Learning Words from Knowledgeable versus Ignorant Speakers: Links Between Preschoolers’ Theory of Mind and Semantic Development

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Two studies addressed whether children consider speakers' knowledge states when establishing initial word-referent links. In Study 1, forty-eight 3- and 4-year-olds were taught two novel words by a speaker who expressed either knowledge or ignorance about the words' referents. Children showed better word learning when the speaker was knowledgeable. In Study 2, forty-eight 3- and 4-year-olds were taught two novel words by a speaker who expressed uncertainty about their referents. Whether the uncertainty truly reflected ignorance, however, differed across conditions. In one condition, the speaker said he made the object himself and thus, he was knowledgeable. In the other condition, the speaker stated that the object was made by a friend and thus, expressed ignorance about it. Four-year-olds learned better in the speaker-made than in the friend-made condition; 3-year-olds, however, showed relatively poor learning in both conditions. These findings suggest that theory-of-mind developments impact word learning.

INTRODUCTION

Imagine spending a leisurely Saturday afternoon at a local museum of natural history with your 4-year-old daughter, who is fascinated with dinosaurs. After naming many, she comes to one she does not know. She points to the dinosaur, looks up at you and says, “What’s that one?” Unless you are a paleontologist (or a preschool teacher), there is a strong likelihood that you will not know. You reach back into your meager lexicon of dinosaur names and come up with one that you have not heard uttered by your daughter yet today and say, “Well, I’m not sure, but maybe it’s a pteranodon.”

This situation contains many variables conducive to word learning. Your daughter has clear interest in the thing being labeled (Nelson, 1973), which occupies your joint attentional focus (Tomasello & Farrar, 1986), and you have provided an unfamiliar label (Golinkoff, Mervis, & Hirsh-Pasek, 1994) along with clear referential cues (Baldwin et al., 1996). Despite these factors, it might be advisable for your daughter to avoid establishing this word-referent link, because as you provided the link, you hesitated and declared your uncertainty about whether the word you were providing was the correct one. Recognizing your ignorance, your daughter could avoid a potential error by resisting establishing this word-referent link and holding out for one furnished by a more authoritative source. Her ability to recognize your ignorance, however, depends on the sophistication of her “theory of mind”—her understanding of mental states and the relation between mental states and behavior. The primary question under investigation in the present research is whether 3- and 4-year-olds’ developing understanding of knowledge states guides their word learning.

Theory of Mind and Word Learning in Infancy

Evidence for links between theory of mind and word learning comes from research showing that even young infants appear to consider speakers' intentional states when establishing initial word-referent links (see Baldwin & Tomasello, 1998). For instance, Baldwin (1991, 1993) has demonstrated that children as young as 18 months reliably link words with referents that are specified by the speaker—that is, what speakers are looking at—as opposed to referents that are most salient or available to them when the label is provided. Further, in situations in which the speaker’s attentional focus cannot be apprehended, children give no clear evidence for learning (Baldwin et al., 1996).

Additional evidence regarding the developmental relation between theory of mind and word learning comes from Carpenter, Nagell, and Tomasello (1998) who found that the onset of joint attention—an important social-cognitive milestone in infancy—is correlated with children’s early language comprehension and production. Further, individuals with autism, a developmental disorder characterized in part by theory-of-mind deficits (Baron-Cohen, 1995), also show inappropriate vocabulary acquisition (Kanner, 1973; Tager-Flusberg, 1994). Research by Baron-Cohen,
Baldwin, and Crowson (1997) suggests that their vocabulary deficits might stem, at least in part, from a tendency to associate words with referents that occupy their own attentional focus, rather than that of the speaker. On the basis of these findings it is reasonable to suggest that early word learning receives important support from children’s theory-of-mind skills.

Little is known, however, about the ways in which theory-of-mind skills continue to be recruited to the task of establishing word-referent links throughout development. One possibility is that children rely on referential cues, such as eye gaze, in a rigid manner, and follow these cues regardless of whether they provide relevant information about speakers’ intentions. Alternatively, children may be able to use these cues more flexibly to achieve the goal of “figuring out what people mean” when speakers use words (Tomasello, 1999). If this were the case, one might expect children’s word-learning abilities to become more sophisticated and flexible as their abilities to make appropriate judgments about speakers’ intentions become more mature. A goal of the present research is to provide some initial findings that indicate whether and how developmental advances in theory of mind might benefit word learning in the preschool years.

**Theory of Mind and Word Learning in Preschoolers**

Research over the past 15 years has provided a general picture of the timetable by which children typically reach particular milestones in theory-of-mind development (Flavell & Miller, 1998; Wellman & Gelman, 1998). In particular, children seem to evidence a sophisticated understanding of so-called motivational mental states, such as intentions and desires, by 18 to 24 months of age (Bartsch & Wellman, 1995; Meltzoff, 1995; Repacholi & Gopnik, 1997). A similarly sophisticated understanding of so-called epistemic mental states, however, such as knowledge and beliefs, appears to develop later—sometime between the ages of 3 to 5 years (Bartsch & Wellman, 1995; Moses & Flavell, 1990).

How might an emerging understanding of epistemic mental states benefit word learning? As noted earlier, an appreciation of epistemic mental states can be powerful in that it can lead children away from errors that might be incurred by learning from people who are not knowledgeable about the things they are labeling. Relying on mechanisms to avoid word-learning errors is likely a crucial part of the word-learning process for a number of reasons (see Baldwin, 1991). For example, research has suggested that the existing lexicon plays an important role in shaping future word learning. For instance, once children have acquired a name for a particular category, they are resistant to learning a second name for that same category (Markman, 1994). If children establish strong word-referent links that come from ignorant speakers (links that have a strong likelihood of being incorrect) overcoming these word-learning errors could be a lengthy process with negative implications for subsequent learning.

Although no research has directly addressed the question of whether children regularly encounter labels offered by ignorant speakers, there are reasons to expect that this is a relatively frequent occurrence. For instance, Callanan, Sabbagh, Perez, and Cervantes (1995) found that in natural language, parents do provide incorrect labels for things while expressing their uncertainty—either through the use of a hedge, or a question intonation (e.g., “Maybe it’s a beluga” or “Is that a beluga?”). Further, Clark (1993) reported that in the course of word learning, children often “innovate” their own word-referent links for objects whose names are unknown. Of course, these innovative word-referent links rarely match the adult conventions. Children are likely to encounter these links offered from the standpoint of ignorance both in their own production and in the production of their peers. Thus, there seems to be considerable potential for children to be exposed to erroneous word-referent links when either they, their parents, or their peers label things from the standpoint of ignorance.

The primary goal of the present research, then, was to investigate whether children’s developing understanding of knowledge states impacts their word learning by leading them to avoid learning words from ignorant and potentially unreliable sources.

**STUDY 1**

The first study sought to establish whether children learn words better from knowledgeable rather than ignorant speakers. Children were taught labels by a speaker who provided clear referential information (i.e., pointing and labeling) and directly expressed either knowledge or ignorance with respect to the link being offered. Direct statements about knowledge and ignorance were provided because previous research has shown that even young preschoolers (i.e., 3-year-olds) demonstrate an appreciation of others’ knowledge states when information about knowledgeability is made explicit (Esbensen, Taylor, & Stoess, 1997; Lyon, 1993). It was predicted that if children rely solely on referential information (i.e., pointing and labeling) to establish word-referent
links, they should learn equally well from both knowledgeable and ignorant speakers. If, however, word learning is guided by social information relevant to the knowledge states of speakers, children in both age groups should learn words better from knowledgeable as opposed to ignorant speakers.

