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Dax Gets the Nod: Toddlers Detect and Use Social Cues to Evaluate Testimony

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Abstract

Children ages 18 and 24 months were assessed for the ability to understand and learn from an adult's nonverbal expression of agreement and disagreement with a speaker's claims. In one type of communicative exchange, a speaker made 2 different claims about the identity or location of an object. The hearer nodded her head in agreement with one claim and shook her head in disagreement with the other claim. In a second type of exchange, the speaker asked 2 different questions about the identity or location of an object. The hearer nodded her head in response to one question and shook her head in response to the other. The 24-month-olds grasped the implication of these gestural responses, by inferring the correct name or location of the object. The 18-month-olds showed a limited grasp of their implications. Thus, in learning from others' testimony, toddlers focus not only on the claims of a single speaker but also on whether that information is accepted or rejected by another hearer. In particular, they detect and act on social cues of assent and dissent.

Keywords

gesture; testimony; social cues; social referencing; selective trust

Very young children are tuned in to the nonlinguistic features of their communicative environment. Four-month-olds prefer to listen to child-directed speech, characterized by its high pitch and exaggerated intonation, rather than adult-directed speech (Fernald, 1985). Four- to 6-month-old infants respond differentially to various emotion expressions, such as by smiling and attending more to happy faces than to sad or neutral expressions (Rochat & Striano, 1999; Trevarthen, 1979; Tronick, Als, Adamson, Wise, & Brazelton, 1978). Toward the end of the first year, typically developing infants engage in social referencing, adjusting their behavior in ambiguous situations, for example, crossing a visual cliff, and approaching a stranger or novel object, in light of a parent's social cues (Campos, 1980–1981; Feinman & Lewis, 1983; Mumme, Fernald, & Herrera, 1996; Sorce, Emde, Campos, & Klinnert, 1985). Eighteen-month-olds use social cues more selectively to guide their motor behavior;

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they are receptive to social signals about whether to walk down a slope, but only when they cannot discern the risk of falling on their own (Tamis-LeMonda, Adolph, Lobo, Karasik, Ishak, S., & Dimitropoulou, 2008).

Within a sociocultural view of development (Bruner, 1990; Rogoff, 1990; Vygotsky, 1978), the words, gestures, and other symbols used in social interactions are of paramount significance for learning and development. They can serve as a vehicle of cultural transmission and provide children with models of mental tools that they can internalize and use themselves. Insofar as social cues can influence decisions to approach or avoid an object or person, it is plausible that such cues can guide additional aspects of toddlers' behavior. In particular, they may influence toddlers' willingness to accept or reject verbal information provided by another person, that is, verbal testimony. In a study on infants' understanding of false labeling events, Koenig and Echols (2003) found that 16-month-olds looked longer both at an adult speaker and at their parent, when the speaker provided an inaccurate label for a familiar object versus an accurate label. Thus, infants may engage in a form of social referencing when verbal information contradicts their existing knowledge. The cues that an attentive bystander provides in response to a claim may guide children, particularly when they cannot assess the validity of a claim on their own. Bystander gestures, like head nodding and head shaking, might be useful for disambiguating correct claims from dubious ones. These gestures, subsequently referred to as *head gestures*, are ubiquitous in many cultures and can transmit information about a person's beliefs and attitudes. They can signal agreement or disagreement with a message as well as approval or disapproval of a given behavior. Thus, these cues may facilitate the selective acceptance of information, but only if children are sensitive to them.

Recent research has established that preschoolers are more likely to accept claims that meet with bystander cues of assent, rather than dissent. Fusaro and Harris (2008) found that typically developing 4-year-olds readily use nonverbal signals, including head nods and head shakes, to identify the agreed-upon name of unknown objects. In that study, children were shown a video in which two female informants offered conflicting names for unfamiliar objects. For example, referring to an obscure hardware item, one informant said, "That's a dax," and the other said, "That's a wug." Two female bystanders nodded their heads and smiled in agreement with one informant and shook their heads and frowned in disagreement with the other. Thus, the "correct" object label could not be determined objectively, but could be inferred from the nonverbal signals of the two bystanders. In nearly all cases, when asked what they thought the object was called, children selected the label that received endorsement from the bystanders. This result suggests that typically developing 4-year-olds can use these nonverbal cues to distinguish correct from incorrect information or to identify the agreed-upon (i.e., conventional) label for a new object.

