

The boss is not always right: Norwegian preschoolers do not selectively endorse the testimony of a novel dominant agent

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Abstract

Theories of cultural evolution posit that cues of competence-based prestige, rather than formidability-based dominance, should guide culturally transmitted learning, but recent work suggested that French and Kaqchikel Guatemalan preschoolers place their epistemic trust in dominant others. In contrast, this study shows that 249 three- to six-year-olds (116 girls, tested between 2016 and 2018 across metropolitan locations with varying ethnic composition and socioeconomic status) randomly endorsed the word-labels of dominant and subordinate agents in the egalitarian culture of Norway, using stimuli which solicit dominance inferences among infants and manipulating anonymity across studies to control for egalitarian desirability bias. A meta-analysis estimated that 48% endorsed the dominant's testimony. This demonstrates that the tendency to endorse the epistemic claims of dominant individuals does not emerge reliably in early childhood.

Most of what we learn through life, we learn from others. When the information provided by different people conflicts, children must decide whom to trust and learn from, and whom to ignore, and in order to become competent cultural members they must learn to make these decisions appropriately. Correspondingly, a large developmental psychological literature has shown that children are sensitive to a host of social cues when determining whom to trust in the face of conflicting information. When using *word learning* and *testimony* paradigms—where two agents give conflicting information about what a novel object is called (e.g., a “catif” or “botus”), or about what happened (the dog ran this way or the dog ran the opposite way), respectively—the social cues that make young children selectively trust the epistemic claims of an agent include for instance their *familiarity* (Corriveau & Harris, 2009), *age* (Jaswal & Neely, 2006), *consensus* (trusting majority statements over dissent; Corriveau et al., 2009), and (majority/in-group)

native linguistic accent (Corriveau et al., 2013; Kinzler et al., 2010).

In addition to the social characteristics above, social hierarchies, too, are ubiquitous across human cultures (Fiske, 1991; Sidanius & Pratto, 1999), and even preverbal infants and toddlers recognize social dominance and hierarchy and use it for navigating their social world (e.g., Enright et al., 2017; Margoni et al., 2018; Mascaro & Csibra, 2012; Pun et al., 2016; Thomas & Sarnecka, 2019; Thomas et al., 2018; Thomsen et al., 2011; for review see Thomsen, 2020). A rapidly expanding body of work has also demonstrated early, sophisticated representations and motives for social hierarchy among preschoolers (e.g., Brey & Shutts, 2015; Charafeddine et al., 2015, 2016, 2019; Enright et al., 2020; Gülgöz & Gelman, 2017; Terrizzi et al., 2019, 2020), and indeed French and Kaqchikel Guatemalan preschoolers have been shown to selectively trust the epistemic claims of dominant agents (Bernard et al., 2016; Castelain et al., 2016).

Abbreviation: BF, Bayes factor

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In these studies, preschoolers were told illustrated stories about two novel agents engaging in a physical fight (Bernard et al., 2016; Castelain et al., 2016) or a verbal disagreement (Bernard et al., 2016). Next, they were asked to indicate which of the two agents—the winner or the loser—knew the whereabouts of a missing animal (Bernard et al., 2016; Castelain et al., 2016) or the correct object label of a novel object (Bernard et al., 2016). The authors found that the majority of the preschoolers endorsed the claim of the prevailing (dominant) agent, and suggested that preschoolers heuristically infer competence from dominance (Bernard et al., 2016). Two additional studies may qualify this cross-culturally convergent, empirical picture: Fusaro et al. (2011) found that 19/28 US preschoolers selectively trusted a novel word label provided by a stronger puppet, but this trend fell short of significance. Conversely, Charafeddine et al. (2019) found that 29/44 Japanese preschoolers selectively endorsed the testimony of a subordinate, rather than dominant, agent, $p = .049$. If one Japanese preschooler had chosen differently, however, the resulting 28/44 binomial outcome would also have fallen within chance ($p = .096$), as was also the case when Japanese preschoolers chose whether to identify with the dominant or subordinate agent. Hence, these prior findings bear further replication before strong, and theoretically important, conclusions are warranted regarding the general effect of dominance status on epistemic trust among preschoolers.

Why might preschoolers selectively endorse the claims of coercively dominant agents? Selective attention to dominant others has deep evolutionary and developmental roots which might extend to their epistemic claims. Among chimpanzees, dominant individuals are copied more than are subordinates (Kendal et al., 2015), and mice, capuchin monkeys, and macaques have all been reported to monitor dominant individuals, presumably because this allows them to adjust their behavior to avoid conflict (Curley, 2016; Deaner et al., 2005; Pannozzo et al., 2007). Similarly, early ethological observational studies showed that dominant preschoolers were watched and selectively imitated more by their peers (Abramovitch & Grusec, 1978; Freniere & Charlesworth, 1983; Vaughn & Waters, 1981). Adults, too, pay more attention to dominant than subordinate individuals (Cheng et al., 2013) and dominant individuals are more likely to attain influence in groups across various domains because people yield to their directions (Anderson & Berdahl, 2002; Cheng et al., 2013). Many evolved cues for prestige, leadership, and dominance also converge, including physical size and posture (cf. Fiske, 1991; Thomsen et al., 2011), and indeed preschoolers infer skills at playing a non-descript game, as well as dominance, from the same postures (Charafeddine et al., 2015). This further supports the suggestion of previous research that young children may use dominance as a heuristic to infer competence and prestige or, alternatively, may conflate the two

because they both relate to social rank (Bernard et al., 2016).

If preschoolers do generally conflate formidability-based dominance and competence across culture, however, it would contradict a key aspect of prominent theoretical models regarding the evolution and transmission of culture and its sustenance by evolved learning biases (Henrich, 2017; Henrich & Gil-White, 2001; Richerson & Boyd, 2005). A central argument here is that people will freely follow and defer to prestigious, especially competent and knowledgeable, individuals in return for having the chance to learn from them. Thus prestige—rather than dominance based on strength and coercion—should selectively induce rank-based socio-cultural learning biases. Moreover, it should be possible to recognize prestigious, especially competent individuals from the popularity and freely conferred, ingratiating deference which they enjoy among their followers. Resorting to physical coercion, then, would presumably indicate a lack of prestige, competence, and stable high rank for which others defer (cf. also Thomas et al., 2018; Thomsen, 2020).

