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Journal of Cognition and Development

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/hjcd20

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To cite this article: Pearl Han Li & Melissa A. Koenig (2020) Children's Evaluations of Informants and their Surprising Claims in Direct and Overheard Contexts, Journal of Cognition and Development, 21:3, 425-446, DOI: 10.1080/15248372.2020.1745208

To link to this article: https://doi.org/10.1080/15248372.2020.1745208

Published online: 13 Apr 2020.

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JOURNAL OF COGNITION AND DEVELOPMENT
2020, VOL. 21, NO. 3, 425–446
https://doi.org/10.1080/15248372.2020.1745208

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ABSTRACT

Children are known to accept communicated information, even when it contradicts their own judgments. Here, we explored the role of direct address and accuracy in children's testimonial decisions and socio-moral evaluations of the speaker. After 4-year-old children (N = 100) gave baseline classification responses for four hybrid animals, an adult speaker either directly told the child information that was in conflict with children's original judgment, or communicated the same information to a third party over the phone. Children accepted new information in both contexts but were more receptive to surprising claims when the information was communicated to them directly than when it was overheard. Once children learned about the accuracy of the testimony they received, their subsequent socio-moral decisions to reciprocate and share information with the speaker were influenced by the accuracy of the speaker's testimony, and not by the manner of address.

Children face testimonial decisions when they receive surprising claims such as "Santa's watching you," or "Cows sleep standing up." On one hand, children have reasons to doubt claims that do not fit with other things they believe. On the other hand, there is always something in favor of accepting such claims, namely, that someone has vouched for their truth. Here, we investigated one speaker behavior that might move children toward taking speakers at their word: direct address. Specifically, we asked whether children were more likely to accept surprising claims that were addressed directly to them than claims that were encountered in overheard testimony directed to someone else. After hearing claims in both direct and overheard contexts, children soon discovered whether the claims they accepted were true or not. We then asked whether the accuracy of the claims and manner of address influenced children's socio-moral decisions to share resources and information with the informant.

The significance of direct address

Much recent developmental and cross-cultural research has investigated the role that child-directed communication plays in children's learning (e.g., Chavajay & Rogoff, 1999; Nielsen, 2006; Rogoff, 2003; Shneidman, Gaskins, & Woodward, 2016; for a review, see Shneidman & Woodward, 2016). In this work, children are either presented

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with an agent who directly interacts with them when providing relevant information, or are presented with an agent who addresses a third-party or remains noninteractive. By 18 months, European American children are equally good at learning novel words as overhearers as when directly addressed (Akhtar, 2005; Akhtar, Jipson, & Callanan, 2001; Floor & Akhtar, 2010). This early ability to learn in overheard contexts is culturally variable, and influenced by the extent to which children are invited and expected to participant in conversations (Chavajay & Rogoff, 1999; Rogoff, 2003; Shneidman et al., 2016). Children from Mayan families in Guatemala, for example, are more likely to engage in sustained attention to interactions that are not directed to them than are children from middle-class European American families, and learn more effectively from such interactions as a result (Correa-Chávez & Rogoff, 2009; de Haan, 1999; Gaskins, 2000).

Because of this cultural variability, many have challenged the view that direct address can elicit a universal, innate attentional bias from the listener (e.g. Csibra & Gergely, 2009, 2011), rather, it likely serves as one of many communicative means that can be recruited in children's interactions, and that may serve to signal the social or cultural relevance of information (Shneidman & Woodward, 2016). Recent work in cultural learning indicates that children often learn at comparable rates across overheard and direct contexts, but they treat information differently in each context. For example, Nielsen (2006) found that 18-month-old children imitated both the means and the goal of an actor's actions of opening a box when they were directly addressed, but only reproduced the end-goal after viewing a socially aloof model. Similarly, Vredenburgh, Kushnir, and Casasola (2015) presented 2-year-old children with two models: One who directly addressed the child while demonstrating one function of a novel object, and the other who demonstrated a different function of the same object without addressing the child. Although children learned both functions at equal rates, they transmitted the function from the model who addressed them significantly more to a new adult. Recently, Lane, Conder, and Rottman (2019) also found that children internalized negative messages about novel groups in both direct address and overheard contexts, but the effects were more pronounced when the messages were provided directly to children. Such results suggest that both direct and non-direct contexts are capable of supporting learning, but that direct address may enhance the *social or cultural value* that children put on these actions.

In parallel to this social account, much contemporary research in philosophy has also recognized the interpersonal significance of direct address. When addressees trust a speaker for the truth, or believe what they are told based on a speaker's authority, many argue that they recognize a distinctive kind of *second-personal reason* to do so (Brandom, 1994; Holton, 1994; McMyler, 2011; Moran, 2005; Ross, 1986). Specifically, when directly addressed, the listener recognizes the speaker's commitment to the truth of what she says (Moran, 2005) in a collaborative exchange (Darwall, 2006; Tomasello, 2014, 2019), one that enables the listener to hold the speaker responsible for the truth of her claims (McMyler, 2011). In other words, listeners who are directly addressed by another person are provided with uniquely *interpersonal or second-personal* reasons that are grounded in the reciprocal or mutual cooperation between a speaker and the addressee.

Another source of evidence regarding the interpersonal significance of address can be found in children's interpersonal protests and their ability to issue complaints to those responsible for false or misleading claims. Contemporary epistemologists argue that listeners who accept the speaker's claims in cases of direct address acquire a suite of rights, including

rights to hold speakers accountable and rights of complaint (Gilbert, 1992; Hinchman, 2005; McMyler, 2011). In fact, a set of studies have found that children sometimes engage in active protest in response to speakers who intentionally offer incorrect information in direct testimonial exchanges. Under conditions of direct address, even infants detect, interrupt and actively correct speakers who make mistakes by misnaming common objects (Begus & Southgate, 2012; Grassmann & Tomasello, 2010; Jaswal, 2004; Koenig & Echols, 2003; Pea, 1982) or by presenting difficult or anomalous requests (e.g, "Can you bring me the refrigerator?"; Grosse, Behne, Carpenter, & Tomasello, 2010; Shwe & Markman, 1997; Wellman, Song, & Peskin-Shephard, 2019). However, it remains unclear whether children would be equally likely to protest against surprising statements in contexts of direct address compared to that in overheard contexts. Do young children treat direct address as a uniquely interpersonal reason to trust? Will they hold the speaker more accountable in cases of direct address compared to overhearing contexts? One way to explore these questions is to present children with surprising claims from a speaker who directly addressed them versus one who they overheard addressing someone else.

