



Preschoolers, but not yet toddlers, prefer to allocate epistemic trust to leaders than to bullies[☆]

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ABSTRACT

From toddlerhood, children distinguish respect-based from fear-based power. We tested if, and at what age, epistemic trust is modulated by the type of social power displayed by informants. Italian children ($N = 445$; age range: 1.5–10 years) and adults ($N = 32$; age range: 18–39) were presented with a leader-character and a bully-character, each labeling a different novel object with the same novel word (“zaffo”). When asked to identify the zaffo, toddlers preferentially selected the object labeled by the bully, indicating a possible early bias to trust individuals who display fear-based power. In contrast, older children and adults favored the leader-character's label, demonstrating a developmental shift toward selective learning from respected figures. These findings suggest that preschoolers, but not yet toddlers, privilege epistemic input from respected leader-like figures.

1. Introduction

Research shows that by 21 months, human toddlers represent respect-based social power, that is, legitimate and consensual leadership (Margoni, Baillargeon, & Surian, 2018; Margoni & Thomsen, 2024; see also Thomas, Thomsen, Lukowski, Abramyan, & Sarnecka, 2018; Thomsen, 2020; Stavans & Baillargeon, 2019). Italian, North American, and Norwegian toddlers (Margoni et al., 2018; Margoni & Thomsen, 2024) distinguish between individuals who elicit deference through respect (e.g., being bowed to by others) from those who assert control through coercion or force (e.g., hitting others and taking their resources). Consistent with this distinction, toddlers expect compliance with a respected leader's directive to persist even in the leader's absence, but they do not attribute the same enduring authority to a bully, that is, an agent exercising fear-based social power.

However, the implications of the distinction between respect-based and fear-based power for children's learning remain untested. In the present study, we tested children aged 1.5 to 10 years to determine whether, and at what age, *epistemic trust*—defined as children's willingness to accept new information—is shaped by whether informants display respect-based or fear-based power. This distinction, originally articulated in social power frameworks (French, Raven, & Cartwright,

1959), has now become central to psychological and evolutionary accounts of leadership (Fiske, 1991, 1992; Garfield, Syme, & Hagen, 2020; Glowacki & von Rueden, 2015; von Rueden & Van Vugt, 2015).

Prominent models of cultural evolution propose that humans rely on socially transmitted knowledge to a degree unparalleled among other species, and that human flourishing depends on cognitive mechanisms specialized for acquiring information across generations (Boyd, 2018). A central mechanism in this process is *testimony*—the capacity to acquire knowledge from others' communicated information—which plays a foundational role in cognitive and socio-cultural development (Harris, Koening, Corriveau, & Jaswal, 2018). Cultural information—including knowledge, beliefs, norms, preferences, and skills—is therefore transmitted not primarily through individual discovery or indiscriminate imitation, but through systematic social learning biases (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981; see also Mesoudi, Whiten, & Laland, 2006). These include conformist bias, which favors majority-endorsed behaviors (Henrich & Boyd, 1998), as well as content-sensitive biases, such as *prestige bias*, whereby learners preferentially acquire information from respected or successful individuals—a mechanism central to the present paper.

Competence-based evolutionary models of leadership converge with this framework by proposing that prestige-based

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leadership—characterized by freely conferred respect and influence—evolved to enhance group welfare and facilitate the transmission of culturally valuable knowledge (Henrich & Gil-White, 2001; Van Vugt & von Rueden, 2020). By contrast, individuals who display dominance grounded in fear, coercion, or aggression, offer limited epistemic benefits, as such individuals prioritize self-interest over group welfare, and do not reliably signal competence, thereby potentially undermining group cohesion and cooperative information exchange. Together, these accounts predict that humans possess evolved social learning biases that favor prestigious over dominant models. Such biases are assumed to emerge early in development, supporting the efficient transmission of knowledge across generations. However, their developmental origins remain poorly understood: it is unclear how early children privilege respected leaders over bully-like dominant figures as sources of information. The present study addresses this gap by testing whether children's epistemic trust selectively favors individuals who display respect-based, as opposed to fear-based power.