Thus, third-party cues of assent and dissent might have an early impact on the child's acceptance of testimony that they cannot verify independently, but it is not yet known when children become sensitive to such cues. The present study is the first to test toddlers' sensitivity to head nodding and head shaking gestures, in a context in which the gestures can be used to disambiguate accurate from inaccurate information. More generally, we ask whether toddlers have internalized the meaning and referential qualities of agreement and

disagreement gestures (Vygotsky, 1978) and can use them to guide their own behavioral response to testimony that elicits such gestures. Most recent research on young children's selective trust has focused on their receptivity to the claims of one individual informant as compared with another (Harris, 2012). However, to the extent that young children are embedded in a community, it is plausible that they are also sensitive to the different types of communicative exchanges that occur between potential informants. In particular, it is plausible that they are receptive to proposals from one informant that elicit assent from another, whereas they remain cautious about proposals that meet with dissent. Tentative predictions about the emergence of that sensitivity may be drawn from what is known about the production of assent and dissent messages early in life.

Children's Production of Assent and Dissent Messages

When do children typically begin to express their acceptance or rejection of an interlocutor's claims? Existing evidence suggests that the ability to express dissent emerges during the second year of life. By 19–23 months, children use the word *no* to express disagreement (Gopnik & Meltzoff, 1985; Pea, 1980). For example, Pea (1980) asked a 25-month-old, "Is that a biscuit?" while pointing to an apple. The child expressed disagreement, "No, apple," demonstrating explicitly the ability to operate on the proposition offered by the speaker and to offer an alternative (i.e., not-A, B). More recently, Koenig and Echols (2003) observed 16-month-olds' behavior in response to an adult speaker's true- and false-labeling of familiar objects. As noted above, infants looked longer at the speaker in the false-labeling condition, suggesting that they were surprised by the unexpected labels. The investigators further found that 15 of 16 infants in the false-labeling condition spontaneously produced corrective labels. Thus, the infants identified that a claim contradicted their prior knowledge and offered an alternative, which Pea (1982) has also described as an early emerging form of negation. None of the infants in Koenig and Echols' false-labeling condition repeated the speaker's labels. In contrast, eight of the 16 children in the true-labeling condition repeated the adult speaker's accurate labels, consistent with the notion that they conveyed an early form of assent.

Infants' ability to express assent and dissent becomes more robust later in the second to third year. Pea (1982) presented 18-, 24-, 30-, and 36 month-olds with true- and false-labeling events (e.g., "That's the car" while indicating a ball or car). In the false-labeling condition, half the sample of 18-month-olds did not produce a correction. Some 18- and 24-month-olds corrected a single aspect of the misnaming; they either said "no," shook their head, or produced a corrective label (e.g., "ball"). An intermediate pattern of response was the successive stringing together of a denial and a corrective label ("No. . . ball"). Two 24-month-olds and the majority of 30- and 36-month-olds expressed dissent using more coordinated denials (e.g., "No, it's the ball," "Not the car," "Isn't car"). Across age groups, children rarely expressed assent explicitly in response to true labels (e.g., "Yes, car"). However, because labels were presented as statements (e.g., "That's the car"), expressing agreement was not obligatory. Guidetti (2000) tested French 21- and 27-month-olds' ability to express agreement and disagreement in response to yes/no questions that prompted a response. To elicit assertive responses, the experimenter held up a puzzle piece and asked about its identity (e.g., "Is this a pig?" while indicting a pig or doll). Children in both age

groups answered correctly more readily when the expected response was assent, rather than dissent. For both response types, the 27-month-olds provided a higher mean number of correct responses than did the 21-month-olds.

Guidetti (2000) further described the form of children's responses, in terms of whether or not they included a head gesture. Collapsing across the sample, over half of children's correct affirmative responses included a head nod, with or without accompanying speech. Similarly, about 40% of their correct negative responses included a head shake, with or without speech. Thus, when explicitly prompted, head gestures were frequently a part of 21- and 27-month-olds' own correct responses to assertive yes/no questions.

Taken together, these findings suggest that when young children express agreement and disagreement with object-labeling events, they are able to do so using either words, head gestures, or both. However, children's accuracy in conveying agreement and disagreement improves around 24 months. In the domain of spoken language, very early word comprehension skills outpace word production skills (Fenson et al., 1994). That is, the number of different words that children understand exceeds the number that they produce, throughout infancy. Similarly, it is plausible that the ability to understand third-party agreement and disagreement messages emerges before the ability to express agreement and disagreement, at the end of the second year. Thus, children's selective endorsement of information guided by assenting and dissenting head gestures may be evident on or before their second birthday.

The Present Study

Given preschoolers' sensitivity to head gestures and toddlers' emerging ability to express assent and dissent, we examined in the present study whether head nods and shakes can provide 18- and 24-month-old children with a means for accepting competing pieces of information selectively.