Children's trust in counter-intuitive claims

In the testimony literature, children's acceptance of surprising claims has been examined in the context of direct acts of telling (e.g., Jaswal, 2004; Jaswal & Markman, 2007; Lane, Harris, Gelman, & Wellman, 2014; Palmquist & Jaswal, 2012). In these paradigms, children are given direct verbal or gestural testimony from a live human agent or puppet; and the testimony is counter-intuitive to the children in some way (e.g., by running counter to their gravity bias, or counter to their prior classification of an object). In these studies, children are often quite receptive to surprising claims that are directly addressed to them. For example, Jaswal and Markman (2007) found that most 2- and 3-year-olds made an initial classification judgment based on the dominant perceptual feature of a hybrid animal ("It's a fish"), and were highly deferential to countervailing claims given to them by an adult ("Look at this bird!"). Among 4-year-olds, children's rates of acceptance decreased, but they readily accepted the unexpected classification when the informant clarified that their claim was intentionally and deliberately chosen (e.g., "You are not going to believe this, but this is actually a bird!"; Jaswal, 2004). Three-year-olds also voluntarily passed the speaker's unexpected labels on to another adult, indicating that they actually believed the counter-intuitive information rather than merely showing social compliance (Jaswal, Lima, & Small, 2009).

Children's acceptance of counter-intuitive claims can also be seen in their encounters with overtly unreliable speakers. When children are directly addressed by a live human agent or puppet, they often fail to reject claims from speakers who deceived them previously (Heyman, Sritanyaratana, & Vanderbilt, 2013; Jaswal, Croft, Setia, & Cole, 2010; Kim, Paulus, & Kalish, 2017; Vanderbilt et al., 2014). For example, when playing a competitive game with a tricky experimenter who repeatedly lied about the locations of stickers, 3-year-olds still searched in the location directly indicated to them by that speaker (Jaswal et al., 2010), and it did not help even when the agent was introduced as the ill-intentioned "Big Bad Wolf" (Heyman et al., 2013). Moreover, when preschoolers encountered a single informant who directly addressed them, they continued to trust that informant even when they were previously inaccurate or uninformative (Kim et al., 2017; Vanderbilt et al., 2014).

Children's acceptance of claims that run counter to the perceptual evidence (Jaswal, 2004; Jaswal & Markman, 2007; Lane et al., 2014), or to the inaccurate record of an informant (Heyman et al., 2013; Jaswal et al., 2010; Kim et al., 2017; Vanderbilt et al., 2014) is interesting in light of preschoolers' documented vigilance toward inaccurate speakers (e.g., Einav & Robinson, 2011; Koenig & Harris, 2005; for a review, see Harris, Koenig, Corriveau, & Jaswal, 2018). One way to reconcile these patterns of acceptance with patterns of vigilance is to consider the manner in which children are addressed. Indeed, as Heyman and colleagues suggested, children may find it especially difficult to reject information when they perceive it as being intentionally and directly offered to them. Here, we provide further test of this idea by examining the role played by direct address on children's acceptance of surprising claims. No testimonial learning studies, to our knowledge, have compared children's rate of acceptance of counter-intuitive claims in direct and overheard contexts. In the present study, we provided children with the same counter-intuitive testimony from a speaker who either directly addressed them or who they overheard addressing someone else. We also coded children's protest when they heard surprising claims in both directed and overheard contexts. If direct address is treated as an interpersonal reason to accept a speaker's claims, it might promote higher rates of acceptance of claims that challenge children's original beliefs. It is also possible that children would engage in more interpersonal protest when directly addressed.

The influence of speaker accuracy and manner of address on children's socio-moral evaluations

Aside from examining active protest, we explored another way that children might hold speakers accountable in interpersonal exchanges: their willingness to share and reciprocate in subsequent interactions. Outside the social learning literature, empirical evidence on children's joint collaboration revealed that children share and reciprocate more often with more cooperative partners (Hamann, Warneken, Greenberg, & Tomasello, 2011; Warneken, Lohse, Melis, & Tomasello, 2011). After receiving resources from an agent with good intentions, children were also subsequently more generous when they had the opportunity to share the same resources with the agent (Vaish, Hepach, & Tomasello, 2018; Warneken & Tomasello, 2013). Conversely, if a social partner explicitly expresses her preference not to collaborate, 3-year-olds share less with her (Melis, Altrichter, & Tomasello, 2013). Here we ask, do children reciprocate and share with more reliable and cooperative speakers in ways that are similar to that seen in physical joint collaborations?

Although a large body of research has demonstrated children's ability to track speaker's reliability based on the accuracy of their prior testimony (e.g., Corriveau & Harris, 2009; Koenig & Harris, 2005), less is known about how the informant's accuracy or manner of address might affect children's willingness to cooperate or reciprocate with the speaker. Recent work has shown that 4- to 8-year-old children rewarded an informant who provided correct information about the location of a sticker more than an informant who provided an inaccurate location (Ronfard, Nelson, Dunham, & Blake, 2019). Similarly, 3-year-old children were more likely to share new information with a puppet who was cooperative compared to one who intentionally withheld information (Dunfield, Kuhlmeier, & Murphy, 2013). In the current study, we assessed children's reciprocity toward a speaker who provided accurate or inaccurate testimony through direct or

indirect address. After children's willingness to accept surprising claims was assessed in both directed and overheard contexts, children discovered whether the claims they accepted were in fact accurate or inaccurate. Children then completed a set of socio-moral measures including a sticker distribution task, an information sharing task, and explicit evaluation of the speaker. Here, we were interested in whether children's socio-moral evaluations would be affected by the speaker's accuracy, the manner in which the information was delivered, or both.

In summary, the current study was designed with two goals in mind. The primary goal was to directly investigate how direct address affects children's acceptance of claims that run counter to their prior judgments. We used novel hybrid animal pictures and first asked for children's baseline judgments of each animal's classification (e.g., cow or horse, rabbit or squirrel, etc.). Then, we measured the rate at which children updated their baseline judgments after hearing a speaker provide unexpected labels in the context of direct address or overheard speech. We also examined children's spontaneous protest after hearing the unexpected claims in both contexts. As discussed, another way that children might hold speakers accountable in interpersonal exchanges is to their willingness to reward and reciprocate toward cooperative informants (Dunfield et al., 2013; Ronfard et al., 2019). Accordingly, the second goal was to assess whether accuracy and manner of address can influence children's socio-moral evaluations of the speaker. After children's final classifications of the hybrid animals were made in both contexts, we revealed the accuracy of the speaker, and explored whether children's decisions to "blame" or "credit" the speaker in a sticker distribution task. We also assessed whether children were willing to share new information with the speaker in return, and how they explicitly evaluated the speaker.

Method

Participants

We recruited a total of 100 4-year-old children (49 female, *M*age = 4.714; *SD* =.190; range = 4.241– 4.931) from a university-maintained database of children who are predominantly Caucasian, native English speakers from middle to upper socioeconomic-status households from a Midwestern city in the United States. Two additional children were tested, but their data were not included due to experimenter error. Children were randomly assigned to one of four between- subject conditions: *inaccurate-directed* condition, *inaccurate-overheard* condition, *accurate-directed* condition, and *accurate-overheard* condition. During the telling phase, E2 directly spoke to the child in the *directed* conditions and talked with a person on the phone in the *overheard* conditions; and her claims turned out to be correct in the *accurate* conditions, and incorrect in the *inaccurate* conditions (See Figure 1 for an overview of our procedure).