While it remains unknown whether children preferentially learn from individuals displaying respect-based rather than fear-based power, a large body of research shows that children's learning is selectively guided by a number of informants' epistemic and social characteristics (Koenig, Li, & McMyler, 2022; Tong, Wang, & Danovitch, 2020). From early in development, children rely on epistemic cues such as knowledgeable, expertise, and confidence in relaying information, as well as social cues, including kindness, familiarity and shared language, when acquiring new words, object functions, or beliefs. Importantly, this work demonstrates that preschoolers not only selectively trust informants based on epistemic competence (knowledgeable vs. ignorant) and, more broadly, sociomoral character (prosocial vs. antisocial), but also—relevant to the present study—attend to cues of *social dominance*, at least in some contexts, when evaluating whom to learn from. Evidence in this domain shows that children's learning is sensitive to asymmetries in social power, although they do not uniformly privilege dominant individuals—those who prevail in competitive, often zero-sum, interactions—and direct comparisons between different forms of social power remain scarce. Specifically, studies examining dominance-based asymmetries indicate variable learning preferences: preschoolers sometimes preferentially trust dominant over subordinate agents (Bernard et al., 2016; Castelain, Bernard, Van der Henst, & Mercier, 2016; see also Flynn & Whiten, 2012), a pattern paralleled in non-human primates, where copying biases favor dominant or high-ranking over subordinate or low-ranking individuals (Horner, Proctor, Bonnie, Whiten, & de Waal, 2010; Kendal et al., 2015). However, this pattern is not consistently observed across contexts, with Japanese children selectively trusting subordinate over dominant agents (Charafeddine et al., 2019) and Norwegian children showing no differentiation between the two (Fonn, Zahl, & Thomsen, 2022).

Please note, however, that while these findings highlight children's sensitivity to dominance and possibly social power, they do not directly inform predictions regarding respect-based versus fear-based power—the primary focus of the present study. The only study to date that instead directly contrasted prestige-based and dominance-based informants found that older children preferentially learned from a prestigious individual, described as friendly and voluntarily imitated by others, rather than from a coercive and aggressive individual (Sequeira, Afshordi, & Kajanus, 2024). Whereas 4- to 8-year-olds showed no clear preference, 9- to 11-year-olds favored the prestigious informant for learning, with 58% choosing the prestigious over the dominant individual, suggesting the emergence of a modest preference for prestige over dominance as a source of knowledge (see also Kajanus, Afshordi, & Warneken, 2020). Using stimuli tailored for school-age children and sampling 4–11-year-olds, this study thus documents a late-emerging, still relatively weak, preference for a prestigious (i.e., friendly, voluntarily imitated) over a coercive informant. In contrast, the present research examines whether such a bias can be detected earlier in development—potentially as early as toddlerhood—by leveraging

previously validated stimuli, shown to elicit robust representations of respect- versus fear-based social power in both toddlers and adults (Margoni et al., 2018; Margoni & Thomsen, 2024).

1.1. The present study

In the present study, we administered a *labeling task* to children aged 1.5 to 10 years and to a group of adults. Participants were introduced to two geometric-shape agents: one depicted as a leader (bowed to by followers and voluntarily given a resource) and one depicted as a bully (who used physical aggression to seize resources from the others). As anticipated above, these characterizations rely on stimuli validated in prior research showing differential responses to respect-based versus fear-based power from early in development (Margoni et al., 2018; Margoni & Thomsen, 2024; see also Margoni, Nava, & Surian, 2022). Notably, this previous work also indicates that toddlers expect continued obedience to leaders but not to generally friendly agents, and that adults reliably interpret these characters as embodying leadership and bullying, respectively, distinguishing the leader from merely prosocial or neutral figures (Margoni et al., 2018). Importantly, unlike in the study by Kajanus et al. (2020), where friendliness was confounded with being followed by others, our stimuli disentangle social power from general likability.

To characterize the informants, *bowing* was employed as a cue due to its cross-cultural role in signaling respect (Fiske, 1991, 2004; Mallery, 1891) and its parallels in prostration behaviors observed across species (e.g., Brown & Maurer, 1986; Buston, 2003). Crucially, bowing alone reliably elicits expectations of spontaneous obedience in toddlers (Margoni & Thomsen, 2024), and in adults it likewise supports authority attributions and obedience expectations even when directed toward a social robot (Seo, Margoni, Itakura, & Kanda, 2025). Conversely, the forceful imposition of costs on group members in the bully scenario was intended to evoke representations of fear- or coercion-based power, consistent with prior findings (Margoni et al., 2018, 2022). Following this initial characterization phase, the leader and bully agents provided conflicting testimonies regarding the referent of a novel word, “zaffo”. Each agent pointed to a different unfamiliar object on screen, uttering, “This is a zaffo! Look, a zaffo!” (see Fig. 1). Subsequently, participants were shown the two novel objects alongside a familiar object (a cube) and were asked to hand the object labeled *zaffo* to the experimenter.