To test this younger age group, we modified the protocol used in Fusaro and Harris (2008) into a live presentation. We streamlined the input by including only two actors: A single speaker presented competing claims, to which a single gesturer responded. The gesturer maintained positive affect during the interaction in order to assess children's comprehension of head gestures when they are not coupled with distinctive emotional cues.

Another procedural modification involved varying the linguistic format in which conflicting information was conveyed. In the study by Fusaro and Harris (2008), 4-year-olds presumably had to interpret the gestures as affirmations and negations of the corresponding claims. For example, a head shake conveyed the message that the object was "not a dax." In the present study, we presented the information that would elicit third-party head gestures both in the form of competing claims (e.g., "This is the wug") and in the form of successive yes/no questions (e.g., "Is this the dax?"). This distinction had not been considered in previous studies of children's production of assent and dissent messages. Using a within-group design, this manipulation allowed us to test whether the type of communicative exchange makes a difference for children's understanding of agreement and disagreement messages conveyed through head gesture.

In each of four trials, children were prompted to endorse information regarding the identity and location of unfamiliar objects. The first interchange of each trial concerned object identity. A speaker either stated (e.g., “This is the wug”) or asked (e.g., “Is this the wug?”) which of the two objects, in succession, had a given name. The gesturer responded with a head nod to one claim or question and with a head shake to the other. The other interchange concerned object location. The speaker either stated (“It’s in here”) or asked (“Is it in here?”) which of the two boxes, in succession, contained the target object. The gesturer signaled which box was correct by responding with a head nod to one of the two successive claims or questions and with a head shake to the other. The children could not verify, through independent direct perception, either the correct object or hiding location, because they involved arbitrary relationships (e.g., word–object pairings).

We predicted a shift in the comprehension of nonverbal messages of assent and dissent at the end of the second year of life. More specifically, we predicted that 24-month-olds would comprehend head gestures both when they were produced as a comment on the validity of competing claims (Claims prompts) and also when they were produced as responses to successive assertive questions (Questions prompts). Nevertheless, we anticipated that head gestures used as responses to yes/no questions (Question prompts) might be easier to understand, because the question/ answer interchange provides a familiar format for interpreting a gesture as a response to the preceding question. Thus, the familiar turn-taking format of a question/answer exchange is likely to help the child work out the implications of the response. Messages produced in response to a declarative claim do not fit into such a familiar format, making the relationship between the claim and the response potentially less clear. Inclusion of a younger group of 18-month-old toddlers, whose skills expressing agreement and disagreement are just emerging, allowed us to test this hypothesis. We expected that the 18-month-olds’ performance would be more systematic, that is, more consistently aligned with the gesturer’s message, in response to Questions than to Claims. The addition of the hiding test allowed us to examine whether children’s receptivity to assent and dissent cues extends beyond object-labeling contexts. We hypothesized that children would be receptive to social cues of assent or dissent displayed by another person in learning about object locations as well as object identity.

Method

Participants

Eighteen 18-month-olds (*M* = 18.34, *Mdn* = 18.46, range = 17.3–19.1) and eighteen 24-month-olds (*M* = 24.70, *Mdn* = 24.74, range = 23.6–25.6) participated in this study. In each age group, the sample was divided evenly by gender. Six additional 18-month-olds (three boys, three girls) were excluded due to fussiness. One additional 24-month-old and one 18-month-old (both girls) were excluded because they responded to fewer than five of the eight trials. Families were recruited from child care centers in the greater Boston area. The centers generally served families from middle- to upper income brackets. The majority of participants (*n* = 27) were White, six were Asian, and three were African American. Ten children were exposed to English and an additional language at home. All children were tested in English, which was the only language used in the child care centers.

Procedure

Children were tested by two experimenters during one morning session either in their own child care center classroom or in an adjoining room. To establish rapport, the two experimenters played in the classroom briefly at the start of each visit and played individually with the participating child at the testing table, with an age-appropriate toy. To further reduce anxiety, a familiar teacher was present during the session. To maintain compliance with regulations about class size, other children were often also in the room, and teachers attended to the other children as needed. Finally, to familiarize the child with the boxes used in the Location interchange (described below), children were encouraged to hide an attractive ball in a plain white cardboard box. The box was closed and reopened, and the child was allowed to retrieve the ball.

The child was seated in a familiar, child-sized chair on one side of a small table. The two experimenters sat beside each other, opposite the child. A stationary video camera was positioned beside or behind the experimenters, and sessions were recorded on mini-DV tape. Sessions lasted approximately 15 min. To provide a context for the interaction, the first experimenter presented the child with the first of four pairs of novel objects and stated, “We brought some new toys to play with. We need you to help us figure out what they are!” See Appendix A for descriptions of the novel objects.

