) or because of loss of internet connection during testing (1).

3.1.3. Procedure

The procedure was identical to the one used in Experiment 1. Data from 25% of the total sample (8 participants) were recoded off-line by two coders who averaged an interobserver agreement of 99% per trial per toddler. Mean looking time during the balanced-familiarization trials and the unbalanced-familiarization trials were compared using an ANOVA with familiarization trial type as a within-subjects factor and condition (balanced-win, unbalanced-win) as a between-subjects factor. No effect was significant, $ps \geq .095$. On average, toddlers were attentive during the 30-s familiarization trials, $M = 27.30$. Last, toddlers were again highly attentive during the test trial and looked on average for 27.55 s at the initial 28-s part of it before we began coding their looking times to frozen stills.

3.2. Results and discussion

Absent acts of resource distribution in familiarization, toddlers now looked *no* longer at the unbalanced-win test event ($M = 16.76$, $SD = 9.11$) than at the balanced-win test event ($M = 20.75$, $SD = 11.84$), $F(1,31) = 0.68$, $p = .416$, $g = 0.28$, $BF_{0-} = 5.37$ (see Fig. 3). Age (in days), sex, and order of familiarization events were also not significant, $p \geq .791$ (see Table S2). Next, we compared looking

times in test across the two experiments using an ANOVA with experiment and test event as between-subjects factors. The analysis revealed a significant interaction between experiment and test event, $F(1,108) = 4.20$, $p = .043$, $\eta_p^2 = 0.04$, and post hoc comparisons confirmed that whereas in Experiment 1 toddlers looked longer at the unfair-win event than at the fair-win event, $t(79) = 2.57$, $p_{\text{Tukey}} = .056$, in Experiment 2 toddlers looked about equally at the two test events, $t(31) = 0.80$, $p_{\text{Tukey}} = .853$.

These results suggest that longer looking at one of the two test events in Experiment 1 cannot be accounted for by the influence of low-level perceptual factors, and it reinforces the conclusion that toddlers were responding to the different sociomoral characteristics of the agents. Yet, one main possible alternative explanation of these findings remains.

4. Experiment 3

In Experiment 1, toddlers looked longer after the unfair, selective agent conquered the space at the center of the scene than after the fair, even agent did so. However, does this prolonged looking reveal that infants expected fair agents to prevail in zero-sum situations? Experiment 3 was designed to test an alternative explanation, namely that these findings reflect a process of increased attention for what the unfair/selective agent will do next. Because the prevailing agent remains prominently at the center stage in the [Mascaro and Csibra \(2012\)](#) dominance paradigm, increased attention to unfair/selective distributors at large could conceivably also result in a similar pattern of longer looking times, even if toddlers do not hold dominance expectations. Sustained attention toward selective, unfair distributors may reflect an evolutionarily adaptive response serving the function of closely monitoring individuals who control valuable resources and distribute them selectively, in order to understand how to gain their favor, or avoid their disfavor, and secure access to resources.

To test this alternative prediction, in Experiment 3, toddlers saw identical events to those of Experiment 1 except that the test events displayed only what in the original movies had been the winning agent with the losing agent removed from the animations: Toddlers saw either the unfair or the fair agent moving around in the field and placing itself within the enclosure in the middle. If the results of Experiment 1 reflect toddlers' expectation that the fair agent will prevail in a zero-sum conflict, then they should no longer show differential looking times across the two test events when the fair agent is no longer competing for the enclosed territory, but simply moving around on its own. Conversely, if the results of Experiment 1 in fact reflect that toddlers 'simply' pay more attention to selective resource distributors, irrespective of whether they engage in conflict or not, then toddlers should still look longer when the unfair vs. the fair agent takes center stage in test. Hence, based on, and testing this alternative account of, the prior results of Experiment 1, the present experiment tests the *unidirectional* hypothesis that toddlers will look longest when the unfair, selective agent is present at center stage.

4.1. Method

4.1.1. Design

Events were identical to those of Experiment 1 except that the losing agent was removed from the test events (see [Fig. 2](#) and Movies S7 and S8).

4.1.2. Participants

Sample size was determined as in Experiment 1. Participants were 32 healthy toddlers born at full term (17 female; $M_{\text{age}} = 21$ months, 18 days; age range = 19 months, 10 days to 23 months, 23 days) from Norwegian-speaking families. Sixteen participated in the fair-present condition (8 female; $M_{\text{age}} = 21$ months, 21 days; age range = 19 months, 10 days to 23 months, 23 days), and 16 in the unfair-present condition (9 female; $M_{\text{age}} = 21$ months, 16 days; age range = 19 months, 17 days to 23 months, 22 days). Another 12 toddlers were excluded because they were overly fussy or active (6), distracted in test by objects (3), or because of experimental errors (2) and parental interference in test (1).

