



ELSEVIER

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

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



Children's and adults' epistemic trust in and impressions of inaccurate informants



Samuel Ronfard ^{a,*}, Jonathan D. Lane ^b

^a Department of Psychology, University of Toronto Mississauga, Mississauga, Ontario L5L 1C6, Canada

^b Department of Psychology and Human Development, Peabody College, Vanderbilt University, Nashville, TN 37203, USA

ARTICLE INFO

Article history:

Received 23 April 2019

Revised 6 July 2019

Keywords:

Testimony

Trait inferences

Development

Epistemic trust

Communicative intent

Apology

ABSTRACT

As children and adults interact with new individuals, they make and revise inferences about these individuals' traits and intentions; they build and refine psychological profiles. Here, we examined how this ability develops during early childhood and manifests during adulthood by focusing on the construction of psychological profiles for individuals who have repeatedly provided inaccurate information. Children aged 4–7 years ($n = 66$) and adults ($n = 62$) played six rounds of a game in which they needed to find a hidden sticker. In each round, an informant made a claim about the sticker's location, and then participants guessed the sticker's location. In each round, after participants guessed, it was revealed that the informant's claim was incorrect. Across trials, children and adults quickly lost trust in the informant's claims. Children's impressions of the informant's smartness, niceness, and intentions became slightly more negative across trials. In contrast, adults' impressions of the informant's smartness increased, whereas their impressions of the informant's niceness decreased, and adults nearly unanimously judged the informant to be purposely (rather than mistakenly) inaccurate. In sum, children and adults track the accuracy of an informant over time and use this information to update their epistemic trust in the informant. However, based on the same data, children and adults end up with different interpretations of the informant's psychological characteristics—her traits and intentions.

© 2019 Elsevier Inc. All rights reserved.

* Corresponding author.

E-mail address: samuel.ronfard@utoronto.ca (S. Ronfard).

Introduction

Informants vary considerably in their accuracy. Within a domain, some informants have strong track records of making accurate claims, and others are often inaccurate. Thus, to avoid learning from people whose claims are unreliable, learners must be epistemically vigilant (Sperber et al., 2010). By 4 years of age, children are able to track and take into account the relative accuracy of two informants when deciding whose information to endorse (Pasquini, Corriveau, Koenig, & Harris, 2007). Around the same age, young children use explicit information about informants in guiding their epistemic trust. This information includes researcher-provided labels and informants' (often dramatized) overt behavior portraying informants' traits (e.g., nice, mean, smart) and intentions (positive vs. negative) (e.g., Lane, Wellman, & Gelman, 2013; Mascaro & Sperber, 2009; Vanderbilt, Heyman, & Liu, 2018).

In this study, we took a different approach. Rather than focusing on whether children can use particular explicit researcher-provided cues to informants' traits or intent to guide their epistemic trust, we explored how learners *independently* construct psychological "profiles" for novel informants—their impressions of those informants' psychological traits and communicative intentions—and how learners update those profiles through repeated interactions (Harris, 2007; Landrum, Eaves, & Shafto, 2015; Ronfard & Lane, 2018). That is, we investigated how children use information they gather from repeated interactions with an informant to not only decide whether to trust the informant's claims but also to make inferences about what that informant is like—the informant's psychological profile. This is an important topic that extends the ecological validity of research on children's epistemic trust given that when children and adults meet new people, they are the ones constructing these profiles from scratch; they typically do not have much background knowledge about those persons' behavioral tendencies, and they are not necessarily privy to other people's opinions of new persons' traits or intentions.

Epistemic trust in inaccurate informants

Previous work has documented that young children are attentive to informants' track records and can take these records into account when evaluating informants' claims (for reviews, see Harris, 2012; Harris, Koenig, Corriveau, & Jaswal, 2018; Robinson & Einav, 2014). For example, when two informants make competing claims (e.g., about an object's location, about the name of a novel object), preschoolers typically endorse the claim of the informant who has a stronger history of providing accurate claims (e.g., Birch, Vauthier, & Bloom, 2008; Brosseau-Liard & Birch, 2011; Koenig & Harris, 2005; Pasquini et al., 2007). In their everyday interactions, however, children are rarely forced to choose between two informants' competing claims. Arguably, more ecologically valid studies of epistemic trust examine trust in a *single* informant's claims over time. One common task asks participants to find a token that is hidden in one of two opaque containers. Containers are placed between participants and an "informant" who claims that the token is located in one container (e.g., the left one). Then, participants are asked either to report where *they* think the token is hidden or to find the token. On the first trial, 3- to 5-year-olds typically report or search in the container that the informant mentioned (Heyman, Sritanyaratana, & Vanderbilt, 2013; Jaswal, Croft, Setia, & Cole, 2010). Then, it is revealed that the token is actually in a different container (e.g., the right one). On later trials, 3-year-olds often continue following the informant's claims, whereas 4- and 5-year-olds quickly distrust the informant and accurately choose containers *opposite* to those identified by the informant (there are several theories that account for this shift between 3 and 5 years of age; see Jaswal & Kondrad, 2016; Jaswal et al., 2014; Lane, 2018; Mills, 2013).

Recent work has revealed that children aged 4 to 7 years also *adjust* their epistemic trust in an informant's claims in response to changes in that informant's accuracy over time. In a study by Ronfard and Lane (2018), children's trust in an informant decreased following her inaccurate statements and increased following her accurate statements. Although 4- to 7-year-olds demonstrated similar patterns of trust in the informant's claims, important age-related differences emerged in children's inferences about the informant's intent and traits. Following the provision of inaccurate information, older children were more likely to judge that the informant had done so on purpose rather

than by mistake and were more likely to downgrade their ratings of the informant's kindness and intelligence. A similar pattern was observed by Ronfard, Nelson, Dunham, and Blake (2019), who found that older children were more likely to attribute negative intentions to an informant who provided incorrect information rather than correct information.

In sum, existing data suggest that by 4 years of age, children can track an informant's accuracy over time and can use this information to adjust their trust in the informant's claims. However, unlike older children, preschoolers seem to make less use of this accuracy information to update their inferences about the informant's intentions or traits. Here, we directly tested this developmental hypothesis by evaluating participants' epistemic trust in *and* impressions of repeatedly inaccurate persons. We focused on repeatedly inaccurate informants because prior research has found that 4- and 5-year-olds quickly distrust their claims (Heyman et al., 2013; Jaswal et al., 2010), whereas research on children's trait attributions has found that 4- and 5-year-olds require more behavioral exemplars than older children to make negative trait inferences (Boseovski, Chiu, & Marcovitch, 2013). By continually evaluating participants' epistemic trust in and impressions of a repeatedly inaccurate informant, we could capture differences in the rate of change in participants' epistemic trust alongside changes in their impressions of the informant, and we could capture absolute differences in their trust and impressions before and after they interacted with the informant. Moreover, we tested whether the informant's explicit expression of positive intent (apologizing for her inaccuracies) moderates participants' epistemic trust in and impressions of informants. Later, we further discuss research on learners' impressions of informants' traits and apologies, and outline additional developmental hypotheses.