Beyond the *learning* of culturally transmitted knowledge, selection pressures for following leaders may also result from the various other benefits they might confer upon their followers, in particular relating to critical group coordination, including sanctioning free-riders and making complex, strategic decisions (e.g., Hagen & Garfield, 2019; Pietraszewski, 2020; Price & Van Vugt, 2014). While especially skilled or knowledgeable individuals should be more able and willing to confer such benefits to their followers (Hagen & Garfield, 2019), dominant individuals might instead secure their own interests at the expense of conferring any benefits to others (Pietraszewski, 2020). Indeed, ethnographic evidence suggests that across cultures and subsistence systems, leaders are more likely to confer benefits than impose costs, and they are more often described as skillful and knowledgeable than as physically formidable (Garfield et al., 2020). Thus, evolution might have favored mechanisms for differentiating especially knowledgeable and skillful individuals from dominant and coercive ones, not only for the sake of broadly epistemic reasons (i.e., learning biases to support cultural transmission), but also for the ability and willingness of competent leaders to coordinate groups and confer other benefits. Still, if prestigious leaders are generally competent, one would expect these cues, rather than those of coercive dominance, to heuristically guide epistemic trust.

This begs the question if young children adequately make the distinction between coercively dominant and more “pro-social,” prestige and competence-driven forms of social rank and leadership (cf. also Hawley, 1999). Socially transmitted cultural learning is a cumulative process starting in earliest childhood. Hence, it should be adaptive for young children to distinguish cues of prestige and leadership from dominance in

order to learn culturally transmitted knowledge from especially competent others, in parallel with the emergence of several other social learning biases (e.g., Corriveau & Harris, 2009; Fusaro & Harris, 2008; Kinzler et al., 2010). Indeed, 5- to 7-year-old children (Kajanus et al., 2020) likely recognize the distinction between dominance and prestige, and even toddlers are sensitive to the difference between respect-based and coercion-based uses of power, expecting that the directions of the former but not the latter will be followed in their absence (Margoni et al., 2018). Moreover, 3- and 4-year-old preschoolers selectively learn from an agent to whom bystanders have devoted selective attention (Chudek et al., 2012). Together, these studies suggest the possibility that *prestige* or *leadership* may be specifically represented early in life, and hence might selectively cue competence and guide early socio-cultural learning during the massive enculturation process that is early childhood.

In contrast, and importantly, the prior results that French and Kaqchikel preschoolers selectively trust the epistemic claims of someone who won a physical resource fight directly question the theoretical model that evolved prestige biases sustain cultural learning and that these learning mechanisms emerge in early childhood to help acquire socially transmitted cultural knowledge (Chudek et al., 2012; Henrich, 2017; Henrich & Gil-White, 2001; Richerson & Boyd, 2005, see also Cheng, 2020; Thomsen, 2020). Rationally speaking, agents who are more tuned into general consensus views (Corriveau et al., 2009), speak the native language as their mother-tongue (Corriveau et al., 2013), or belong to the ingroup (Chen et al., 2013) might indeed be more likely to know the culturally correct word label of a novel object (which, by definition, reflects ingroup consensus within a language community) or possess culturally appropriate know-how, but it is not obvious why a physically dominant agent would be more likely to do so. Significant theoretical implications thus hinge upon whether preschoolers generally infer competence from coercive, formidability-based dominance.

It is, however, also possible that individuals might defer to dominant others—endorsing, mimicking or yielding to their epistemic claims—for other reasons than epistemic trust. By definition dominant individuals are more likely to get their way in conflict and, *ceteris paribus*, it is adaptive to avoid costly injury by deferring to more formidable, dominant others (Maynard Smith & Parker, 1976). Young children are also acutely attuned to coalitional dominance dynamics (e.g., Lourenco et al., 2016; Pietraszewski & German, 2013; Pietraszewski & Shaw, 2015), suggesting that they may be motivated to go along and ingratiate themselves with dominant others who are potential, valuable coalition partners (cf. Thomas et al., 2018, but see also Bernard et al., 2016; Castelain et al., 2016; Charafeddine et al., 2018). In sum, people including young children may say that a dominant other is right

in order to avoid conflict arising from challenging them and to stay on their good side.

If prior results that French and Kaqchikel preschoolers endorse the epistemic claims of dominant individuals (Bernard et al., 2016; Castelain et al., 2016) reflect that young humans possess an evolved, general learning bias that conflates competence and dominance, then we would expect this effect to generally emerge across culture. If, on the other hand, prior results reflect default attempts at ingratiation and avoidance of aggression, then this effect might depend on the degree to which coercive dominance strategies are accepted practices in a given cultural setting—for instance, between parents and children, teachers and children, or among children themselves. Furthermore, the degree to which people of high prestige tend to also enact coercively dominant, rather than *noblesse oblige*, strategies within a given culture should affect whether children in different cultures observe that dominance and prestige do in fact go together in their local, social world. For instance, people in positions of dominance may have better learning opportunities, or more competent people might be awarded privileges of coercive dominance, to varying degrees across cultural settings, and thus affect whether a heuristic to infer prestige from dominance would prove useful for young children. In particular, experiences with different parenting-styles across culture might affect whether young children experience their closest caregivers as both competent and acting dominantly (cf. also Bernard et al., 2016; Castelain et al., 2016).

Castelain et al. (2016) describe the tested, small-scale Kaqchikel Mayan population in the following manner: “Kaqchikel societies are not egalitarian. Although the hierarchical order does not perfectly track standard dominance, since the elders occupy a high hierarchical position, there is still a strong link between physical dominance and hierarchical position, with men having a higher position than women who have a higher position than children (UNDP, 2014).” One might speculate that a hierarchical society might support culturally specific, experiential confluences of coercive dominance and competence, prestige, and leadership. However, Bernard et al. (2016) found the same effect in what is described as the “relatively egalitarian” French culture. Still, any cultural influences on the effects of dominance on epistemic trust should be even further attenuated in the highly egalitarian Scandinavian culture, as compared to France. For instance, using but one validated typology for cross-cultural comparison (Beugelsdijk & Welzel, 2018; Beugelsdijk et al., 2015; Hofstede, 2001; Hofstede et al., 2010), the most recent Hofstede ranking rates France in the 68th percentile on power distance–inequality, but ranks Norway and Sweden in the 31st, Iceland in the 30th and Denmark in the 18th percentile. Similarly, this most recent Hofstede ranking rates France in the 43rd percentile on masculinity–competitiveness, but

rates Norway in the 8th, Sweden in the 5th, Iceland in the 10th, and Denmark 16th percentile of masculinity–competitiveness, respectively (Hofstede, 2015; see also Bendixsen et al., 2018 and Thomsen et al., 2007 for review and data regarding Scandinavian egalitarianism).