In total, four trials were administered, each trial pertaining to one pair of novel objects. At the start of each trial, the child was encouraged to touch and play with the two objects for approximately 15 seconds, after which the first experimenter gently retrieved them. For two of the four trials, information about the objects was presented in question form (Question prompts). For the other two trials, information was presented in declarative claim form (Claim prompts). A within-subjects design was used, such that all children responded to Question and Claim prompts. Half the children in each age group received Questions first, and the other half received Claims first. Each of the four trials included an Identity test and a Location test, described next. The Identity test was always presented first, so that the new object would always be labeled first and then used for play. This order more closely resembles the sequence of events in a typical adult-directed introduction to a novel object or event. We also maintained this ordering because the Hiding test would highlight one object in the pair, making any subsequent choices between the two objects confounded in terms of object salience. Appendix B describes an example of an identity test, using a Claim prompt.

Identity tests—The first experimenter, the speaker, initiated an identity test by asking the child, for example, “Which one is the modi?” (labels included *modi*, *dax*, *mib*, *wug*). She then used that novel label in reference to each object in the pair, in succession. For Question prompts, she asked the child, “Is this [holding up Object 1] the modi?” and “Is this [holding up Object 2] the modi?” For Claim prompts, she stated, “This [holding up Object 1] is the modi,” then “This [holding up Object 2] is the modi.” The second experimenter, the gesturer, produced a head gesture after each question or claim, while looking at the child. She indicated one object as correct (up-down head nod) and the other as incorrect (left-right head shake), while maintaining a friendly, positive demeanor. This sequence was presented twice during each test, in immediate succession (see Appendix B), to reduce the memory

demands of the task. If the child did not spontaneously glance at the gesturer as she produced the head nod or headshake, the gesturer called attention to herself by tapping her finger on the table or moving her head into the child's view. The speaker then asked, "Which one is the modi?" and held the objects in the child's reach. The child responded by manually selecting an object. For both tests, if the child did not make a selection or selected both items, the prompt sequence was presented a third time.

Location tests—A similar procedure was used with the target object (i.e., the correct modi) in a hiding game. The speaker handed the object to the gesturer, and told the child, "My friend is going to hide it in a box and we're going to try to find it!" Out of the child's view, the gesturer surreptitiously placed the target object and a distractor into identical plain white cardboard boxes. The two boxes were then placed equidistant from the child, out of his or her reach. The speaker asked, "Where is that toy?" and immediately offered two options. For Question prompts, she touched each box in succession and asked the child, "Is it in here?" For Claims prompts, she similarly touched each box in succession but stated, "It's in here" each time. In response to each option, the gesturer nodded her head in response to one option and shook her head in response to the other option. This sequence was presented twice during each test, in immediate succession. The speaker then asked, "Where is it?" and moved the boxes toward the child. Children responded by touching a box and/or attempting to open it. In each trial, the speaker retrieved the box and said, "We'll open this at the end" so that no explicit feedback was provided during the session.

The order in which labels (e.g., *dax*, *wug*) were used was counterbalanced across children, as was the identity of the correct object in each pair and the order in which each pair was presented. For each participant, the left/right location of the correct hiding box was alternated such that it was not in the same position for more than two trial sequences in a row.

In addition to the two tests described above, a Function test was also administered between the Identity and Location tests. The Function test followed the same format as the others. The speaker modeled two simple actions using the target object (e.g., the modi). For example, the wooden juicer was used in two ways: tapping on the table three times and rolling on the table three times. For each action, the speaker either stated "It's for this" (Claim prompt) or asked "Is it for this?" (Question prompt). The gesturer nodded her head in response to one demonstration and shook her head in response to the other. The speaker asked, "What do you think it's for?" and held the object out for the child. However, for about half the trials, children did not produce a response. Possible explanations for children's general unresponsiveness on this Function test are considered in the Discussion.

Results

For each trial, correct performance required that the child selected the object or box associated with the gesturer's affirmative, head nodding cues. To generate scores, each correct selection of the target object or box was coded as a 1, and each incorrect selection was coded as 0. Trials in which the child did not select an object after the third prompt were coded as missing.[1] Selection of both objects after the third prompt was scored as .5

(chance).[2] The mean proportions of correct responses (out of a possible total of two), by age group, prompt type (questions vs. claims), and test type (identity vs. location) are displayed in Table 1. We conducted preliminary one-sample *t* tests (two-tailed, .05 level of significance) to examine whether scores differed from chance (.50). Inspection of Table 1 shows 24-month-olds generally chose correctly at levels that were above chance, with the exception of Identity tests in the context of Question prompts. In addition, the collapsed scores of 24-month-olds were above chance in response to both Question and Claim prompts. By contrast, the 18-month olds' scores were generally at chance, with the exception of their more systematic performance on Location tests in the context of Question prompts. Eighteen-month-olds' total scores showed a trend toward significance in the context of Question prompts but not in the context of Claim prompts.