Method

Participants

Forty-eight normally developing English-speaking children from two age groups participated. The 3-year-olds ranged from 3 years, 0 months (3,0) to 3,6 (M = 3,3); and the 4-year-olds ranged from 4,0 to 4,6 (M = 4,3). The mean ages of participants across conditions were the same. There were equal numbers of boys and girls. Participants were recruited from a database drawn from a primarily White, middle-class population in the Pacific Northwest of the United States. All children received either a $5 gift certificate or a colorful T-shirt for participating.

Materials

Toys

During a brief warm-up session, a wooden maze with multicolored pegs was used. For the experimental trials, two sets of three unfamiliar (i.e., novel and nameless) toys were used as stimuli. Included in toy set A was a ball covered with multicolored suction cups (the “gripper”); a hard, plastic bell attached by a rivet to a handle with two strikers on either side (the “bell”); and a collapsible cup (the “cup”). Toy set B consisted of a tightly tied string of multicolored, prism-shaped blocks that could be twisted into interesting shapes (the “snake”); a red, corrugated plastic cylinder that squeaked when compressed (the “squeaker”); and a toy with two ball-ended, plastic levers conjoined so that the two levers moved in tandem to make the ball ends collide (the “clacker”). The toys within each set were chosen to be distinctive from one another and were balanced for salience.

Novel Words

Children were introduced to two novel words, blicket and dawnoo, selected because they were unfamiliar and followed the phonotactic constraints of English.

Experimental Props

Children were tested at a small table in a quiet room on a university campus. On the table was a mailbox pasted with pictures of a parrot hand puppet (“Birdie”), an answering machine, and a mock speakerphone consisting of a push-button desk telephone with the receiver mounted upside down in the cradle, and two small stereo speakers attached to a portable tape player hidden under the table.

Data Collection

Experimental sessions were video recorded using a camcorder outfitted with a wide-angle lens. The camcorder was mounted on a tripod unobtrusively placed in the corner of the room and had an unobstructed view of the experimental site. Children’s performance was coded off-line from the videotape.

Design

In a between-subjects design, children were randomly assigned to one of two experimental conditions: (1) speaker knowledgeable, in which the word-referent link was provided by a speaker who claimed to know that it was correct and (2) speaker ignorant, in which the word-referent link was provided by a speaker (male experimenter) who claimed to be uncertain whether the link was correct. Children participated in two trials. They heard the word blicket on the first trial and dawnoo on the second trial. For each child, a pair of toys, one from set A and one from set B, served as target toys—one toy was the target in Trial 1 and the other was the target in Trial 2. Toys were assigned as three target pairs: (1) the gripper from set A and the squeaker from set B, (2) the cup from set A and the clacker from set B, and (3) the bell from set A and the snake from set B. Across children, all toys served as targets in both conditions equally often. Further, all toys were targets in Trials 1 and 2 equally often. The position of the target at time of labeling (left, center, or right) was counterbalanced across children with the constraint that the position differed across trials for any given participant. Finally, in a comprehension test that came at the end of the experiment, the question that was asked first (blicket or dawnoo) was counterbalanced across children.

Procedure

Following a 10-min warm-up task that involved moving pegs of different colors through a wooden maze frame, children began the experimental task. Both experimental trials had the same four-episode structure: (1) label introduction, (2) play session, (3) label training, and (4) elicited production test. After
the first trial was completed, the second trial began. At the end of the second trial, the experimenter administered a comprehension test involving the novel words and toys from both trials combined. For brevity, only the first trial and the final comprehension test are described in detail.

**Trial 1**

**Label introduction.** The experimenter began by explaining that the playroom was a room shared with a friend, Birdie, who was out playing on the playground, and that Birdie sometimes called the experimenter to send her toys. The experimenter then proceeded to play a prerecorded answering machine message from Birdie who explained that she had left her blicket in the playroom and that she would like the experimenter to send it to her (see the Appendix). To ensure understanding by the children, the experimenter recapitulated the message and asked them to say the word themselves (“Did you hear that? Birdie said that she forgot her blicket. Can you say blicket?).

The critical experimental manipulation followed the introduction of the novel word. In the speaker-knowledgeable condition, the experimenter said, “You know, I’d really like to help my friend Birdie, and I know right where her blicket is,” and then indicated a plastic, large index card box with Birdie’s picture on it that contained the toys, saying, “It’s in this box, here.” In the contrasting speaker-ignorant condition, the experimenter said, “You know, I’d really like to help my friend Birdie, but I don’t know what a blicket is. Hmmmm.” Then after appearing to search around for a moment, the experimenter picked up Birdie’s box and said, “Maybe it’s in this box, here.”

The experimental conditions were balanced throughout the experimental procedure for number of utterances used to convey the knowledge state, and for number of times the novel label was used.

**Play session.** The experimenter took three toys out of a box, placed them in a row, and encouraged children to play with them. During the play session (~2 min), the experimenter indirectly reinforced his knowledge or ignorance by communicating his relative familiarity with the toys. In both conditions, he spoke enthusiastically about each of the toys and made three utterances intended to communicate his knowledge or ignorance about the potential referents for the word blicket. (In the speaker-knowledgeable condition the experimenter said, “I’ve seen Birdie play with these a lot. I’ll show you what this does. I’ve seen all these toys before.”) In the speaker-ignorant condition the experimenter said, “I’ve never seen Birdie play with these. I wonder what this does. I’ve never seen these toys before.” The toys were not labeled in either condition.

Information about familiarity also was provided indirectly through the experimenter’s play style. In the speaker-knowledgeable condition, the experimenter directly demonstrated the function of each toy, thereby indicating his level of familiarity with each. In the speaker-ignorant condition, the experimenter played with the toys more tentatively, and appeared to “discover” the function of each toy. Across conditions, the experimenter twice demonstrated the function of each toy and the child was asked to perform the toy’s function. Care was taken to ensure that children played with each of the toys an equal amount of time.

**Label training.** After the play session, the experimenter put the toys out of the children’s reach and labeled the target. In the speaker-knowledgeable condition, the experimenter said, “You know, I’d like to help my friend Birdie, and I know just which one’s her blicket. It’s this one [pointing to the target toy]. This one’s her blicket [touching the target toy]. Could you put it in the mailbox to send to Birdie?” The child then put the target toy in the mailbox and the experimenter closed the mailbox saying, “Good, now Birdie will get her blicket.” In the speaker-ignorant condition, the experimenter said, “You know, I’d like to help my friend Birdie, but I don’t know what a blicket is. Hmmmm. Maybe, it’s this one [touching the target toy]. Maybe this one’s her blicket. Could you put it in the mailbox to send to Birdie?” When the child put the toy in the box, the experimenter said, “Good, now maybe Birdie will get her blicket.” In both conditions, the experimenter provided labeling utterances with sufficient enthusiasm to maintain the children’s attention; the verbal cues were relied on to provide the information about the speaker’s relative knowability.