An a priori G Power 3.1 analysis was run to determine the appropriate sample size with standard alpha (.05) for the main ANOVA analysis, which showed that a sample of 100 participants was sufficient to achieve 85% power and a medium effect size of 0.3 (Faul, Erdfelder, Lang, & Buchner, 2007). The study was approved by the University of Minnesota Institutional Review Board under the project name Child Directed (Study Number STUDY00001998). The data that support the findings of this study are openly available in Open Science Framework at https://osf.io/gnqku/.

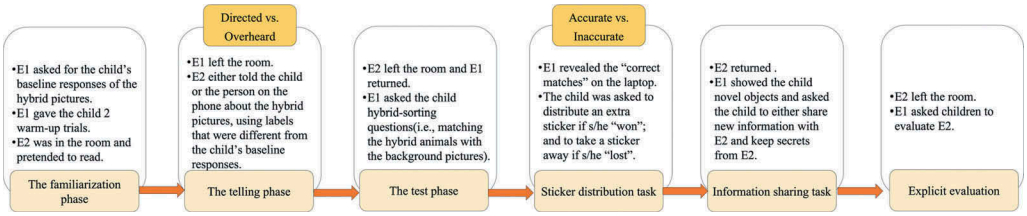


Figure 1. The flow chart and brief descriptions of the procedure.

Materials

The four hybrid animal pictures that were used in the familiarization and telling phases were hybrid animal pictures created by Jaswal (2004). Specifically, the four pictures we used are squirrel–rabbit, cat–dog, bear–pig, and horse–cow. Each image was printed in color on a card approximately 12 × 10 cm in size and laminated. A book holder was set on the table for the experimenters to present each picture.

During the test phase, each animal picture was presented again in color on the top of a size A4 answer sheet, with two background pictures (e.g., some carrots that a rabbit would eat and some nuts that a squirrel would eat) at the bottom on each side (see Figure 2). A set of slides were also used, with each slide showing the hybrid animal and the two locations which were identical to the answer sheets. After a single click, the animal at the top would move to one of the locations. For each participant, the lead experimenter (E1) made the slides either in favor of the child's *baseline responses* (in the *inaccurate* conditions) or in favor of the second experimenter (E2)'s claims in the telling phase (in the *accurate* conditions).

Procedure

Participants were brought to a quiet testing room by E1 after a brief warm-up session at the waiting area in the lab space. E2 was already in her seat, facing the table and reading



Figure 2. An example of the answer sheets used in the test phase.

a magazine when the child entered the room. In all conditions, E2 sat on the left side of the table approximately 2 feet from the participant.

The familiarization phase

After entering the room, E1 always said: "Oh, [child name], this is my friend [E2 name]. She is just reading here." E2 then briefly turned to the child and said, "Hi!", and then continued to look down at the magazine, pretending to read. E1 then explained to the children that they would play a "matching game" but E1 wanted to show the child some pictures first, and that she did not know anything about the animals in the pictures. E1 then presented the four hybrid pictures one by one, asking for the child's *baseline responses* (e.g., "What do you think this is? A [rabbit] or a [squirrel]?"). Regardless of their selections, children were given neutral feedback ("Okay!"). At the same time, E2 secretly recorded children's answers on a written note under the table. Then, children participated in two warm-up trials with familiar animals to ensure that they knew how to play a game that matched animals to their habitats or preferred food (i.e., "The matching game"). In the warm-up trials, E1 gave the child a crayon and asked the child to draw a line from the animal on the top to one of the two location pictures at the bottom (e.g., "Look at this penguin. Where does this penguin go? Does it go on ice or does it go in the barn?").

The telling phase

Following familiarization, E1 asked the child to wait while she went to get the matching game outside the room. In the two o*verhead* conditions (i.e., *accurate-overheard* condition and *inaccurate-overheard* condition), E1 also gave the child two small wooden blocks, saying, "Can you play with these blocks while you wait for me?" This was done to occupy children during E2's phone conversation and to indicate that the E2's conversation was not intentionally meant to include them. Before leaving the room, E1 left the animal pictures on the book holder.

In the two *directed* conditions (i.e. *accurate-directed* condition and *inaccurate-directed* condition), E2 put down the magazine shortly after E1 left the room, turned to the child, saying, "Hey [child name]! Do you want me to tell you about the animals in the matching game?" After the child agreed, E2 pointed to each of the pictures on the book holder, made eye contact with the child, and taught the child the alternative labels that were different from the child's baseline response, repeating each label four times (see Figure 3). For instance, if the child had told E1 the first hybrid animal was a rabbit during the *familiarization phase*, E2 would say: "Look at this, [child name]. This is a [squirrel]. Yep, it is a [squirrel]. Look at the [squirrel]. [Child name], it's a [squirrel]." E2 made eye contact with the child throughout and pointed at each picture during the labeling process.

In the two *overhead* conditions, E2's cellphone rang shortly after E1 left the room, and E2 answered the phone after two rings with the following script: "Hello? [short pause] Hi Sam, what's up? Yes, I'm at the lab right now, and we have the matching game here with different animals. [short pause] Yeah. So, Sam, do you want me to tell you about the animals in the matching game?" E2 then labeled each animal four times using the alternative labels that were different from the child's baseline responses (see Figure 3 for an example of the script). During the entire process, E2 only looked at the pictures and never made any eye contact with the child. After labeling all four hybrid animals, E2, still on the phone, said, "OK! Bye!" Here, we used the phone paradigm instead of having children observe two speakers' live

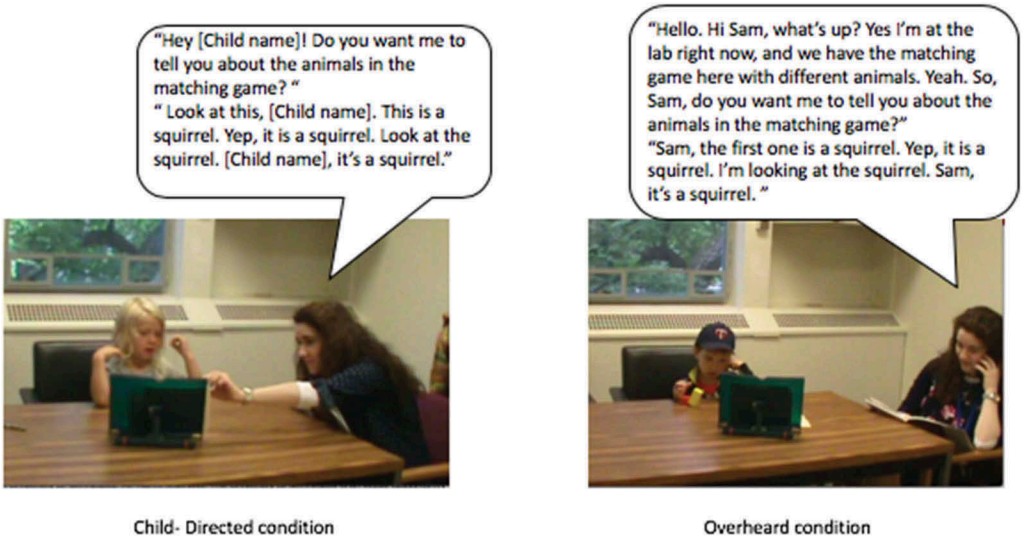


Figure 3. The set-up and an example of the script for the telling phase in the *directed* conditions (left) and the *overheard* conditions (right) in the experiment. The hybrid animal pictures were placed on the book holder between the child and the speaker.

conversation because we wanted to keep the number of people that children were exposed to consistent across the two conditions. Also, the phone set-up seemed less "staged" and unlikely to invite the possibility that the child might be addressed.