Most studies that evaluate trust in informants who provide repeated inaccuracies include participants in a limited developmental window, typically children aged 3 to 5 years (e.g., Heyman et al., 2013; Jaswal et al., 2010; Vanderbilt, Heyman, & Liu, 2014). An assumption behind the focus on this narrow age range might be that the developmental transition described above marks the beginning and end of the developmental story; 5-year-olds' tendency to quickly distrust informants in this paradigm is "adult like" or "mature." Or, it may be assumed that participants older than 5 years will simply perform at ceiling. These assumptions may be correct, but they should be directly tested. We addressed the protracted development of trust in repeatedly inaccurate informants by using a similar epistemic trust paradigm with participants ranging from 4 to 7 years old as well as adults. We did not have strong predictions regarding age-related differences in epistemic trust, but given that 4-year-olds are quick to distrust such informants, we expected that older children and adults would be as well.

Impressions of inaccurate informants

A large body of research has revealed how informants' traits can influence learners' epistemic trust (e.g., Fusaro, Corriveau, & Harris, 2011; Heyman et al., 2013; Landrum, Mills, & Johnston, 2013; Lane et al., 2013; Mascaro & Sperber, 2009). In this study, we instead focus on how an informant's history of providing inaccurate claims influences learners' inferences about that informant's traits. Brosseau-Liard and Birch (2010) began to address this question by presenting preschoolers with two informants: one who provided accurate labels and one who provided inaccurate labels across four episodes. Then, children were asked to identify which of the two informants engages in prosocial behavior (e.g., "Who always shares her toys?"). They found that 5-year-olds, but not 4-year-olds, demonstrated a halo effect, judging that the more accurate informant was also more prosocial.

In the current study, we *tracked* whether and how impressions of a single informant *change* in response to that informant's continual inaccuracies. Instead of asking participants to make a prediction about the informant's future behavior only after they had obtained data about the informant's accuracy, we asked participants to evaluate an informant's niceness and smartness before they provided any claims and then again after one, two, and six inaccurate claims. This allowed us to more precisely evaluate how participants *update* their impressions of an informant as they gain behavioral information. Ronfard and Lane (2018) provided initial data on how 4- to 7-year-olds update their impressions of an informant based on her ongoing accuracy. Across three episodes, an informant provided accurate information twice and inaccurate information once. Overall, children's impressions of the informant were very positive, but immediately after the informant's single inaccuracy, older children's (6- and 7-year-olds) evaluations of her niceness and smartness dropped; younger children's

(4- and 5-year-olds) evaluations did not change. These results are consistent with work demonstrating that young children generally hold positive impressions of others (Boseovski & Lee, 2006, 2008; Heyman, 2009) and require more behavioral exemplars than older children to make negative trait inferences (Boseovski et al., 2013). However, one limitation of Ronfard and Lane (2018) is that they obtained trait ratings following only *one* incorrect claim. Their data reveal how children's inferences about an informant's traits change following one inaccurate claim but not how those inferences continue to change as children are provided with additional inaccurate claims.

Importantly, the development of trait inferences extends well beyond childhood (e.g., Lockhart, Chang, & Story, 2002). In light of these findings, in the current study we expected that preschoolers' initial evaluations of the informant would be more positive than older children's and adults' evaluations, and we expected that preschoolers' evaluations would drop more slowly across trials (i.e., after the informant provided more inaccuracies) compared with older children's and adults' evaluations. Importantly, given the protracted development of these abilities, we expected a difference even between older children and adults.

Apology's effect on trust in and impressions of informants

Impressions of informants' communicative intent can influence children's trust in their claims (Liu, Vanderbilt, & Heyman, 2013). Apologies are one way to signal positive intent and goodwill. Children as young as 4 years understand that apologies express a transgressor's remorse and expect that victims will feel better if a transgressor apologizes to them (Smith, Chen, & Harris, 2010). When children personally receive an apology from a victimizer, they report feeling better and judge the victimizer as remorseful and less mean (Drell & Jaswal, 2016; Oostenbroek & Vaish, 2018; Smith & Harris, 2012). To the extent that an inaccurate informant's apology signals goodwill and the intention to not repeat the error, an apology following an inaccuracy might mitigate distrust toward that informant. To test this, Ronfard and Lane (2018) manipulated whether 4- to 7-year-olds received an apology from an informant after her single inaccuracy (amid two other accurate claims) was revealed. Even though children more often reported that an apologetic (vs. non-apologetic) informant's errors were made "by mistake" (we discuss this in greater detail later), the informant's apology had no measurable influence on children's epistemic trust. Thus, we hypothesized that an informant's apologies in the current study would not influence children's or adults' trust; whether an informant apologizes once or multiple times for her inaccuracies, participants will continually distrust her claims.

How might impressions of a repeatedly inaccurate informant differ if the informant apologizes for her inaccuracies? In Ronfard and Lane (2018), when an informant apologized (vs. did not apologize) for making a *single* inaccurate claim, children aged 4 to 7 years more often inferred that the inaccuracy was unintentional and was provided "by mistake." However, these results might not hold when an informant is *repeatedly* inaccurate and *repeatedly* apologizes. It is possible that, when an informant repeatedly errs, apologies no longer convince learners that errors were unintentional. For young children and adults, apologies help to maintain and repair social relationships because they imply that normative or moral violations will *not* be repeated (Darby & Schlenker, 1982; Oostenbroek & Vaish, 2018; Smith & Harris, 2012). But repeated errors violate these implied promises to *not* repeat violations. This may lead children and adults to infer that repeated apologies for the same behavior are disingenuous. Moreover, continuing to provide misleading claims following an apology reveals that the apology itself was misleading. Thus, repeated apologies might *compound* the negative influence of inaccuracies; the informant may seem doubly mischievous because the informant's claims and apologies are both misleading. Thus, we expected that consistently inaccurate informants would be interpreted as especially unkind when they repeatedly apologize (vs. when they never apologize).

The current study

The current study addressed three primary research questions. First, we investigated 4- to 7-year-old children's and adults' trajectories of epistemic trust in repeatedly inaccurate informants. Second, we investigated how repeated inaccuracies shape children's and adult's conceptions of these informants (i.e., their intelligence, kindness, and intent). Finally, we investigated whether trust in

and conceptions of the informant vary depending on whether she repeatedly apologizes for her inaccuracies.