1.2. Transparency and openness

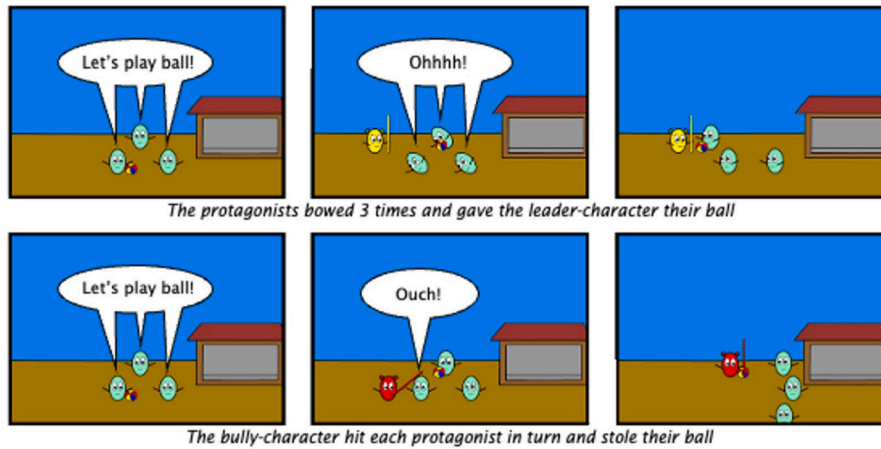
Supplementary Material (SM), Movies S1-S4, and raw data are accessible at OSF: <https://osf.io/p5hm8/overview>. Although the study was not initially pre-registered, an additional data collection involving toddlers and preschoolers was pre-registered (<https://aspredicted.org/k39r-b32c.pdf>). Although the additional data collection was initially conceived as a replication, the datasets were subsequently pooled because the target population and experimental procedure were identical. Accordingly, the pre-registered data are analyzed here in combination with the original, non-preregistered dataset to increase statistical power and improve the precision of the estimates. Analyses conducted on the original dataset alone are reported in the SM and are overall consistent with the main patterns observed from the combined dataset.

2. Materials and methods

2.1. Participants

Participants were 445 Italian children aged 1.51–11.18 years and 32 adults (participant demographics by age group are provided in Table 1). Another 14 toddlers (age group: 1–2 years) were tested but excluded because they did not give any object to the experimenter when prompted to hand over the zaffo (11) or because they chose to give an object after 90 s elapsed (3). Participants were recruited in two cities in

Familiarization Trials



Object-Labeling Trial



Action Test

"Please, give me a zaffo!"



Fig. 1. Children were introduced to a leader-character (yellow) and a bully-character (red). Subsequently, each agent labeled a different novel, unfamiliar object “zaffo”. In the action test, children were prompted to hand over the “zaffo” from the objects displayed. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 1
Participant demographics by age group.

Age group	N	N Female	M _{Age}	Min _{Age}	Max _{Age}
1–2 years	40	23	2.06	1.51	2.62
3–4 years	124	63	3.99	3.00	4.98
5–6 years	99	52	5.85	5.00	6.99
7–8 years	83	38	8.13	7.01	8.99
9–10 years	99	52	10.02	9.05	11.18
Adults	32	19	26.13	18.00	39.00

the Northern part of Italy (Trento and Milano). Parents provided informed consent, and the research was approved by the University of Trento and the University of Milano-Bicocca Ethics Committees.