In all conditions, E2 turned to the child after the labeling events and told the child that she was going to check on E1 to see if the game was ready and left the room. Children's spontaneous verbal protests during the *telling phase* were also recorded. Whenever children protested, E2 waited for children to finish, but continued to follow the script in repeating the alternative labels.[1]

The test phase

Following this, E1 returned to the testing room with the four answer sheets containing the background pictures, and the laptop with the slides containing the "correct answers". E1 explained that the child could play "the matching game" first, and then they would check the matches together on the laptop. Participants then completed four trials of the *hybrid sorting task*. For each trial, children saw one answer sheet with a picture of the hybrid animal on top, and two background pictures underneath at each side (see Figure 2). E1 first asked a *memory-check question*. For example, in the first trial, E1 said: "Remember this one? I still don't know what this is. When I first asked you, you said it was a [rabbit]. When I was gone, did E2 [tell you/tell someone on the phone] that this was a [rabbit] or [squirrel]?" If the child answers correctly, E1 said "OK" in a neutral tone. Children were

[1]If child protested after E2 finished a sentence, in the *directed* condition, E2 would look at the child and wait for her/him to finish speaking, and then continue to follow the script. To keep the conditions consistent, E2 would also pause if the child said something in the *overheard* condition, but she never looked at the child, and acted as if she was still on the phone. If the child interrupted E2 mid-sentence, E2 would continue to speak in both the *directed* and *overheard* conditions.

corrected if they said the wrong animal. E1's ignorance to the pictures was stressed again here to ensure that children would not infer that E1 was asking this question because she favored one of the two options. Then, E1 explained the background picture and asked a *hybrid sorting question* (e.g., "Here are some [carrots] that a [rabbit] would eat. Here are some [nuts] that a [squirrel] would eat. Where does this animal go?"). Children were then encouraged to draw a line from the animal to one of the background pictures.

Sticker distribution task

After finishing the four test trials, E1 used the laptop to show the slides that had the "correct matches". This was done to reveal the accuracy of the speaker so that we could directly assess whether accuracy and manner of address could influence children's socio-moral evaluations on the speaker. The sticker distribution task was included to examine children's level of blame or credit toward the speaker. E1 put two identical plastic cups on the table, one of which had a tag with the child's name and the other had a tag with E2's name written on it. There were already four stickers in each cup, which was done to ensure that children who "lost" all four trials could have the option to take stickers out of one chosen cup only. A small blue bin was placed in the middle of the two cups. E1 told the child that there were four stickers in each cup, and that the child could take home all the stickers left in his or her cup, whereas E2 would take all the stickers left in the other cup. E1 also explained that sometimes the child would need to take a sticker from one of the cups and put it in the blue bin, and nobody would get to keep the stickers in the bin. E1 then asked a few comprehension check questions to ensure that children understood which cup was theirs, which cup was E2's, as well as the function of the bin.

Then, E1 and the child checked the child's answers in the *hybrid sorting task* one by one by looking at the "correct answer" slides in the laptop. In the two *inaccurate* conditions (i.e. the *inaccurate-directed* condition and *inaccurate-overheard* condition), the "correct answers" were the child's previous baseline responses (i.e. contradicting E2's claims). In the two *accurate* conditions (i.e. the *accurate-directed* condition and *accurate-overheard* condition), the "correct answers" were what E2 had said in the *telling phase*. For instance, if the child's initial response to the rabbit-squirrel hybrid was that the animal was a rabbit, E2 would subsequently say that the hybrid was a squirrel. Then, in the *inaccurate* conditions, the "correct answer" on the laptop would turn out to be a rabbit going to the carrots (the child's initial response). In the *accurate* conditions, the "correct answer" would be a squirrel that goes to the nuts (E2's testimony).

If the child's choice was "correct", E1 would hand the child a sticker and say, "It did go to [location A], so it must be a [animal A]. Good job! Here is one sticker! Now, you can either put the sticker in your cup, or you can put the sticker in E2's cup. Where should we put the sticker?" If the child chose the background picture that did not correspond to the one on the laptop, E1 would say, "Oh, no. This one doesn't go here. It goes to [location B], so it should be a [animal B]. Now, because this wasn't right, we have to take a sticker from one of the cups. You can take one sticker from your cup and put it here in the bin, or you can take one sticker from E2's cup and put it here. Which cup should we take a sticker away from?"

Information sharing task

Afterward, children completed a task to evaluate whether they would be willing to interact with the speaker (E2) and provide the speaker with new information (adapted from

Dunfield et al., 2013). The information sharing task included four trials: two *hybrid picture labeling* trials and two *novel object function* trials. For each trial, children were presented with some new information, and were given the option to either share the information with E2 or keep secrets from E2. Throughout the task, E2 pretended to be reading a magazine with headphones on, and only put the headphones down and turned to face the child when E1 or the child addressed her in each trial. This was done to minimize the social pressure from E2 when E1 was explaining the two options to the child.

The first two trials were *the hybrid picture labeling* trials. Here, a bird-fish hybrid picture and a cup-hat hybrid picture were used. In each of the two trials, E1 showed the hybrid picture to child, saying: "Look, I have another picture. Let's find out what this is." E1 then showed the child another picture of the animal or object in a specific location (i.e., the bird-fish hybrid in a nest, and the cup-hat hybrid on a boy's head), saying, "Look! It goes [to the nest/on the boy's head]. So, what do you think this is?" For children who made the correct inference, E1 confirmed their correct answer. For children who did not make the correct inference, E1 provided corrective feedback. The third and fourth trial were the *novel object function* trials. In each of these trials, E1 brought out an unfamiliar object (i.e. a cylinder with a handle and a small hammer wrapped in colored tape) and said: "Let's check out what this is for." E1 then demonstrated the use of the object, saying: "See, it's for [looking through/hammering]." E1 then invited the child to use the object.

After making sure that the child knew and felt confident about the labels or functions, E1 explained that E2 did not know what the picture was (or what the object was used for) and told the child that s/he can either decide to share the information with E2, or keep it a secret. E1 also reassured the child that the decision was entirely up to the child. After the child had made a choice, E1 set the picture on the book holder or put the object close to E2 and waited for 5 seconds before saying: "Hey [E2 name], look at this." E2 then looked up from the magazine and looked at the picture (or object), and then said: "Hmm. I don't know what this is (for)." If the child did not say anything after 5 seconds, E2 would say: "Hmm. I wonder what this is (for)?" If the child still did not say anything after another 5 seconds, E1 would whisper to the child and remind the child of the two options: "Would you like to tell [E2 name] what this is (for), or keep it a secret to yourself and don't say anything?"

