REPORT

Two-year-olds’ sensitivity to speakers’ intent: an alternative account of Samuelson and Smith

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Abstract

Seventy-two 2-year-olds participated in a study designed to test two competing accounts of the effect of contextual change on children’s ability to learn a word for an object. The mechanistic account hypothesizes that any change in context that highlights a target object will lead to word learning; the social-pragmatic account maintains that a change in context must be perceived as relevant to the speaker’s communicative intentions. Consistent with the latter account, we found that children learned the word when a change in context was intentional but not when it was accidental, and children failed to learn the word for the highlighted object when a speaker naive to the preceding context named the object.

Introduction

Researchers in word learning have identified a variety of mechanisms children rely on when inferring the meanings of words. For instance, it has been argued that children are guided by lexical-specific constraints (Markman, 1989; Waxman, 1990), syntactic form (Hall & Graham, 1999), conceptual knowledge (Soja, Carey & Spelke, 1991), mechanisms of attention and memory (Smith, Jones & Landau, 1996) and an understanding of intentionality (Akhtar & Tomasello, 2000; L. Bloom, 1998). Recently, there have been some proposals on how to integrate these multiple mechanisms (P. Bloom, 2000; Hollich, Hirsh-Pasek & Golinkoff, 2000; Woodward & Markman, 1998). A crucial step in such proposals is a detailed analysis of the relative role of different mechanisms in explaining specific phenomena at specific stages of development (see for instance, Diesendruck & Markson, 2001; Hollich et al., 2000; Moore, Angelopoulos & Bennett, 1999). The present paper takes such a step and compares two competing accounts of a word learning phenomenon that has been described in 2-year-olds.

According to the social-pragmatic account, children infer the meanings of words by relying on an understanding of people’s minds.1 Grounded in this understanding, children engage in a flexible and strategic use of a variety of cues present in the discourse context. For example, 18- to 24-month-olds attend to speakers’ gaze direction (Baldwin, 1993), affective expression (Tomasello, Strosberg & Akhtar, 1996) and other behaviors (Tomasello & Barton, 1994) as cues to speakers’ communicative intents. According to the mechanistic account, children’s interpretations of the meanings of words derive from non-strategic mechanisms of perception, attention and memory that automatically guide children’s associations of words to referents (Smith et al., 1996).

1 We use the term ‘understanding of mind’ to indicate that according to a social-pragmatic account of word learning, children rely on a variety of mental states speakers may hold at the time of communication. For instance, children might be sensitive to a speaker’s attentional focus, emotions, thoughts, desires, knowledge and intentions. As will become clearer in the paper, we agree that 2-year-olds do not have the sophisticated understanding of mind that adults, or even 4-year-olds, have. Rather, their understanding is mostly limited to a sensitivity to others’ referential intentions, desires and knowledge states. Nonetheless, we will argue that for a 2-year-old to learn a word in the naming contexts discussed in the present paper, such a limited understanding of mind is all he or she might need.

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These two accounts have recently been contrasted as explanations for a finding by Akhtar, Carpenter and Tomasello (1996) with 2-year-olds. In their Study 2, Akhtar et al. showed children three objects in the presence of a parent and two experimenters. After the presentation of the third object, the parent and Experimenter 2 left the room, and Experimenter 1 showed children a fourth object. When the parent and Experimenter 2 returned to the room, Experimenter 2 looked inside a box containing all four objects and said, ‘Look, I see a gazzer in there!’ In a control condition, Experimenter 2 simply exclaimed, ‘Look at that!’ After playing with the objects, Experimenter 2 asked children to give her the ‘gazzer’. Akhtar et al. found that significantly more children in the Experimental condition than in the Control condition selected the fourth object – the only one novel to Experimenter 2 – as the referent for ‘gazzer’. In line with a social-pragmatic account, the authors concluded that 2-year-olds are sensitive to the knowledge states of others and believe that speakers tend to comment on things that are new to the discourse context.

