Do word learners ignore ignorant speakers?*

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ABSTRACT

Thirty-six three- to four-year-old children were tested to assess whether hearing a word-referent link from an ignorant speaker affected children’s abilities to subsequently link the same word with an alternative referent offered by another speaker. In the principal experimental conditions, children first heard either an ignorant or a knowledgeable speaker link a novel word with one of three toys. The first speaker’s labelling episode was followed by a second in which a different speaker used the same novel label but for a different toy. There was also a Base-line condition which was the same as the experimental condition involving the ignorant speaker except that she did not associate the novel label with a referent. When tested for comprehension of the novel label, children selected the FIRST speaker’s toy at high levels when the first speaker was knowledgeable, but selected the SECOND speaker’s toy when the first speaker was ignorant. These findings suggest that children’s experience with the ignorant speaker did not affect their abilities to learn a subsequently presented alternative word-referent link. These findings are discussed in terms of understanding the mechanisms by which children adapt their word-learning in line with speakers’ knowledge states.

INTRODUCTION

In everyday conversation children are likely to encounter instances in which they are presented with a new word for an unfamiliar object from a source

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that might not be reliable. That source could be children themselves, who will often innovate new lexical or syntactic constructions when they are unsure of the appropriate convention (Pinker, 1989; Clark, 1993). Parents also can be unreliable sources given that children’s questions about the names of things (especially interesting prehistoric and aquatic animals) can sometimes test the limits of their parents’ knowledge. Indeed, recent naturalistic work from Callanan & Sabbagh (2002) suggests that parents often provide young children with word-referent links from the standpoint of uncertainty. For instance, a father with his daughter on a trip to the aquarium might label a species of whale he is unsure of by saying, ‘I don’t know, maybe it’s a beluga.’

Labelling episodes such as these involving ‘unsure’ parents raise interesting questions regarding children’s word learning. Of primary importance is whether children might show any evidence for having learned labels offered by unsure or ‘ignorant’ speakers. Some insight into this question comes from research by Sabbagh & Baldwin (2001) in which they found that children were less likely to show evidence of learning new words from ignorant vs. knowledgeable speakers. In their experimental studies, three- and four-year-old children heard a phone message in which the experimenter was asked to find a *blicket* for a friend. The experimenter then feigned knowledge or ignorance about which of three possible toys was the referent for *blicket*. Results from comprehension and elicited production tests suggested that children showed poorer learning from the ignorant speaker than from the knowledgeable speaker. A similar pattern of results was demonstrated in a second study in which judgments about the speaker’s knowledge or ignorance had to be based on contextual factors. These findings suggest strongly that both three- and four-year-olds pay attention to information regarding the knowledge states of the speaker when learning words, and that this information affects the extent to which children evidence learning from ignorant speakers.

These findings fit together well with a broader theoretical perspective suggesting that children’s remarkable efficiency in word learning is supported, at least in part, by their abilities to make appropriate judgments about others’ mental states, or their ‘theory of mind’ (Baldwin & Moses, 2001; Sabbagh & Baldwin, 2002). One of the main ways in which theory of mind might make word learning more efficient is by guiding children away from certain alluring but erroneous hypotheses about how a given word is associated with a referent. For instance, Baldwin (1991, 1993) has demonstrated that in experimental studies, children as young as 1;6 reliably link words with referents that are specified by the speaker’s attentional focus. Most impressively, children follow this rule to the extent that they will avoid linking words with objects that occupy their own attentional focus when it is evident that their focus is not shared by the speaker. Similarly, the findings
from Sabbagh & Baldwin (2001) show that children will avoid learning from ignorant speakers, even though they provide a number of reliable cues that would otherwise promote making a mapping, including pointing to the novel object and using a novel word.

While these findings and others have established that children might avoid errors in their word learning by tuning into information regarding others’ mental states, there has been relatively little discussion of the mechanisms by which this adaptive error avoidance takes place. Sabbagh & Baldwin (2001) proposed two possible mechanisms by which children might avoid learning words from ignorant speakers. One possibility is that children might use a ‘filtering’ strategy. That is, perhaps children avoid encoding, or only weakly encode, word-referent links that are trained by ignorant speakers. An alternative possibility was that children deal with ignorant speakers’ word-referent links by deploying an ‘encoding and marking’ strategy. Over the preschool years, children are rapidly developing the ability to represent the source of a given piece of knowledge (see Roberts, 2000, for a recent review). Indeed, there is some reason to believe that source marking plays an important role in allowing bilingual children to separate different languages in the course of acquisition (see e.g. Au & Glusman, 1990). In the present context, the ‘encoding and marking’ hypothesis suggests that children are capitalizing on these emerging representational skills to encode both the word-referent link offered and the knowledge state of the speaker.

These two strategies make separate predictions regarding the extent to which preschoolers represent word-referent links spoken by ignorant speakers in lexical memory. Specifically, if children use a filtering strategy, children should have a highly degraded, or perhaps absent trace for the word-referent link offered by an ignorant speaker. In contrast, if children use an encoding and marking strategy, they should have some trace in memory for the word-referent link, accompanied by a ‘tag,’ or marker, indicating the link was offered by a tenuous source (see Tulving, 1985; Perner, 1991).