4.1.3. Procedure

The procedure was identical to the one used in Experiment 1. Data from 25% of the total sample (8 participants) were recorded off-line by two coders (interobserver agreement = 97%). Mean looking time during the fair-familiarization and the unfair-familiarization trials were compared using an ANOVA with familiarization trial type as a within-subjects factor and condition (fair-present, unfair-present) as a between-subjects factor. None of the effects was significant, $ps \geq .285$. On average, toddlers were attentive during the 30-s familiarization trials, $M = 28.95$, as well as during the initial 28-s phase of the test trials where toddlers looked on average for 27.04.

4.2. Results and discussion

Toddlers looked longer at the test event where the unfair agent was present ($M = 23.94$, $SD = 15.19$) than at the test event where the fair agent was present ($M = 14.24$, $SD = 7.85$), $F(1,31) = 3.58$, $p_{\text{one-tailed}} = .034$, $g = 0.65$, $BF_{-0} = 4.32$ (see [Fig. 3](#)). Age (in days), sex, and order of familiarization events, if added to the model, did not predict looking times, $ps \geq .192$ (see Table S3). Indeed, the looking times of Experiment 3 were remarkably similar to those of Experiment 1 (though the evidence in favor of a condition effect was weaker, see Table S3). In both cases, toddlers looked 14 s at the test trial where the fair agent took the center of the scene, and 22 versus 23 s at the other test trial where the unfair agent took center stage in Experiment 1 and 3, respectively. Two Bayesian independent samples *t*-tests with experiment as predictor confirmed this observation; for both test events ('fair', 'unfair' takes center stage), the

Bayesian evidence was in favor of the null hypothesis of no difference between experiments, $BF_{01} = 3.36$ ($g = 0.06$) and $BF_{01} = 3.23$ ($g = 0.10$), respectively.

In sum, toddlers in Experiment 3 responded similarly to those in Experiment 1; they looked longer when the selective agent took the scene. These results suggest that the looking behavior observed in Experiment 1 does not reflect a violation of dominance expectations, but rather increased attention at large toward agents who distribute resources selectively. Even in the absence of conflict, the mere fact that the agent on the scene was unfair or selective in its prior third-party resource distribution led toddlers to increase their level of attention, a phenomenon we use to reinterpret the prolonged looking found in Experiment 1.

5. Experiment 4

We asked whether prolonged looking at an unfair agent winning could be explained by increased attention to the agent's movements, as the unfair agent, when prevailing, occupied a central position and exhibited more movement than the other agent. Results of Experiment 3 were consistent with this explanation of the findings. However, whereas in Experiment 1 both agents were present in test, in Experiment 3 only one agent was. Perhaps this lack of social co-occupancy or comparison might affect infant attention to the previously unfair agent. Hence, Experiment 4 was designed to further test the alternative explanation we put forward—namely, that infants track the actions of uneven, selective distributors with heightened attention—in a more decisive manner by presenting both agents on the scene simultaneously. Again, no conflict was displayed in test, and one agent still performed the same movements of the winning agent in Experiment 1; however, unlike Experiment 3, Experiment 4 included the second agent, albeit confined to a corner.

5.1. Method

5.1.1. Design

Events were identical to those of Experiment 3 except that the second agent (i.e., the fair agent in the condition in which the unfair agent moved, and the unfair agent in the condition in which the fair agent moved) remained stationary in the right corner of the scene (see Fig. 2 and Movies S9 and S10).

5.1.2. Participants

Sample size was determined as in Experiment 1. Participants were 32 healthy toddlers born at full term (19 female; $M_{age} = 21$ months, 21 days; age range = 19 months, 3 days to 23 months, 29 days) from Norwegian-speaking families. Sixteen participated in the fair-moving condition (10 female; $M_{age} = 21$ months, 29 days; age range = 19 months, 3 days to 23 months, 29 days), and 16 in the unfair-moving condition (9 female; $M_{age} = 21$ months, 13 days; age range = 19 months, 4 days to 23 months, 14 days). Another 7 toddlers were excluded because overly fussy or active (3), distracted in test by objects (3), or because of loss of internet connection during testing (1).