Samuelson and Smith (1998) offered an alternative explanation for this finding. In their view, the reason why 2-year-olds in Akhtar et al.’s (1996) Study 2 selected the fourth object had nothing to do with children’s inferences of referential intent. Rather, children’s responses derived from general mechanisms of perception, attention and memory. Specifically, Samuelson and Smith (1998) presented the following alternative account of the finding. The context in which the first three objects were presented was similar to the context in which the name was offered. In these events, two experimenters and a parent were present in the room. In contrast, the context of presentation of the fourth object was quite different from the context in which the name was offered. In the former, there was only one experimenter in the room. Given the greater overlap between the naming context and the context of presentation of the first three objects, compared to the contrast between the naming context and the context of presentation of the fourth object, the fourth object appeared to the child as the most novel among the four objects. Being the most novel, the fourth object was also the most attention-grabbing, and consequently children tended to associate this object with the new name.

To test this alternative account, Samuelson and Smith (1998) conducted an experiment in which they manipulated the context of presentation of the objects, rather than the knowledge states of the speakers. In their Experimental condition, 2-year-olds were shown and played with three objects – one at a time – while sitting on the floor. The experimenter then invited children to move to a table where they were shown, and played a different game with, a fourth object. The experimenter and the child then moved back to the floor, the four objects were placed inside a box, and the experimenter said five times, ‘There is a gazzer in here’ (or in a Control condition, ‘Look at that!’). The child played with all four objects, and was then asked to give the experimenter the ‘gazzer’. The findings revealed that more children in the Experimental condition than in the Control condition selected the fourth object as the referent of the novel name. Samuelson and Smith (1998) concluded that their mechanistic account involving memory and attention is all that is needed to explain Akhtar et al.’s (1996) findings.

An alternative account: back to pragmatics

In a further attempt to decide between these two theoretical accounts of this particular word learning phenomenon among 2-year-olds, we examine an alternative explanation for Samuelson and Smith’s (1998) findings. The explanation builds on a growing body of research that suggests that by their second birthday, children interpret the behaviors of other people not in mechanistic terms, but primarily in psychological terms (Carpenter, Akhtar & Tomasello, 1998; Gelman & Ebeling, 1998; Golinkoff, 1993; Meltzoff, 1995; Moses, Baldwin, Rosicky & Tidball, 2001; Woodward, 1999; Zelazo, Astington & Olson, 1999). In our opinion, Samuelson and Smith (1998) did not just manipulate the context of presentation of the objects. Rather, they manipulated the context in an intentional and relevant way. In particular, it seems that 2-year-olds in their task had a fairly sensible inference to draw about what object the experimenter was referring to when she exclaimed, ‘There’s a gazzer in the box!’ The experimenter had played with three objects in the same manner while sitting on the floor. She then moved to a table, showed the child a fourth object, and played a different game with this object than the game she had played with the first three objects. It seems that children had sufficient cues that the fourth object was special to the experimenter. Why else would the experimenter have moved to the table to show children the fourth object? Why did they play a different game with that object?

In their discussion, Samuelson and Smith (1998) considered this kind of social-pragmatic explanation of their findings but rejected it on three grounds: (a) it is both ad-hoc and post-hoc, (b) it is circular and (c) it is questionable whether 2-year-olds have such a sophisticated understanding of others’ minds. The present paper attempts to circumvent these issues by proposing specific empirical
predictions based on this social-pragmatic account. The above citation of some of the current work on infant social cognition suggests that while 2-year-olds do not have a fully developed understanding of others’ beliefs, they are sensitive to the intentions underlying others’ behavioral and verbal expressions. The current study tests the hypothesis that this sensitivity is what children used to infer the referential intention of the experimenter in Samuelson and Smith’s (1998) study.

Two empirical tests

Although Samuelson and Smith (1998) claim that Akhtar et al.’s (1996) results are more parsimoniously and appropriately explained by a mechanistic account than by a social-pragmatic account, it is important to note that they did not directly pit these two accounts against one another within the same experimental paradigm. In other words, their study did not involve a manipulation relevant to the social-pragmatic account, and thus their findings cannot directly reject such an account. The goal of the current study was to allow such a direct comparison of the two accounts. For this purpose, we closely replicated Samuelson and Smith’s (1998) experimental procedure, and introduced two manipulations for which the alternative accounts had contrasting hypotheses.