Method

Participants

Children ranging from 4 to 7 years of age ($n = 66$; 29 girls) participated individually at a science museum in the northeastern United States. For analytic purposes, children were divided into two age groups: 4 to 5.5 years ($n = 34$; 14 girls; $M_{\text{age}} = 4$ years 9 months, range = 4 years 0 months to 5 years 5 months) and 5.5 to 7 years ($n = 32$; 15 girls; $M_{\text{age}} = 6$ years 5 months, range = 5 years 6 months to 7 years 9 months). Following prior research on young children's epistemic trust using single-informant designs (e.g., Jaswal et al., 2010), we planned to recruit 16 children per condition within each age group. Thus, we aimed to recruit at least 64 children. Recruitment stopped the day that this goal was reached at our recruitment site. An additional 3 children were tested but excluded from analyses because they did not complete the study. Most children's families were of middle- to upper-middle socioeconomic status. Children represented a variety of racial and ethnic backgrounds but were predominantly White/European American. Adults ($n = 62$) were recruited through Amazon's Mechanical Turk and individually completed a web-based version of the study ($M_{\text{age}} = 37$ years 9 months, range = 21–73 years; 36 women), a sample size chosen to be similar to the whole child sample (see Table 1). The study was advertised as a study about “making decisions based on what you are told.” In the description of the study, prospective participants were told, “The purpose of this study is to understand how children and adult participants make decisions based on what other people tell them.” The study was open only to adults who resided in the U.S. state of Massachusetts (the same state from which child participants were recruited). Among these adults, 51 identified as White/European American, 5 as Asian/Asian American, 3 as Black/African American, 1 as both Black/African American and White/European American, and 1 as both Black/African American and Native American (1 participant did not report on their racial background). Most adults ($n = 52$) had completed an associate's or more advanced degree and 9 had most recently graduated high school (1 participant did not report on their educational background). Adults were promised compensation of \$1 plus bonuses based on their performance (for equity, all adult participants ultimately received \$1.30 regardless of their performance).

Data availability

The data and syntax files for this study are openly available at the Open Science Framework at https://osf.io/u357q/?view_only=386e0d001f054e46a7bd8f42f277cca0.

Procedure

Participants played a game in which they were to find stickers hidden in opaque cups, similar to the game participants played in Ronfard and Lane (2018). The game had three phases: (a) meeting the

Table 1
Sample makeup by age group and condition.

	Age group		
	4 to 5.5 years	5.5 to 7 years	Adults
No apology	$n = 18$ (5 girls) $M_{\text{age}} = 4$ years 9 months $SD = 5$ months	$n = 16$ (8 girls) $M_{\text{age}} = 6$ years 5 months $SD = 9$ months	$n = 30$ (18 women) $M_{\text{age}} = 39$ years 3 months $SD = 14$ years 3 months
Apology	$n = 16$ (9 girls) $M_{\text{age}} = 4$ years 9 months $SD = 5$ months	$n = 16$ (7 girls) $M_{\text{age}} = 6$ years 5 months $SD = 8$ months	$n = 32$ (18 women) $M_{\text{age}} = 36$ years 4 months $SD = 13$ years 5 months

players, (b) learning the game, and (c) playing the game. For child participants, an experimenter proceeded through the phases using still images and videos presented on a laptop computer; questions were asked verbally. Children could respond to questions verbally or by pointing. For adult participants, identical images and videos were viewed, but they progressed through the phases by clicking a “Next” button on their web browser-based survey. Adult participants read questions themselves and responded by mouse clicking their answers.

Meeting the players

Each session began with participants viewing a picture of two women sitting across from one another at a table. Participants were told that the woman facing them (i.e., facing the camera) was named Tracy (the informant) and that the woman facing away from them was named Lynn (the player). Lynn was included in the protocol because participants did not personally interact with Tracy; thus, it made sense for them to watch footage of Tracy’s in-person interaction with someone else (Lynn). Using videos ensured a uniform presentation of stimuli across all participants and is common practice in research on the development of epistemic trust (e.g., for a review, see [Harris et al., 2018](#)). After Tracy and Lynn were introduced, child participants were asked to identify each of them (if necessary, children were corrected). Then, both child and adult participants were shown an image of Tracy and were asked to provide *initial* assessments of her *niceness* and her *smartness*: “Do you think Tracy is [nice/smart] or [mean/not smart]?”, followed by “Okay. Do you think Tracy is very [nice/smart or mean/not smart] or just a little [nice/smart or mean/not smart]?”

Learning the game

Participants were shown the same image of Tracy and Lynn sitting at a table, but now two cups (one striped and one with dots) were set in front of Tracy. Participants were instructed, “In this game, you and Lynn are going to try to find stickers hidden in cups. For each turn, there will be two cups on the table and there will be *one* sticker hidden in *one* of the cups. Sometimes the sticker is hidden in the cup on this side, and sometimes it’s hidden in the cup on this side. You and Lynn won’t look in the cups, but Tracy *will* look in the cups. She’ll say something about the sticker, and then you can choose where *you* think the sticker is. You can choose the same cup Tracy says or a different cup. It’s up to you. After you choose, Lynn will choose, and then everyone will get to see what’s inside the cups.” As small incentives to choose correctly, children earned a point every time they picked the cup with the sticker, and adults earned 5 cents every time they picked the cup with the sticker. To help child participants follow along, the experimenter pointed to Lynn, Tracy, and the cups during the instructions. Participants were then asked whether they were going to try to find as many stickers as they could, and all responded “yes.” They then saw a video of Lynn stating that *she* was going to try to find as many stickers as *she* could.

Playing the game

Participants played six trials of the game, and for each trial the informant provided inaccurate information about a sticker’s location. Participants were randomly assigned to either receive or not receive an apology from the informant on each trial immediately after her inaccuracy was revealed. Trials were presented on videos, shot from the same perspective as the photos and videos previously described, over the shoulder of the player (Lynn) who was sitting at a table across from the informant (Tracy). The video began with an empty table. A third woman, whose face was not visible, placed on the table two different solid-colored cups upright (their contents were not visible to Lynn or to participants). At this point, for child participants only, the video was paused and children were asked to name the color of each cup; corrective feedback was offered if necessary. The video then showed the informant standing up and slowly looking into each cup. Whether the informant looked into the left or right cup first was counterbalanced across trials. The informant then sat down and stated the location of the sticker: “The sticker is in the [color] cup.” At that point the video was paused and participants were asked: “Where do *you* think the sticker is?” After participants answered, the video resumed and showed Lynn choosing the cup suggested by the informant. Lynn always followed the informant’s suggestion in order to create a context where it made sense for the informant to apologize after her inaccuracy was revealed (among participants in the Apology condition). The woman who ini-

tially set up the cups returned and tilted each cup towards the camera, first with the empty cup (saying “It’s not in this one”) and then with the cup containing the sticker (saying “It’s in this one”). In the Apology condition, after the informant’s inaccuracy was revealed, she looked up and said, “I’m really sorry. I made a mistake.” In the No Apology condition, the informant looked up without saying anything. Participants were then informed that new cups would be placed on the table and proceeded to the next trial. Following the first and second trials, participants again rated the informant’s niceness and smartness. The actual location of the sticker (left or right cup) was counterbalanced; participants were randomly assigned to one of two mirror-opposite orders for the sticker’s location (left, right, right, left, left, right or right, left, left, right, left, left, right, right, left). Different colored cups were used for each trial.

After participants had completed all six trials of the game, they were asked to rate the niceness and smartness of the informant a fourth and final time. In sum, participants rated the niceness and smartness of the informant four times during the experiment: prior to receiving testimony (when the informant was 0 for 0) to measure participants’ initial impressions of the informant, after the informant was inaccurate just once (0 for 1), after she was inaccurate twice (0 for 2), and at the end of experiment after her sixth inaccuracy (0 for 6) to measure the cumulative impact of having received incorrect information six times in a row. Data from these four time points make it possible to examine whether participants’ evaluations of the informant decrease quickly (i.e., after the first and second inaccurate statements) before stabilizing (with small differences between evaluations after the second and final inaccurate statements) or whether the decrease is more gradual and linear.