Explicit evaluation

In the two *inaccurate* conditions, E1 first asked the child if E2 said some wrong answers before and asked the child why E2 did this. If the child did not say anything, E1 asked: "Do you think [E2 name] said the wrong answers on purpose to trick you, or do you think [E2 name] told you the wrong answers because she didn't know what the animals really were?" This question was used to probe whether children would interpret the speaker's intention differently in the directed and overheard contexts. In the two *accurate* conditions, if the child had deferred to E2 in at least one trial, E1 would ask a source-memory question: "Do you remember when I first showed you the animal pictures and you were telling me what they are? Why did you change your mind about what these animals are when you were playing the matching game?" This question was included to explore whether children would be more likely to mention the source of the counter-intuitive information, E2, in the *directed* conditions compared to the *overheard* conditions.

In all four conditions, E1 then asked the child whether E2 was being nice, just OK, or naughty. Afterward, E1 brought out a three-point Likert scale with cartoon faces that measured children's emotion intensity, and asked if E2 made them feel good, just OK, or bad.

Results

Preliminary analyses revealed no significant effects or interactions of participant gender on all dependent measures, so subsequent analyses collapsed across male and female participants. There were also no significant differences in children's baseline responses between the *directed* and *overheard* conditions.

The test phase

First, we evaluated children's memory and level of acceptance of the speaker's claim during the test phase. Note that the accuracy of the speaker's claims had not been revealed yet. Therefore, we only compared the *directed* and *overheard* conditions. Children in each condition received a point if they correctly remembered what the speaker said during the telling phase (maximum = 4). Children in *directed* and *overheard* conditions performed above chance (2 out of 4) in remembering the speaker's claims: *directed* conditions, $M = 3.62$, $SD = .805$, $t\ (49) = 14.224$, $p < .001$; *overheard* conditions, $M = 3.46$, $SD = 1.034$, $t\ (49) = 9.981$, $p < .001$. A one-way Analysis of Variance (ANOVA) was conducted with Directedness (whether the testimony was child-directed or overheard) as the between-subjects factor and the total memory score as the dependent variable. There was no main effect of Directedness, $F\ (1, 99) = .745$, $p = .\ 39$, revealing no significant difference between the *directed* and *overheard* conditions in the memory-check questions. Children were able to remember the speaker's claims equally well across conditions.

We then examined whether children would update their initial beliefs to agree with the speaker in the *hybrid sorting task*. Children in both *directed* and *overheard* contexts performed above chance (2 out of 4) in accepting the counter-intuitive claims: *directed* conditions, $M = 3.24$, $SD = 0.981$, $t\ (49) = 8.941$, $p < .001$; *overheard* conditions, $M = 2.58$, $SD = 1.513$, $t\ (49) = 2.711$, $p = .009$. However, after performing a one-way ANOVA with Directedness as the between-subject variable and the number of trials children deferred to the speaker (E2) during the test phase (0–4) as the dependent measure, we found a significant main effect of Directedness, $F\ (1, 99) = 10.890$, $p = .011$, $\eta_p^2 = .064$. On average, children in the *directed* conditions updated their beliefs on more trials compared to children in the *overheard* conditions (see Figure 4). This finding indicates that children were more likely to update their beliefs to align with the speaker's testimony when they were directly addressed compared to when they overheard the same speaker making the same claims to a third party.

Children's protest

To examine children's spontaneous responses after hearing the unexpected claims, we next compared the rates at which children intervened or protested in response to counter-intuitive testimony across conditions. During testing, the first author (who acted as E1)

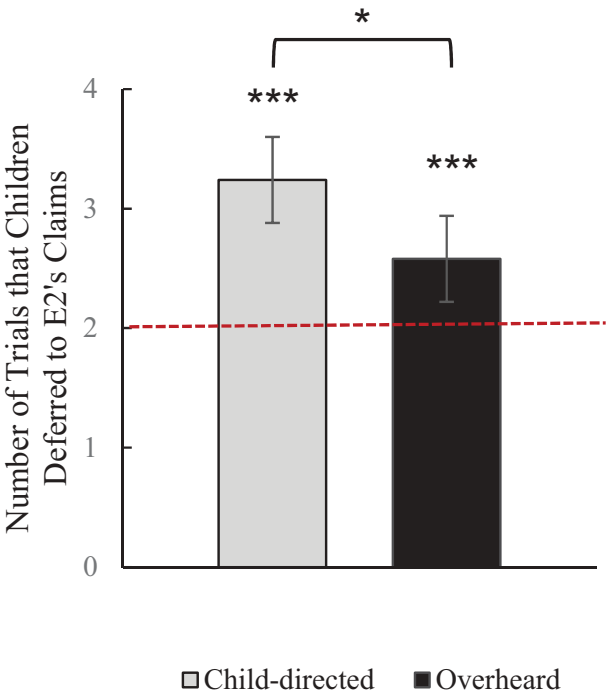


Figure 4. Mean number of trials that children deferred to E2's claims (range = 0– 4) as a function of Directedness. Bars reflect standard error, and asterisks denote that children's acceptance was significantly different from chance (*$p < .05$. **$p < .01$. ***$p < .001$). The bracket above shows that children's acceptance in the *directed* conditions were significantly different from the *overheard* conditions.

coded whether children engaged in protest in each trial during the *telling phase*. Two additional coders, blind to the conditions and the hypothesis of the study, also transcribed children's utterances during the telling phase and recoded the data of the whole sample from the videotaped sessions. Inter-rater reliability was high (Cohen's Kappa = 0.874) with disagreements resolved by the first author. Spontaneous protest was defined as explicit verbal expressions of surprise, critique or rejection in response to the speaker's claims. Children's verbal protest toward the counter-intuitive testimony fell into the following four categories: (1) stating the alternative animal label (e.g., "It is a cat."; "But this is a horsey."); (2) highlighting the contradicting features (e.g., "But it's brown."; "It has a long tail."); (3) expressing explicit denial (e.g., "It's not a cat."; "No it's not."); and (4) asking questions or repeating the speaker's labels in a questioning tone (e.g., "A pig?"; "Why does it have that stuff like a cow on it?").

Overall, 36 of 100 children (36%) protested in at least one of the four trials after hearing the counter-intuitive testimony from E2 in the telling phase. We found that a higher percentage of children protested in the *directed* conditions (56%, 28 out of 50 participants) compared to the *overheard* conditions (16%, 8 out of 50 participants), a difference that was statistically significant across the conditions after conducting Pearson's Chi-squared test, $\chi 2$ (1, N = 100) = 17.361, $p < .001$, Cramér's $V = .417$.