The encoding and marking strategy is particularly intriguing because of its implications for children’s subsequent word learning. For instance, if there is any likelihood that the ignorant speaker’s guess could be right, having some trace for the word-referent link in lexical memory could speed learning that particular link if it is reencountered. However, in the event that an ignorant speaker’s guess is wrong, an encoding and marking strategy could lead to some difficulties. To illustrate by continuing with the example from above, imagine that the child who just heard the label ‘beluga’ for a referent designated by her admittedly ignorant father subsequently heard the same label but for a different referent uttered by a confident aquarium docent. Having a memory for the word-referent link offered by the ignorant father could make it difficult to learn the docent’s correct link for two reasons. First, children
could experience proactive interference whereby the link trained by the ignorant speaker interferes with either the encoding (Murdoch, 1982) or the retrieval (Murnane & Shiffrin, 1991) of the subsequently presented link. Second, correcting the erroneous link might be effortful because of mutual exclusivity – the putative word learning constraint which biases children to prefer one word for one object (Markman, 1992). Research suggests that, in line with mutual exclusivity, children have difficulty linking new words with referents that are already named (Markman & Wachtel, 1988; Liittschwager & Markman, 1994), and with linking new referents with words that have previously been associated with different referents (as with homonyms, see Doherty, 2000).

The goal of the present study was to examine whether exposure to a word-referent link issued by an ignorant speaker affects children’s ability to attach the same word to a new referent offered by a more confident speaker. While this is an interesting question in its own right, the results may also offer some insight into whether children use the encoding and marking strategy when dealing with word-referent links offered by ignorant speakers.

To investigate this question, we adapted the paradigm used in Sabbagh & Baldwin (2001). In a between-subjects design, children were presented with an initial word-referent link in one of two conditions: 1) Ignorant-first, in which the first word-referent link was presented by a speaker who admitted to being uncertain about whether the link was correct, and 2) Knowledgeable-first, in which the word-referent link was provided by a speaker who claimed to be certain it was correct. In both conditions, the first speaker was followed by a second speaker who provided an alternative to the first speaker’s word-referent link – that is, she used the same label as the first speaker, but linked the label to a different object. This speaker made her word-referent link clearly but incidentally, without providing special information about her relative knowledge or ignorance. A Base-line condition was also included in which an ignorant speaker did not provide an initial word-referent link, but was followed by the second speaker who did. The Base-line condition was crucial because it provided the clearest assessment of children’s learning from the second speaker in the absence of any competing information.

We reasoned that if children followed an encoding and marking strategy when presented with words from ignorant speakers, they might show difficulty in learning the alternative link from the second speaker in the Ignorant-First condition relative to the Base-line condition in which no initial link was provided. The complementary prediction was that children would not select the second speaker’s referent at high levels when the first speaker was knowledgeable, because of either proactive interference, mutual exclusivity, or the joint operation of these two cognitive mechanisms.
METHOD

Participants
Thirty-six normally developing three- and four-year-olds participated (14 boys, 22 girls). Children’s ages ranged from 3;9 to 4;11 (M = 4;4). The children were recruited from local daycares and community recreational centres within a community that is predominantly comprised of middle-class families of Caucasian descent. Children were randomly assigned to one of three experimental conditions (12 per condition). The mean ages of children did not differ across conditions. Children and their parents were given a $5 gift certificate for a local toy store as thanks for participating.

Materials
Toys. During a brief warm-up session, children played with plastic interlocking blocks. 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 multicoloured 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 multicoloured 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 such that the two levers moved in tandem to make the ball-ends collide (the ‘clacker’). The toys within a set were chosen to be distinctive from one another and balanced for salience.

Novel words. Children were introduced to two novel words: fep and dax. These novel words were selected because they follow the phonotactic constraints of English.

Experimental props. Children were tested in a quiet room on a university campus at a child-size table. On the table there was a mailbox pasted with pictures of a parrot hand-puppet (‘Birdie’), a small mailbox, an answering machine, and a mock speaker-phone 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. A second researcher was dressed as a mail carrier outfitted with a blue-collared shirt, and a navy blue shoulder bag for parcels.

Data collection. Experimental sessions were video-recorded using an 8 mm camcorder. The camcorder was mounted on a tripod unobtrusively in the corner of the room and had an unobstructed view of the experimental situation. Children’s performance in the experiment was coded off-line from the videotapes.
Design
As noted above, we used a between-subjects design in which children heard an initial word-referent link in two different conditions: 1) Ignorant-first, in which a first word-referent link was presented by a speaker who admitted to being uncertain about whether the link was correct, and 2) Knowledgeable-first, in which a first word-referent link was provided by a speaker who claimed to be certain it was correct. In both conditions, the first speaker was followed by a second speaker who provided an alternative to the first speaker’s word-referent link—that is, she used the same label as the first speaker, but linked the label to a different object. This speaker made her word-referent link clearly but incidentally, without providing special information about her relative knowledge or ignorance. In addition, we included a Base-line condition which was the same as the ignorant-first condition, with the exception that the first speaker did not provide an initial word-referent link. The Base-line condition was included to characterize what children’s learning of the second speaker’s referent is like in the absence of any interfering information from the first speaker.