Sample size for the child sample was determined by an a-priori power analysis (performed with G*Power 3.1; Faul, Erdfelder, Buchner, & Lang, 2009) for a logistic regression testing the effect of age (continuous predictor, normally distributed) on children’s trust in leader’s vs. bully’s testimony. To detect an Odds Ratio = 1.5 (that is, the difference between 50% of the youngest children and 60% of the oldest

children trusting the leader’s testimony, which is an increment of 10 percentage points, an effect that can be considered small in size), with alpha set at 0.05 and power of 0.80, a minimum total sample size of 208 participants was required. We therefore targeted this sample size, collecting additional data as permitted by practical constraints (e.g., number of parental consents returned following recruitment), and to guard against the possibility that the main effect of age on children’s responses was smaller than predicted (Perugini, Gallucci, & Costantini, 2014), resulting in a final sample of 337 participants. After this initial data collection, we pre-registered a second data collection (<https://aspre dictated.org/k39r-b32c.pdf>) and added 12 toddlers, 32 3-year-olds, 32 4-year-olds, and 32 5-year-olds, resulting in a slightly larger 3–4 years age group than the others and a total sample of $N = 445$. Analyses reported in the main text are based on the final combined sample; analyses conducted on the original sample ($N = 337$) are reported in the SM.

2.2. Design and procedure

Participants underwent two familiarization trials, one object-labeling trial, and a subsequent test question. Each familiarization

trial involved a 25-s computer-animated event. In one trial, the agent was depicted as a leader: following prior research (Margoni et al., 2018, 2022), three protagonists bowed and handed their ball to the leader-character (Movie-S1). In the other, the agent was characterized as a bully, who hit the protagonists with a stick and forcibly took their ball (Movie-S2). Events looped until trial completion for toddlers (see SM for criteria) or were played three times for older children. Next, the object-labeling trial featured a 60-s animation in which the leader and bully agents each pointed to a different novel object, uttering, “This is a zaffo! Look, a zaffo!” (Movie-S3). Afterwards, participants saw the two novel objects alongside a familiar cube arranged on a cardboard, and were prompted by the experimenter to hand over “the zaffo” (“Please, give me the zaffo!”). For toddlers only, an additional preferential looking test was administered after the object-labeling trial and before the action test: a 40-s movie in which the two novel objects were displayed while a voice-over prompted infants to locate the “zaffo” (Movie-S4). Moreover, in the action test, toddlers received six objects in total (two exemplars of each novel object and two familiar cubes; see Fig. 1), and were prompted to hand over “a zaffo”. Agents’ colors (leader yellow vs. red) and the order of familiarization trials (leader first vs. second) were counter-balanced across participants within each age group. The SM contains a full detailed description of materials and methods.

3. Results

Fig. 2 displays the proportion of participants in each age group (1–2, 3–4, 5–6, 7–8, 9–10 years, and adults) who handed over the object labeled by the leader-character. Excluding responses of participants who chose the familiar object (i.e., the cube), which might simply indicate a failure to learn or apply the novel label and therefore do not inform preferences between the two informants, the proportion of children who handed over the object labeled by the leader-character increased from 33% in toddlerhood to 84% at 9–10 years. To analyze these results statistically, we conducted a generalized linear model with age (continuous, 1.51–11.18 years) and sex (female, male) as predictors, and children’s response (bully, leader) as the outcome. The model revealed a significant effect of age, $\chi^2(1, 420) = 26.18, p < .001$. To further qualify this result, we performed two-tailed binomial tests within each age group against chance level (0.50). Significant effects are marked in Fig. 2 (top panel), and full analyses are available on OSF. The results indicate that toddlers (1–2 years) tended to trust the bully-character (67%, $p = .080$), whereas 3–4-year-olds showed the opposite tendency, trusting the leader-character (65%, $p = .002$), a tendency which remained significant across all older age groups (69–84%, $ps < .001$).

Aggregating ages into two-year bins increased statistical power and estimate precision, but at the cost of a coarser developmental resolution. Thus, to more precisely determine the onset of a preference for the