To ensure that the experimenter’s level of physical contact with the target toy was equal to that of the distracter toys, the distracters were also put into the mailbox. In the speaker-knowledgeable condition, the experimenter said, “You know what? Maybe Birdie forgot these other ones, too [pointing to the distracters]. Maybe we should send these to Birdie, just in case.” In the speaker-ignorant condition, the experimenter said, “You know what? We might be wrong. It might be one of these [pointing to the distracters]. Maybe we should send these to Birdie, just in case.”

To summarize, children in both conditions heard the word blicket eight times: four in the answering machine message, twice in the label introduction, and then twice during label training while the exper-
imenter looked at and touched the toy. The difference across conditions was whether the speaker claimed to be knowledgeable or ignorant about the word’s referent.

_Elicited production test._ Directly following label training, children were tested in an elicited production task. The experimenter told children that they were going to play a picture book game during which they would name pictures. The experimenter explained to the children that some of the pictures were really hard and that it was all right for them to answer “I don’t know” when they did not know something.

The picture book included two color printouts of digitized pictures of the target toy, two pictures of each of the two distracter toys, and pictures of eight familiar objects digitized from a picture book suitable for young preschoolers. The novel objects were interspersed randomly with the familiar objects with the following constraints: the whole set of three toys (target and two distracters) was presented before any novel object was repeated, and no more than two novel objects could appear consecutively. All children viewed the same picture book. The picture book used in the elicited production test for the second trial (described later) had the same constraints, although it contained a different set of pictures than the book used in the first (blicket) trial.

The experimenter showed children the pictures in sequence. For each picture the experimenter asked, “What’s this?” After children provided an answer, the experimenter said “ok” regardless of whether it was correct. The second time each toy in the set was presented, if the child said, “I don’t know” or provided a label other than the one that was involved in the training, children were asked two follow-up questions. One question was asked to assess their memory of the object (“What does this do when you play with it?”), and the second one further elicited production of the novel label (“Is it called anything special?”). These questions were not asked any time that children used the novel label, even if the usage was incorrect.

**Trial 2**

After the elicited production test for Trial 1, children played a brief filler game of coloring with crayons and paper for approximately 5 min, and then the experimenter began Trial 2. Conditions for the second trial were the same as the first with the exception that children overheard a scripted speakerphone call instead of an answering machine message (see the Appendix). After the phone call, the second trial proceeded exactly as the first.

**Comprehension Test**

Immediately after the second elicited production test, children were given a comprehension test. All six toys used across both trials were taken out of the mailbox and arranged randomly on the table in a 3 (column) × 2 (row) array. After the toys were arranged, children were asked to touch each of the toys one time. The experimenter then looked directly at the child and asked, “Could you put the [blicket/dawnoo] in the mailbox?”, once for each novel word. The toy selected in response to the first question was not removed from the mailbox before the second comprehension question was asked, and thus was not present when the second question was asked.

**Post Hoc Control Coding**

One potential concern was that the experimenter might be more enthusiastic in the speaker-knowledgeable condition than in the speaker-ignorant condition. To address this possibility, three independent coders rated the experimenter’s enthusiasm throughout the procedure on five dimensions: (1) prosody—the amount and range of variability in the pitch of the voice, (2) volume—how loud the experimenter spoke, (3) facial expressiveness—the level of expressiveness and interest in the experimenter’s facial expressions, (4) rate of speech—how fast the experimenter spoke, and (5) proximity to child—how close the speaker was to the child at the time of labeling. Each of these categories was rated on a 3-point scale (1 = lower-than-normal levels, 2 = normal levels, and 3 = higher-than-normal levels). Ratings on all five dimensions were taken during all three phases of both experimental trials, giving a total of six ratings on each dimension for every participant. Inter-rater reliability was attained on 20% of the videotaped sessions and found to be of an acceptable level, $k = .72$. Because of audio difficulties (lower volume) with the videotape, two participants could not be included in this analysis (one from the speaker-knowledgeable condition and one from the speaker-ignorant condition).

**Results**

For the elicited production data, children received a point each time they correctly labeled the picture of the target object with the target label. If children overextended the target label to one of the distracter toys in the elicited production test, they received zero points for that trial. Children had two chances on
both trials, for a possible maximum score of 4. For the comprehension data, children were given a point each time they correctly selected the appropriate target object in response to the novel word question. Children were asked one question about each word, for a possible maximum score of 2.

Preliminary Analyses

Speaker Enthusiasm Control

The enthusiasm ratings were averaged over phases of the experimental trials (total of six) for each of the five coding dimensions. Average ratings on the five dimensions were then treated as dependent variables and submitted to a one-way MANOVA with experimental condition as the independent variable. This analysis revealed no significant multivariate main effect for condition, Wilks’s $\lambda = .81$, $F(5, 40) = 1.82$, ns. A second analysis that focused only on ratings taken during the two label-training phases also revealed no significant main effect for condition, Wilks’s $\lambda = .86$, $F(5, 40) = 1.27$, ns. Finally, two regression analyses were performed in which these five dimensions were entered as predictor variables, with children’s performance on each dependent measure (elicited production and comprehension) as the outcome variables. The model failed to significantly predict outcomes on either measure, elicited production: $F(5, 40) = 1.77$, ns; comprehension: $F(5, 40) = 1.74$, ns. Thus, any condition effects could not be attributed to condition differences in the enthusiasm of the speaker.

Trial Analyses

Two 2 (trial) $\times$ 2 (condition) $\times$ 2 (age) mixed-design ANOVAs with trial as the repeated measure were carried out, one for the elicited production data and one for the comprehension data. There was a significant effect for trial for the elicited production data, $F(1, 44) = 6.27, p < .05$; children showed better evidence for learning on Trial 1 (blicket) ($M = .936, SD = .993$) than on Trial 2 (dawnoo) ($M = .604, SD = .885$). There were no significant interactions with either age or condition factors. Further, there were no significant main effects or interactions involving the trial factor for the comprehension data. The trial effect in the elicited production data was likely due to fatigue because the elicited production test for Trial 2 always occurred about 8 to 10 min after the elicited production test for Trial 1. Because there were no significant interactions with age or condition, the trial effect was considered unproblematic.

Gender Analyses

Finally, a 2 (gender) $\times$ 2 (condition) $\times$ 2 (age) ANOVA found no significant main effects or interactions involving gender for either the elicited production data or the comprehension test data. Thus, the data were also collapsed across gender.

Age and Condition Effects

Elicited Production Test

In the elicited production data, children showed near-perfect naming accuracy rates for the 16 familiar objects ($range = 75–100\%, M = 95\%$). Additionally, all children who did not provide labels for novel objects correctly answered the memory control question (“What does this do when you play with it?”), thereby suggesting that failure to label could not be attributed to entirely forgetting their experience with the object.

Figure 1 Mean performance (with standard error bars) in Study 1 on the (A) elicited production, and (B) comprehension test measures.
A 2 (age) × 2 (condition) ANOVA with children’s combined elicited production scores as the dependent measure (maximum score = 4) revealed a significant main effect for condition; children in the knowledgeable condition (M = 2.33, SD = 1.52) evidenced better learning than children in the ignorant condition (M = .42, SD = 1.02), F(1, 44) = 25.19, p < .05, d = 1.03. This analysis revealed no main effect for age, or Age × Condition interaction. Planned contrast analyses revealed that both 3- and 4-year-olds showed increased learning in the speaker-knowledgeable condition relative to the speaker-ignorant condition, Fs(1, 44) = 11.52, 13.71, ps < .05, ds = .90, 1.19, respectively. The similarity in patterns of condition differences across age groups was striking (see Figure 1A).