The first variable we manipulated was whether or not the change in context was deliberate. According to the pragmatic account, children interpreted the move to the table as an intentional choice made by the experimenter. That move was the first cue to the children that the fourth object was special to the experimenter. To test this interpretation, we contrasted an Intentional condition that was almost identical to Samuelson and Smith’s (1998) Experimental condition, with an Accidental condition in which the move to the table occurred unintentionally. In this latter condition, as the experimenter lifted the fourth object, it slipped from her hands and ‘happened to land’ right next to the table. The accidental nature of the event was made explicit by the experimenter’s behavior and facial and verbal expressions (i.e. she exclaimed ‘Oops!’ with a slightly disappointed face; see Carpenter et al., 1998; Tomasello & Barton, 1994, for similar expressions of ‘accidents’ for 18- to 24-month-olds). The experimenter went to retrieve it and then simply invited the child to join her over there, since she was ‘already there anyway’. The procedure continued as in the Intentional condition, with the child and experimenter moving back to the floor where the naming event occurred.

According to Samuelson and Smith’s mechanistic account, it is the novelty of the fourth object’s context relative to the context of presentation of the first three objects and of the naming episode that automatically directs the child’s attention to the fourth object at the time of naming. In these respects, the Intentional and Accidental conditions were identical: in both, children saw the three objects at the floor, saw the fourth object at the table, and were exposed to the novel name at the floor. Therefore, the mechanistic prediction is that children in these two conditions will respond similarly, selecting the fourth object as the referent of the novel word. According to the pragmatic account, children are sensitive to the actions of the speaker. When the change in context is perceived as being intentional, children will infer that the fourth object is special to the experimenter, and thus will interpret the name as referring to it. When the change in context is perceived as being accidental, children will realize that the fourth object is not necessarily special, and thus will interpret the name as referring to any of the four objects. In other words, the two accounts have different predictions as to how children in the Accidental condition will respond.

The second variable that seemed important in deciding between the two accounts was the involvement of the speaker doing the naming. According to the pragmatic account, children in Samuelson and Smith’s (1998) study concluded that the fourth object must have been special to the experimenter. She was the one who moved to the table, showed children the fourth object, and encouraged them to play with it in a special game. Consequently, when she offered a name, children inferred that she must have been referring to the fourth object. But what if someone who was not involved in, and was in fact unaware of, the previous activities with the objects, was to enter exactly when the experimenter had returned all of the objects to the box, looked inside the box and exclaimed, ‘There’s a gawzer in here!’? Would children be sensitive to that speaker’s absence from the preceding context, irrespective of their own presence, and conclude that they cannot decisively infer which object that speaker is referring to? To answer this question, we created such a scenario (Different-Speaker condition) to contrast with the Intentional/Same-Speaker condition.

According to Samuelson and Smith’s account, the mechanisms of memory and attention are endogenous to the child, and thus independent of the communicative context. From the child’s perspective, the contexts in which the objects were seen were exactly the same in the two conditions. Thus, both when the experimenter does the naming and when a different speaker does the naming, the fourth object is the one that should be perceived as novel by the child and consequently be associated with the name. According to the pragmatic account, the fourth object is special to the experimenter, and thus
when she does the naming (the Intentional/Same-Speaker condition), the child can confidently infer that she is referring to the fourth object. The fourth object is not special to the different speaker – he is an uninformed stranger. Therefore, when he does the naming (Different-Speaker condition), the child cannot confidently infer that he is referring to the fourth object – he could be referring to any of the four objects. In other words, the two accounts differ in their hypotheses regarding children’s responses in the Different-Speaker condition.

**Method**

**Participants**

Seventy-two 2-year-olds ($M = 24.8$ months, range = 22.0–28.0 months) participated in this study. The mean age of the participants in the present study is comparable to that of the children in Samuelson and Smith’s (1998) study ($M = 24.7$), although they included younger children in their sample (range = 18.2–28.2). Thirteen additional children were dropped from the study because they were noncompliant or did not complete the task. Children were recruited from local daycare centers, and written parental consent was obtained prior to testing. All of the children were Israelis, native Hebrew speakers, from diverse secular cultural backgrounds. Thirty-seven girls and 35 boys participated, approximately equally divided between the Intentional/Same-Speaker, Accidental, and Different-Speaker conditions.