Finally, in principle it is also possible that unconscious, experimenter-induced response bias (cf. Rosenthal, 1976) might account for the prior observations that coercive dominance solicits selective epistemic trust, contradicting theories of cultural evolution. In many “live” developmental paradigms, it is impossible for the experimenter to be unaware of the predicted answer of each participant if the disruption of changing experimenters during the test session is to be avoided. For instance, all prior studies demonstrating an effect of dominance status on epistemic trust (Bernard et al., 2016; Castelain et al., 2016; Charafeddine et al., 2019) describe using a paradigm where the same experimenter first tells the preschool participants a dominance-inducing picture-based story, pointing to the characters, and then conducts the test phase of the study, asking participants to point to which way they think an animal ran or what the correct word label is. In principle, the theoretical possibility that unconscious, experimenter-induced response bias could have influenced results along the lines of experimental hypotheses thus cannot be discounted a priori.

In sum, selective attention to, mimicry of, and deference for dominant others have deep evolutionary roots and lasting effects on adult social psychology, but if preschoolers generally infer competence from coercive dominance and place their selective epistemic trust in dominant others, as suggested by previous work among French and Kaqchikel preschoolers, it would question key theory regarding the evolution of culture and leadership. However, the effect of dominance on epistemic trust may also vary across methodology and culture (cf. Charafeddine et al., 2019), reflecting the cultural degree to which dominance status is valued, enforced, or confounded with competence in real life.

The present research

Here, we further probe the cross-cultural robustness of the effects of dominance rank on epistemic trust in five, fully blinded experiments with Norwegian preschool samples. We tested a total of 249 Norwegian preschoolers, a number which is comparable to the total number of participants ($N = 312$) tested across all earlier studies devoted to the same topic (Bernard et al., 2016; Castelain et al., 2016; Charafeddine et al., 2019; Fusaro et al., 2011).

Our main interest is in the theoretical consequences which an early, systematic conflation of coercive dominance and competence would have for theories of the evolution of culture and leadership. Therefore, we used a word-learning task as our dependent variable because language is a prime example of culturally transmitted

competence and knowledge. We induced dominance rank using stimuli previously shown to elicit dominance inferences even among preverbal infants (Pun et al., 2016; Thomsen et al., 2011) as well as social approach preferences among both infants and toddlers (Thomas & Sarnecka, 2019; Thomas et al., 2018), and we asked preschoolers to indicate which of the two agents—the subordinate or the dominant—they believed knew the correct name of a novel object.

In addition, we varied across studies whether caregivers were present during testing and whether children would think that the experimenter saw what they answered or were assured that he did not. This was to probe the possibility that social desirability biases or cultural display rules might affect our results, masking a true effect of dominance status on epistemic trust. This was of particular importance because we conducted our study in Norway, one of the egalitarian Scandinavian cultures where young children are routinely instructed to act in an egalitarian manner (taking turns and dividing resources and decision rights equally) at home and in preschool. As there were only minor variations between the studies, for sake of brevity we present the methods and results from all five studies together in the same general sections below. Altogether, our hypothesis that young children should not generally place selective epistemic trust in dominant agents was highly theory-driven. Still, given the complexity of culture and its effects on early development, our approach was broadly exploratory.

METHOD

Participants

A total of 249 preschool-aged children were included in the five experiments and their combined meta-analysis ($M_{\text{age}} = 5.06$, range = 3.05–6.92, $SD = 0.96$, 116 girls). The age range was thus similar to that of Bernard et al. (2016) and Castelain et al. (2016), whose sample consisted of 3- to 5-year-olds and 4- to 6-year-olds, respectively. We first ran a pilot study with 29 participants to estimate the effect of dominance status on preschool epistemic trust in Norway (reported here as Experiment 1) and found a strong, highly significant effect (Cohen's $g = .32$). Hence, we aimed at testing 60 preschoolers in the remaining four studies, with power calculations suggesting that we would have a 99% chance of correctly rejecting the null hypothesis when assuming a similar effect size of Cohen's $g = .30$, but that the experiments would also be sufficiently powered at .80 when assuming a comparably smaller effect size, $g = .19$. The final sample sizes of the individual studies did, however, vary somewhat due to the variable number of preschoolers being excluded and because we tested as many children as possible on the days allocated to us in each testing session (typically a single preschool, with a finite number of children to test).

The children were either tested in preschools ($n = 171$), in a science museum ($n = 74$), or an arthouse cinema lobby ($n = 4$), all located in metropolitan Oslo, Norway. Eleven additional children were excluded from the sample: Seven children were excluded for not providing an answer to the experimental task, two were excluded due to parental interference and two were excluded due to an experimenter error. In addition to this, seven children fell outside the pre-specified age range, eight children were not included because parents or caregivers were present during testing (in Experiments 3–5, children were to be tested without direct supervision by a caregiver or a parent) and conversely, two children were excluded for being tested alone (in Experiment 2, all children were to be tested together with a parent or caregiver). The children who were tested in the museum received a small prize for their participation (a rubber popper toy). Table 1 details the sample characteristics for each of the five experiments.

Information about the participants' race or ethnic background was not formally registered due to Norwegian privacy and data protection regulations. However, the public preschool samples were recruited in preschools from all over Oslo. They were socioeconomically and ethnically diverse and, as the preschools themselves, likely to resemble the demographics of greater metropolitan Oslo (of which approximately 30% have immigrant backgrounds, where the major countries of origin are Pakistan, Sweden, Somalia, and Poland, Statistics Norway, 2020). Children tested in the museum and cinema lobby were predominately White, reflecting the customer base which may also be predominantly from a middle-class background. See Supporting Information for more detailed demographic information about the urban districts in which preschools were located.