Children participated in two trials. In all conditions, children heard the word *fep* in Trial 1, and *dax* in Trial 2. The toy sets used in each trial were counterbalanced such that half the time toy sets A and B were used in trials 1 and 2 respectively, and vice versa. Within a toy set, the toy labelled by the first speaker will be referred to as the ‘S1 target’ while the toy labelled by the second speaker was designated as the ‘S2 target.’ Across children, all toys appeared as S1 targets equally often in each of the three conditions. Since there were no S1 targets in the Base-line condition, the toys that served as the S2 targets were counterbalanced for the ignorant speaker and knowledgeable speaker conditions. The position of the S1 target at labelling (left, centre, or right) was counterbalanced across conditions, with the constraint that the position was not the same on Trial 1 as on Trial 2. The same was true for the order in which the S2 target was labelled (first, second, or third) by the second speaker. Similarly, the locations of the S2 targets 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 labelled. The position of the S2 target was fixed relative to the position of the S1 target: if the S1 target was left, centre or right, then the S2 target was on the right, left, or centre respectively. Finally, the label asked first in the comprehension test that came at the end of the experiment (*fep* or *dax*) was counterbalanced across children.

Procedure
During a ten-minute warm-up period, children and the experimenters played with interlocking plastic blocks while parents completed consent forms.
As noted above, the procedure we used was adapted from that used by Sabbagh & Baldwin (2001) with a key modification that a second speaker was added to provide an additional labelling event. Both experimental trials had six phases: 1) label introduction, 2) play session, 3) S1 target training, 4) S2 target training, 5) elicited production test, and 6) 3-item comprehension test. Since the two trials were essentially identical, we will describe only the first in detail.

**Label introduction.** The experimenter began by telling children that the playroom was a room shared with his friend, Birdie, who was out playing on the playground. The experimenter then directed children’s attention to an answering machine that contained a prerecorded message from Birdie asking the experimenter to send him a *fep*. To ensure understanding, the experimenter recapitulated the message and asked children to say the word *fep* themselves.

The critical experimental manipulation followed the introduction of the novel word. In the Base-line and Ignorant-First conditions, the experimenter claimed to not know which of three objects was the target (i.e. ‘You know, I’d really like to help my friend, Birdie, but I don’t know what a *fep* is. Hmmm. Maybe it’s in this box here.’). In the contrasting Knowledgeable-First condition, the experimenter said that she knew which of the three objects was the target (i.e. ‘You know, I’d really like to help my friend, Birdie, and I know right where his *fep* is. It’s in this box here.’).

**Play session.** The experimenter took three toys out of a box, placed them in a row and encouraged children to play with them. Care was taken to ensure that children played with all of the toys equally. During the play session (approx. 2 min.), the experimenter spoke enthusiastically about each of the toys and said things to reinforce the notion that he was either knowledgeable or ignorant about these toys (e.g. Ignorant Speaker: ‘I wonder what these do,’ ‘I’ve never seen these before,’ or Knowledgeable Speaker: ‘I’ve seen Birdie play with these before,’ ‘I’ll show you what these do.’). The toys were not labelled during the play session.

The experimenter’s play style also indirectly indicated her familiarity with the toys. When the experimenter was ignorant, she played with the toys tentatively, and appeared to ‘discover’ the function of each toy. When she was knowledgeable, the experimenter directly demonstrated the function of each toy, thereby displaying her familiarity. Across conditions, the function of each toy was demonstrated by the experimenter and the child was asked to perform all of the toys’ functions. Care was taken to ensure that children played with each of the toys equally.

**S1 target training.** After the play session, the first experimenter put the toys out of children’s reach and labelled the target. In the Ignorant Speaker condition, the experimenter said, ‘You know, I’d like to help my friend, Birdie, but I don’t know what a *fep* is. Hmmm. Maybe, it’s this one (touching the target toy). Maybe this one’s her *fep*. 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 his fep.’ In the Knowledgeable Speaker condition, the experimenter said, ‘You know, I’d like to help my friend Birdie, and I know just which one’s his fep. It’s this one (touching the target toy). This one’s his fep (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 his fep.’ To ensure that the experimenter’s level of physical contact with the S1 target was equal to that of the other toys, the two other toys were also put into the mailbox. To motivate this, the experimenter said, ‘Maybe we should put these other toys in the mailbox, too.’ Once all of the toys were put in the mailbox, the experimenter invited the child to colour.