After the final questions about niceness and smartness, participants were also asked about the informant’s intent: “Do you think Tracy named that cup *on purpose* or *by mistake*?” (scored as 0 = *by mistake* and 1 = *on purpose*). Asking about intent at the end of the experiment makes it possible to assess the cumulative impact of receiving incorrect information from an informant who does or does not apologize for her inaccuracies. This also allows us to compare the current participants’ intent attributions with prior work in which participants were asked the same question when the informant had been incorrect only once (Ronfard & Lane, 2018).

Results

We first assess how the informant’s prior accuracy and provision of apologies influenced participants’ trust in her subsequent claims. We then examine participants’ evaluations of the informant: their ratings of her niceness and smartness, and their judgments of her intent. For each dependent measure, we first test for differences between the younger and older groups of children; when no differences are found, the two child groups are combined.

Influence of the informant’s accuracy and apologies on epistemic trust

Initial analyses revealed no differences in trust between the two child groups (4–5.5 years vs. 5.5–7 years; see online [supplementary material](#)). Thus, the two child groups were combined ($n = 66$), and we compared children’s and adults’ trust in the informant’s claim at each level of informant accuracy. Initial analyses also revealed no effect of receiving an apology on participants’ trust in the informant’s claim at each level of the informant’s accuracy for each age group (see [supplementary material](#)). Thus, a mixed-effects logistic regression model (xtlogit, Stata 14) predicted trust in the informant based on the informant’s accuracy (i.e., trial), participants’ age group, and the interaction between the informant’s accuracy and participants’ age (see [Table 2](#)).

Levels of trust were equivalent between children and adults for some trials and were significantly different for other trials, as indicated by the significant interaction effects in [Table 2](#). As depicted in [Fig. 1](#), children and adults trusted the informant’s first claim (before they had gained information about her accuracy) at similar rates and did so significantly above chance (50%) (general linear hypothesis [GLH] test: children, $\chi^2(1) = 8.92, p < .01$; adults, $\chi^2(1) = 7.41, p < .01$). However, after the informant’s first inaccuracy (when she was 0 for 1), children trusted her claim significantly *below* chance and continued to distrust her subsequent claims (GLH tests: 0 for 1, $\chi^2(1) = 19.27, p < .001$; 0 for 2, $\chi^2(1) = 22.81, p < .001$; 0 for 3, $\chi^2(1) = 31.48, p < .001$; 0 for 4, $\chi^2(1) = 29.29, p < .001$; 0 for 5, $\chi^2(1) = 27.84,$

Table 2

Mixed-effects logistic regression comparing participants' trust in the informant's claims following each of her inaccuracies (with 0 for 0 as the reference category) for children and adults (with children as the reference category).

	OR	z Score	95% CI
Adults	0.92	0.18	0.36, 2.32
0 for 1	0.07***	5.62	0.03, 0.18
0 for 2	0.05***	5.91	0.02, 0.14
0 for 3	0.02***	6.53	0.01, 0.07
0 for 4	0.03***	6.38	0.01, 0.09
0 for 5	0.04***	6.28	0.01, 0.10
Adults × 0 for 1	6.30**	2.95	1.85, 2.32
Adults × 0 for 2	4.96*	2.51	1.42, 21.42
Adults × 0 for 3	3.91~	1.85	0.92, 17.30
Adults × 0 for 4	1.81	0.83	0.44, 7.38
Adults × 0 for 5	0.78	0.33	0.18, 3.41
Constant	2.72**	2.99	1.41, 5.26
Ln(random effects variance)	0.32		-0.26, 0.91
Wald χ^2	125.26***		
Model <i>df</i>	11		

Note. *N* = 128 participants; 768 observations. OR, odds ratio; CI, confidence interval.

~ *p* < .10.

* *p* < .05.

** *p* < .01.

*** *p* < .001.

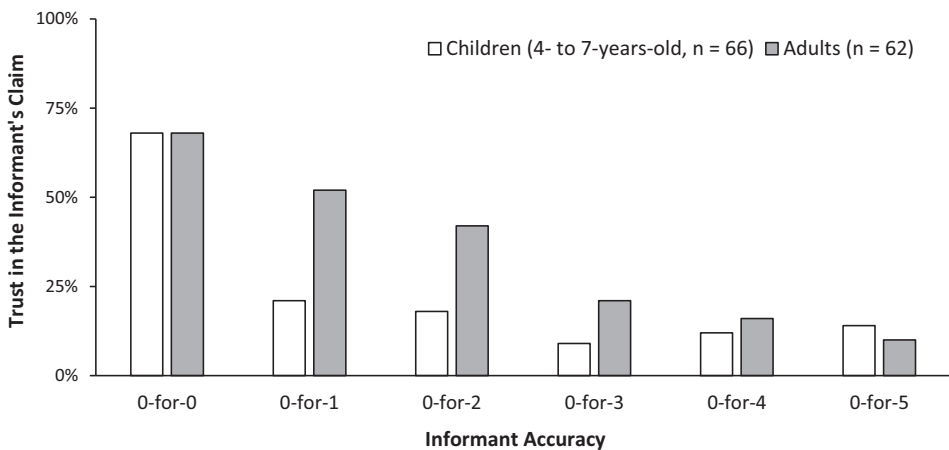


Fig. 1. Proportions of children and adults who trusted the informant as a function of her prior accuracy. Trial 1 = 0-for-0, Trial 2 = 0-for-1, Trial 3 = 0-for-2, Trial 4 = 0-for-3, Trial 5 = 0-for-4, Trial 6 = 0-for-5.

p < .001). In contrast, when the informant was 0 for 1 and 0 for 2, adults' trust in the informant's claim was at chance (GLH tests: 0 for 1, $\chi^2(1) = 0.07$, *p* = .78; 0 for 2, $\chi^2(1) = 1.49$, *p* = .22) and adults were significantly more likely to trust her claim than children (0 for 1, odds ratio [OR] = 6.30, *z* = 2.95, *p* = .003; OR = 4.96, 0 for 2, *z* = 2.51, *p* = .012). When the informant was 0 for 3, 0 for 4, and 0 for 5, adults and children trusted the informant's claims at similar rates and below chance (GLH tests for adults: 0 for 3, $\chi^2(1) = 18.19$, *p* < .001; 0 for 4, $\chi^2(1) = 23.52$, *p* < .001; 0 for 5, $\chi^2(1) = 29.23$, *p* < .001).