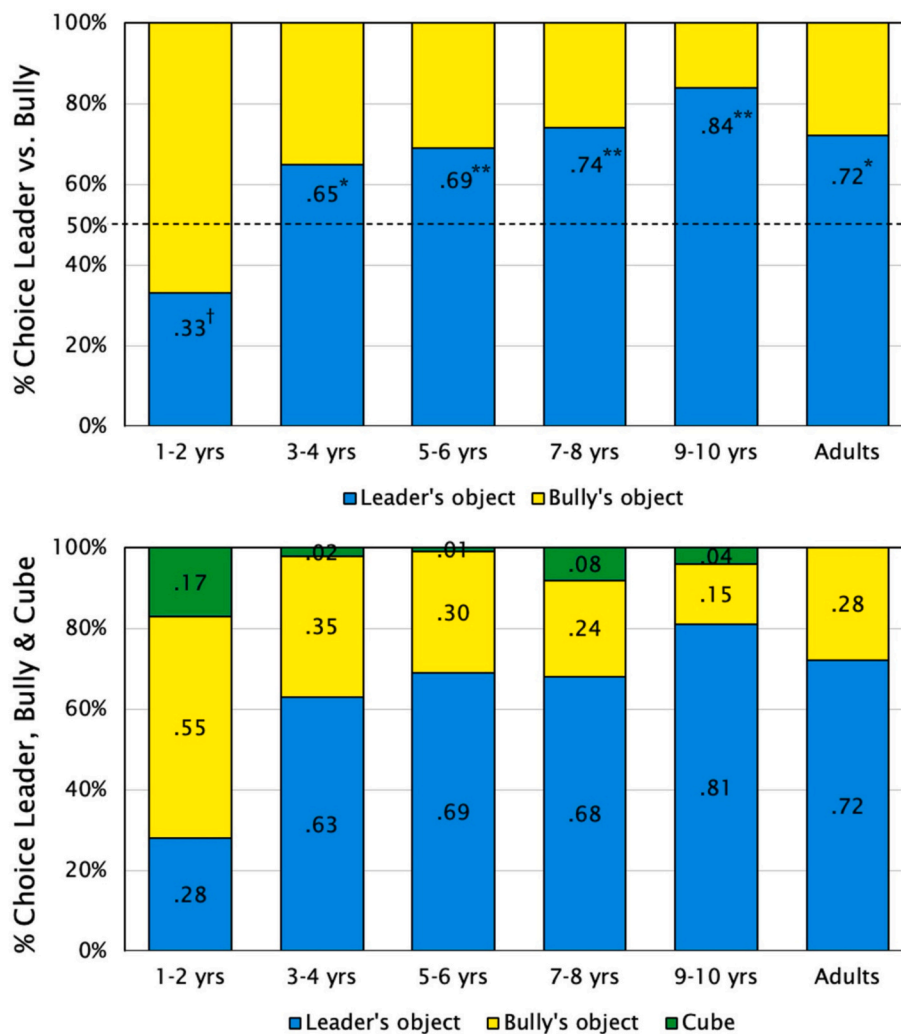


Fig. 2. Proportion of participants who handed over the object labeled by the leader (blue) or the bully (yellow), excluding (top panel) or including (bottom panel) participants who chose the familiar object (green). † $p = .080$, * $p < .050$, ** $p < .001$. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

leader-character during the preschool years, we conducted exploratory binomial tests separately for ages 3, 4, and 5. Three-year-olds did not differ from chance (63%, 37/59, $p = .067$), whereas 4-year-olds (66%, 41/62, $p = .015$) and 5-year-olds (64%, 39/61, $p = .040$) reliably endorsed the leader-character's label, indicating that this tendency emerges by age 4. Notably, however, the proportions are similar in magnitude across adjacent ages, suggesting a shift in statistical reliability rather than a marked change in effect magnitude.

In addition, for the toddler subsample, the preferential looking task provided no evidence of a preference for either informant: first looks were at chance (17/34 toward each object, $p = 1.00$), and looking times did not differ between the object labeled by the leader and the object labeled by the bully ($M = 11.58$ s vs. 11.48 s), $t(32) = 0.09$, $p = .928$ (see SM for full analyses).

At the descriptive level, some children – including 4% of the 9–10-year-olds – selected the familiar object (see Fig. 2, bottom panel). This may reflect misunderstanding, inattention, or uncertainty when faced with a genuinely ambiguous social scenario. Still, including these responses in the analysis yielded similar if not stronger effects (see Fig. 2, bottom panel): endorsement of the leader-character increased from 28% in toddlers to 63% in young preschoolers. Full statistical details are available on OSF.

Moreover, analyses restricted to the original sample (i.e., excluding the pre-registered additional data collection added to increase statistical power and precision of the estimates) yielded a highly similar pattern of results, with comparable percentages in each age group. The only notable difference was that, in the 3–4-year group, endorsement of the leader-character (62%) was a non-significant trend, $p = .087$. Importantly, however, this percentage is still very close to the 65% observed in the combined sample, indicating convergent estimates across datasets. Full analyses are reported in the SM.