**Stimuli**

Four novel objects were used in the study: (a) a black bracelet-like band made of nylon and cloth, (b) a pink irregularly-shaped sponge object, (c) a wooden flat hexagon with pieces of sponge glued on top and (d) a red hook-like plastic object. Children did not know the names of any of the objects, and did not offer names for any of them throughout the duration of the study. The objects were presented in four different orders within each condition, such that each object appeared an equal number of times as the first, second, third and fourth object.

In addition, a hand puppet of an animated character and a puppet-house were used in the three conditions.

**Design**

Children were randomly assigned to one of three conditions: Intentional/Same-Speaker, Accidental, and Different-Speaker. The mean age of children in the three conditions did not differ, $F(2, 69) < 1$. It is important to note that, as outlined in the Introduction, the present investigation actually consists of two separate and independent tests. The first test addressed the effect of intentionality. To assess this effect, we compared children’s responses in the Intentional/Same-Speaker condition with the responses of children in the Accidental condition. The second test addressed the effect of speakers knowledge. To assess this effect, we compared children’s responses in the Intentional/Same-Speaker condition with the responses of children in the Different-Speaker condition. The study was not meant to be a $2 \times 2$ design, because the inclusion of the ‘fourth’ cell of such a design – namely a condition in which the move to the table occurs accidentally and the puppet is the one who does the naming – seemed uninformative from a theoretical standpoint. Specifically, there would be no clear pragmatic prediction as to how children might respond in such a confusing situation, and thus this condition would not serve to contrast the two alternative accounts.

**Procedure**

Children were tested individually by one of two female experimenters in a quiet area of their daycare. The experimenter set up the room while no children were around. She placed a table and two chairs 3–4 meters (10–13 feet) from where she would be sitting on the floor. She covered the table with a blue tablecloth, and placed a basket on top of the tablecloth, which was used to play with the fourth object. The experimenter also placed the puppet’s house with its door closed next to her on the floor.

The three conditions began in the exact same way. The experimenter greeted the child, sat with him or her on the floor, and announced that she was going to show the child some things she brought from her house. She took the first object out of the box – which was out of the child’s sight – showed it to the child and simply said, ‘Look what I have here.’ She then placed the object inside a pan made of aluminum foil, covered the pan, and shook it to make a noise. She handed the object to the child and encouraged him or her to play with it and the pan. The child was allowed to play with the object for approximately 1 minute. The experimenter then asked the child for the object, returned it to the box, and brought out a second object. The same procedure was repeated for both the second and the third objects.

**Intentional/Same-Speaker condition**

The Intentional/Same-Speaker condition proceeded in a very similar way to Samuelson and Smith’s (1998)
procedure (see their Figure 1). Specifically, after the child had seen the first three objects, the experimenter took the fourth object out of the box – but did not present it to the child – stood up, and invited the child to move to the table by saying, ‘Come play with me over here.’ The experimenter and the child sat at the table, the experimenter showed the child the fourth object, put it in the basket, and spun the object inside the basket. She then handed the object to the child, and encouraged him or her to play with it for approximately 1 minute. After this play period, the experimenter invited the child to move back to the floor, where she put the fourth object inside the box next to the other three objects.

At this point, a puppet came out of his house. The puppet was manipulated by the experimenter who also spoke for him in a different tone of voice. He introduced himself, commented on how well he had slept, and asked who they were and what they were doing. The experimenter replied, and then turned her attention back to the child. This introduction scenario lasted about 20 seconds. Immediately following this introduction, the experimenter looked at the box, and then while staring at the child exclaimed, ‘Look, there’s a teega in here! A teega! There’s a teega in here. Look, a teega. A teega!’ Identical to Samuelson and Smith’s (1998) procedure, the name was repeated five times. The experimenter then invited the child to play with all four objects and the aluminum pan for approximately 1.5 minutes. After this play period, the experimenter asked the child a comprehension question. The experimenter returned the objects to the box, and while looking at the child, asked, ‘Can you give me the teega?’