Material and procedures

In the dominance induction phase in all experiments, the participating children saw a non-verbal animation which we adapted from previous experimental demonstrations that even preverbal infants use the relative physical formidability of novel, animated agents to predict the outcome of zero-sum right-of-way conflict (Thomsen et al., 2011). In contrast to Thomsen et al. (2011), we used agents of the same size, but apart from this, we followed the original

stimuli closely: The two agents took turns crossing a stage in opposite directions before they both meet in the middle, blocking each other's way, after which one of them prostrated before the other and yielded the way for the dominant agent to prevail in crossing the stage (for sample animation, see Supporting Information). In all five studies, the experimenter was unaware which of the two agents was dominant and subordinate (because the experimenter had not seen the animation which was displayed on a touch-screen laptop).

Next, we conducted a standard labeling task (e.g., Corriveau & Harris, 2009; Corriveau et al., 2009; Pasquini et al., 2007): We told participants that the dominant and subordinate agent gave conflicting testimonies regarding the name ("piff" or "paff") of a novel object (a plastic light bulb socket inserted with a pouring spout), and we then asked them which of the two agents they believed was correct. We chose these two novel words for our Norwegian adaptation of the word learning paradigm, because they sound Norwegian and are clearly distinguishable in Norwegian, while also being matched in phonological complexity and ease of processing. Many words in the Scandinavian languages differ phonologically only by the vowel, and these phonological distinctions are regularly typified in common children's rhymes and stories (e.g., *snip, snap, snute, så er den historien ute*) so that the equivalent distinction between *piff* and *paff* would be clear for young children to grasp. Indeed, foundational work suggested that the vowel distinction between I, A, and U, is the most basic distinction found across languages, is the first one acquired by children across most languages, and is the last one lost in aphasia (Jakobson, 1941).

Experiment 2–5 also included a memory check, probing the children's memory for the identity of the agents in the original right-of-way scenario (i.e., in direct translation from Norwegian: "Do you remember that one of them bowed down and became small [as a result of scooting towards the back of the stage]? Can you tell me who that was?"). In Experiment 2, this memory check was followed by a further manipulation check, which probed the children's understanding of the induction phase (i.e., in direct translation *Can you tell me which of the two who is strongest?, Can you tell me which of the two is the least strong?, Can you tell me which of the two who decides the most?, Can you tell me which of the two decides the least?*, and a control question not related to dominance: *Can you tell me which one of the two who likes pizza?*).

TABLE 1 Sample characteristics

Study	<i>N</i>	Gender distribution	Age statistics	Test location
Experiment 1	29	15 girls, 14 boys	$M = 4.6$, $SD = 1$, range = 3.0–6.8	Museum, cinema and preschool
Experiment 2	57	19 girls, 38 boys	$M = 4.98$, $SD = 1.11$, range = 3.08–6.85	Museum
Experiment 3	51	26 girls, 25 boys,	$M = 4.95$, $SD = 0.85$, range = 3.28–6.21	Preschool
Experiment 4	59	24 girls, 35 boys	$M = 5.63$, $SD = 0.81$, range = 3.67–6.92	Preschool
Experiment 5	53	32 girls, 21 boys	$M = 4.86$, $SD = 0.69$, range = 3.30–6.50	Preschool

In Experiment 5, this memory check was also followed by a further general epistemic comprehension task aimed at assessing the validity of our labeling task. Since our adaptation of the labeling task differed slightly from the task used in earlier studies by using the everyday colloquial Norwegian phrasing to ask children which of the two agents they thought was “right”, we asked children which of two novel agents were “right” about the color of a red apple presented to them (with one agent correctly claiming that the apple was red and the other falsely claiming that it was yellow). Figure 1 depicts the procedures across the five experiments. The material is described in greater detail in Supporting Information.

We also varied the following factors across the five experiments: (a) whether or not the child responded in the presence of parents or caregivers, (b) whether or not the study was experimenter-led or automatized (in the latter case, the children responded using a touch screen computer, and all stimuli were presented electronically), and (c) whether or not the child responded in private (by responding while wearing headphones so that the experimenter could not hear the instructions and while the experimenter looked away). Table 2 details how the five experiments differed with respect to these variables.

RESULTS

Did the preschoolers selectively trust the dominant agent?

In Experiment 1, we found a marked tendency among the children to choose the subordinate agent over the dominant one (24 of 29 children chose the subordinate agent, binomial test of this dichotomous variable, $p = .001$). However, this finding was not replicated in Experiment 2, which used a larger sample ($N = 57$) with identical procedures with respect to the labeling task. The only difference between the two studies was that all of the children were tested together with their parents or caregivers in Experiment 2, whereas a small number of children were tested alone in the initial Experiment 1. Indeed, and in contrast to earlier studies of the effect of dominance status on epistemic trust, we found no evidence that children selectively trust the subordinate, nor the dominant agent in the remaining four of five experiments (binomial tests, range: $BF_{01} 1.501\text{--}4.918$, p values: $.117\text{--}.597$, Cohen's $g = .043\text{--}.11$, see Figure 2).

Table 3 summarizes the inferential statistics from each of the five experiments. Here, we also include the results