4. Discussion

We investigated the tendency to preferentially trust respected leaders over coercive bullies in children aged 1.5 to 10 years to identify when this learning bias emerges and how it develops. In doing so, we probed the developmental origins of core psychological biases that underpin the cultural transmission of information. The results support two main conclusions. First, although toddlers differentiate between respect-based, legitimate power and fear-based, coercive power (Margoni et al., 2018), they do not yet appear to use this distinction to guide selective learning in the hypothesized direction. Indeed, a reliable tendency to learn from individuals displaying legitimate, respected power—central to evolved leadership–followership relational cognition (Fiske, 1992; Henrich & Gil-White, 2001)—emerges only in the preschool years and strengthens with age. Second, an opposite and unpredicted, trend-level tendency emerged for toddlers to trust fear-based over respect-based informants; we outline possible explanations below reminding, however, that the finding remains exploratory and requires replication.

Cultural evolutionary frameworks propose that the intergenerational transmission of knowledge depends not on indiscriminate, unbiased copying, but on structured selectivity in whom learners attend to and trust (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981; see also Mesoudi et al., 2006). Within this perspective, prestige-based learning—preferential uptake from prestigious individuals or from individuals who command voluntarily conferred respect—has been proposed as a key mechanism for the efficient diffusion of culturally valuable information, in contrast to learning from models who exert influence through threat or coercion (Henrich & Gil-White, 2001). Despite the centrality of this proposal, developmental evidence bearing directly on early-emerging prestige-sensitive learning has been limited. The present findings address this gap by showing that a reliable preference to learn from individuals displaying respect-based power is evident by the preschool years, emerging reliably by age 4 (66%) following a non-significant tendency at age 3 (63%) and persisting

across older groups (approximately 69–84%). Notably, this preference emerges earlier and more robustly than in the only prior study that directly contrasted prestige- and dominance-based informants: Sequeira et al. (2024) reported a relatively weak preference for a prestigious over a coercive informant (58%) in 9- to 11-year-olds, with no clear bias in younger children. We likely facilitated the detection of this bias in much younger, preschool children by using stimuli that were validated for eliciting representations of respect- versus fear-based power even in toddlers (Margoni et al., 2018; Margoni & Thomsen, 2024).

The pattern revealed in the present study is consistent with accounts linking prestige to epistemic value, yet it also indicates that selective trust in respected leaders emerges only in the preschool years, not in toddlerhood, despite toddlers' capacity to distinguish different forms of social power (Margoni et al., 2018). One admittedly tentative explanation, consistent with a life-history perspective on the timing of adaptive social-cognitive developments (Sheskin, Chevallier, Lambert, & Baumard, 2014), is that early childhood following toddlerhood represents an evolutionarily optimal window for the emergence of prestige-based learning. Across human evolutionary history, this period may have marked the point at which children began participating more actively in the broader social group and required the cognitive and cultural tools necessary for effective engagement in cooperative, hierarchical communities. This account remains speculative and warrants further testing—for example, by examining whether a similar developmental trajectory is observed when children are directly embedded within the social group rather than observing leaders and coercive individuals from a third-party perspective.

This account may also be tempered by the observation that infants and toddlers already exhibit sophisticated sociomoral cognition and early forms of social selectivity—including behavioral preferences and approach–avoidance tendencies—well before such capacities are fully deployed in complex social interactions (e.g., Margoni & Tan, 2026; Ting, Buyukozer Dawkins, Stavans, & Baillargeon, 2020). However, although young children must begin acquiring socially relevant information from early in development, a prestige-based learning bias may represent a more specialized form of epistemic selectivity. Early-emerging social-cognitive capacities may instead function as foundational mechanisms that enable infants and toddlers to navigate their social environment, interpret others' behavior, and begin acquiring social norms. During this period, children may rely on other forms of social learning selectivity that support basic social interpretation and engagement (Poulin-Dubois & Brosseau-Liard, 2016), with selective learning from prestigious individuals emerging along a later developmental trajectory. In this sense, the present findings might constitute a developmental case in which social representations precede their functional deployment in learning and decision-making.