No significant differences were detected between girls' and boys' scores in each prompt and test type combination (all *p*s > .10). Similarly, there were no significant differences between scores of monolingual and bilingual children (all *p*s > .10). Differences by these factors were nonsignificant when analyzed by age group and for the pooled sample, and thus were not included in subsequent analyses.

For subsequent analyses, we applied an arcsine transformation to mean (percent correct) scores. We subjected transformed scores to a three-way repeated measures analysis of variance (ANOVA), with age group (18 months, 24 months) as a between-subjects factor and prompt type (questions, claims) and test type (identity, location) as within-subjects factors. A marginal main effect of age was detected, $F(1, 33) = 3.74$, $p = .062$, reflecting a trend toward higher overall scores by 24-month-olds as compared with 18-month-olds. In addition, a significant Age × Prompt interaction was detected, $F(1, 33) = 8.48$, $p = .006$.

Figure 1 displays the mean untransformed scores by age and prompt type, collapsing across Identity and Location tests. We conducted further analyses of the Age × Prompt interaction using tests of simple effects, collapsing across test types. These analyses revealed that scores in the Claims condition were higher among 24-month-olds than among 18-month-olds, $F(1, 34) = 6.13$, $p < .05$; $d = .9$, whereas performance did not differ significantly by age in the Questions condition, $F(1, 34) = 0.0004$, *ns*. In addition, the scores of 24-month-olds were significantly higher in the context of Claims than Questions, $F(1, 34) = 6.19$, $p < .05$, whereas the scores of 18-month-olds' did not differ significantly with prompt type, $F(1, 34) = 1.62$, *ns*.

To check for order effects, we added a dichotomous variable to the repeated measures ANOVA as a between-subjects variable, indicating whether the child first heard questions or claims prompts. No significant main effects or interactions involving order were detected. The same pattern of results reported above was obtained when order was included in the model.

[1]Of those children who provided no response on at least one of eight trials, six children missed one trial and three missed two trials.
[2]Selection of both objects occurred in 14 of the 144 question trials, by 11 children (all 18-month-olds), and in 18 of the 144 claim trials, by 11 children (ten 18-month olds, one 24-month-old).

In immediate response to the gesturer's actions, several children were observed nodding and shaking their own heads. We examined whether this spontaneous behavior was related to performance on the experimental task. Videotapes were adequate for this analysis for the majority of participants (29 out of 36; 14 eighteen-month-olds and 15 twenty-four-month olds). Of these 29 children, four 18-month-olds and eight 24-month-olds imitated the gesturer at least once. To assess the impact of such imitative responses, we subjected the transformed scores to a three-way repeated measures ANOVA, with age group (18 months, 24 months) and imitation (imitated at least once vs. never imitated) as between-subjects factors and prompt type (questions, claims) as a within-subjects factor. No significant effects involving imitation were identified. However, among the 12 children who did imitate, mean subscores (percent correct) were higher for those trials during which they imitated the model (M = .81, SD = .32), compared with those trials when they did not imitate (M = .52, SD = .28). A paired samples t test on arcsine transformed subscores confirmed that this difference was significant (t = 2.42, p = .036).

Discussion

We asked whether toddlers who witnessed distinctive nonverbal reactions to claims and questions could work out their implications and act accordingly. In one type of interchange, a speaker made successive claims about the identity or location of an object. The gesturer nodded her head in agreement with one claim but shook her head in disagreement with the other claim. In a second type of interchange, the speaker asked questions about the identity or location of an object. The gesturer nodded her head in response to one question and shook her head in response to the other. In general, 24-month-olds grasped the implication of these interchanges by inferring the correct name or location of the object. Thus, 24-month-olds were sensitive to head gestures in the context of conflicting claims about identity and location. They were also sensitive to these gestures in the context of yes/no questions, but only with respect to location not with respect to identity. The 18-month-olds responded less systematically. They produced chance-level performance in the context of successive claims. However, they were sensitive to head gestures in the context of successive questions, although, like the 24-month-olds, only with respect to location and not with respect to identity. Overall, although both age groups performed similarly in the context of interchanges involving questions, the older group was more accurate than the younger group in the context of interchanges that involved claims.

In this section, we discuss what we learned from these findings regarding the development of children's sensitivity to nonverbal messages of assent and dissent. We then consider their mixed performance in response to Question prompts, identifying task features that may explain the pattern of results. Finally, we offer an interpretation of the incidental findings regarding children's imitation of the gesture model and draw conclusions about how nonverbal cues might figure into children's selective learning.