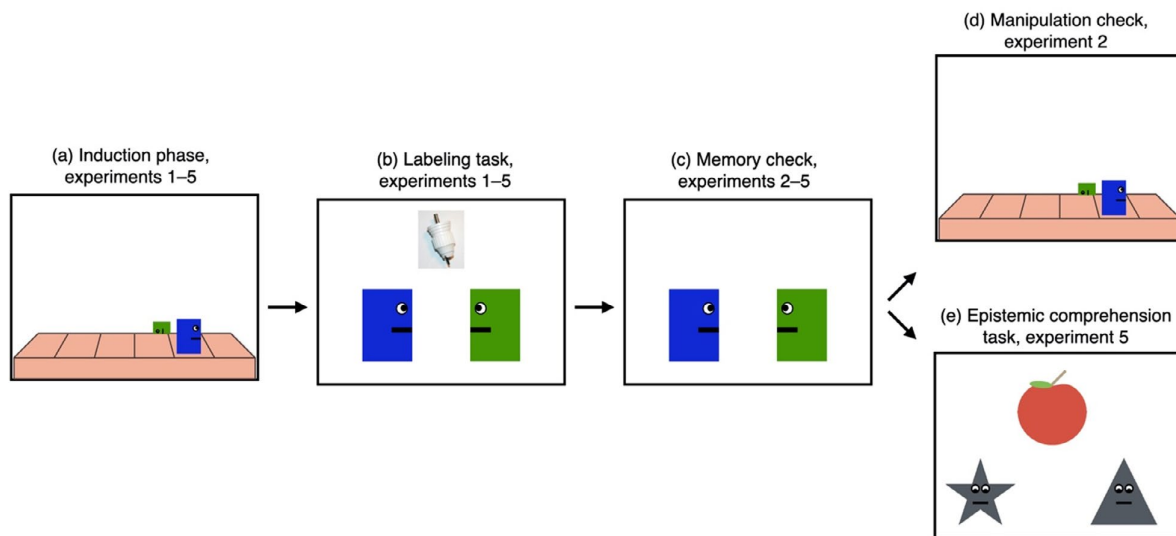


FIGURE 1 Depiction of task order across the five experiments, including the induction phase (a), labeling task (b), memory check (c), manipulation check (d), and epistemic comprehension task (e).

TABLE 2 Differences between the experiments with respect to mode of administration, presence of parents and caregivers, and anonymity while responding

Study	Mode of administration	Caregivers/parents present?	Responding in private?
Experiment 1	Experimenter-led	Mostly	No
Experiment 2	Experimenter-led	Yes	No
Experiment 3	Experimenter-led	No	No
Experiment 4	Automatized	No	No
Experiment 5	Automatized	No	Yes

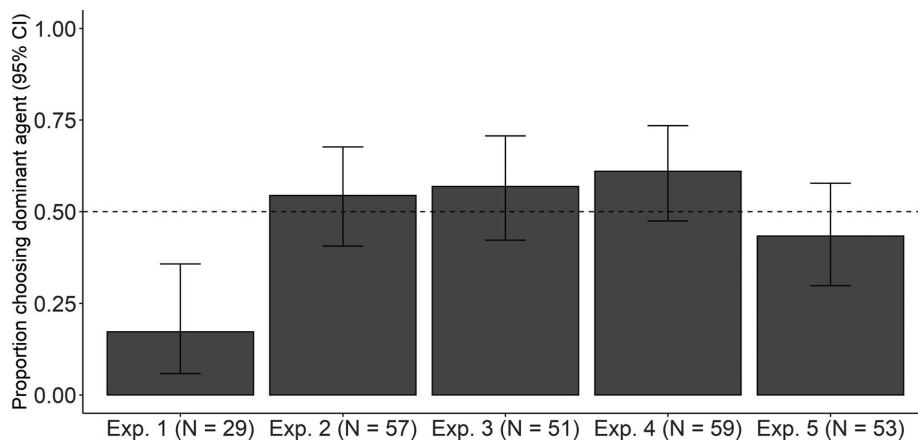


FIGURE 2 Diagram of choices (single proportions) in all experiments, 95% CI, Clopper-Pearson intervals

from Bayesian binomial tests of the same data (for all Bayesian analyses included in this paper we used default priors pre-specified to encompass the likely effect ranges of psychological research in the JASP statistical package, Wagenmakers, Love, et al., 2018; Wagenmakers, Marsman, et al., 2018). With the exception of Experiment 1, Bayes factors (BFs) indicated positive evidence in favor of the null over the experimental hypothesis in the remaining four experiments ($1.501 < BF_{01} < 4.918$). Binary logistic regression analyses did not reveal any age or gender effects in any of the five studies.

Finally, we conducted a meta-analysis to estimate the effect size across the five studies. To do so, we used the `Metaprop` function in the `Meta` package in R (Schwarzer, 2007). Due to the methodological differences between the studies, we assumed a random effects model for our data, assuming studies to estimate a distribution of effects rather than the same underlying effect (Schwarzer et al., 2015). We used a logit transformation for calculating the overall proportion of choices, the confidence intervals were calculated using the exact Clopper-Pearson interval, and the DerSimonian-Laird estimate for assessing the heterogeneity of the studies included in the meta-analysis. As a further check, we obtained very similar results (changes in effect estimates of .01 and confidence intervals of .01–.06) when using the alternative Paule-Mandel estimator as well as the generalized linear mixed model approach, which some recommend over the traditional DerSimonian-Laird method (e.g., Langan et al., 2015; Stijnen et al., 2010).

Assuming a random effects model, this meta-analysis yielded an estimate that the proportion endorsing the dominant's testimony across the five studies was .48 (95% CI [.35–.61]). The heterogeneity of results between the studies was statistically significant ($I^2 = 74\%$, $\tau^2 = .2491$, $p < .01$). The results of the meta-analysis thus suggest that the preschool participants preferred neither a dominant nor a subordinate agent when choosing whom to trust in the face of conflicting information: The effect estimate indicates that roughly half of the children would endorse

the testimony of the subordinate agent and the other half would endorse the testimony of the dominant. This pattern of results is consistent with children simply replying randomly and suggests that the dominance status of the agents did not affect children's epistemic trust in them.

Still, given the large confidence interval of the proportion of children who chose the dominant agent (95% CI [.35–.61]), in principle, the results of the meta-analysis are not inconsistent with there existing one or two opposing effects where small majority of preschoolers would selectively endorse the claim of the dominant or, alternatively, the claims of a subordinate agent. However, disregarding the minor variations across the five studies in their presentation of the same experimental paradigm, a Bayesian binomial test of the pooled data across all five experiments indicated strong support in favor of the null hypothesis (i.e., that the agents' dominance status did not affect preschoolers' epistemic trust in them) over the two-tailed experimental hypothesis (that dominance status had any effect on epistemic trust): Across all five experiments, 124 of 249 children chose the dominant agent, $BF_{01} = 12.603$.

Were the results biased by the presence of parents and caregivers, the mode of administration, or whether children responded in private?