Influence of the informant's accuracy and apologies on trait attributions

Participants rated the niceness and smartness of the informant four times during the experiment: prior to receiving testimony (when the informant was 0 for 0), after the informant was inaccurate once

(0 for 1), after she was inaccurate twice (0 for 2), and at the end of the experiment after her sixth inaccuracy (0 for 6). Participants' trait ratings were converted to numerical scores and treated as a continuous variable: *very mean/not smart* = 0, *a little mean/not smart* = .33, *a little nice/smart* = .67, and *very nice/smart* = 1. Initial analyses revealed no differences in the trait attributions (i.e., smartness or niceness) made by the two child age groups; thus, the two child groups were combined ($n = 66$) (see [supplementary material](#)). Below we describe analyses for ratings of the informant's niceness and smartness.

Niceness ratings

Variability in niceness ratings was assessed with a mixed-effects analysis of variance (ANOVA) with apology (apology or no apology) and age (children or adults) as between-participants factors and accuracy (0 for 0, 0 for 1, 0 for 2, or 0 for 6) as a within-participants factor. This analysis revealed an effect of accuracy, $F(3, 372) = 109.5, p < .001, \eta_p^2 = .47$, an effect of age, $F(1, 124) = 40.43, p < .001, \eta_p^2 = .34$, and an Accuracy \times Age interaction, $F(3, 372) = 29.70, p < .001, \eta_p^2 = .19$. To unpack this interaction, we conducted simple-effects tests using a Bonferroni correction for multiple comparisons (adjusted $\alpha = .003$; 16 comparisons). The interaction is depicted in [Fig. 2](#).

Children began the experiment by rating the informant as "very nice" (on average) but immediately downgraded their ratings to "a little nice" after she provided one inaccurate claim ($p < .001$). Children's niceness ratings remained fairly constant thereafter. The pattern for adults was different. Adults began the study by rating the informant as "a little nice" (on average), significantly lower than children had rated her ($p < .001$). Unlike children, adults' niceness ratings did not drop immediately. Their ratings remained similar after the informant provided one inaccurate claim ($p = .18$) and then dropped sharply to "a little not nice" after her second inaccurate claim ($p < .001$). Adults' ratings remained at that level thereafter. Thus, by the end of the study, children and adults rated the informant as less nice than at the start of the experiment (children: $p < .001$; adults; $p < .001$), with adults providing significantly lower ratings than children ($p < .001$).

Smartness ratings

Variability in smartness ratings was assessed with a mixed-effects ANOVA with apology and age as between-participants factors and accuracy as a within-participants factor. This analysis revealed effects of accuracy, $F(3, 372) = 8.90, p < .001, \eta_p^2 = .067$, age, $F(1, 124) = 10.02, p = .002, \eta_p^2 = .13$, apology, $F(1, 124) = 10.02, p = .002, \eta_p^2 = .13$, an Accuracy \times Age interaction, $F(3, 372) = 49.80, p < .001, \eta_p^2 = .29$, and an Accuracy \times Apology interaction, $F(3, 372) = 6.01, p = .001, \eta_p^2 = .046$. To unpack these

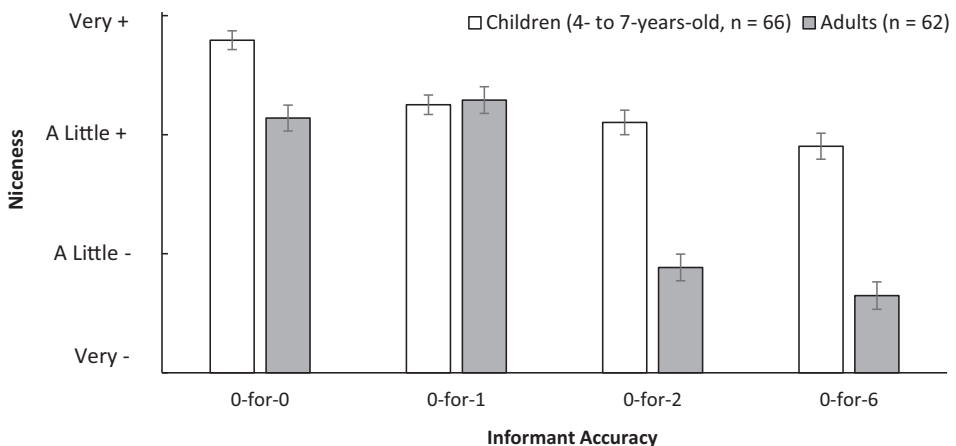


Fig. 2. Average niceness ratings (and standard errors) as a function of participants' age and the informant's accuracy. Trial 1 = 0-for-0, Trial 2 = 0-for-1, Trial 3 = 0-for-2, after Trial 6 = 0-for-6.

interactions, we conducted simple-effects tests using a Bonferroni correction for multiple comparisons (adjusted $\alpha = .0016$; 32 comparisons).

Fig. 3A displays the Accuracy \times Age interaction. Children and adults differed in their evaluation of the informant's smartness before she presented any information ($p < .001$). On average, children rated the informant between "a little smart" and "very smart," whereas adults rated her between "a little not smart" and "very not smart." After the informant's first inaccuracy, children's and adults' ratings converged. Children's average rating decreased to "a little smart" ($p < .001$), whereas adults' average rating increased to "a little smart" ($p < .001$). Child and adult ratings of smartness remained similar thereafter.

Fig. 3B depicts the Accuracy \times Apology interaction. Children's and adults' average smartness ratings were initially similar, that is, neutral between "a little not smart" and "a little smart." Participants who received an apology continued to rate the informant at this level for the duration of the study. In contrast, participants who did not receive an apology increased their smartness ratings to "a little smart" immediately after the informant's first inaccuracy ($p < .001$) and continued to do so after her