5.1.3. Procedure

The procedure was identical to the one used in Experiment 1. Data from 25% of the total sample (8 participants) were recoded off-line by two coders (interobserver agreement = 98%). Mean looking times during the fair-familiarization and the unfair-familiarization trials were compared using an ANOVA with familiarization trial type as a within-subjects factor and condition (fair-moving, unfair-moving) as a between-subjects factor. None of the effects was significant, $ps \geq .779$. On average, toddlers were attentive during the 30-s familiarization trials, $M = 28.66$, and during the initial 28-s part of the test trial, $M = 26.93$.

5.2. Results and discussion

Toddlers looked longer at the test event in which the unfair agent moved ($M = 23.24$, $SD = 17.48$) than at the test event in which the fair agent moved ($M = 11.36$, $SD = 6.48$), $F(1,31) = 3.98$, $p_{one-tailed} = .028$, $g = 0.69$, $BF_{-0} = 6.96$ (see Fig. 3). Age (in days), sex, and order of familiarization events, if added to the model, did not predict looking times, $ps \geq .070$ (see Table S4). Thus, the pattern of looking times in Experiment 4 was similar to those in Experiments 1 and 3. If pooled together, data from Experiments 3 and 4 reveal that toddlers looked at the test events with the unfair agent either alone or moving on the scene for $M = 23.59$ ($SD = 16.11$), and at the test events with the fair agent either alone or moving for $M = 12.80$ ($SD = 7.23$), $F(1,63) = 7.58$, $p_{one-tailed} = .004$, $g = 0.66$, $BF_{-0} = 61.85$. A Bayesian independent samples t -test with experiment as predictor (Experiment 1 vs. Experiments 3 & 4 combined) further confirmed that for both test events, there is at least anecdotal Bayesian evidence of no difference between experiments, $BF_{01} = 2.91$ ($g = 0.16$) and $BF_{01} = 3.89$ ($g = 0.01$), for fair and unfair test events respectively. Last, a regression analysis on the combined data from Experiments 1, 3, and 4 showed that condition remained a significant predictor of test looking after controlling for looking during unfair familiarization trials, indicating that the condition effect cannot be explained by attention to the unfair familiarization event (Table S5).

In sum, toddlers in Experiments 3 and 4 responded similarly to those in Experiment 1. This pattern of results suggests that the prolonged looking observed in Experiment 1, when the selective distributor won a zero-sum dominance conflict, was unlikely to have been driven by the conflict outcome itself. Instead, it appears to have reflected heightened attention to the unfair, selective agent. Toddlers also looked longer when this agent performed the same actions independently of any conflict, either when it was alone in the scene (Experiment 3) or in the presence of but not interacting with the other agent (Experiment 4). The mere movement of the unfair, selective (rather than fair, nonselective) agent within the scene was sufficient to capture toddlers' attention.

6. General Discussion

We examined 21-month-olds' responses to even/fair and selective/unfair distributors in a default situation where no other information would suggest that resources should be distributed in a selective manner, and across four experiments found evidence of a heightened attention for what unfair, selective distributors would do next. Specifically, in Experiment 1, toddlers were presented with two agents—a fair and an unfair distributor—competing to access a desired space marked by a small enclosure at the center of the scene. Toddlers looked longer when the unfair agent physically outcompeted the fair agent, forcing it into a corner, compared to when the opposite outcome occurred. With Experiment 2, we ruled out the possibility that this prolonged looking was a mere by-product of differences in low-level perceptual and non-social features between the test events, and confirmed that toddlers were indeed reacting to the social characterization of the agents. Finally, Experiments 3 and 4 tested whether the results of Experiment 1 reflected specific inferences about who would prevail in physical conflict or general attention to selective distributors at large, presenting toddlers with the same events used in Experiment 1 except that no competition was depicted. In Experiment 3, only one agent was present during the test phase, whereas in Experiment 4 both agents were present, but one stood to the side of the scene and the other was moving during the test phase in the exact same manner as in Experiment 1. In both cases, toddlers looked longer when the unfair agent took the center of the scene as in Experiment 1, compared to when the fair agent did so, suggesting that toddlers' prolonged looking reflected increased attention toward the selective distributor: Across three experiments that varied the presence of conflict and whether both agents were present in the test scene, toddlers consistently showed increased interest when the selective agent took center stage. Hence, the initial results from Experiment 1 must be reinterpreted in light of additional evidence gathered in Experiments 3 and 4. Instead of indicating an expectancy violation related to the outcome of the territorial competition, we argue that longer looking in Experiment 1 reflects heightened attention toward what the unfair, selective distributor would do next.