Table 1 shows the distribution of children’s response patterns across conditions collapsed across age. The main effect found in the ANOVA was confirmed nonparametrically in a chi-square test of independence showing that the distribution of response patterns depended on condition, χ²(4, N = 48) = 20.04, p < .05. Finally, an item analysis treating target toy as the random factor revealed that target toys were picked more often in the knowledgeable condition than in the ignorant condition, paired t test: t(5) = 5.97, p < .05. Every toy showed the predicted condition difference.

One benefit of testing children’s word learning in a comprehension test is that it allows for comparison against chance. On the first trial, children had a one in six chance of randomly selecting the target; on the second trial, the chance was one in five. Thus, the probability of randomly selecting the target zero, one, or two times was 20 in 30, 9 in 30, and 1 in 30, respectively. Children’s performance was compared with chance in a one-sample t test against the mean that would be expected if children had responded randomly—that is, if 20 children scored 0, 9 children scored 1, and 1 child scored 2, μ = .37 (μ = .37 out of 2). Children in the speaker-knowledgeable condition chose targets significantly above chance, t(23) = 8.74, p < .05; however, children in the speaker-ignorant condition did not, t(23) = 1.75, ns. These findings suggest that children’s comprehension performance was systematic only in the speaker-knowledgeable condition.

Comprehension Test

A 2 (age) × 2 (condition) factorial ANOVA with the combined comprehension score as the dependent measure (maximum score = 2) revealed a significant main effect for condition, F(1, 44) = 20.96, p < .05, d = .95; children in the speaker-knowledgeable condition showed stronger comprehension test performances (M = 1.54, SD = .66) than children in the speaker-ignorant condition (M = .63, SD = .71). The ANOVA revealed no significant effect for age, as well as no significant Age × Condition interaction. Planned contrast analyses confirmed that both 3- and 4-year-olds showed a significant tendency to learn better in the speaker-knowledgeable condition than in the speaker-ignorant condition (see Figure 1B), Fs(1, 44) = 7.02, 14.64, ps < .05, ds = .67, 1.31, respectively.

Table 2 shows the distribution of children’s response patterns across conditions. A chi-square test of independence revealed that response patterns were significantly influenced by condition, χ²(2, N = 48) = 15.39, p < .05. An item analysis treating target toy as the random factor revealed that target toys were picked more often in the knowledgeable condition than in the ignorant condition, paired t test: t(5) = 5.97, p < .05. Every toy showed the predicted condition difference.

Discussion

Findings from Study 1 revealed that children did not rely solely on referential cues when establishing initial word-referent links; instead, children considered the knowledge states of the speaker. Specifically, children tended to learn words taught by knowledgeable speakers, but as a group did not tend to learn words from ignorant speakers.

An important question, however, is whether children were truly basing word learning on judgments about the speaker’s knowledge. Although the two experimental conditions were balanced for a number of surface factors (such as number of times the label was
used and pointing-and-labeling cues), the conditions differed in terms of the speaker’s hesitation and hedging at the time of presenting the label. For adults, signs of hesitation may serve as reliable contextual cues regarding the speaker’s ignorance. Children’s word learning, however, may be influenced directly by signs of hesitation when the experimenter provides the word-referent link, without any conceptual appreciation that such hesitancy arises from the speaker’s ignorance (see Perner, 1991). This possibility was explored in Study 2.

A second possible explanation for the pattern of results is that the word-referent link was more explicitly ambiguous in the speaker-ignorant condition than in the speaker-knowledgeable condition. In both conditions, after the target toy was placed in the mailbox, the remaining distracter toys were placed in the mailbox as well. This design element was motivated differently across conditions. In the speaker-knowledgeable condition, the speaker said, “Maybe Birdie forgot these toys, too . . . .” whereas in the speaker-ignorant condition the speaker said, “We might be wrong. It might be one of these . . . .” It is possible that the utterance used in the speaker-ignorant condition had the effect of nullifying the target association by reinforcing referential ambiguity. For adults, referential ambiguity is related to inferences about knowledge states—if a speaker suggests that a blicket could be any one of three things, it is assumed that the speaker doesn’t know the conventional mapping. Children, however, need not have appreciated this concept for learning to have been undermined in Study 1. The question, therefore, was if referential ambiguity were omitted, would children show signs of learning from ignorant speakers?

STUDY 2

Study 2 was carried out to address the issues raised in Study 1 and extend the findings from Study 1 to another situation. To achieve these goals, surface information correlated with ignorance, such as signs of hesitation, were held constant. Specifically, the speaker always expressed uncertainty about the referent for a given novel label. The difference between conditions concerned what the experimenter told children about the origins of the referent being labeled. Researchers in the fields of philosophy and psychology have noted that the conventional name, or category assignment, of an artifact is designated by the artifact’s creator (Bloom, 1996; Putnam, 1987). This insight provided the basis for the experimental manipulation in Study 2. In one condition, the experimenter hesitantly provided children with a novel word for a toy his friend had made (“My friend said one of these toys she made is a modi, but I don’t know which one.”). Because the conventional label in this case originated with the speaker’s friend, the speaker’s uncertainty reflected ignorance of the conventional name. In a second condition, the experimenter hesitantly used a novel word to name a toy that was made by the experimenter (“I would really like to call one of these toys I made a modi, but I don’t know which one.”). Here, because the speaker himself made the referent, his hesitancy did not reflect ignorance of the conventional label; rather, it reflected only that he had not yet decided which toy he wanted to call by the novel name. The subsequent naming of an object indicated that the speaker had resolved the uncertainty and thus, the label should be learned.

It was predicted that if children’s judgments were based solely on the speaker’s hesitancy, they would show equal levels of learning across conditions given the equated hesitancy information. If, however, children truly appreciated the role that having appropriate knowledge plays in word learning, they would show poorer learning in the friend-made condition than in the speaker-made condition, because only in the friend-made condition was the speaker truly ignorant. Of particular interest was whether 3- and 4-year-olds would show the same pattern of results. As was previously noted, 3-year-olds’ judgments about knowledge states are most reliable when direct information about those states is made explicit (Lyon, 1993). In experimental paradigms in which direct information is sparse or ambiguous, 3-year-olds’ judgments about knowledge are less reliable (Povinelli & DeBlois, 1992; Wimmer, Hogrefe, & Perner, 1988). Given these previous findings, it was hypothesized that 3-year-olds would not show the predicted condition difference, whereas 4-year-olds would.

The experimental procedure for Study 2 was modeled closely on the design of Study 1. Some important changes were made, however, to address the questions raised in Study 1: As previously noted, the carrier phrases within which the novel words were presented were similar across conditions, thereby equating the directly available concomitants of knowledge states (“I don’t know which one”). Also, the distracter toys were handled in the same way across conditions, thereby eliminating any possible condition differences in referential ambiguity. Finally, in addition to the comprehension test at the end of the entire procedure, a comprehension test followed the elicited production test in each of the two trials. These “immediate” comprehension tests were added to provide the most sensitive test of word learning possible in both conditions.
Method

Participants

The participants were 48 English-speaking, pre-school-age children: twenty four 3-year-olds (range = 3,0 to 3,6, M = 3,2) and twenty four 4-year-olds (range = 3,11 to 4,6, M = 4,2). An additional five children participated in the study but their data were omitted from the analyses (four because of experimenter error and one due to fussiness). The mean ages across conditions were not significantly different. Children were recruited and compensated as in Study 1.