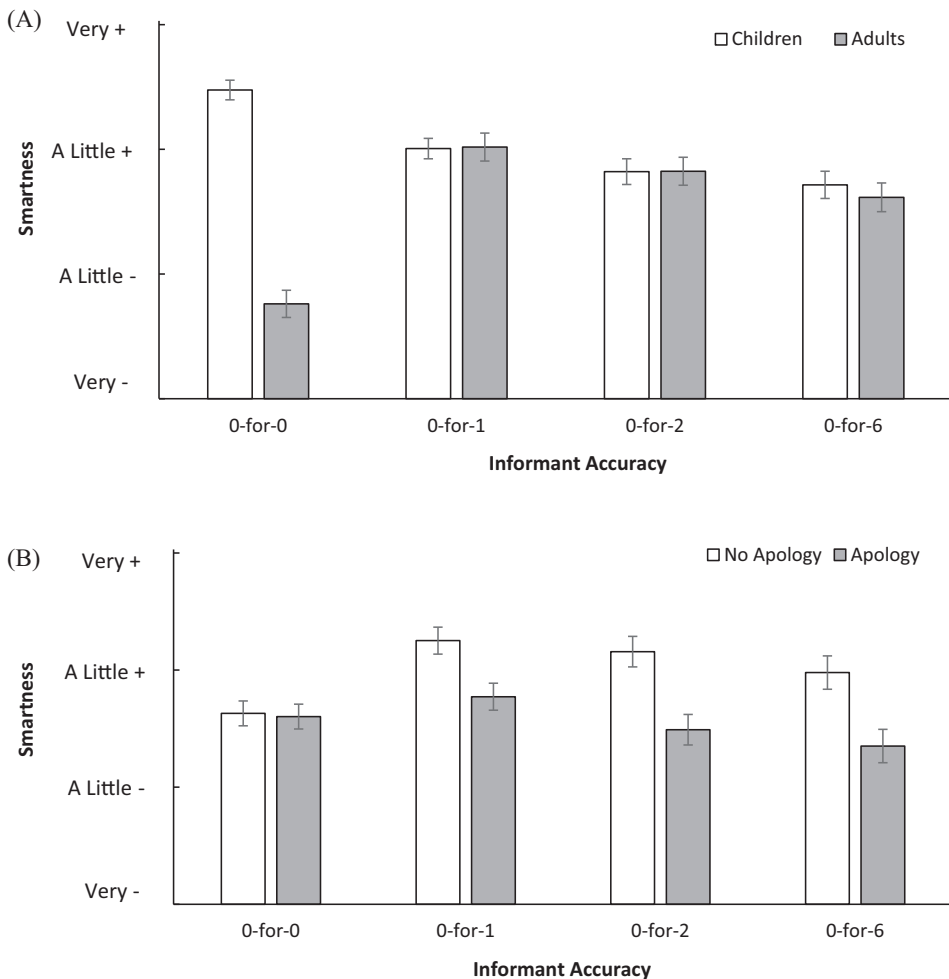


Fig. 3. Average smartness ratings (and standard errors) as a function of (A) the informant's accuracy and participants' age, and (B) the informant's accuracy and provision of an apology. Trial 1 = 0-for-0, Trial 2 = 0-for-1, Trial 3 = 0-for-2, after Trial 6 = 0-for-6.

second inaccuracy. However, this increase was temporary. By the end of the study, participants who received an apology rated the informant at the same level of smartness that they attributed to her at the start of the experiment. Nevertheless, by the end of the study, participants in the Apology condition rated the informant as less smart than participants in the No Apology condition ($p < .001$).

Influence of informant's apologies on intent attributions

Following the final trial, when the informant was 0 for 6, all participants were asked whether she had provided incorrect information on purpose or by mistake. One child in the younger age group and one child in the older age group did not provide an answer. Initial analyses revealed significant differences in the responses of younger versus older children; thus, the two child age groups were kept separate in these analyses. Fig. 4 displays the proportion of participants in each age group and condition who judged that the informant provided inaccurate information on purpose rather than by mistake. A logistic regression model (Table 3, Model 1) predicted participants' judgments (0 = *by mistake* and 1 = *on purpose*) based on their age group, whether they received an apology, and an Age \times Apology interaction. There was no main effect of apology or interaction between age and apology, $\chi^2(3) = 1.25$, $p = .74$. However, intent attributions differed significantly between the age groups. Younger children attributed negative intent (i.e., judging that the informant purposely provided incorrect information) least often, older children attributed negative intent more often than younger children ($z = 2.02$, $p = .043$), and adults did so more often than both groups of children (vs. younger children, $z = 4.71$, $p < .001$; vs. older children, $z = 2.83$, $p = .005$) (Table 3, Model 2).

Discussion

As individuals interact with one another, they form impressions of and expectations about the other's behavior, traits, and trustworthiness. We examined trajectories of children's and adults' epistemic trust in and impressions of a repeatedly inaccurate informant. Across trials, children aged 4 to 7 years quickly distrusted a repeatedly inaccurate informant, whereas adults gradually grew more distrusting. Children's impressions of the informant's smartness, niceness, and intentions became slightly more negative across trials. In contrast, adults' impressions of the informant's smartness increased, their impressions of her niceness decreased, and nearly all adults judged that she purposely (rather than mistakenly) made inaccurate claims. These findings support the hypothesis put forward in the Introduction that the ability to track and use an informant's prior accuracy to decide whether to trust

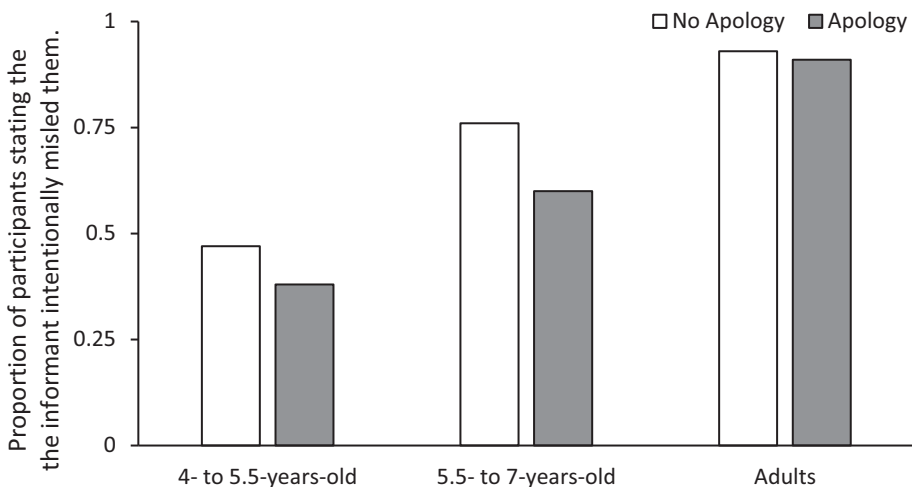


Fig. 4. Proportions of participants in each age group and condition who judged that the informant purposely rather than mistakenly provided inaccurate information.

Table 3

Logistic regression predicting judgments that information was provided on purpose as a function of age (with 4–5.5 years as the reference category) and whether participants received an apology (with not receiving an apology as the reference category).

	Model 1			Model 2		
	OR	z Score	95% CI	OR	z Score	95% CI
5.5 to 7 years	3.38	1.61	0.77, 14.81	2.89 [†]	2.02	1.03, 8.11
Adults	15.75 ^{**}	3.14	2.81, 88.12	16.19 ^{***}	4.71	5.08, 51.55
Apology	0.68	0.55	0.17, 2.70	0.61	1.07	0.25, 1.51
5.5 to 7 years × Apology	0.74	0.28	0.09, 5.86			
Adults × Apology	1.02	0.02	0.10, 10.45			
Constant	0.89	0.24	0.34, 2.30	0.93	0.17	0.41, 2.10
Pseudo- R^2	.20			.20		
χ^2	29.47 ^{***}			29.37 ^{***}		
Model <i>df</i>	5			3		

Note. $N = 126$ participants. OR, odds ratio; CI, confidence interval.

[†] $p < .05$.
^{**} $p < .01$.
^{***} $p < .001$.

that informant's claims may begin to develop during early childhood (the age period most commonly studied) but continues to develop well beyond early childhood and indeed may continue to develop into adulthood. As well, these data reveal how children and adults can be confronted with the same behavioral data and differ substantially in how they *interpret* that behavior—how they construct and update psychological profiles of informants. Thus, these data underscore the importance of looking beyond early childhood in studies of epistemic trust and trait inferences. Next, we discuss these results and their implications in greater detail.