A second possibility to explain the developmental pattern observed in the present study is that children's endorsement of a leader over a bully is not driven solely or mainly by epistemic trust—understood narrowly as judging who is the better source of information—but also by broader social motivations. Children's preference for leaders may reflect increasing affiliative tendencies, such as aligning with positively valued or socially respected individuals. Within this alternative perspective, one could even propose that children in the present study were responding affiliatively to positively valued agents and/or avoiding negatively valenced, antisocial agents, thus construing the task in terms of social affiliation rather than power or epistemic evaluation. Although this account is theoretically possible, prior research shows that toddlers already avoid agents who prevail through coercion and prefer those who are voluntarily deferred to (Thomas et al., 2018), and more generally show affiliative preferences for prosocial over antisocial agents (Margoni & Tan, 2026). This indicates that social selectivity based on the sociomoral or social valence of actions—on which this alternative explanation would rely—emerges earlier than the developmental shift observed here, making it unlikely that the present findings can be fully explained by affiliative motivations alone. Still, future research could

aim to more clearly disentangle respect-based or prestige from general positivity, and fear-based power from general negativity or antisociality, despite the inherent challenges, in order to determine the extent to which the learning effects we observe are driven by the social valence of leadership and bullying versus the specific forms of power themselves.

Next, the current study also yielded an unpredicted finding. In the main action task, only 33% of toddlers trusted the leader—a proportion that contrasts sharply with the 65% of younger preschoolers who did so, but which only approached statistical significance ($p = .080$) and was not supported by the preferential-looking test measure, which showed no evidence of a learning preference. This finding therefore requires replication, and the interpretation we offer here regarding why toddlers might be more inclined to trust a bully-like character is exploratory. Moreover, this finding should be interpreted with caution also in light of procedural differences between toddlers and older participants. Recall that toddlers completed an additional preferential looking trial before the action test and, in the latter, were presented with six objects rather than one per type as in the older groups. In general, the task may have been particularly demanding for toddlers, requiring them to represent two forms of social power, maintain informant–object associations, and succeed across two sequential tests. Under these cognitive demands, toddlers may have relied on the more perceptually and socially salient agent—which, in this paradigm, may have been the bully. Indeed, one speculative possibility is that coercive, fear-based actions elicit stronger attentional engagement than respect-based interactions, thereby strengthening the bully–object association (although this claim is difficult to test with the current or past data, since the familiarization phase was designed for maximum looking time rather than for comparing attention to bullies versus leaders; nevertheless, some evidence suggests that toddlers do show heightened attention to violators of moral principles; see e.g., Margoni, Surian, Hadjichristidis, & Thomsen, 2025). However, this explanation remains tentative and requires direct empirical testing.

Beyond the more conservative alternative just discussed, a second, theoretically more informative possibility is that the data reveal an early-emerging bias that may reflect an evolutionarily ancient proclivity to attend to and follow physically dominant individuals, rather than those who wield respect-based, legitimate power. Indeed, this tendency appears to persist into adulthood to some extent (Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013; McClanahan, Maner, & Cheng, 2022), and a possibly related tendency—namely, the social selection of antisocial versus prosocial agents—has been documented in one of our closest primate relatives, the bonobo (Krupenye & Hare, 2018; see also Townrow & Krupenye, 2025). This might also be consistent with classical observational studies showing that coercive strategies regulate, to some extent, patterns of imitation and affiliation in infancy, toddlerhood, and early preschool years, but they cease to play a major role by middle childhood (e.g., Hawley, 2003; Russon & Waite, 1991; Strayer & Trudel, 1984). Under this interpretation, dominance cues—such as physical strength or coercive control—may serve, early in development, as more salient or evolutionarily prioritized signals of influence or competence than prestige-, respect-, or prosocial-based cues. However, this interpretation remains speculative and requires direct empirical testing.

In conclusion, we investigated the origins and developmental of children's epistemic trust in respected leaders versus coercive bullies, testing ages 1.5 to 10 years. This study provides the first evidence that selective trust in non-coercive, respected informants emerges in early childhood but is notably absent in toddlerhood.

CRedit authorship contribution statement

Francesco Margoni: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Elena Nava:** Writing – review & editing, Resources, Investigation, Data curation. **Luca Surian:**

Writing – review & editing, Supervision, Resources, Methodology, Investigation, Conceptualization.

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Declaration of competing interest

The authors declared no competing interest.

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