This mechanism of sustained attention toward selective distributors who violate default assumptions of equality (Buyukozur Dawkins et al., 2019; Schmidt & Sommerville, 2011; Sloane et al., 2012; Surian & Margoni, 2020) may reflect an evolved response: In social contexts, it may serve an adaptive function to closely monitor agents who hold resources and distribute them in a biased way to figure out what it takes to be on their good side and capitalize on access to available resources (for similar arguments regarding toddlers' reaching preferences for dominant others, see Thomas et al., 2018; Thomsen, 2020). In line with this account, research on adult behavior has shown that individuals devote considerable attention and may set aside moral considerations in order to ingratiate themselves with biased or despotic leaders, aiming to attain higher status and secure privileged access to resources (Appelbaum & Hughes, 1998; De Clercq et al., 2021). Young children have also been shown to favor uneven distributions when such outcomes are personally advantageous (Blake & McAuliffe, 2011; McAuliffe et al., 2017). The finding that infants and preschoolers expect people to prioritize resources for in-group over out-group members, especially under conditions of scarcity (Bian et al., 2018; Jin & Baillargeon, 2017; Lee et al., 2018)—provides further empirical support for the broader proposal that mechanisms of strategic social engagement guide early attention. These mechanisms include the allocation of attentional resources to understand and predict the behavior of those who hold resources and distribute them in a biased way. Here, we provide the first evidence that such mechanism of heightened attention toward biased selective distributors is at play already in the mind of young toddlers.

Importantly, the absence of differential looking during the *familiarization phase*—which we also observed in the current study, where toddlers attended equally to fair and unfair distributions—conflicts neither with previous evidence that infants and toddlers expect resources to be distributed fairly (e.g., Buyukozur Dawkins et al., 2019; Meristo et al., 2016; Schmidt & Sommerville, 2011; Sloane et al., 2012), nor with our proposal that toddlers show heightened attention toward selective distributors. This null effect is expected, as the familiarization phase was not intended to test expectations or selective attention, but rather to provide toddlers with enough information to begin forming predictions to be evaluated during the test phase, or simply to characterize the two agents later presented in the test events. Toddlers in our study generally looked for the maximum allowable time during familiarization, consistent with the fact that this phase was not intended to generate variability amenable to experimental manipulation. Additionally, unlike previous studies designed to test infants' fairness expectations, in which looking times were measured to static end-state distributions (e.g., paused scenes depicting fair or unfair outcomes), the present study presented distribution events in a continuous loop and measured looking times across the entire sequence.

Still, further research is needed to determine whether the heightened attention to uneven resource distributors is primarily driven by the agent's selective and potentially exploitable distribution strategy, by the agent's unexpected violation of the fairness norms (which has been shown to guide early sociomoral reasoning), or by both. Indeed, a possibility is that toddlers' heightened attention reflects ongoing processing of the fairness violation. That is, toddlers may attend more closely to selective distributors as they attempt to understand why the violation occurred. General evidence in favor of this type of processing comes from work showing that infants respond to violations of both physical and social expectations not only by looking longer at surprising events, but also by actively seeking explanations, integrating new information, and learning about the objects or agents involved (Cao et al., 2025; Perez & Feigenson, 2022; Stahl & Feigenson, 2015). Applied to the present findings, toddlers' prolonged looking at selective distributors could similarly reflect continued analysis of why equality was violated, rather than—or in addition to—simply tracking selective agents.

A promising way to disentangle these possibilities would be to present toddlers with agents who distribute resources evenly but unfairly (e.g., ignoring merit; as in Sloane et al., 2012). If toddlers were to exhibit similarly increased attention toward such agents, this would support the interpretation that their responses are primarily driven by sensitivity to moral norm violations rather than by selectivity/inequality alone. Importantly, prior evidence showing that infants react with surprise to unfair distributions—including findings by Sloane et al. (2012) that infants are sensitive to violations of merit-based allocations—is not, by itself, sufficient to adjudicate between these alternative accounts, because in those paradigms infants are presented with test events that explicitly violate

a fairness principle. Hence, increased attention can be interpreted as a response to an expectation violation. In the present context, however, the critical issue is whether sustained attention would also be detectable in test events that do not involve any unexpected outcome, but simply depict agents who previously violated or conformed to infants' expectations. In other words, demonstrating surprise at unfair outcomes establishes that infants hold expectations about fair distributions, but it does not address whether they also possess a mechanism that selectively continues to track agents who have allocated resources in an uneven manner, possibly to infer how best to gain their favor and access their resources. To provide key evidence that toddlers preferentially track selective distributors—rather than simply showing heightened attention to norm violators—it would be useful to show that they display increased attention to test events that do not involve a violation per se, even when the agent's distributions in the familiarization phase, which characterize the agent, are normatively permissible but selective (as in the case of a merit-based allocation).