Materials

Toys

During the warm-up session, a wooden maze with multicolored pegs and a handful of multicolored, plastic Duplo blocks were used.

Two sets of novel toys were used as stimuli. Set A included a yellow-and-blue plastic toy that made noise when a dial was rotated or when two of its parts were clapped together (the “clapper”), a multicolored wooden crank that made a clicking noise when turned (the “clicker”), and a multicolored ball covered with suction cups attached to a plastic rattle handle with a yellow plastic star that spun around the handle (the “gripper”). Set B consisted of a small, red, plastic corrugated cylinder covered with white circles that made a squeaking sound when compressed (the “squeaker”); a handheld fruit juicer painted different colors and decorated (the “juicer”); and a multicolored, flexible wooden chain with rings that could move along the length of the chain (the “woggle”). Toys within a set were selected to be distinctive, balanced for salience, and to look as if they were made by someone (i.e., not factory made).

Novel Words

Children were introduced to two novel words, modi and toma, selected because they were unfamiliar and adhered to English phonotactic constraints.

Data Collection

Experimental sessions were videotaped and coded off-line as in Study 1.

Design

This study employed a between-subjects design in which children were randomly assigned to one of two conditions: speaker made—in which novel labels were linked with toys the experimenter stated were self-made, or friend made—in which novel labels were linked with toys that were made by a friend. All children participated in two trials. In the first, children were trained using the word modi; and in the second, they were trained using toma. Toys were combined into fixed pairs as in Study 1. The target pairs were (1) the gripper from set A and the squeaker from set B, (2) the clapper from set A and the woggle from set B, and (3) the clicker from set A and the juicer from set B. Use of toy pairs was balanced as in Study 1.

The location of the target toy at the time of labeling (left, center, right) was counterbalanced across children with the constraint that the location during Trials 1 and 2 was different for any given participant. Similarly, the locations of the target toys during the comprehension test that followed each of the training sessions were counterbalanced across children with the constraint that the positions during the test differed from the positions in which they were labeled. Finally, the question that was asked first in the comprehension test at the end of the experiment (modi or toma) was counterbalanced across children.

Procedure

Children first participated in a 10-min warm-up period consisting of two activities. The first involved moving multicolored pegs around a wooden maze frame as in Study 1. Afterward, the experimenter explained to the children that one of his favorite things to do was “make toys,” and invited the children to help him make some toys out of Duplo blocks.

Both experimental trials had five phases: (1) label introduction, (2) play session, (3) label training, (4) elicited production test, and (5) comprehension test. The second trial began after the completion of the first trial. A final comprehension test, similar to the comprehension test administered in Study 1, was administered after both trials were completed. Because the two trials were structurally identical, only the first is described.

Trial 1

Label introduction. After putting the Duplo blocks away, the experimenter picked up a box containing a toy set and explained to the children that he would like to show them some toys. Before opening the box, the experimenter introduced the novel label. In the speaker-made condition, the experimenter said, “Yesterday I made three toys and put them in this box.
And you know what? I’d really like to call one of them a modi.” In the friend-made condition, the experimenter said, “Yesterday, my friend made three toys and put them in this box. And you know what? She said that one of them is called a modi.” The experimenter then asked children to say the word themselves (“Can you say modi?”). After the children repeated the word, the experimenter displayed uncertainty about which toy would be the target. In the speaker-made condition, the experimenter said, “Yeah, I’d like to call one of these toys a modi, but I don’t know which one.” In the friend-made condition, the experimenter said, “Yeah, she said that one of these toys is called a modi, but I don’t know which one.”

Play session. The play session followed the same procedure as in Study 1, except that the experimenter did not provide information about his familiarity with the toys, either verbally or nonverbally. The play session lasted approximately 2 min.

Label training. After all the toys had been played with an equal amount of time, the experimenter established the novel word-referent link. In the speaker-made condition, the experimenter said, “You see all of these toys I made? Well, I’d really like to call one of them a modi, but I don’t know which one. Hmmm. Maybe this one [touching the target]. Maybe this one’s a modi.” In the friend-made condition, the experimenter said, “You see all of these toys my friend made? Well, she said one of them is a modi, but I don’t know which one. Hmmm. Maybe this one [touching the target]. Maybe this one’s a modi.” After the word-referent link was made, the experimenter asked each child to put the target toy back in the box (“Can you put this one back in the box?”) in both conditions, after the child placed the target toy in the box, the experimenter touched the toy and said, “Maybe this one’s a modi.” The experimenter then asked each child to place the two distracter toys in the box (“Can you put these ones away, too?”), and then the box was put away.

In summary, children in both conditions heard the novel label six times in all: three times in the label introduction and three times in the label training phase (twice while the speaker was looking at and touching the target object). The critical difference between conditions was whether children were told that the toys were made by the speaker’s friend or by the speaker himself.

Elicited production test. An elicited production test was administered immediately after the label training phase. The picture books used in this study were structured according to the same constraints as in Study 1, and the test was administered in the same fashion. The books used in Trials 1 and 2 had no pictures in common.

Comprehension Test 1

In contrast to Study 1, a comprehension test that directly followed the elicited production test was inserted into the Study 2 procedure. This first comprehension test was used to provide the most sensitive measure possible of children’s word learning. The three toys were removed from the box and placed in front of the child. The experimenter then looked directly at the child and asked, “Could you tell me which one’s the modi?” The child responded by touching or pointing to one of the toys. If a response was ambiguous, the experimenter asked the child, “Could you touch it?” After each child selected a toy, the experimenter returned all of the toys to the box and put the box on the floor.

Trial 2

Immediately after the comprehension test, the experimenter began Trial 2 by stating that there was another set of toys that either he or his friend had made in a box on the shelf next to the table. Trial 2 was identical in structure to Trial 1. After the second trial was completed, children participated in a 5-min interim task in which they were shown cartoon pictures of objects with salient parts and asked to name the color of the whole object or the salient part. None of the stimuli or labels used in the present study were used in the interim task.

Comprehension Test 2

Following participation in the color-naming task, children were given a final comprehension test identical to the comprehension test that came at the end of the Study 1 procedure, with the exception that instead of being asked to place targets in a mailbox, children were simply asked to touch them (“Can you tell me which one is the modi/toma?”). Thus, all six toys were placed in front of the children for the questions about both novel words.

Results

The elicited production data (maximum score = 4) and the data from the two comprehension tests (each with a maximum score = 2) were scored as in Study 1.

Preliminary Analyses

A series of three 2 (trial) × 2 (age) × 2 (condition) mixed-design ANOVAs with trial as the repeated measure were carried out on each of the dependent
measures (elicited production, Comprehension Test 1, Comprehension Test 2). These analyses revealed no significant main effects or interactions involving the trial factor, and so, for all subsequent analyses, the data from each dependent measure was collapsed across trials. A series of three 2 (gender) × 2 (age) × 2 (condition) ANOVAs revealed no significant main effects or interactions involving the gender factor. Thus, gender was excluded as a factor from the additional analyses.

Age and Condition Effects

Elicited Production Test

As in Study 1, all children were quite accurate at naming the 16 familiar objects (range = 75–100%, M = 94%). Further, all children showed some memory for the novel objects that they did not name in the elicited production tests by correctly demonstrating the toys’ functions. These findings confirmed that the elicited production test was a good measure of children’s abilities to name objects for which they knew labels.