Given the egalitarian, Scandinavian cultural context (cf. Bendixsen et al., 2018; Thomsen et al., 2007) of the present Norwegian test setting, it is possible that cultural display rules for egalitarianism and accompanying social desirability biases might operate and mask any true effect of dominance on epistemic trust. This would be the case if these cultural display rules made children hesitant to confess to endorsing the claims of a dominant agent in front of parents, preschool teachers, or the experimenter, even if children were more likely to endorse the claims of a dominant agent when

TABLE 3 Inferential statistics from experimental tasks included in multiple experiments

Study	Labeling task				Memory check			
	Proportion choosing dominant agent	<i>p</i>	Cohen's <i>g</i>	BF	Proportion choosing correct agent	<i>p</i>	Cohen's <i>g</i>	BF
Experiment 1	5/29 = .17	.001	.33	BF ₁₀ = 150.694	N/A	N/A	N/A	N/A
Experiment 2	31/57 = .54	.597	.043	BF ₀₁ = 4.918	52/53 = .98	<.001	.48	BF ₁₀ = 3.147e+12
Experiment 3	29/51 = .56	.401	.068	BF ₀₁ = 3.604	37/51 = .73	.002	.23	BF ₁₀ = 33.499
Experiment 4	36/59 = .61	.117	.11	BF ₀₁ = 1.501	47/57 = .82	<.001	.32	BF ₁₀ = 57,539.853
Experiment 5	23/53 = .43	.410	.066	BF ₀₁ = 3.737	45/53 = .84	<.001	.34	BF ₁₀ = 188,193,289

Note: All *p* values are based on two-tailed binomial tests. Bayes factors (BFs) are based on Bayesian binomial tests with flat priors, Beta (1,1).

they were not being monitored by the same adults who routinely issue egalitarian instructions to them. To guard against this possibility, we systematically varied the presence of preschool teachers and parents, the apparent involvement of the experimenter, and the salience of privacy or anonymity across the five studies when the preschoolers responded to the labeling task. In principle, this methodological variation could also explain the heterogeneity between the studies revealed by our meta-analysis. However, statistical analyses revealed no effects related to these factors:

First, we found no significant differences between Experiments 3 and 4, which differed only with respect to mode of administration (Experiment 3 was led by a human experimenter whereas Experiment 4 was fully automatized and conducted on a touch screen computer), $\chi^2(1, N = 110) = 0.195, p = .659, \phi = .042, BF_{01} = 3.930$.

Second, we found no significant differences between Experiments 4 and 5, which differed only with respect to whether the children were responding in private while completing the task (in Experiment 5 the preschoolers wore headphones and responded without being monitored by the experimenter, whereas in Experiment 4 the children did not wear headphones and the experimenter oversaw the children's responses), $\chi^2(1, N = 112) = 3.477, p = .062, \phi = .17, BF_{10} = 1.292$. This comparison did yield a marginally significant result. Note, however, that a smaller proportion of preschoolers (43%) chose the dominant agent in Experiment 5 (where they were made to feel anonymous) than in Experiment 4 (61%; where the experimenter oversaw their responses). In other words, the observed non-significant trend ran contrary to the hypothesis that social desirability related to egalitarian norms and instructions might mask any true effect of dominance rank on epistemic trust among Norwegian preschoolers.

Finally, we also did not find any differences between Experiments 2 and 3, which differed mainly with respect to whether or not parents or caregivers were present during testing, $\chi^2(1, N = 108) = 0.067, p = .796, \phi = .025, BF_{01} = 4.116$.

Together, these results suggest that the effect of dominance status on epistemic trust was not affected by egalitarian social desirability biases. Thus, these factors unlikely explain the present null results, nor the heterogeneity of results observed in the meta-analysis.

Can difficulties in understanding the labeling task or dominance scenario, or a lack of memory about the identities of the two agents, account for the null results?

The following results suggest that the participating preschoolers did understand both the dominance scenario and the labeling task, and that they remembered the identities of the two agents in the dominance scenario while responding to the labeling task:

First, the manipulation check in Experiment 2 indicated that the children understood which of the two agents was the dominant one in the adapted right-of-way paradigm (Thomsen et al., 2011): We found that 49/56 children indicated that the dominant agent was strongest (binomial test, two-tailed, $p < .001$, Cohen's $g = .37$, $BF_{10} = 5.451e+6$) and that 39/56 children indicated that the dominant agent decided the most (binomial test, two-tailed, $p = .005$, Cohen's $g = .29$, $BF_{10} = 12.900$). Equivalent results were obtained for the reversed questions: 50/56 children indicated that the subordinate agent was the least strong (binomial test, two-tailed, $p < .001$, Cohen's $g = .39$, $BF_{10} = 3.894e+7$), and 41/55 children indicated that the subordinate agent decided the least (binomial test, two-tailed, $p < .001$, Cohen's $g = .24$, $BF_{10} = 147.781$). As predicted, there was no effect of dominance status in either direction on the control question of who liked pizza (with 28/56 children choosing the dominant agent, binomial test, two-tailed, $p = 1.000$, Cohen's $g = 0$, $BF_{01} = 6.050$). In other words, a large majority of the children were able to infer which agent was dominant and which was subordinate on the basis on our induction phase, and these effects of prevailing in zero-sum conflict were specific to characteristics of dominance.

Second, an overwhelming majority of children in Experiment 5 demonstrated comprehension of the specific wording we used in the labeling task (i.e., the question of who was “right”) with 48/52 children answering that the agent correctly claiming that an apple was red was the one who was right (binomial test, two-tailed, $p < .001$, Cohen's $g = .42$, $BF_{10} = 3.189e+8$). That is, the children had no problems in determining which of two novel agents “was right” in a scenario where they could assess their accuracy objectively.

Finally, the preschool participants performed well above chance on the memory check, which was included in Experiments 2–5 (all p values $< .01$, Cohen's $g .23$ – $.48$) and BFs indicated “strong” to “extreme” support in favor of the hypothesis that the children remembered the correct identities of the two agents (range: $33.499 < BF_{10} < 3.147e+12$, cf. Wagenmakers, Love, et al., 2018; see Table 3).

In sum, across the present studies, the 249 preschoolers understood the dominance scenario, remembered its outcome, and understood the labeling task in the test phase of the study, but they did not selectively endorse the novel word label provided by the dominant agent over that of the subordinate. Thus, the demonstrated null effect of dominance status on epistemic trust cannot be explained by lack of understanding, or memory, of dominance status and experimental task.