Moreover, one riveting further competing possibility to our account is that the mechanism of heightened attention we observed reveals a form of vigilance toward norm-violating agents who can be represented as *potential threats*. Evidence of vigilance toward agents who violate social norms, sources of potential threat, and would-be high-rank individuals has been shown both in non-human primates and other animals (Beauchamp, 2015; Chance, 1967; De Waal, 2007; Dimond & Lazarus, 1974) as well as in humans (Boehm, 1999; Cheng et al., 2013; La Freniere & Charlesworth, 1983). This account is also consistent with findings showing that infants and toddlers generalize from distributive behavior to other social expectations, in particular they associate unfair distributors with a greater likelihood of engaging in antisocial actions (Gill & Sommerville, 2023; Surian et al., 2018; Ting & Baillargeon, 2021; Zeng et al., 2026). Such generalization may suggest that unfair agents are not merely encoded as violators of a specific norm, but may be represented more broadly as potentially dangerous individuals, thereby providing a basis for heightened vigilance. Although this richer interpretation goes beyond what the present data can directly address (and indeed the current experiments were not designed to test it) it does suggest a set of testable predictions that may guide future research. In particular, if this vigilance-based account is correct, toddlers should not only attend more to selective distributors, but also show avoidance of such agents, and perhaps heightened sensitivity to their actions across contexts. Conversely, the account that toddlers selectively track uneven distributors to best ingratiate themselves for receiving their resources would predict that toddlers selectively approach such uneven distributors, just as they preferentially approach high-ranking agents for whom others defer and yield (Thomas et al., 2018).

To further and more directly test our original hypotheses regarding whether even/fair or selective/unfair distributors solicit inferences about who will prevail, other avenues for future research involve considering the manner of resolution of the displayed dominance conflict and other acts of deference as well as reducing the inferential complexity required to generate expectations about zero-sum situations. Specifically, in Experiment 1 we used the Mascaro and Csibra (2012) dominance paradigm where a resource conflict is resolved through brute physical force. Insofar as toddlers expect that distributors who perpetuate inequality would themselves be more formidable and likely to prevail, this may not be an issue. However, if toddlers see individuals who distribute resources *equally* among third parties as *leader* figures, the inferential link to a physical fistfight is less straightforward. In contrast, in the Thomsen et al. (2011) right-of-way paradigm, the dominance conflict is resolved through prostration and deferential yielding in the absence of physical force, consistent with both stable and consensual hierarchies indexed by such different formidability cues as physical and coalition size, depth of voice and previous win-lose history all yield effects in this right-of-way paradigm (see Filesi et al., 2025; Pun et al., 2016, 2021; Thomas et al., 2018). Indeed, whereas toddlers selectively reach for agents for whom others yield, they actively avoid agents who win dominance conflicts through brute force (Thomas et al., 2018). Furthermore, the act of prostration, bowing before someone else, is itself a sufficient cue for licensing inferences of obedience to a leader figure (Margoni et al., 2018; Margoni & Thomsen, 2024; see also Seo et al., 2026). In sum, a conflict which is resolved through prostration and voluntary deferral such as in the right-of-way paradigm might reveal any inferences of leadership and consensual social rank based on even versus biased distributive behavior.

Given the complexity of the inferential chain in the current study, it is also possible that 21-month-olds found it difficult to generate dominance expectations. Indeed, to generate such expectations, toddlers would have had to (a) attribute a stable character to the two agents who, crucially, did not interact with each other during the familiarization phase (note that this is more complex than attributing stable relations, see Mascaro and Csibra, 2012), and (b) predict the outcome of the territorial conflict solely on the basis of inferred stable dispositions to distribute resources evenly or unevenly. Additionally, to generate the expectation that the *fair* agent will prevail, toddlers would have had to first represent that agent as a leader acting prosocially, and then *also* expect it to have preferential rights because of its status. To complicate matters further, whereas some infant evidence might currently lend possible support to the hypothesis of an early emerging mental association between inequality and dominance (Surian et al., 2018; Ting & Baillargeon, 2021), no clear evidence supporting an association between equality and rank through leadership attribution is available.