A 2 (age) × 2 (condition) ANOVA with elicited production performance as the dependent variable (maximum score = 4) revealed a significant main effect for condition; children learned more readily in the speaker-made condition (M = 2.05, SD = 1.55) than in the friend-made condition (M = .50, SD = .89). F(1, 44) = 19.17, p < .05, d = .97. There was no significant main effect for age, nor a significant Age × Condition interaction. Planned contrasts, however, showed that although the condition difference was strong for 4-year-olds, F(1, 44) = 18.16, p < .05, d = 1.12, it was only marginally significant for 3-year-olds, F(1, 44) = 3.73, p = .06, d = .60 (see Figure 2A).

The distribution of response patterns in each condition is summarized for each age group in Table 3. The distribution of response patterns was dependent on condition for 4-year-olds, χ²(4, N = 24) = 15.79, p < .05, but not for 3-year-olds, χ²(4, N = 24) = 7.16, ns. Thus, the analyses of the elicited production tests revealed a robust condition effect for 4-year-olds, but only weak evidence for a similar condition effect in 3-year-olds.

Comprehension Test 1

A 2 (age) × 2 (condition) ANOVA computed for performance on the first comprehension test collapsed across trials (maximum score = 2) revealed a significant main effect for condition, F(1, 44) = 5.47, p < .05. This main effect was qualified, however, by a significant Age × Condition interaction, F(1, 44) = 4.94, p < .05. The means and standard errors for this interaction are presented in Figure 2B. Planned contrast analyses investigating the source of the interaction revealed a significant condition difference for 4-year-olds, F(1, 44) = 10.40, p < .05, d = 1.02, but not for 3-year-olds, F(1, 44) = .01, ns, d = .02. These findings suggest that only 4-year-olds showed evidence for better learning in the speaker-made condition relative to the friend-made condition in the first comprehension test. Additional contrast analyses revealed that 4-year-
olds demonstrated better learning in the speaker-made condition than did 3-year-olds, F(1, 44) = 4.13, p < .05, d = .73. Similar age differences were not found in the friend-made condition, F(1, 44) = 1.24, ns, d = .28. Thus, in the face of a hesitant speaker, 4-year-olds demonstrated better evidence than 3-year-olds for learning words when it was contextually appropriate to do so.

The distribution of response patterns for each age group within each condition is summarized in Table 4. The distributions were dependent on condition within the 4-year-old age group, χ²(2, N = 24) = 9.04, p < .05, but not for the 3-year-olds, χ²(2, N = 24) = .015, ns. Item analyses treating toy as the random factor were carried out for both age groups and revealed that target toys were selected by 4-year-olds more often in the speaker-made condition than in the friend-made condition, paired t test: t(5) = 2.42, p = .06. The item analysis was not significant for 3-year-olds, paired t test: t(5) = 2.00, ns. These analyses suggest that the condition effect was quite robust for 4-year-olds, and that no significant condition differences were present for 3-year-olds.

One-sample t tests were carried out to compare both 3- and 4-year-olds’ performance in each condition with chance. On each trial, children had a one out of three chance of randomly selecting the correct object. The probability of randomly selecting the correct object zero, one, or two times across trials was four out of nine, four out of nine, and one out of nine, respectively. The chance mean was average performance if children performed randomly (i.e., if 4 out of 9 scored 0, 4 out of 9 scored 1, and 1 out of 9 scored 2; μ = .67). Of interest, 3-year-olds’ performance in their selection of target objects was above chance in both the speaker-made condition, t(12) = 3.97, p < .05, and the friend-made condition, t(10) = 3.08, p < .05. By contrast, 4-year-olds’ performance was above chance in the speaker-made condition, t(10) = 13.62, p < .05, but not in the friend-made condition, t(12) = 1.93, ns.

### Table 3 Distribution of Elicited Production Test Scores in Study 2 by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Condition</th>
<th>Number of Correct Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-year-olds</td>
<td>Speaker made</td>
<td>3 2 6 1 1</td>
</tr>
<tr>
<td></td>
<td>Friend made</td>
<td>8 0 2 1 0</td>
</tr>
<tr>
<td>4-year-olds</td>
<td>Speaker made</td>
<td>3 0 2 0 6</td>
</tr>
<tr>
<td></td>
<td>Friend made</td>
<td>9 3 1 0 0</td>
</tr>
</tbody>
</table>

### Table 4 Distribution of Children’s Comprehension Test 1 Scores in Study 2 by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Condition</th>
<th>Number of Correct Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-year-olds</td>
<td>Speaker made</td>
<td>1 6 1</td>
</tr>
<tr>
<td></td>
<td>Friend made</td>
<td>1 5 5</td>
</tr>
<tr>
<td>4-year-olds</td>
<td>Speaker made</td>
<td>0 1 10</td>
</tr>
<tr>
<td></td>
<td>Friend made</td>
<td>3 6 4</td>
</tr>
</tbody>
</table>

### Comprehension Test 2

A 2 (age) × 2 (condition) ANOVA was carried out with the data from the second comprehension test that occurred at the end of the procedure (maximum score = 2) as the dependent measure. In contrast to previous analyses, this analysis showed a significant main effect for condition, F(1, 44) = 3.92, p < .05, d = .35. In particular, 3-year-olds (M = .63, SD = .77) selected target toys less frequently than did 4-year-olds (M = 1.04, SD = .91). The ANOVA also revealed a significant main effect for age, F(1, 44) = 5.33, p < .05, d = .43. As before, this analysis revealed that children showed better evidence for learning in the speaker-made condition (M = 1.08, SD = .93) than in the friend-made condition (M = .58, SD = .72). The ANOVA revealed a significant Age × Condition interaction; however, planned contrasts revealed that 4-year-olds learned better in the speaker-made condition, F(1, 44) = 5.34, p < .05, d = .64, whereas 3-year-olds did not (see Figure 2C), F(1, 44) = .91, ns, d = .29. Additional contrast analyses indicated that 4-year-olds evidenced better learning than 3-year-olds in the speaker-made condition, F(1, 44) = 4.32, p < .05, d = .52. No age differences were found for the friend-made condition, F(1, 44) = .52, ns. This overall pattern of findings was similar to those from the earlier comprehension tests.

The distribution of response patterns for each age group in each condition are summarized in Table 5. Four-year-olds’ response patterns were dependent on condition, χ²(2, N = 24) = 9.50, p < .05, but 3-year-olds’ were not, χ²(2, N = 24) = .59, ns. Item analyses treating target toy as the random factor were carried out for each age group and revealed that target toys were selected more often by 4-year-olds in the speaker-made condition than in the friend-made condition, paired t test: t(5) = 2.91, p < .05. The item analysis did not reveal a significant difference for 3-year-olds, paired t test: t(5) = 1.75, ns.