Sticker distribution task

In the *inaccurate* conditions, children would lose on every trial that they trusted the speaker. In the *accurate* conditions, children would lose on trials in which they maintained their original judgment and did not trust the speaker. To examine the extent to which children chose to take stickers away from E2's cup, we first calculated a proportion score corresponding to the proportion of trials that they took a sticker from E2's cup over their own cup out of all the trials that they "lost". Children were more likely to take stickers from E2's cup than from their own cup in all four conditions(see Figure 5): *inaccurate-directed* condition, $M = 0.717$, $SD = 0.356$, $t\ (24) = 3.043$, $p = .003$; *inaccurate-overheard* condition, $M = 0.746$, $SD = 0.326$, $t\ (20) = 3.454$, $p = .001$; *accurate-directed* condition, $M = 0.875$, $SD = 0.354.$, $t\ (7) = 3$, $p = .010$; and *accurate-overheard* condition, $M = 0.826$, $SD = 0.259$, $t\ (10) = 4.165$, $p = .001$. A 2 (Directedness) $\times$ 2 (Accuracy) two-way ANOVA revealed no significant effect of Directedness, $F(61) = .012$, *ns*, or Accuracy, $F(61) = 1.695$, *ns*, indicating that children were equally likely to "punish" the speaker when their matches turned out to be incorrect both when they were directly addressed and when they overheard the claims, and both when the speaker's claims were correct and incorrect.

Learning the answers in the *accurate* condition led children to win on each trial that they trusted the speaker, and resisting the speaker's claims in the *inaccurate* condition led children to win on trials that they did not trust. Next, we looked only at the trials that children won, and computed a similar proportion score for which children credited E2 (i.e. putting one sticker in E2's cup instead of their own cup) out of all the trials that they won. Children in all four conditions rarely credited E2 and were more likely to credit themselves: *inaccurate-directed* condition, $M = 0.089$, $SD = 0.188$, $t\ (14) = -8.488$; *inaccurate-overheard* condition, $M = 0.094$, $SD = 0.272$, $t\ (15) = -5.975$; *accurate-directed* condition, $M = 0.097$, $SD = 0.149$, $t\ (23) = -13.261$; and *accurate-overheard* condition, $M = 0.163$, $SD = 0.214$, $t\ (21) = -7.377$, all $p < .001$. Again, we did not find

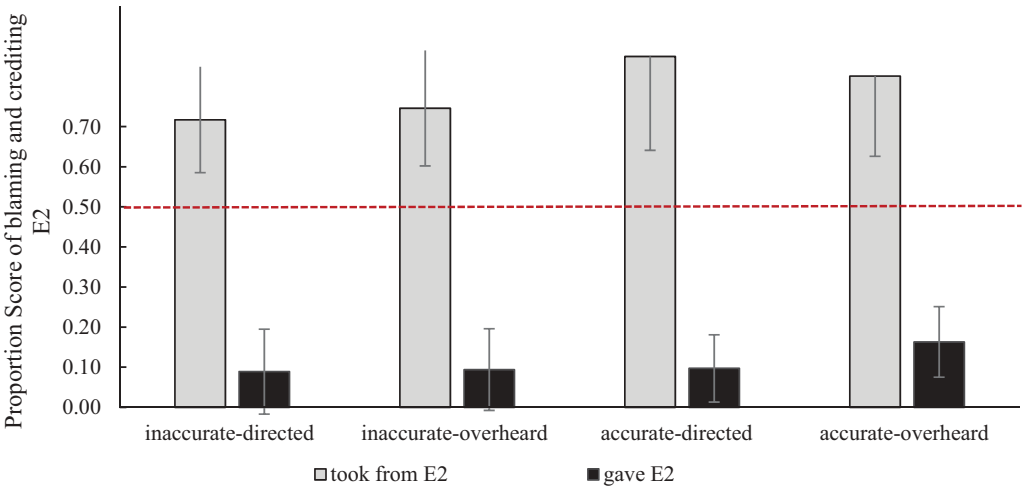


Figure 5. Mean proportion scores that children took stickers from E2 and gave stickers to E2 in each condition.

a significant effect of Directedness, $F(73) = 0.546$, *ns*, or Accuracy, $F(73) = 0.658$, *ns*, indicating that children's high rates of credit to themselves held across all four conditions.

Information sharing task

We evaluated children's secret keeping decisions based on the number of trials that they withheld information from E2 (maximum = 4). As the data were skewed, we used nonparametric Mann-Whitney-U tests with Directedness and Accuracy as factors and the number of trials that children kept secrets from E2 as the dependent measure. The number of trials on which children withheld information from E2 was significantly higher for children in the *inaccurate* conditions ($M = 2.42$, $SD = 1.642$) compared to children in the *accurate* conditions ($M = 1.76$, $SD = 1.623$; $U = 947$, $p = .031$, $r = 0.216$). Interestingly, this pattern held regardless of direction of address (*directed* conditions: $M = 2.06$, $SD = 1.671$, *overheard* conditions: $M = 2.12$, $SD = 1.662$), $U = 1206.5$, $p = .756$, indicating that children withheld from the speaker at similar rates, regardless of whether the information was directed to them or to a third party.

We also calculated a telling sum-score for each child by scoring how many prompts children required before telling E2 the new information (range = 0– 16). In each of the four trials, children got 4 points if they initiated the conversation with E2 immediately and offered information before E2 said the first prompt; 3 points if they told E2 the information after E2's first prompt ("Hmm, I don't know what this is."); 2 points if they told E2 the information after E2's second prompt ("Hmm, I wonder what this is?"); 1 point if they decided to tell after the third prompt by E1("So do you want to tell E2 that this is (for) or do you want to keep it a secret and do not say anything?"); and 0 points if they still said they wanted to keep a secret. The telling score was coded live by E1 during the task. To assess reliability, an independent coder (blind to conditions and hypotheses) coded a randomly selected 25% of participants ($N = 25$). Reliability was perfect ($\kappa = 1.00$). Children in the *accurate* conditions had significantly higher telling scores ($M = 7.62$, $SD = 5.746$) compared to children in the *inaccurate* conditions ($M = 4.94$, $SD = 5.633$; $U = 905.5$, $p = .015$, $r = 0.243$, see Figure 6). There was no statistical difference between children's telling sum-scores in the *directed* conditions and the *overheard* conditions ($p = .696$).

Explicit evaluations

In the two *inaccurate* conditions, E1 first asked whether E2 told the wrong answers on purpose or out of ignorance. Eighteen children (38.30%) thought E2 told them the wrong answers on purpose and 29 children (61.70%) thought E2 did not know what the animals were. Children's evaluations were not affected by the directedness of the speaker's claims, $\chi 2$ $(1, N = 47) = .908$, *ns*. In the two *accurate* conditions, if children had accepted E2's claims in at least one trial, E1 would ask children why they changed their minds about the animals. Twenty children (44.44%) were able to say that they heard E2 either telling them or the person on the phone about the animals. The accuracy of children's source-memory for their updated beliefs was not affected by the directedness of the speaker's claims, $\chi 2$ $(1, N = 45) = .641$, *ns*.