DISCUSSION

Do preschool children generally selectively trust the epistemic claims of dominant others, using a heuristic

that socially dominant individuals are also more competent (cf. Bernard et al., 2016)? If this were so, it would contradict the basic theoretical argument that cues to leadership and prestige—freely conferred based on expertise and the ability to confer benefits to followers—should guide culturally transmitted learning, rather than cues to formidability-based dominance, which is based on the ability to inflict costs upon others (Henrich, 2017; Henrich & Gil-White, 2001, cf. also Hagen & Garfield, 2019; Pietraszewski, 2020; Price & Van Vugt, 2014). If, on the other hand, the overall theoretical distinction between the functions of prestige and dominance for culturally transmitted social learning holds, and if these social learning biases emerge in early childhood as would be expected if their function is to ensure the transmission of culturally accumulated knowledge to new generations, then it begs the questions why French and Kaqchikel preschoolers placed selective epistemic trust in the localization (Kaqchikel and French participants) and word label testimony (French participants) provided by coercively dominant others (Bernard et al., 2016; Castelain et al., 2016), and if these previous findings generalize across different methodological paradigms and in cultures more unlikely to confound coercive dominance and competence (cf. also Charafeddine et al., 2019).

Here, we tested if dominance status begets epistemic trust in a highly egalitarian culture, using a previously validated and replicated experimental dominance paradigm that even infants understand (Thomas & Sarnecka, 2019; Thomas et al., 2018; Thomsen, 2020; Thomsen et al., 2011). We found no evidence across five, fully blinded experiments that Norwegian preschoolers selectively trust the word label provided for a novel object by a dominant agent, consistent with the argument that dominance should not guide culturally transmitted learning (Henrich, 2017; Henrich & Gil-White, 2001). While the initial Experiment 1 found a strong effect that Norwegian preschoolers selectively trusted the claims of a *subordinate* agent, the next four experiments failed to replicate this result and found no effect of dominance status on epistemic trust. This further exemplifies the risk of taking at face value even highly significant results of single studies, such as the present Experiment 1. Indeed, a meta-analysis of all five experiments estimated that the proportion of preschoolers who selectively chose to trust the dominant agent was .48, consistent with them choosing by chance, and a Bayesian binomial analysis of the pooled data across all five experiments showed strong positive evidence in favor of the null hypothesis (that children chose randomly) over the experimental hypothesis (that dominance status would affect their epistemic trust in any manner). Since most of the participating children were tested across several preschools located in neighborhoods with different ethnic and socioeconomic demographics, this null finding is likely generalizable to at least the urban Norwegian preschool population (although, as always, sampling bias could in

principle have occurred in that only children of consenting parents participated in the experiments).

We also ruled out several alternative interpretations of the results, namely that the children did not understand the dominance scenario or the word learning paradigm as intended, that they did not remember which of the two agents was socially dominant, and that they simply avoided endorsing the dominant agent whilst observed by parents, preschool teachers, or the experimenter.

It is possible that methodological factors account for the discrepancy between the present results from 249 Norwegian preschoolers and prior results from previously reported studies of a combined 240 preschoolers in France ($N = 141$) and Mayan Guatemala ($N = 99$).

First, while the right-of-way dominance scenario which we used in the induction phase is based on a well-tested paradigm from research on the expectations and preferences for more formidable, dominant agents among both infants and toddlers (Pun et al., 2016; Thomas & Sarnecka, 2019; Thomas et al., 2018; Thomsen et al., 2011, for review see Thomsen, 2020), it differs from the dominance scenarios of Bernard et al. (2016) and Castelain et al. (2016) which showed pictures of children play fighting or fighting over a contested toy. Still, both the present and prior experimental paradigms induce dominance status by showing agents prevailing or losing in conflict. Furthermore, both the right-of-way and physically coercive resource conflict paradigm have both been validated extensively in several studies by independent labs among preverbal infants (e.g., Gazes et al., 2017; Mascaro & Csibra, 2012; Pun et al., 2016; Thomsen et al., 2011). Indeed, even preverbal infants associate losing a resource fight with yielding territory (cf. Mascaro & Csibra, 2012). So if it were in fact the case that preschoolers only use winning a physical resource fight as a cue for their epistemic trust, but not right-of-way or territorial possession, then it would suggest a highly methodologically specific effect which does not generalize to the dominance cues represented even by preverbal infants. Moreover, Bernard et al. (2016) also reported that children were more likely to endorse the claims of an agent who gets to decide how to furnish a bedroom, that is, an agent who prevails in conflict without physical coercion.

It is also the case that several previous studies used believing the dominant versus subordinate agents' testimony about which way an animal ran as the dependent variable, rather than believing their competing claims about which is the correct label for a novel object, as we did here. Again, however, parallel results have been obtained for the effect of dominance status on both the experimental word-learning and testimony (animal) tasks in previous studies (Bernard et al., 2016).

In sum, there does not seem to be any principled theoretical reason why dominance-inducing stimuli without overt physical coercion would not suffice in soliciting an effect on word-learning if dominance status did in fact

reliably serve as a cue for epistemic trust in early childhood. If it were still the case that any such specific design differences in experimental paradigms account for the fact that the current five studies could not conceptually replicate those of earlier research (Bernard et al., 2016; Castelain et al., 2016), then this would again speak to our main point here: that preschool children do not reliably endorse the epistemic claims of dominant agents.

Because it was not possible for the experimenter to be unaware of the predicted answer of each participant in the experimental paradigm of previously published studies, in principle it is also possible that unconscious experimenter bias (cf. Rosenthal, 1976) could have influenced prior results along the hypothesis that dominance rank will affect epistemic trust. This issue cannot simply be assumed trivial a priori, precisely because young children are active and capable cultural learners who presumably pay close attention to cues for what knowledgeable, competent adult experimenters may think is the correct answer (indeed, this general notion is the very point of the general epistemic trust paradigm).