In at least three ways, these results extend our understanding of young children's comprehension of head gestures signaling assent and dissent. First, although we previously reported that 4-year-olds are sensitive to these gestures (Fusaro & Harris, 2008), the present study shows that this sensitivity develops early. In particular, the 24-month-olds' overall

performance shows that nonverbal cues can guide children's selective acceptance of competing pieces of information before the preschool period. Between 18 and 24 months of life, it appears that children progress in their development of the skills required for successful performance, which may include encoding these social cues, relating them to the task materials, drawing inferences from this coordination, and using those inferences to guide their behavior. Second, the present study addresses a potential confound in Fusaro and Harris (2008), in that bystanders produced head nodding and shaking gestures in tandem with exaggerated affect displays (i.e., smiles and frowns). The present study coupled both nodding and shaking gestures with positive facial affect, so that distinctions could not be made on the basis of positive and negative emotional cues. Hence, the present study was a more stringent test of children's receptivity to assent and dissent messages, in that these messages were conveyed in only the gestural modality. Finally, the 24-month-olds' systematic performance on the location test in the present study demonstrates that children's sensitivity to agreement and disagreement is not limited to contexts that involve object identity. Taken together, these findings suggest that 2-year-olds monitor adult assent and dissent cues. More specifically, they are able to differentiate between the valid and invalid information proposed by a speaker by taking note of a hearer's head gestures. By implication, toddlers can learn not only from the testimony of individual speakers but also from the subsequent expressions of agreement and disagreement that they observe.

We predicted that because yes/no questions are routine interactions that follow a simple turn-taking format familiar to young children, they would be relatively easy for the children to understand. In line with this prediction, the 18-month-olds had some success, scoring similarly to 24-month-olds when gestures were presented as responses to yes/no questions concerning object location. Why might the young children have responded systematically in this particular prompt and test combination? One possibility is that in the Hiding test, the same person who hid the toy subsequently produced the head gesture. Thus, there was a reason for the child to see that person as a particularly good informant about the object's location. However, 18-month-olds' scores were not higher on location tests in response to claim prompts. If there was a facilitative effect of the hider's identity in the hiding condition, it should have applied across prompt types. Another possibility is that repeated questions in a hiding game provided the most familiar context for the young children. That is, in everyday play, children may occasionally be prompted with questions to find an object from among multiple locations, whereas the other prompt and test type combinations are less likely to occur. Thus, if toddlers' skills in interpreting head gestures are just emerging, the familiar context of a "where is it?" game may have scaffolded their performance. In other words, comprehension of these gestures may be within the range of what children can accomplish only with support (i.e., within the zone of proximal development), such as the support of embedding them in a familiar schema of a "where is it?" interaction.

Although the 18-month-olds met with some success, children's overall performance in response to Questions was uneven, for both age groups. Features of the task presentation may have taxed children's comprehension. In particular, the present protocol was modeled on that used by Fusaro and Harris (2008). In that study, the speakers and gesturers did not interact; instead, the speakers looked either at the novel object or at an additional actor who prompted the speakers for information. The bystanders stood behind the informants, faced

forward, and produced gestures as third-party comments about the speakers' utterances. This format deviates from typical information-sharing routines, particularly question/answer exchanges. In the present study, the gesturer was presumably answering the speaker's questions, but the two adults did not engage in typical patterns of eye contact. Children's performance may have been impacted negatively by this departure from familiar patterns of interaction. Future research might consider whether children are more sensitive to gestures when they are presented in a more typical fashion, even if eye contact and other ostensive cues directed to the child are reduced as a result.

Success in both experimental conditions also depended on children's ability to shift attention between the speaker, gesturer, and the object or hiding location in order to keep track of the interaction. In the naming tests, children also had to attend to the new word that was presented. Successful performance thus required the coordination of multiple visual and auditory components of the task. Age-related increases in this coordination of input likely contributed to the 24-month-olds' relative success. By 18 months, infants can use a speaker's direction of gaze to map a novel label to a correct target object (Baldwin, 1991). The task demands in the present study exceed this level, given the additional actor involved in the exchange. Attention demands likely contributed to variation in overall performance. In line with this interpretation, the attention-related demands were highest in the Function test, which was eliminated from analysis due to children's lack of responsiveness. In this test, two actions were demonstrated using a novel object. Corresponding head gestures were presented to identify one of the actions as correct. Thus, the Function test involved additional actions on objects for children to track. The response demands were also higher in this test than the others because children had to demonstrate an action, rather than choose an object or a hiding location. Furthermore, unlike object labels and locations, object functions are not mutually exclusive. Thus, children may have perceived both demonstrated actions as acceptable, rather than being in conflict. Without a feeling of uncertainty, children may be less receptive to the assent and dissent cues. Such an interpretation is in line with the finding that 18-month-old toddlers are less likely to use social cues to guide motor behavior when the risk of falling is unambiguous (Tamis-LeMonda et al., 2008). Simplification of the Function test, as well as systematic tracking of the children's looking behavior, would illuminate the role of attention-related demands and task features in processing agreement and disagreement messages across various learning contexts.