The Base-line condition was the same as the Ignorant-First condition, except that no target was selected as the referent for the novel word, fep. In this condition, the experimenter said, ‘You know, I’d really like to help my friend, Birdie, but I don’t know what a fep is. Hmmm. I don’t know which one’s the fep, let’s send all of the toys to Birdie.’ The child and experimenter then put all of the toys into the mailbox, and after that, began to colour together.

S2 target training. Approximately 30 seconds after all of the toys were put into the mailbox, a second experimenter dressed as a mail carrier came into the playroom to ‘pick up Birdie’s mail.’ She said, ‘Hello! I’m here to pick up the mail. Do you have any mail for Birdie? Let’s see.’ The second experimenter then proceeded to remove the toys from the mailbox, one at a time. For the S2 target toy, which was different from the S1 target, she said, ‘We’ve got a fep,’ and she put it in her bag. For the other toys, she said, ‘We’ve got this toy here, and we’ve got this other toy here.’ The feeling that this created was that the mail carrier labelled the object clearly but incidentally, without providing special information regarding her knowledge of the object’s label. Once all of the toys were removed from the mailbox, the second experimenter said, ‘Okay, I better get these out to Birdie. Bye!’ and she exited the playroom until her return for the second trial.

Elicited production test. Once the second experimenter left, the first experimenter and child resumed colouring for approximately one minute. The experimenter then told children that they were going to play a picture book game in which they were going to name pictures. It was explained that some of the pictures were really hard and that it was okay for children to answer ‘I don’t know’ when they did not know something.

The picture book included two colour printouts of digitized pictures of the target toy, two pictures of each of the two distracters, and eight pictures of familiar objects taken from a picture book suitable for young preschoolers. The novel objects were interspersed with the familiar objects randomly 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. Once the picture book was created, it was considered fixed and all children viewed the same picture book.

The experimenter showed children the pictures in sequence asking for each ‘What’s this?’. After children provided an answer, the experimenter said, ‘Okay,’ regardless of whether it was correct. The second time each target was presented if children said, ‘I don’t know’ or provided a label other than the one that was involved in the training, they were asked a follow-up question to assess their memory of the object (‘What does this do when you play with it?’). These questions were NOT asked anytime children used the novel label, even if the usage was incorrect.

3-item comprehension test. Immediately after the elicited production test, children were given a comprehension test. Digitized pictures were edited such that they were all the same size ($3' \times 4'$) and so that the background colours were the same (beige). These pictures were then laminated for use in the comprehension test. Three pictures, each representing one of the objects seen in the label trainings, were placed in a row in front of children. After asking them to touch each picture to ensure that they were accessible, the experimenter asked, ‘Could you give me the picture of the fep?’

Trial two. After the picture book game, the experimenter and child resumed colouring. After about two minutes, the experimenter began trial two. Trial two was the same as trial one with the exception that children overheard a scripted speaker-phone call instead of an answering-machine message. In the Ignorant-First and Base-line conditions, after Birdie asked for the dax, the experimenter said: ‘Gosh, Birdie, I don’t know what a dax is. But, I’ll try to send it to you.’ In the contrasting Knowledgeable-First condition, the experimenter said, ‘Sure, Birdie. I know right where your dax is. I’ll send it to you right now.’ After the phone call, the second trial proceeded exactly like trial one.

6-item comprehension test. Approximately two minutes after the end of trial two, children were given a final comprehension test. The laminated pictures that were used in each of the 3-item comprehension tests were shuffled and placed randomly in front of children in a 2 (row) × 3 (column) array. Children were asked to touch each one of the cards to make certain they were all accessible. Then, children were asked the comprehension questions, ‘Can you give me the fep/dax?’ once for each of the novel words trained. The card the child selected in response to the first question was not replaced for the second question.

RESULTS
The main question under consideration is whether hearing a word-referent link affected children’s tendencies to associate the same word with a
subsequently presented alternative referent. Children’s learning of the second speaker’s word-referent link (i.e. identification of S2 targets as the referent for the novel labels) was measured in three ways: 3-item comprehension test following each trial, a 6-item comprehension test that came at the conclusion of the procedure, and elicited production tests which followed each trial. Before we report the data pertaining to this question, we report two preliminary analyses.

**Preliminary analyses**

*Time-interval control.* Because the procedure incorporated a number of different events, the amount of time between the training phases and the testing phases likely varied from subject to subject. To ensure that there were no systematic differences in these time intervals across the three conditions, we measured three critical time intervals that we reasoned were most likely to affect the comprehension tests: 1) the interval between the S1 target and S2 target training for each trial, 2) the interval between the S2 target training and the 3-item comprehension test in each trial, and 3) the interval between the 3-item comprehension test in trial 2 and the 6-item comprehension test in trial 3. Each of these time intervals was considered as a dependent measure in a one-way ANOVA with experimental condition (Base-line, Ignorant-First, Knowledgeable-First) as the independent variable. These analyses revealed no significant differences in any of these crucial time intervals, thereby giving confidence that the procedure was comparable across conditions.