Alternatively, the present results that dominance rank did not solicit epistemic trust among Norwegian preschoolers might also be accounted for by the egalitarian culture typical of Norway and the Scandinavian countries more broadly (cf. Bendixsen et al., 2018; Hofstede, 2001, 2015; Thomsen et al., 2007). Still, if the null results reported here can indeed be accounted for by the egalitarian setting in which the studies were conducted, our results speak against the possibility that this cultural context simply led children to comply to certain cultural display rules for egalitarianism: We did not find any evidence of an egalitarian, social desirability response bias such that the observation by caregivers, parents or an experimenter affected whether the preschoolers endorsed the claim of the dominant or the subordinate agent. This indicates that Norwegian preschoolers did not suppress any "real" tendency to trust the dominant agent in order to comply with cultural norms for egalitarianism when they were observed by the adults who routinely issue egalitarian instructions to them.

Nevertheless, the benefits of prevailing in a conflict might be lower in an egalitarian setting where resources and privileges are distributed equally (cf. Kunst et al., 2017; Sheehy-Skeffington & Thomsen, 2020). If so, perhaps Norwegian preschoolers might be less motivated in general to go along with the claims of dominant individuals in order to ingratiate themselves or avoid conflict, because the risk of being subjugated to coercive dominant behavior, as well as the potential benefits of having dominant coalition partners, might be lower in a highly egalitarian context. Cultures vary in authoritarian parenting styles (e.g., Rudy & Grusec, 2001) as well as in how dominance is valued (e.g., Freeman et al., 2009; Triandis & Gelfand, 1998). And like the present, highly significant pilot Experiment 1—where 24/29 Norwegian preschoolers endorsed the word label provided by the subordinate

agent—a recent study also suggested that Japanese preschoolers were more likely to endorse the testimony of a subordinate over a dominant novel agent (Charafeddine et al., 2019), discussed by the authors in terms of the lower valuing of dominance in Japanese culture. Because the results of this single study in Japan hovered at the brink of significance, however, further replication data are needed to firmly establish if Japan might, alternatively, represent yet another cultural setting in which dominance status is in fact disregarded for epistemic trust, as the meta-analysis of all the current five experiments showed was actually likely the case in Norway.

Culture-specific explanations for the effect of dominance rank on epistemic trust would be consistent with the claim that there are no evolved biases to learn from dominant individuals specifically (cf. Henrich, 2017; Henrich & Gil-White, 2001), but that humans may sometimes, depending on the circumstances, fare better by overtly going along with their claims, for example, in order to attain formidable alliance partners (cf. Thomas et al., 2018) or simply to avoid conflicts which they are likely to lose. Perhaps speaking against the possibility that preschoolers may endorse the claims of dominant individuals because of their value as formidable coalition partners is the finding that French preschoolers did *not* explicitly state their liking for the very same non-coercively dominant agent in whom they expressed selective epistemic trust (Bernard et al., 2016). However, one may defer to dominant others to avoid conflict without liking them. Other studies have also found that both French preschoolers and North-American toddlers hold social preferences for dominant agents (Charafeddine et al., 2018; Thomas et al., 2018), and so it cannot yet be concluded that young children are not motivated to affiliate with dominant individuals (cf. Pietraszewski & German, 2013; Thomsen, 2020).

On the other hand, it is also possible that *epistemic* motivations to learn from dominant individuals arise specifically in hierarchical contexts where the skills typically possessed by dominant individuals, such as fighting skills or Machiavellian intelligence, are more valuable. Although dominance and prestige have proven distinct strategies in laboratory settings (Cheng et al., 2013), dominance and prestige may correlate in certain cultural, real-life settings where the high rank afforded to highly competent, prestigious individuals also gives them the power and resource control to inflict costs upon others (cf. Henrich & Gil-White, 2001; Thomas et al., 2018; Thomsen, 2020). If dominance and prestige are actually and observably correlated in a given ecological context, then presumably even young children might learn to infer prestige from displays of dominance based on their own experience and, accordingly, appear to hold a dominance-bias for cultural learning and epistemic trust. That is, in these settings young children may learn to infer competence from dominance, as suggested by Bernard et al. (2016).

Furthermore, the degree to which dominance and prestige are connected in this manner may depend on the degree of actual societal inequality, such that those who have prestige become relatively more advantaged as compared to those who do not. For example, having a university education has been documented to yield a larger pay-off in terms of salary in France and the United States as compared to Norway and the Scandinavian countries (OECD, 2020). Such cultural differences, too, might perhaps explain why preschoolers in France, but not in egalitarian Norway, tend to endorse the testimonies of a dominant agent. On the other hand, studies of the relatively egalitarian Tsimane have also found that physical formidability (fighting ability and body size) and community influence were correlated among men (von Rueden et al., 2008). For example, people might voluntarily follow formidable individuals due to their ability to coordinate group members by sanctioning defectors, even in an egalitarian context (cf. von Rueden et al., 2014, see also Bøggild & Laustsen, 2016). This suggests that any relation between social inequality and the dominance-prestige distinction is not straight-forward and that an early heuristic confounding the two could in principle have emerged in an egalitarian culture, too.

Note that it need not be theoretically at odds with the claims we have made here if preschool children selectively endorse the epistemic claims of dominant agents in some specific cultural contexts. As we have argued, there is a number of reasons to endorse the claims of dominant individuals beyond epistemic ones, including fear of challenging dominant others and that dominance and prestige may be more correlated in some contexts where one may serve as a cue for the other. But if theory is correct that cues to prestige rather than dominance should guide human cultural learning (cf. Henrich & Gil-White, 2001), and if evolved, reliably developing learning mechanisms to support such cultural learning emerge in early childhood (as would appear adaptive), then young children should *generally and reliably* rely on formidability cues in their social learning. The present results show that this is the case.

In conclusion, and regardless of whether the results of the current studies differ from previous ones for cultural or methodological reasons, the present results from 249 Norwegian preschoolers across five, fully blinded studies provide positive Bayesian evidence that preschool children do *not* reliably develop selective epistemic trust in socially dominant agents across culture. Thus the results of the current, combined dataset—comparable in size to the combined number of participants in all previous studies of the effect of dominance status on epistemic trust among preschoolers—is consistent with predictions from evolutionary theories of culture and leadership that coercive, formidability-based dominance should not generally cue competence and guide social learning of culturally transmitted knowledge.

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CONFLICT OF INTEREST

None declared.

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