Epistemic trust in the informant

Children's and adults' initial and final levels of trust in the informant were nearly identical. However, there were significant differences in the rate at which participants grew to distrust the informant; children did so quickly (typically after the first trial), whereas adults did so gradually. Children's rapid distrust in the informant's claims is consistent with prior work with 4- and 5-year-old children (e.g., Heyman et al., 2013; Jaswal et al., 2010). However, adults' more gradual distrust across trials was not expected. One post hoc explanation is that this pattern reflects adults' richer experience with others; they have stronger expectations that an informant (even a generally poor informant) would not be *repeatedly* inaccurate; thus, adults required more behavioral evidence to counter their strong expectations. Additional work can help to identify the specific reason why we found these intriguing age-related differences. By any account, these findings suggest that we should be hesitant to conclude that the epistemic trust of 4- and 5-year-olds (an age so often targeted in research on this topic) is synonymous with "mature" or "adult-like" epistemic trust.

Neither children's nor adults' trust was influenced by the informant's apologies following her inaccurate claims. This finding replicates patterns observed by Ronfard and Lane (2018), and reveals that this pattern also extends to adult participants. Perhaps apologies would be more effective at shaping epistemic trust when individuals are more uncertain about an informant's intentions because it is more plausible that the informant is mistaken. For example, an apology might be more effective in cases where it is difficult for the informant to gain information about the location of the stickers because it is difficult to see inside the cups. However, even in such cases, apologies might influence trust only immediately after their first use. Indeed, as we discuss next, repeated apologies for repeated mistakes are more often seen as intentionally misleading.

Impressions of the informant

As expected, children provided higher ratings of the informant's niceness and smartness than adults (see also Lockhart et al., 2002). As well, approximately half of the children judged that the infor-

mant's six inaccuracies were unintentional (made by mistake), whereas nearly all adults interpreted them as intentional (made on purpose). Thus, children generally had more positive impressions of the informant both before and after her multiple inaccuracies. Children's initially high ratings were also more stable than those of the adults. Indeed, despite having an informant provide them with inaccurate information six times in a row, children typically maintained relatively positive assessments of the informant; they judged that she was "a little nice" and "a little smart." Given that repeated questioning may lead to instability in children's responses, because children will sometimes change their answers to please the experimenter (Siegal, Waters, & Dinwiddy, 1988), the relative stability of children's trait ratings over four instances of questioning that coincided with increases in the informant's inaccuracy is remarkable. Of note, despite being relatively stable, all three measures of children's impressions of the informant moved in the same direction; they all decreased slightly. In contrast, the ratings provided by adults did not cluster in the same manner and proved to be more malleable; by the end of the study, adults typically judged that the informant was *not* nice and was *somewhat* smart (ratings were between "a little smart" and "a little not smart"). Taken together, the trait ratings and the intent judgments are consistent with patterns observed in prior work demonstrating that with increasing age individuals need fewer exemplars to make inferences about actors' mental states and dispositions (Boseovski et al., 2013; Heyman, 2009) and become increasingly likely to attribute negative qualities to others (Boseovski & Lee, 2008). The observed age-related increase in participants' inferences that the informant intentionally provided incorrect information is consistent with those previously-observed patterns.

An important implication of these results is that there appears to be substantial differences in how children and adults construct psychological profiles of informants, with children being less apt than adults at adjusting their profiles across multiple interactions. Children's developing ability to use accuracy information to simultaneously make decisions about whether to trust an informant's claims and to update their psychological profile of the informant may lead to differences in epistemic trust (relative to adults) over time. Specifically, whereas children may be quick to distrust an inaccurate informant, they may also be quick to trust the informant again if he or she starts to provide accurate claims. In contrast, for adults, the informant's increasing accuracy will be considered in conjunction with a more negative and robust psychological profile for that informant, and this may lead adults to be more distrustful of the informant even if he or she is now consistently accurate. Thus, adults might be slower to regain trust in the informant, requiring that he or she provide many more accurate claims before overturning their negative impressions.

We had hypothesized that repeatedly inaccurate informants who repeatedly apologize would be interpreted as particularly unkind and deceptive relative to equally inaccurate informants who had not apologized. Our results do not support this hypothesis. The informant's apologies did not influence children's judgments about the informant's niceness or attributions of negative intent at the end of the experiment. Children's evaluations of an informant who apologized after repeated inaccuracies intriguingly contrasts with their evaluations of an informant who apologized for just a single inaccuracy; children more often judge that the latter informant's inaccuracy was a mistake (Ronfard & Lane, 2018). Thus, even for young children, the effectiveness of others' apologies varies depending on when and how frequently apologies are made. This suggests that by 4 years of age, children not only understand that apologies express blameworthiness and regret (Drell & Jaswal, 2016; Oostenbroek & Vaish, 2018; Smith & Harris, 2012) but also understand that apologies express a commitment not to repeat one's transgression (Darby & Schlenker, 1982). Repeated apologies for the same behavior reveal that the apologies are not genuine, and as a result those apologies no longer confer a benefit to the person who apologized.

Adults' ratings of the informant's smartness increased dramatically after her first inaccuracy, and both children's and adults' ratings of her smartness increased somewhat when she did *not* apologize after her first inaccuracy. One plausible explanation for this pattern is that participants, especially adults, thought that the informant was savvy in providing inaccurate information on the first trial. They might have felt as if they had been "tricked." Indeed, older participants, especially adults, stated that the informant had provided them with inaccurate information *on purpose*. Adults' increasingly positive evaluation of the informant's smartness may also stem from the fact that adults began the experiment with relatively low impressions of her smartness; thus, there was substantial room for

their impressions to increase over the course of the experiment. We did not expect adults to begin the experiment with such low assessments of the informant's smartness, and we do not have a good explanation for this finding, so we are hesitant to speculate on its meaning.

It is worth noting a potential limitation of this study. The paradigm we used was developed for young children so that we could closely compare the current findings against prior developmental work (e.g., Heyman et al., 2013; Jaswal et al., 2010; Ronfard & Lane, 2018). As a result, adult participants were faced with a somewhat simplistic social situation. Adult participants were not aware that they were completing a task initially designed for children, and all actors in the videos and photographs were adults themselves. Nevertheless, it will be important to conduct additional research on this topic using a different paradigm. This will help to clarify whether the results we obtained with adults generalize to more complex interactions with repeatedly inaccurate informants. Additional research with adults may also help to clarify why adult participants began the experiment with favorable views of the informant's niceness but not of the informant's smartness.

Conclusions

Effectively learning from other people is not easy. Individual informants might differ dramatically in their behavior, traits, and trustworthiness. To navigate this complex social world, individuals interpret the behavioral data from new informants in light of their past experiences with other informants (Landrum et al., 2015). We found that children and adults both eventually distrust someone who consistently provides inaccurate information; however, adults' distrust is more gradual than that of children. This pattern highlights the importance of studying the development of epistemic trust across the lifespan and provides additional evidence that the development of epistemic trust from early childhood to adulthood is not simply a matter of increased skepticism (Lane, 2018). Moreover, when individuals interact with informants, they are making inferences beyond whether someone is trustworthy. Indeed, the current data uncovered intriguing age-related differences in children's and adults' construction of informants' psychological profiles.