*Gender analyses.* To establish whether there were any main effects of gender, or interactions between sex and experimental condition, we conducted three (2) gender × (3) condition: Base-line, Ignorant-First, Knowledgeable-First ANOVA for each of the three dependent measures (3-item comprehension, 6-item comprehension, and elicited production). None of these analyses revealed any significant main effects of gender, nor gender by condition interactions. Thus, the following analyses were conducted collapsing across gender.

**Elicited production test**

For the elicited production tests, children had a chance to use the target word for the S2 target item two times on each trial, for a maximum possible score of four. Unfortunately, children performed very poorly on this test. In the Base-line condition, in which children did not hear S1 associate the word with a referent, only 1 child produced the novel label in response to a S2 target item. One reason this test may have been so difficult is because it taps recall memory for a word-referent link that was presented to children just once and ‘in passing.’ It could be that although children may have some kind
of memory for this word-referent link, it was not strong enough to support the level of recall memory that is required for correct performance in the elicited production test.

Since children’s performance in the Base-line condition was so poor, it is difficult to evaluate any of the differences that may have arisen between the Ignorant-First and Knowledgeable-First conditions. For this reason, the elicited production data were not considered further.

**3-item comprehension test**

The 3-item comprehension test is the most sensitive test of children’s word learning under difficult conditions. Recall that this test immediately followed the elicited production test, and the S2 target appeared with only two other objects – the S1 target and another distracter. For scoring, children were given a point for each time they selected the S2 target. They received one question on two trials, thereby giving them a maximum possible score of two. For descriptive purposes, the mean proportions of trials in which children selected the S1 target, S2 target, and the distracter item are illustrated in Figure 1.

A one-way ANOVA investigating the effect of condition (Base-line, Ignorant-First, Knowledgeable-First) on children’s S2 target selection in
the 3-item comprehension test revealed a strong effect of condition,
\( F(2, 33) = 10.69, p < 0.05, \eta^2 = 0.39 \). Follow-up post-hoc comparisons (L.S.D.,
\( p < 0.05 \)) revealed that children in the Knowledgeable-First condition selec-
ted the S2 target less often (\( M = 0.42, SE = 0.15 \)) than children in either the
Base-line Condition (\( M = 1.58, SE = 0.19 \)) or in the Ignorant-First condition
(\( M = 1.42, SE = 0.23 \)). These post-hoc comparisons failed to show a difference
between the Base-line and Ignorant-First conditions. Thus, these findings
show that children were less likely to select the S2 target when the first
speaker was knowledgeable about her word-referent link. However, when
an initial word-referent link was provided by an ignorant speaker, children
selected the second speaker’s referent in the comprehension test at levels
comparable to that shown in the Base-line condition where no initial word-
referent link was offered.

Children’s patterns of S2 target selection on the 3-item comprehension
test is summarized in Table 1. The condition effect from the ANOVA was
confirmed non-parametrically in a chi-square test of independence, which
revealed that whether children selected the S2 target 0, 1, or 2 times depended
on condition, \( \chi^2 (4, N = 36) = 14.53, p < 0.05 \). As is evident from the table,
children selected the S2 target consistently in the Base-line and Ignorant-
First conditions, but not in the Knowledgeable-First condition.

The comprehension test also provides the opportunity to compare the rate
of children’s selection of the S2 target against levels that would be expected
by chance. On each trial, children had a 1/3 chance of selecting the S2 target.
Thus, the probability of selecting the S2 target 0, 1, or 2 times was 4/9,
4/9, and 1/9 respectively. The distribution of children’s S2 selection was
compared to that expected by chance in chi-square goodness-of-fit tests.
These analyses revealed that children’s selection of S2 targets differed from
chance in the Base-line and Ignorant-First conditions, \( \chi^2 (2, n = 12) = 37.64
\) and 27.01, respectively, \( p < 0.05 \). In the Knowledgeable-First condition,
however, S2 selection was not reliably different from chance, \( \chi^2 (2, n = 12)
= 1.88, n.s. \) These findings show that children systematically selected the
S2 target objects only in the Base-line and Ignorant-First conditions.

The chance analyses raise the question of whether children in Ignorant-
First or Knowledgeable-First conditions showed any hint of systematically

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<thead>
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<th>Condition</th>
<th>Number of S2 targets picked</th>
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<tr>
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<td>Base-line</td>
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<td>Ignorant-first</td>
<td>2</td>
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<tr>
<td>Knowledgeable-first</td>
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selecting the S1 target. Such a pattern seemed likely for children in the Knowledgeable-First condition wherein children selected the S1 target more frequently ($M = 2.50$, $SE = 0.20$) than children in the Ignorant-First condition ($M = 1.34$, $SE = 0.18$), $t(22) = 3.08, p < 0.01$. To test this possibility, we compared the distribution of children’s selection of the S1 target to levels that would be expected by chance for the Knowledgeable-First and Ignorant-First conditions. These findings revealed that, indeed, children’s selection of the S1 target was different from chance in the Knowledgeable-First condition, $\chi^2 (2, n = 12) = 13.60, p < 0.05$. In the Ignorant-First condition, selection of the S1 target was not different from chance $\chi^2 (2, n = 12) = 0.94, \text{n.s.}$

To summarize, the findings from the sensitive 3-item comprehension test showed a very clear pattern. Children were far less likely to select the S2 target in the Knowledgeable-First condition relative to the Base-line and Ignorant-First conditions. By contrast, we observed no reliable differences between the Base-line condition and the Ignorant-First condition. This pattern suggests that hearing an initial label come from an ignorant speaker does not interfere with their learning of a subsequently presented alternative.