Children’s performance in both conditions was compared with chance in a series of one-sample t tests. The probabilities of randomly selecting the target object zero, one, or two times were 25 out of 36, 10
about a speaker’s knowledge state, and not simply on 4-year-olds base their word learning on inferences. These findings provide compelling evidence that the speaker’s knowledgeability in the critical speaker-ignorant condition of Study 1, including referential ambiguity, was not required to undermine children’s word learning performance. This highlights the importance of considering alternative explanations for their relatively poor performance in the speaker-made condition. One clear alternative is that 3-year-olds may have understood the “naming-rights” principle and, thus, had no reason to believe that the hesitancy cues signalled anything but the speaker’s ignorance. Although this possibility cannot be ruled out based on the current data, findings from Bloom and Markson (1998) suggest that 3-year-olds may understand the implicit understanding of the special rights of creators to assign labels. In their study, children were asked to make a drawing of a balloon, and then one of a lollipop. Although these drawings were virtually indistinguishable in appearance, children adamantly argued that the one they intended to be a balloon was a balloon, no matter how much the experimenter claimed it looked like a lollipop. In a second condition, 3- and 4-year-olds extended their judgments about naming rights to others’ drawings, claiming that a small scribble represented a mouse whereas a big scribble represented an elephant when it was clear that the creator intended this to be the case. Even though there were important differences between these studies and the present Study 2 (e.g., drawings versus real objects, familiar versus novel artifacts and words), Bloom and Markson’s (1998) results provide some evidence that even 3-year-olds understand the role that creators’ intentions play in establishing conventional labels (see also, Bloom, 1996).

Three-year-olds’ overreliance on hesitancy cues does not necessarily rule out the possibility that they are indeed making judgments about knowledge states. Although the data from experimental research providing on the question of 3-year-olds’ concept of knowledge is equivocal, natural-language data suggest that even young 3-year-olds appropriately refer to knowledge states in everyday conversations (Bartsch & Wellman, 1995; Sabbagh & Callanan, 1998). Some researchers have taken these findings to suggest that 3-year-olds have a fledgling concept of knowledge (Bartsch & Wellman, 1995). If this is true, it could well be that 3-year-olds truly consider speakers’ knowledge states when learning words, but that their abilities to do so are constrained by the extent to which those knowledge states are made manifest through the provision.

Table 5: Distribution of Children’s Comprehension Test 2 Scores in Study 2 by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Condition</th>
<th>Number Correct Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-year-olds</td>
<td>Speaker made</td>
<td>6 4 3</td>
</tr>
<tr>
<td></td>
<td>Friend made</td>
<td>7 3 1</td>
</tr>
<tr>
<td>4-year-olds</td>
<td>Speaker made</td>
<td>3 0 8</td>
</tr>
<tr>
<td></td>
<td>Friend made</td>
<td>6 5 2</td>
</tr>
</tbody>
</table>

Discussion

One goal of Study 2 was to explore alternative explanations for children’s failure to learn in the speaker-ignorant condition of Study 1, including referential ambiguity and hesitancy. In Study 2, referential ambiguity was eliminated by never having the speaker explicitly refer to the fact that the distracters were possible referents, as was done in Study 1. Results indicated that both 3- and 4-year-olds did not evidence word-learning when the speaker showed signs of ignorance, despite the fact that there was no referential ambiguity. These findings suggest that referential ambiguity is not required to undermine children’s word learning performance.

With respect to the question of how a speaker’s hesitancy affects word learning, the results of Study 2 hint at the possibility of a developmental progression. In all three tests (elicited production, Comprehension Test 1, and Comprehension Test 2), 4-year-olds showed evidence for guiding their word learning in line with the speaker’s knowledge state, even though the speaker’s knowledgeability in the critical speaker-made condition was not apparent in the labeling utterance (e.g., saying “I don’t know which one”). These findings provide compelling evidence that 4-year-olds base their word learning on inferences about a speaker’s knowledge state, and not simply on a speaker’s hesitancy. In contrast, 3-year-olds did not appear to do the same: overall, they showed no condition differences and poorer evidence for learning than 4-year-olds in the critical speaker-made condition. Both of these findings suggest that 3-year-olds’ word learning was guided primarily by their sensitivity to hesitancy information.

Before stating with confidence that 3-year-olds were overreliant on hesitancy information, it is important to consider alternative explanations for their relatively poor performance in the speaker-made condition. One clear alternative is that 3-year-olds may not have understood the “naming-rights” principle, and thus, had no reason to believe that the hesitancy cues signalled anything but the speaker’s ignorance. Although this possibility cannot be ruled out based on the current data, findings from Bloom and Markson (1998) suggest that 3-year-olds may have an implicit understanding of the special rights of creators to assign labels. In their study, children were asked to make a drawing of a balloon, and then one of a lollipop. Although these drawings were virtually indistinguishable in appearance, children adamantly argued that the one they intended to be a balloon was a balloon, no matter how much the experimenter claimed it looked like a lollipop. In a second condition, 3- and 4-year-olds extended their judgments about naming rights to others’ drawings, claiming that a small scribble represented a mouse whereas a big scribble represented an elephant when it was clear that the creator intended this to be the case. Even though there were important differences between these studies and the present Study 2 (e.g., drawings versus real objects, familiar versus novel artifacts and words), Bloom and Markson’s (1998) results provide some evidence that even 3-year-olds understand the role that creators’ intentions play in establishing conventional labels (see also, Bloom, 1996).

Three-year-olds’ overreliance on hesitancy cues does not necessarily rule out the possibility that they are indeed making judgments about knowledge states. Although the data from experimental research bearing on the question of 3-year-olds’ concept of knowledge is equivocal, natural-language data suggest that even young 3-year-olds appropriately refer to knowledge states in everyday conversations (Bartsch & Wellman, 1995; Sabbagh & Callanan, 1998). Some researchers have taken these findings to suggest that 3-year-olds have a fledgling concept of knowledge (Bartsch & Wellman, 1995). If this is true, it could well be that 3-year-olds truly consider speakers’ knowledge states when learning words, but that their abilities to do so are constrained by the extent to which those knowledge states are made manifest through the provision.
of explicit statements and observable behavior. Perhaps then, where 3- and 4-year-olds differ is not in their readiness to consider the knowledge states of the speaker when learning words, but in the relative sophistication of this ability. This proposal dovetails nicely with previous research findings regarding an important transition in children’s understanding of knowledge (see Ferner, 1991).

A final noteworthy aspect of these findings is that, whereas 3-year-olds’ performance in the speaker-made condition was poor relative to 4-year-olds, in the first comprehension test they responded at above-chance levels. Interestingly, however, their performance in the speaker-made condition was similar to their performance in the friend-made condition. One possible interpretation of this pattern is that 3-year-olds are less skilled than 4-year-olds at blocking word learning from speakers who show signs of ignorance. This may have allowed 3-year-olds to establish a weak word-referent link that influenced performance on Comprehension Test 1, but was insufficient to influence performance on the more difficult elicited production test and later occurring Comprehension Test 2. The notion that 3-year-olds may have difficulty blocking, or inhibiting, a particular cognitive process is consistent with research findings that have directly investigated children’s inhibitory skills more generally (Kochanska, Murray, Jacques, Koenig, & Vandengeest, 1996). It is important to note that the lack of a difference across conditions in either the first or second comprehension test is consistent with children’s reliance on uncertainty cues to guide their word learning.

**GENERAL DISCUSSION**

These two studies highlight a previously unexplored dimension of the social context that appears to be important for word learning. In Studies 1 and 2, speakers consistently presented novel labels for novel objects while also providing sociopragmatic cues that are typically thought of as good indicators of labeling intentions. That is, the experimenter looked at, touched, and oriented his body toward the target object at the time of labeling. Yet, across studies, when the speaker displayed ignorance about the conventional word-referent link, children were less likely to evidence learning than when the speaker was knowledgeable. These findings suggest that children’s criteria for establishing word-referent links include not only cues that give information regarding whether the speaker’s utterances are directed toward a particular object, but also cues relevant to whether the speaker is knowledgeable or ignorant about the word-referent link.