An unexpected but intriguing finding of this study was that some children spontaneously imitated the gesturer on a subset of trials. This behavior raised the question of whether imitation facilitated children's understanding and application of the agreement and disagreement messages. Because the children who imitated scored no higher, overall, than the nonimitators, it is unlikely that the imitators had a better general understanding of the head gestures. It is plausible that spontaneous imitation indicates that, on those particular trials, the children were attending particularly well to the gesturer's actions and trying to incorporate them into their own response. Speculating further, the imitative acts may have helped children to remember the intended yes/no response. Evidence from adults suggests that performing an action facilitates memory for the action, compared with hearing a description of an action or imagining someone perform it (see Engelkamp & Zimmer, 1989). It may also be the case that moving the head in a way that is linked to a positive or negative

attitude impacts one's attitude toward a target. There is evidence for such a connection in adults. In particular, Wells and Petty (1980) found that college students were more likely to agree with a counter-attitudinal message in favor of tuition increases when they were asked to nod their heads while listening to the message, as opposed to shaking their heads while listening to it (see also Ping, Dhillon, & Beilock, 2009, for a review). Imitation may facilitate the translation from a perceived gesture into the corresponding attitude toward competing pieces of information. It is not possible, based on this study, to determine whether this spontaneous imitation had any causal impact on performance. These behaviors may simply be a reflection of the child's comprehension on those trials. Future studies could examine this line of inquiry directly to clarify what the child's imitative actions tell us about the interpretation and internalization of valenced information.

The present study does not allow us to determine whether the children used each of the two gestures equally. It is possible that children used one gesture to draw a conclusion about one claim, and responded systematically based on that inference. Indeed, previous work on children's selective trust has shown that 3-year-olds are particularly attuned to informants' errors. They distinguish an informant who is inaccurate from one who is either consistently accurate or makes neutral remarks. In contrast, they do not distinguish between an accurate informant and one who makes neutral remarks (Corriveau, Meints, & Harris, 2009). Thus, inaccuracy may be particularly significant for guiding young children's selectivity. A future study might present the gestures separately, to probe this question of differential sensitivity to the two gesture types.

The key finding of 24-month-olds' selective endorsement of competing claims is of theoretical interest for research in social referencing and selective trust. Social referencing research in the first 2 years of life generally focuses on children's use of social cues to guide their behavior toward a physical target, such as an unfamiliar object or an ambiguous crawling or walking surface. The present study suggests that 24-month-olds can also systematically use gestural cues that are directed toward verbal statements. A developmental perspective on social referencing suggests that as children begin to master skills in any domain, such as the comprehension of object labels, they will concurrently become open to social cues that guide their learning at that developmental level. With greater mastery, children may become increasingly efficient at integrating multiple sources of information, and acting in accordance with social cues.[3] Future research may confirm the notion that any behavior will become subject to the effects of social referencing, once that behavior is within the child's repertoire.

These findings also advance theoretical perspectives on selective trust, because they suggest an expanded range of social antecedents that can lead to selectivity. In the classic selective trust paradigm, the child is invited to choose one individual informant versus another on the basis of the informants' own behavior, namely, their use of accurate or inaccurate object labels. Subsequent studies have shown that children can draw distinctions between informants on the basis of other behaviors, such as the use of familiar or unfamiliar accents (Kinzler, Corriveau, & Harris, 2011), and their performance of familiar acts (Rakoczy,

[3]We thank an anonymous reviewer for this suggestion.

Warneken, & Tomasello, 2009). Furthermore, we know that an informant's identity as someone familiar to the child (e.g., a caregiver) tends to predispose the child to selective trust (Corriveau & Harris, 2009; Corriveau, Harris, Meins et al., 2009). The present findings suggest that children's selectivity is not limited to settings that involve selecting one informant over another on the basis of person-specific characteristics. Instead, their selectivity is also guided by the nature of the communicative acts that transpire between informants. More specifically, children are sensitive to expressions of agreement and disagreement by one informant in reference to the other. Thus, preschoolers are not disposed to accept any and all information that they encounter. Instead, they are selective learners, interpreting the communicative exchanges between informants as well as the behaviors and characteristics of individual informants to determine what claims to accept.