Six-item comprehension test

The six-item comprehension test is a somewhat more stringent measure of children’s learning, since it came at the end of the procedure, and for each question there were more distracter items. As with the 3-item comprehension test, children were given a point for each question they answered correctly. Since there were two questions (one for each word) children could score 0, 1, or 2.

A one-way ANOVA with condition (Base-line, Ignorant-First, Knowledgeable-First) as the independent variable demonstrated a significant main effect of condition, $F(2, 33) = 5.75, p < 0.05, \eta^2 = 0.26$. Follow-up post-hoc analyses (L.S.D., $p < 0.05$) revealed a pattern of differences similar to that found for the 3-item test. Children in the Knowledgeable-First condition picked the S2 target less often ($M = 0.17$, $SE = 0.11$) than children in the Base-line Condition ($M = 1.08$, $SE = 0.19$) or the Ignorant-First condition ($M = 0.75$, $SE = 0.25$). Again, we found no evidence for a difference between the Base-line and Ignorant-First condition for S2 target selection. Though the means are generally lower than in the 3-item test, likely due to its relative difficulty, the pattern of results in the 6-item comprehension test is completely consistent with the pattern from the 3-item test.

Table 2 shows the distribution of children’s responses in the 6-item comprehension test. A chi-square test of independence showed that the number of children who selected the S2 target 0, 1, or 2 times depended on condition, $\chi^2(4, n = 36) = 11.83, p < 0.05$. Once again, children were more likely to select
the S2 targets in the Base-line and Ignorant-First conditions than in the Knowledgeable-First condition. Finally, as above, children’s performance in each condition was compared against performance expected by chance. On the first trial, the probability that children would select the S2 target object was 1/6; on the second trial it was 1/5. Thus, the probably of selecting 0, 1, or 2 S2 targets by chance was 20/30, 9/30 and 1/30 respectively. In a series of chi-square goodness-of-fit tests, the distribution of children’s selection of S2 target referents in each condition was compared with the distribution expected by chance (see Table 2). These analyses revealed that S2 targets were selected at above-chance levels in the Base-line, \( \chi^2(2, n=12) = 24.61, p < 0.05 \), and Ignorant-First conditions \( \chi^2(2, n=12) = 17.50, p < 0.05 \). However, the distribution of S2 target selection did not differ from chance in the Knowledgeable-first condition, \( \chi^2(2, n=12) = 1.61, n.s \). These findings suggest, again, that in the Ignorant-First condition, children’s S2 target selection was systematic despite having been previously exposed to a discrepant word-referent link.

### Table 2. Distribution of children’s responses in the 6-item comprehension test

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of S2 targets picked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base-line</td>
<td>2  7  3</td>
</tr>
<tr>
<td>Ignorant-first</td>
<td>6  3  3</td>
</tr>
<tr>
<td>Knowledgeable-first</td>
<td>10 2 0</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The question of primary interest in the present study was whether hearing a word-referent link presented by an ignorant speaker interfered with children’s ability to learn an alternative link (same word-different referent) subsequently presented by a knowledgeable speaker. The most direct assessment of this question came in determining whether children in the ignorant-first condition were less likely than in the Base-line condition to select the second speaker’s referent as the appropriate referent for the novel word. This comparison was key because these two conditions were identical except that in the ignorant-first condition, an ignorant speaker provided a label that could potentially compete with the label provided by the second speaker. Results from both the three-item and six-item comprehension tests failed to show a significant decrement in children’s selection of the second speaker’s referent in the Ignorant-First condition relative to Base-line. These findings suggest that first hearing the ignorant speaker’s link...
did not affect children’s learning the subsequently presented link by the second speaker.¹

The lack of difference between the Base-line and ignorant-first conditions is difficult to interpret on its own. In particular, it is important to show that the lack of difference in selecting the second speaker’s referents cannot be attributable to some particular characteristics of the procedure. However, when children’s performance is considered across all three conditions, we are able to rule out many plausible alternative explanations of the present results. For instance, it is not possible that children’s tendencies to select the second speaker’s referents at similarly high levels in the ignorant-first and Base-line conditions is simply due to a recency effect – children were more likely to select the first speaker’s referents in the Knowledgeable-First condition even though the second speaker’s referents were presented more recently. Also, the condition differences in performance patterns could not be attributed to the fact that the first speaker was always the speaker who administered the comprehension tests – this aspect of the procedure was consistent across conditions. When considered in light of the overall pattern of the results, the present study gives strong evidence that exposure to a word-referent link offered by an ignorant speaker did not affect children’s ability to associate the same word with a subsequently presented alternative referent.