In fact, research on older children shows that preschoolers associate social power (being “in charge”) with indifference toward others' needs (Terrizzi et al., 2020; see also Charafeddine et al., 2015; Gülgöz & Gelman, 2017; Pieper et al., 2024), and do not perceive leaders as entitled to personal gains or special access to group resources (Stavans & Diesendruck, 2021) both of which would speak against any such inferences that even distributors should hold priority rights in conflict. Thus, one might speculate that in Experiment 1 toddlers were in fact expecting the unfair agent to prevail, but because of the inferential complexity required to generate expectations about the given scenarios, they looked longer at what best completed the event, rather than showing surprise (this phenomenon around reverse findings is discussed in Margoni et al., 2024). However, such an interpretation would be unable to account for why, even in the absence of any dominance contest with greatly simplified scenarios (as per our Experiments 3 and 4), toddlers still showed the same response of prolonged looking at the unfair, selective agent; regardless of any possible inferences of conflict outcomes, the fact of selective attention to biased distributors clearly still holds.

More broadly, our main finding—that toddlers exhibit heightened attention toward selective distributors—offers a compelling lens through which to interpret prior findings that may appear counterintuitive. In particular, it can explain the reversed findings reported

in Meristo and Surian (2014). In two related pieces of work (Meristo & Surian, 2013, 2014), 10-month-olds' expectations about positive and negative reciprocity toward fair and unfair distributors were tested. In the 2013 study, infants observed an agent either rewarding a fair distributor (expected event) or an unfair distributor (unexpected event). In the 2014 study, they observed an agent either punishing the fair distributor (unexpected event) or the unfair distributor (expected event). Whereas in the first study infants looked longer at the unexpected event, in the 2014 study they looked longer at the expected event. These findings are difficult to reconcile with the hypothesis that infants were responding to a violation of the expectation that the fair distributor would be punished, but an alternative possibility is that infants looked longer when the unfair agent was punished simply because their attention was already drawn to the unfair distributor. It is possible that other VOE results similarly mask sustained attention toward agents of norm violations or, as recently suggested by Mackiel and Woodward (2026), toward agents whose violations simultaneously provide informative cues about the social relationships among the individuals involved, potentially making violators (e.g., unequal, partial distributors) more informative than non-violators (e.g., equal distributors) (but see also Baillargeon et al., 2026; Thomsen, 2026). Future research could be devoted to uncover such cases.

Finally, an important question concerns the extent to which the present findings are culturally constrained (e.g., Meristo & Zeidler, 2022). On the one hand, the very young age of the participants may limit the influence of culturally specific norms, as 21-month-olds have had relatively limited exposure to culturally variable practices and institutions. On the other hand, toddlers are still exposed to cultural input, and most research in this area has been conducted in Western populations. Future cross-cultural investigations, together with studies targeting even younger children, would help further assess the generalizability of the present findings.

We examined 21-month-old toddlers' reactions to agents who distributed resources evenly or unevenly, and across four experiments the current investigation led us to conclude that toddlers exhibit heightened attention toward selective distributors. The present findings underscore the need for further research to elucidate whether, and under which conditions, toddlers' increased attention to agents who violate core sociomoral norms reflects enhanced cognitive processing that is independent of expectancy violation.

Studies in human

This study was performed in compliance with relevant laws, regulatory frameworks and guidelines where the research took place.

Ethics committee approval was not required under relevant laws and institutional guidelines. The procedure we employed was approved by the Norwegian Centre for Research Data (NSD).

CRediT authorship contribution statement

Francesco Margoni: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Luca Surian:** Writing – review & editing, Supervision, Conceptualization. **Constantinos Hadjichristidis:** Supervision, Conceptualization. **Lotte Thomsen:** Writing – review & editing, Supervision, Resources, Methodology, Funding acquisition.

Informed consent and patient details

Informed consent to take part in the study and to publish the article has been obtained from all participants or their legal representatives. The privacy rights of participants have been observed.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary materials and data

Supplementary materials and data can be found online at <https://doi.org/10.1016/j.cogpsych.2026.101831>.

Data availability

Data and supplementary materials are available on the Open Science Framework (link provided in the paper).

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