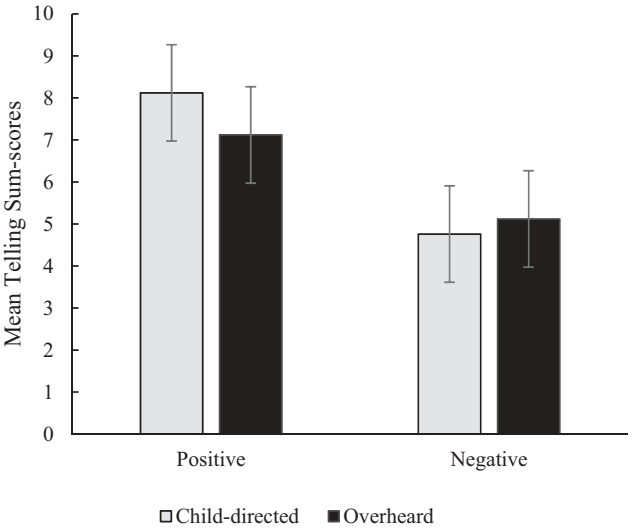


Figure 6. Mean telling sum-scores in the information sharing task (range = 0– 16) in added the error bars the *accurate* and *inaccurate* conditions as a function of Directedness. Bars reflect standard error.

In all conditions, E1 then asked the child whether E2 was being nice, just OK, or naughty. Children's general evaluation of E2 was significantly impacted by Accuracy (i.e., whether E2's claims turned out to be correct), $\chi 2$ (2, N = 100) = 19.192, p < .001, Cramér's V = .438. Specifically, there were fewer children who said E2 was being naughty in the *accurate* conditions (N = 4) than the *inaccurate* conditions (N = 22). Children's evaluation was not significantly different across the two type of directedness, $\chi 2$ (2, N = 100) = 1.543, *ns*.

Children's feelings toward E2 fell into three categories: good, just OK or bad. Again, children's feelings toward E2 were significantly impacted by Accuracy, $\chi 2$ (2, N = 100) = 10.832 p = .004, Cramér's V = .329, with children more likely to report feeling good in the *accurate* (N = 44) than *inaccurate* conditions (N = 31). Children's feelings were not significantly different across the *directed* conditions and the *overheard* conditions, $\chi 2$ (2, N = 100) = 1.154, *ns*.

Discussion

Directedness, or manner of address, has been argued to serve unique functions in cultural learning and transmission, as well as cooperative functions that feature in children's social behavior more generally (Shneidman & Woodward, 2016; Tomasello, 2014). In the current study, we examined 4-year-old children's memory and acceptance of counter-intuitive testimony in child-directed and overheard contexts, as well as their rates of protest. We also examined children's socio-moral evaluations of the speaker by assessing their sticker distribution and information sharing decisions upon learning the accuracy of her prior claims. We found that children accepted counter-intuitive claims at higher rates after being directly addressed by an adult. Children were also significantly more likely to engage in spontaneous verbal protest in the *directed* conditions than the *overheard* conditions. In contrast, children's decision to share new information with the informant

and their explicit liking of the informant were influenced by the accuracy of the speaker's testimony, and not the manner of address. Below we discuss each finding in turn.

Of primary interest was the finding that 4-year-old children were more likely to accept counter-intuitive claims when the information was directly communicated to them by a speaker. Recall that after children gave baseline classification responses for four hybrid animals, an adult speaker either directly told them claims that were in conflict with children's baseline responses, or communicated the exact same conflicting information to a third party over the phone. At test, while children remembered the claims across both direct address and overheard conditions equally well, we found that on average, children changed their original classification and accepted the speaker's testimony more often in the *directed* than the *overheard* condition. It is important to note that across the *directed* and *overheard* conditions, children encountered the same speaker making the same counter-intuitive claims, with the same confidence and frequency. Therefore, it was not the plausibility of the statements nor the speaker's perceived expertise, confidence or personal characteristics that influenced children's differential tendency to update their beliefs. Rather, children's increased rate of acceptance was likely the result of the contextual, pragmatic factor that we manipulated: whether the testimony was directed to children themselves or to another interlocutor.

The finding that children were more receptive to counter-intuitive information conveyed through directed communication carries important implications. Specifically, this finding suggests that children learn from testimony in ways that are susceptible to interpersonal influences. Thus far, the interpersonal dimensions of trust have not been demonstrated in empirical research on children's testimonial learning. Previous studies on children's trust in testimony have typically adopted an "evidential" approach, reducing speaker characteristics (e.g., a history of knowledge, reliability or expertise) to a form of inductive evidence for children to evaluate (for discussion, see Harris et al., 2018; Pesch, Suárez, & Koenig, 2018). Despite its many strengths, this approach does not clarify the interpersonal grounds that children have for trusting others, or children's social goals when interacting with speakers (Jaswal & Kondrad, 2016; Pesch et al., 2018). Acknowledging the interpersonal significance of direct address might also help situate or inform a range of conflicting findings in the testimonial learning literature – namely, that children are sometimes vigilant toward inaccurate sources, but sometimes accept misinformation from problematic informants. In the classic selective trust paradigms (e.g., Corriveau & Harris, 2009; Koenig & Harris, 2005),children may be more likely to be vigilant when they are put in the position of observing and evaluating the evidence that two speakers make available; whereas when directly addressed by a live human agent or puppet (e.g., Heyman et al., 2013; Jaswal, 2004; Jaswal & Markman, 2007), children are positioned to receive a speaker's interpersonal bids for trust.

There are several interpretations of our finding, all of which involve understanding the interpersonal significance of direct address. The first possibility is that children, especially those from Western or WEIRD populations, learn to treat direct address as a culturally specific marker for conventional, normative, or relevant knowledge, and this favored context moved children to accept the counter-intuitive information more frequently (Shneidman & Woodward, 2016). To investigate this possibility, it will be useful for future research to explore whether effects of directedness on testimonial learning would be

observed at younger ages and in children raised in cultural contexts where directed interactions are less normative (Correa-Chávez & Rogoff, 2009; Shneidman et al., 2016).

Another possibility, not inconsistent with the first explanation, is that direct address invites children to take a collaborative or cooperative attitude toward the speaker, and thereby provides children with the basis for holding the speaker accountable (Darwall, 2006; Holton, 1994; McMyler, 2011; Tomasello, 2014). It is possible that when a child is engaged in a communicative interaction with another individual, there is a mutual recognition and respect that each conversational partner gives the other, and expects from the other. Therefore, children might place a higher level of trust in speakers they directly interact with because they have come to expect a fundamentally cooperative attitude from that speaker (Darwall, 2006; Tomasello, 2014), one that the speaker can be held responsible for (Holton, 1994; McMyler, 2011).