¹ One potentially very sensitive way of measuring children’s experience of interference is through response latency (see Gerstadt, Hong & Diamond, 1994). With respect to the present data, the possibility that there was more interference in the Ignorant-First condition relative to the Base-line condition may have been reflected in longer latencies to respond during the comprehension test in the Ignorant-First condition. Although our study was not designed to use response latency as an informative dependent measure, response latency data was available for coding from our videotapes of the experimental sessions. To extract these data, the 3-item and 6-item comprehension test sequences were digitized from the videotape and prepared for analysis using a computer programme that allowed for frame-by-frame viewing of the video track (30 frames per second), along with the accompanying audio waveform (Adobe Premiere, 1996). Two independent coders, blind to condition, measured the latency in seconds from the time the experimenter began to say the last word of the comprehension test question (i.e. ‘Can you give me the fep/dax’) to the time children finally released the picture of the object they selected in response. Outliers (children with response times more than 2.5 standard deviations from the mean) were removed from the analyses.

For the 3-item test, the latency data were submitted to a mixed design (3) condition × (2) trial ANOVA with repeated measures on trial. This analysis revealed a significant main effect of trial, $F(1, 31) = 5.85, p < 0.05$. Inspection of the means revealed that, collapsed across condition, children were quicker to complete their responses on trial 2 ($M = 3.79, SE = 0.33$) than they were on trial 1 ($M = 5.77, SE = 0.74$). Most importantly, though, the ANOVA failed to reveal a significant main effect of condition, $F(2, 31) < 1$, nor did it reveal a significant condition by trial interaction, $F(2, 31) < 1$.

For the 6-item test, an analysis similar to that conducted above failed to reveal any significant main effects or interactions. Thus, the latency analyses did not reveal evidence to suggest children were slower to respond in the Ignorant-First condition relative to the Base-line condition.
The present findings offer a replication and extension of some initial findings regarding children’s abilities to use information about the speaker’s epistemic mental states (e.g. knowledge and belief) to guide their word learning. As was noted above, Sabbagh & Baldwin (2001) found that children did not show evidence of learning word-referent links from speakers who are ignorant. The present findings go one step further to reveal that children’s consideration of the speaker’s knowledge states at the time of labelling affects children’s subsequent experiences. Specifically, if an ignorant speaker provides a word-referent link, there is no evidence to suggest that there is any negative effect on children’s subsequent learning. These findings strengthen the general view that children’s social-cognitive skills play a vital practical role in allowing children to establish word-referent links in a manner that is both reasonably fast and reliable (Akhtar & Tomasello, 2000).

In addition to being of practical importance, the present findings may also provide some insight into the cognitive mechanisms responsible for children’s adaptive treatment of word-referent links that issue from ignorant speakers. The hypothesis that hearing words from ignorant speakers would cause difficulty in learning alternative links derived from the ‘encoding and marking’ theory (Sabbagh & Baldwin, 2001). This theory suggests that children deal with word-referent links offered by ignorant speakers by establishing the link in memory, with an additional piece of information that helps them to track the source of this link. We reasoned that this strategy may have incurred some cost to children in their attempts to learning alternative referents for the same word, because of the general cognitive effects of proactive interference, or more specific linguistic principles, such as mutual exclusivity. The fact that initial exposure to word-referent links offered by ignorant speakers did not affect children’s subsequent learning suggests that children may not be following an encoding and marking strategy.

There is, however, an alternative formulation of the encoding and marking theory that may better account for these data. Specifically, perhaps children encode word-referent links that issue from ignorant speakers and mark them as having been spoken by an ignorant speaker only to reject the link when a more appropriate alternative is presented. This mechanism might be similar to the mechanism responsible for the possible ‘correction’ effect of mutual exclusivity wherein children will replace a previous word with a subsequently presented alternative for the same referent (Merriman & Bowman, 1989). Indeed, there is additional evidence from the domain of mutual exclusivity research suggesting that children will ‘wait and see’ which of two words presented in close succession is the most appropriate for a given referent (Savage & Au, 1996). These ideas leave open the possibility that children are meaningfully encoding word-referent links provided by ignorant speakers.

The ‘wait-and-see’ formulation of the encoding and marking theory can only be tested through future research. Yet, it should be noted that there
is some reason to doubt whether it can account for the data. Specifically, if children adopt a variant of the ‘wait-and-see’ strategy, we might expect children to show reasonably strong comprehension-test performance for word-referent links offered by ignorant speakers so long as children are not exposed to a ‘correction trial.’ Some evidence against this possibility comes from Sabbagh & Baldwin (2001) who showed that children evidenced poor learning from ignorant speakers even when no alternative was provided. Of course, their study was not designed to test the hypothesis, and so this disqualification cannot be considered definitive.