With respect to whether children were truly sensitive to the knowledge states of the speaker, the data were clear only with respect to 4-year-olds, as was evidenced by their performance in Study 2. When the speaker was hesitant, 4-year-olds only showed evidence for avoiding learning when the hesitation was a sign of ignorance; when the hesitation was not a sign of ignorance, they showed systematic learning as a group. Three-year-olds, however, did not show good evidence for learning from hesitant speakers in either condition of Study 2, thereby suggesting that the hesitancy of the speaker played an important role in their word learning. As was noted above, there are a number of possible reasons for this pattern of results. One that is consistent with previous research findings is that these data reflect a developmental progression in children’s appreciation of knowledge states. Specifically, both 3- and 4-year-olds may consider speakers’ knowledge states when learning words; where 3- and 4-year-olds differ is in the sophistication of their judgments about knowledge and ignorance. Three-year-olds may rely more on cues that are directly available in the labeling situation (e.g., cues to uncertainty), whereas 4-year-olds appreciate the importance of either having or not having the relevant knowledge. Put more succinctly, the present findings suggest the possibility that as children’s theory of mind becomes more sophisticated, so too does their word learning.

In summary, the present findings highlight the importance of epistemic aspects of theory of mind for children’s word learning. Instead of being limited to so-called intentional cues (e.g., eye gaze direction, intention fulfillment), both 3- and 4-year-olds seem also to rely on information relevant to epistemic mental states (i.e., knowledge or ignorance) when learning words. With the present findings, it is apparent that 4-year-olds’ word learning is based on judgments about speakers’ knowledge states. More research is required, however, to accurately characterize whether 3-year-olds’ use of surface information related to knowledge states is a basis for their actual competence with these high-level understandings.

**Modifying Referential Intentions or Uncertainty Marking?**

One interesting aspect of the present results is that, as a group, children did not seem to erroneously establish word-referent links offered by ignorant speakers. Even 3-year-olds, whose appreciation was not as sensitive as that of 4-year-olds, seemed to err on the side of caution—they did not establish word-referent links offered by any speaker who showed signs of ig-
nance. What is the mechanism for this? One possibility is that children frame their inferences about labeling intentions in terms of judgments about speakers’ knowledge states. Moses (1993) noted that a sophisticated conceptualization of intention includes both motivational and epistemic aspects, such that the selection of intentional goals depends not only on one’s desires but also on one’s knowledge and beliefs. Perhaps children were sensitive to the fact that intentions to provide conventional labels must be accompanied by the appropriate relevant knowledge states. This understanding may have led them to ignore or otherwise not encode word-referent links offered by ignorant speakers.

An alternative explanation for children’s performance is that they may have specially encoded, or “marked,” the word-referent link issued by a speaker who was ignorant about the conventional label as “unreliable” without inferences about intentions. In other words, they may have noted and then subsequently rejected or refused to apply the word-referent links offered by ignorant speakers. Pinker (1989) proposed that an uncertainty-marking mechanism might be at work in grammar acquisition to help children interpret input that comes from unreliable sources (including themselves or their peers). An uncertainty-marking mechanism may be even more important in the semantic domain where it is of potential use to temporarily maintain even potentially erroneous word-referent links for the purposes of communicating with the people using them. This proposal contrasts with the one previously discussed in that instead of being part of the process of discerning speakers’ referential intentions, the uncertainty-marking mechanism is characterized as a tool that stands separate from, and in addition to, the tools that are already in place to learn words. As such, an uncertainty-marking explanation is in line with a number of proposals that knowledge supporting language development may be distinct from other conceptual systems (Pinker, 1994).

Although the present data do not provide the ability to tease apart these two explanations, there is some reason to question whether an uncertainty-marking strategy is within young preschoolers’ cognitive abilities (Perner, 1991). In particular, uncertainty marking would require children to store in memory both the word-referent link and the information regarding the uncertainty of the source. Many studies have shown that young preschoolers are notoriously poor at recovering information about the sources of their knowledge (O’Neill & Gopnik, 1991; Taylor, Esbensen, & Bennett, 1994). For this reason, it is suspected that children’s differential learning was likely due to changes in the encoding of the actual word-referent link, as opposed to storing the link with additional information. Intention modification could provide a basis for such changes in encoding.

**Implications for Word-Learning Trajectories in Preschool**

Much of the research characterizing the rate and trajectory of word learning has focused on the dramatic changes that take place in the late-infancy period. By contrast, very little research has focused on describing these aspects of word learning after infancy. One of the potentially exciting implications of the present findings is that some facets of word learning may take on a somewhat different character over the early to midpreschool years. There are two ways in which a developing understanding of epistemic mental states might affect word learning. First, children might use this understanding to avoid learning from ignorant speakers. In line with this possibility, children’s developing abilities to accurately judge speakers as ignorant may give them a tool for avoiding potential mapping errors that arise when learning words from those ignorant speakers. Second, children might require sufficient reason to believe that the speaker is knowledgeable before they will learn a word from that speaker (Perner, 1991). Thus, children’s acquisition of vocabulary would be expected to accelerate as they become better at discerning whether a speaker is knowledgeable. These possibilities raise two questions about vocabulary acquisition in the preschool period: Do children go through a phase in the early preschool years in which mapping errors are more common relative to a later period? Additionally, is there a period of vocabulary growth acceleration between the ages of 3 and 4? Although careful research on the rate and content of vocabulary development is notoriously difficult to carry out in the postinfancy years (but see Anglin, 1993; Clark, 1993), the present findings point to interesting directions for future research on this topic.

These results are not alone in requiring a more detailed characterization of vocabulary development in the preschool years. Researchers have long noted that word learning capitalizes on a number of cognitive skills, including theory of mind (Baldwin & Tomasello, 1998; Bloom, 2000), categorization (Gopnik & Meltzoff, 1987), and phonological short-term memory (Gathercole, Willis, Emslie, & Baddeley, 1992), a number of which undergo considerable transition during the preschool years. If these skills continue to be recruited for word learning throughout develop-
ment, as we suggest is the case for theory-of-mind skills, these developments would be expected to impact word learning noticeably.

**Conclusion**

These two studies have shown that the social criteria preschoolers use to establish initial word-referent links go beyond so-called referential or pointing-and-labeling cues to also include information relevant to the epistemic mental states of the speaker. Specifically, preschoolers did not learn labels from a speaker who showed hesitation arising from ignorance about the word-referent link in question, despite the fact that the speaker provided a number of cues that typically lead to word learning. Although the results from Study 1 pointed to some commonalities in 3- and 4-year-olds’ skills in this arena, Study 2 highlighted important differences. In Study 2, 4-year-olds appeared to appropriately learn words from knowledgeable speakers even when the speakers’ knowledgeability was undercut by their hesitancy when providing the label. In contrast, 3-year-olds did not demonstrate as sophisticated an understanding of knowledge states. That is, they appeared overreliant on hesitancy information, regardless of its relevance to the speaker’s knowledge of the word-referent link. These findings potentially highlight a link between children’s developing theory of mind and word learning: as children’s theory of mind becomes more sophisticated, so too do their word-learning skills.

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