This possibility receives some support from the finding that children were significantly more likely to engage in spontaneous verbal protest in the *directed* (56%) than the *overheard* (16%) conditions. Children are known to engage in spontaneous normative protest when they perceive social norm violations (see, e.g., Kachel, Svetlova, & Tomasello, 2018; Rakoczy, Warneken, & Tomasello, 2008; Rossano, Rakoczy, & Tomasello, 2011; Schmidt, Rakoczy, & Tomasello, 2019; Warneken et al., 2011), and when they encounter speakers who falsely address them (e.g., Jaswal, 2004; Koenig & Echols, 2003; Pea, 1982; Rakoczy & Tomasello, 2009; Wellman et al., 2019). Our study extends these findings by directly comparing children's protest when unexpected claims were either meant for children or meant for another listener. The result that children protested against the speaker significantly more in the *directed* conditions compared to the *overheard* conditions could have reflected children's second-personal normative expectations for speakers who directly address them. Specifically, it is possible that when speakers made claims that stood in conflict with children's own intuitions, children in the *directed* condition thought that they had the right to engage in second-personal protest as a means to ask for clarification, and even as an attempt to reconcile their disagreement with the speaker. In other words, children were more likely to protest when the testimony was marked as "for them" than when the same utterances were meant for somebody else, indicating that children may be more inclined to hold speakers responsible for their claims directly addressed to them (Hinchman, 2005; Koenig & McMyler, 2017; McMyler, 2011).

It is also interesting to note that children in the directed contexts often protested and then went on to accept these claims when asked later. In fact, among the children who protested in at least one trial, 20 out of the 28 children (71%) in the *directed* conditions subsequently accepted more than half of the counter-intuitive claims, but only 2 out of 8 children (25%) in the *overheard* conditions did so. Therefore, it is possible that children in the *directed* conditions who recognized this cooperative attitude between the speaker and themselves, showed their understanding *both in their protest behavior and their acceptance decisions*. It is also possible that the more frequent protests in the *directed* conditions actually contributed to children's choices to defer to the speaker's claims later. Indeed, children may have monitored the speaker's verbal and non-verbal responses after they asked for clarification, and may have reasoned that since the speaker did not take back or change her claims in response to their protest, this adds yet further support to her intention to communicate this counter-intuitive information. However, even after excluding the 36 children who protested in at least one trial, the main effect of Directedness still

remains statistically significant ($F(1, 62) = 4.524$, $p = .037$), Therefore, children's monitoring of the speaker's persistence after they protested cannot be the exclusive explanation for the deference we observed in the directed conditions.

Our second goal was to assess whether direct address and the informant's accuracy would affect children's socio-moral evaluations, including their willingness to credit and reciprocate toward the speaker. After children's final classifications were made in both contexts, the accuracy of their decisions was revealed. We found that children's decision to share new information with the informant was primarily influenced by the accuracy of the speaker's testimony. This finding lends further support to the idea that children's cooperation and reciprocity is influenced by how cooperative the informant is perceived to be (Dunfield et al., 2013; Ronfard et al., 2019). For example, Dunfield et al. (2013) found that children selectively shared information with a more responsive agent over an agent who explicitly refused to provide the child with information on previous occasions. Our study extends this finding by showing that the speaker's accuracy also affected children's information sharing decisions. Compared to children who found out that the speaker's testimony was incorrect, children in the *accurate* conditions shared information with the speaker in more trials, and they also shared the new information more readily, without the need for support. By implication, children may have treated the reliability of the speakers as signaling good intentions, and identified an accurate speaker as a potentially trustworthy collaborator. Thus, children were more likely to reciprocate toward the more accurate speaker in return, and they may have appreciated information as a resource that could be shared or withheld. This study is the first to show that children's information-sharing behavior is sensitive to the prior accuracy of the informant.

Interestingly, we did not find any differences in children's information-sharing behavior and positive affect toward the speaker when we compared the *directed* and *overheard* conditions. Perhaps children were more inclined to give back to, and to like, speakers from whom they have received good information, whether they received that information via a collaborative means or not. In other words, in deciding how much they liked a speaker and whether to share information with them, children considered the prior accuracy of the speaker a more important factor than the manner in which they had been addressed. Because our socio-moral measures (i.e., information sharing task; explicit evaluation) came after the accuracy of the claims was revealed, our study did not directly assess the effects of directedness on children's social preferences for the speakers without the influence of other competing characteristics. In future studies, we could consider measuring children's information sharing, liking and resource allocation before accuracy information is introduced – to better examine the role that direct address plays in their socio-moral evaluations.

The one measure that did not show any systematic variation in relation to direct address or speaker accuracy was the sticker distribution task. It is possible that 4-year-old children simply adopted a primarily self-interested strategy: Whenever children won a sticker, they most frequently rewarded themselves and rarely credited the speaker. Whenever children lost a sticker, they took it out of the speaker's cup to avoid losing stickers themselves. Indeed, previous studies have shown that preschool-aged children often favor themselves in costly sharing situations even though they endorse fairness norms related to sharing (e.g., Smith, Blake, & Harris, 2013). Also, although 44.44% of the participants in the *accurate* conditions correctly cited E2's testimony as the reason why they updated their beliefs toward the end of the session, it could still be cognitively

challenging for 4-year-old children to link their immediate success or failure with the testimony the informant had provided earlier, especially in the face of attractive rewards. Future research could benefit from the use of non-costly resource allocation tasks, or experimenter instructions that explicitly ask children to recall the reasons that may have contributed to their success or failure in winning stickers.

The significance of direct address for children's testimonial learning carries important implications for the methods commonly used to study children's selective trust. Indeed, one favored paradigm for examining children's selective learning often confounds the cues of direct and indirect address. For example, in the common two-person paradigm (Koenig & Harris, 2005), children encounter two speakers presented on video who are asked to name a series of objects by a third-party confederate, and each speaker answers the confederate in response but directs their answers to the child participants seated off camera. The fact that the confederate poses the questions, and that her questions are posed to the two speakers (not to the child), might place children in the position of observing testimonial exchanges as third-party listeners. However, the fact that the speakers direct their claims toward the child seated off camera might place children in the role of direct addressee, rendering both speakers' testimony more compelling. If the manner in which listeners are addressed is a significant factor in testimonial learning decisions, as suggested here, then these mixed cues of address might increase the confusion, and the noise, in children judgments.

The interpersonal influences that operate in children's testimonial learning has received little attention. Previous research has indicated that children place social value on child-directed learning contexts, and often find it hard to reject counter-intuitive information that is intentionally and directly offered to them. This study directly compared children's acceptance of unexpected claims using the interpersonal cue of direct address. It is the first to examine whether children were more likely to accept counter-intuitive testimony when the testimony was directly communicated to them compared to being overheard. The finding that children accepted testimony at a higher rate when communicated through direct address carries important theoretical and methodological implications for children's cultural learning.

Acknowledgments

We thank the parents and children for their participation. We also thank Kevin Ly, Nicholas Mattson, Noa Singer and Daiqing Zhao for help with data collection and coding. Finally, we wish to thank Benjamin McMyler for comments on an earlier version of this manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

Data availability statement

The data described in this article are openly available in the Open Science Framework at DOI:10.17605/OSF.IO/TPA6U.

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