An alternative account for how children deal with word-referent links offered by ignorant speakers comes in the form of the ‘filtering out’ theory. Specifically, it seems possible that children do not encode in lexical or semantic memory words spoken by ignorant speakers. Thus, when children are exposed to a ‘correction trial,’ they experience no competition with the previously offered word-referent link and semantic encoding can proceed without costs. In the present study, the fact that there was no difference between the Base-line condition and the ‘ignorant-first’ condition suggests that there was no cost to hearing a word-referent link from an ignorant speaker, which is consistent with the ‘filtering out’ account.

Sabbagh & Baldwin (2001) also noted that there was some reason to favour the ‘filtering’ explanation for their own data. As in the present study, word learning in their study was measured through comprehension tests in which the target and distracter objects were placed in front of the child and the child was asked to hand the experimenter the object corresponding with a particular novel word (e.g. ‘Can you give me the blicket?’). Comprehension tests such as these are thought to be highly sensitive measures of word learning because they tap recognition memory for the word-referent link, (Huttenlocher, 1974; Woodward, Markman & Fitzsimmons, 1994). Thus, if children had some trace for the word-referent link offered by the ignorant speaker, they would have shown above-chance responding in these comprehension tests. However, Sabbagh & Baldwin (2001) found that children who were taught words by ignorant speakers performed at chance levels in these sensitive comprehension tests. These findings suggest that children may have filtered these links out, thereby not encoding them in lexical memory.

The proposal of a filtering mechanism fits together well with previous proposals regarding the role that judgments about others’ mental states might play in guiding word learning. Specifically, Baldwin and colleagues (e.g. Baldwin, Markman, Bill, Desjardins, Irwin & Tidball, 1996) has suggested that children consider whether a given speaker has appropriate referential intentions as a necessary condition for establishing initial word-referent links. Without such cues, or perhaps with signs that the speaker’s referential intentions lie elsewhere, children do not establish word-referent links (Baldwin & Moses, 2001). This proposal applies to the current discussion
because a more sophisticated conceptualization of referential intentions includes a consideration of both desires and epistemic states (see Bratman, 1987; Moses, 1993). Put in terms of the present study, true referential intentions cannot be based solely on the speaker’s desire to name something. Instead, a true referential intention has to be based on the speaker’s knowledge of the conventional term. Speakers who lack this crucial epistemic aspect, then, do not have referential intentions, per se. Rather, they have the intention to ‘guess’ at what the object might be called. Thus, it may have been that children in the present study inferred that ignorant speakers did not have appropriate referential intentions, and as such did not encode these speakers’ word-referent links.

There has been some research suggesting that children as young as 4;0 correctly understand the contrast between knowing and guessing (Johnson & Wellman, 1980; Moore, Bryant & Furrow, 1989). However, more research is necessary to characterize children’s understanding of the relation between referential intentions and speakers’ knowledge states. This kind of research will be an important step in fully understanding the role that children’s consideration of speakers’ intentions play in guiding word learning throughout early childhood.

**Conclusion and future directions**

Our main research question concerned whether initial exposure to a word-referent link offered by an ignorant vs. a knowledgeable speaker would affect subsequent learning from a second speaker relative to a Base-line condition in which no initial link was provided. Results showed clearly that when the initial exposure came from a knowledgeable speaker, performance in a comprehension test was affected. However, when the initial exposure came from an ignorant speaker, performance in the comprehension test was not affected. These findings suggest that initial exposure to word-referent links that issue from ignorant speakers does not hamper subsequent learning.

Throughout the discussion, we focused on characterizing the possible mechanisms by which children avoid the possible ill effects of establishing lasting word-referent links offered by ignorant speakers. However, it should be noted that there might be some benefit in maintaining some sort of representation of ignorant speakers’ word-referent links over a short period of time. First, there is some possibility that even an ignorant speaker is correct. If children maintained some representation of the word-referent link, they might show savings in learning the link when they hear it from a more authoritative source. In other words, the present study suggests that children may not be susceptible to proactive interference as the result of being exposed to word-referent links from ignorant speakers, but, it is unclear as to...
whether children might show evidence for something like repetition priming in these cases.

A second reason children may wish to maintain word-referent links offered by ignorant speakers is to maintain a local convention, shared perhaps only by the speaker and the child, that could facilitate communication over a given period (Clark, 1993). The comprehension-test questions used in the present study were designed to assess children’s global semantic representations (i.e. ‘Which one is the fep?’), and thus may have been insensitive to whether children had established a local convention. It is an open question as to how we might attempt to assess whether children have established a temporary local convention for words trained by ignorant speakers. One possibility is that, given their time-limited character, local conventions may be associated with episodic rather than semantic memory. Thus, a more sensitive test of a local convention would have included a question about the labelling event rather than the representation (e.g. ‘Which one did I say is the fep?’ vs. ‘Which one is the fep?’). This is a possibility that we are currently exploring in our lab and our findings will be important for developing a detailed picture of how children’s word learning is adaptively affected by speakers’ knowledge states.

REFERENCES