Acknowledgments

A portion of this study was conducted in the Living Laboratory at the Museum of Science in Boston. We appreciate the museum staff and volunteers for their support, and we thank the parents and children for their participation. We also thank Tracy Elizabeth and Lynneth Solis for starring in our video stimuli.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jecp.2019.104662>.

References

- Birch, S. A. J., Vauthier, S. A., & Bloom, P. (2008). Three- and four-year-olds spontaneously use others' past performance to guide their learning. *Cognition*, *107*, 1018–1034.
- Boseovski, J. J., Chiu, K., & Marcovitch, S. (2013). Integration of behavioral frequency and intention information in young children's trait attributions. *Social Development*, *22*, 38–57.
- Boseovski, J. J., & Lee, K. (2006). Children's use of frequency information for trait categorization and behavioral prediction. *Developmental Psychology*, *42*, 500–513.
- Boseovski, J. J., & Lee, K. (2008). Seeing the world through rose-colored glasses? Neglect of consensus information in young children's personality judgments. *Social Development*, *17*, 399–416.
- Brosseau-Liard, P. E., & Birch, S. A. J. (2010). "I bet you know more and are nicer too!": What children infer from others' accuracy. *Developmental Science*, *13*, 772–778.
- Brosseau-Liard, P. E., & Birch, S. A. J. (2011). Epistemic states and traits: Preschoolers appreciate the differential informativeness of situation-specific and person-specific cues to knowledge. *Child Development*, *82*, 1788–1796.
- Darby, B. W., & Schlenker, B. R. (1982). Children's reactions to apologies. *Journal of Personality and Social Psychology*, *43*, 742–753.
- Drell, M. B., & Jaswal, V. K. (2016). Making amends: Children's expectations about and responses to apologies. *Social Development*, *25*, 742–758.

- Fusaro, M., Corriveau, K. H., & Harris, P. L. (2011). The good, the strong, and the accurate: Preschoolers' evaluations of informant attributes. *Journal of Experimental Child Psychology*, *110*, 561–574.
- Harris, P. L. (2007). Trust. *Developmental Science*, *10*, 135–138.
- Harris, P. L. (2012). *Trusting what you're told: How children learn from others*. Cambridge, MA: Belknap Press/Harvard University Press.
- Harris, P. L., Koenig, M. A., Corriveau, K. H., & Jaswal, V. K. (2018). *Annual Review of Psychology*, *69*, 251–273.
- Heyman, G. D. (2009). Children's reasoning about traits. In P. J. Bauer (Ed.), *Advances in child development and behavior* (Vol. 37, pp. 105–143). London: Elsevier.
- Heyman, G. D., Sritanyaratana, L., & Vanderbilt, K. E. (2013). Young children's trust in overtly misleading advice. *Cognitive Science*, *37*, 646–667.
- Jaswal, V. K., Croft, A. C., Setia, A. R., & Cole, C. A. (2010). Young children have a specific, highly robust bias to trust testimony. *Psychological Science*, *21*, 1541–1547.
- Jaswal, V. K., & Kondrad, R. L. (2016). Why children are not always epistemically vigilant: Cognitive limits and social considerations. *Child Development Perspectives*, *10*, 240–244.
- Jaswal, V. K., Pérez-Edgar, K., Kondrad, R. L., Palmquist, C. M., Cole, C. A., & Cole, C. E. (2014). Can't stop believing: Inhibitory control and resistance to misleading testimony. *Developmental Science*, *17*, 965–976.
- Koenig, M. A., & Harris, P. L. (2005). Preschoolers mistrust ignorant and inaccurate speakers. *Child Development*, *76*, 1261–1277.
- Landrum, A. R., Eaves, B. S., Jr., & Shafto, P. (2015). Learning to trust and trusting to learn: A theoretical framework. *Trends in Cognitive Sciences*, *19*, 109–111.
- Landrum, A. R., Mills, C. M., & Johnston, A. M. (2013). When do children trust the expert? Benevolence information influences children's trust more than expertise. *Developmental Science*, *16*, 622–638.
- Lane, J. D. (2018). Children's belief in counterintuitive and counter perceptual messages. *Child Development Perspectives*, *12*, 247–252.
- Lane, J. D., Wellman, H. M., & Gelman, S. A. (2013). Informants' traits weigh heavily in young children's trust in testimony and in their epistemic inferences. *Child Development*, *84*, 1253–1268.
- Liu, D., Vanderbilt, K. E., & Heyman, G. D. (2013). Selective trust: Children's use of intention and outcome of past testimony. *Developmental Psychology*, *49*, 439–445.
- Lockhart, K. L., Chang, B., & Story, T. (2002). Young children's beliefs about the stability of traits: Protective optimism? *Child Development*, *73*, 1408–1430.
- Mascaro, O., & Sperber, D. (2009). The moral, epistemic, and mindreading components of children's vigilance towards deception. *Cognition*, *112*, 367–380.
- Mills, C. M. (2013). Knowing when to doubt: Developing a critical stance when learning from others. *Developmental Psychology*, *49*, 404–418.
- Oostenbroek, J., & Vaish, A. (2018). The emergence of forgiveness in young children. *Child Development*. <https://doi.org/10.1111/cdev.13069>.
- Pasquini, E. S., Corriveau, K. H., Koenig, M., & Harris, P. L. (2007). Preschoolers monitor the relative accuracy of informants. *Developmental Psychology*, *43*, 1216–1226.
- Robinson, E. J., & Einav, S. (2014). *Trust and skepticism: Children's selective learning from testimony*. New York: Psychology Press.
- Ronfard, S., & Lane, J. D. (2018). Preschoolers continually adjust their epistemic trust based on an informant's ongoing accuracy. *Child Development*, *89*, 414–429.
- Ronfard, S., Nelson, L., Dunham, Y., & Blake, P. R. (2019). How children use accuracy information to infer informant intentions and to make reward decisions. *Journal of Experimental Child Psychology*, *177*, 100–118.
- Siegal, M., Waters, L. J., & Dinwiddie, L. S. (1988). Misleading children: Causal attributions for inconsistency under repeated questioning. *Journal of Experimental Child Psychology*, *45*, 438–456.
- Smith, C. E., Chen, D., & Harris, P. L. (2010). When the happy victimizer says sorry: Children's understanding of apology and emotion. *British Journal of Developmental Psychology*, *28*, 727–746.
- Smith, C. E., & Harris, P. L. (2012). He didn't want me to feel sad: Children's reactions to disappointment and apology. *Social Development*, *21*, 215–228.
- Sperber, D., Clément, F., Heintz, C., Mascaro, O., Mercier, H., Origg, G., & Wilson, D. (2010). Epistemic vigilance. *Mind & Language*, *25*, 359–393.
- Vanderbilt, K. E., Heyman, G. D., & Liu, D. (2014). In the absence of conflicting testimony young children trust inaccurate informants. *Developmental Science*, *17*, 443–451.
- Vanderbilt, K. E., Heyman, G. D., & Liu, D. (2018). Young children show more vigilance against individuals with poor knowledge than those with antisocial motives. *Infant and Child Development*, *27*, e2078.