In conclusion, we examined in this study toddlers' selective acceptance of information on the basis of gestural cues of assent and dissent. The findings support the proposal that an individual's head gestures can guide children's selective learning around the end of the second year of life. When faced with information that they cannot verify independently, toddlers focus not only on the claims of a single speaker but also on the way that information is accepted or rejected by another person. They take on the attitude toward conflicting pieces of information that matches the attitude of another listener. Thus, the process of learning from others is guided by social cues, notably gestures of agreement and disagreement, displayed by other people.

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Appendix A

Description of Novel Object Pairs

Wooden juicer; blue and white plastic toilet flapper
Yellow plastic gas tank spout; gray plastic wire holder
Black foam knee pad with strap; black round utility sponge (one side cut into a zig-zag)
Black rubber toilet sinker; white rubber tub stopper

Appendix B

Description of a Sample Identity Test, Using a Claim Prompt

Speaker gives juicer and flapper to child for 15 seconds; retrieves objects.
Speaker: “Which one is the wug?”
Speaker: [Holding up juicer] “This is the wug.” Gesturer: Nods head
Speaker: [Holding up flapper] “This is the wug.” Gesturer: Shakes head
Speaker: [Holding up juicer] “This is the wug.” Gesturer: Nods head
Speaker: [Holding up flapper] “This is the wug.” Gesturer: Shakes head
Speaker: [Holding both objects in child’s reach] “Which one is the wug?”
Child chooses one object. Correct response: Juicer
If the child selects both items, or does not respond, continue:
Speaker: [Holding up juicer] “This is the wug.” Gesturer: Nods head
Speaker: [Holding up flapper] “This is the wug.” Gesturer: Shakes head
Speaker: [Holding both objects in child’s reach] “Which one is the wug?”
Child chooses one object. Correct response: Juicer

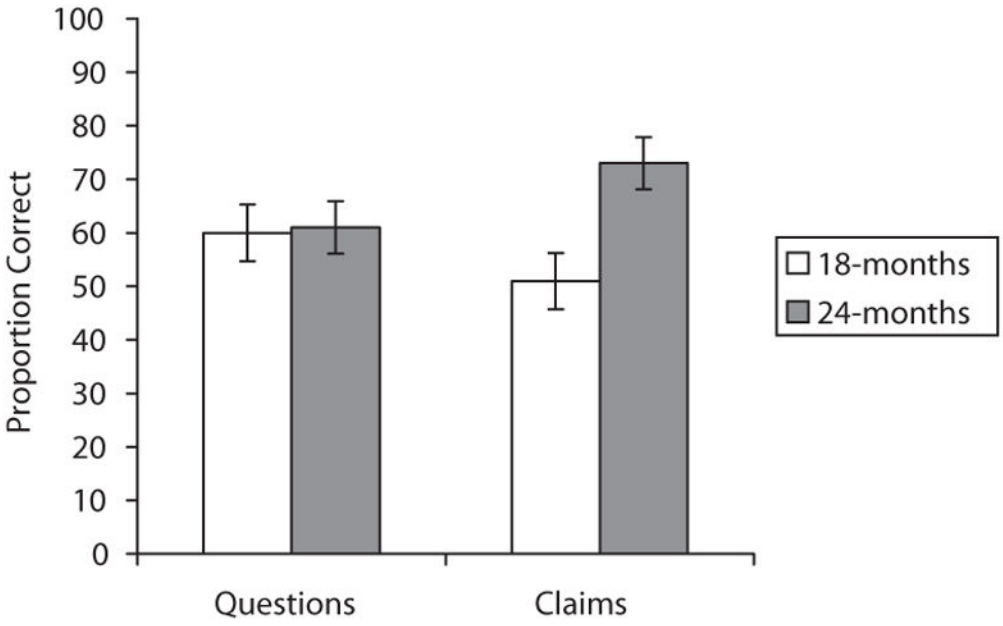

Figure 1.
Proportion correct by age and prompt type. Error bars indicate +/−1 *SE*.

Table 1

Mean Proportion Correct, Standard Deviations (in Parentheses), and Comparisons to Chance (.50) by Age, Prompt Type, and Test Type

Trial type	18-month-olds (*n* = 18)	24-month-olds (*n* = 18)
Question prompts		
Identity test	.56 (.35)	.53 (.32)
Location test	.65 (.24)*	.69 (.30)*
Total	.60 (.23)†	.61 (.18)*
Claim prompts		
Identity test	.50 (.32)	.74 (.35)**
Location test	.54 (.28)	.72 (.31)**
Total	.51 (.22)	.73 (.24)**

† $p < .10$.

* $p < .05$.

** $p < .01$.