Accidental condition

In the Accidental condition, the procedure was basically the same as in the Intentional/Same-Speaker condition except that the move to the table was made to appear unintentional. As the experimenter was bringing the fourth object out of the box, it slipped from her hands, the experimenter exclaimed, ‘Oops! It slipped from my hands’, and the object landed right next to the table. The experimenter stood up to retrieve the object, and then turned to the child and said, ‘Come play with me over here. I’m already here anyway.’ The experimenter then sat on one of the chairs by the table, and waited for the child to sit on the other chair.

From that point on the procedure continued exactly as in the Intentional/Same-Speaker condition. Namely, the experimenter showed the child the fourth object at the table, played with it by spinning it in the basket, and then moved back to the floor. On the floor, the procedure was identical to the one in the Intentional/Same-Speaker condition. The puppet was introduced, and the same naming event and subsequent comprehension test performed by the experimenter occurred.

Different-Speaker condition

The only difference between the Different-Speaker condition and the Intentional/Same-Speaker condition is that in the former the puppet, rather than the experimenter, named the objects. That is, in the absence of the puppet, the experimenter showed children the four objects – three on the floor and a fourth at the table. As in the Intentional/Same-Speaker condition, the puppet was only then introduced, but differently from the Intentional/Same-Speaker condition, the puppet looked inside the box and while staring at the child exclaimed, ‘Look, there’s a teega in here! A teega! There’s a teega in here. Look, a teega. A teega!’ The child then played with all four objects and the aluminum pan for approximately 1.5 minutes, after which the objects were returned to the box. The puppet then looked at the child and asked, ‘Can you give me the teega?’

To summarize: (a) children in all three conditions saw the first three objects and heard the name while sitting on the floor, (b) children in all three conditions saw and played with the fourth object while sitting at a table, (c) these contextual changes were identical to those used by Samuelson and Smith (1998), (d) the only two differences between the conditions was whether the experimenter deliberately or accidentally moved to the table, and whether the experimenter or the puppet did the naming.

Results

Coding

The dependent measure was the number of children who selected the fourth object in response to the request for a teega. The coding of children’s responses was straightforward: the first object the child distinctly pointed to or gave to the experimenter in response to the request for a teega was coded as the child’s selection. Due to security regulations, we could not videotape inside the daycare

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2 Samuelson and Smith (1998) used a slightly different comprehension question. Specifically, they told children, ‘One of these is a gazzer. Give me the gazzer.’ We chose the current phrasing of the comprehension question to avoid use of a demonstrative pronoun. In Hebrew, such pronouns (and object names) are varied and grammatically gendered. Thus, we believed use of such a pronoun might influence children’s choices.
centers. Thus, to ascertain that the coding scheme was clear, 14 children were tested while the two experimenters were present, one testing and the other observing quietly. The experimenters agreed on the coding of all 14 children’s selections.

Preliminary analyses

Preliminary chi-square analysis across all conditions revealed that the distribution of children who selected the fourth object did not differ in terms of gender. A chi-square analysis on the distribution of children tested in the different orders in terms of selection of the fourth object was also not significant. Given that in each order a different novel object was the fourth, this finding indicates that children’s selection of the fourth object was unaffected by which particular novel object was the fourth.

Comparison to previous studies

Table 1 presents the results from this study, along with the corresponding findings from Akhtar et al.’s (1996) and Samuelson and Smith’s (1998) Experimental conditions. As can be seen in Table 1, there was no significant difference between the number of children in the present Intentional/Same-Speaker condition who chose the fourth object and the number of children in Samuelson and Smith’s (1998) Experimental condition who did so, $\chi^2(1, n = 48) < 1.00$. This is important because it indicates that the present study succeeded in replicating Samuelson and Smith’s (1998) study, despite the slight procedural differences (e.g. the presence of a puppet). The number of children who selected the fourth object in response to the comprehension question in Samuelson and Smith’s (1998) Experimental condition of Akhtar et al.’s (1996) Study 2.

The effect of intentionality

According to the pragmatic account, children’s responses should vary depending on whether or not the speaker who named the objects was involved in the manipulation of the objects. According to the mechanistic account children in both conditions should select the fourth object. To test these hypotheses, we compared the responses of children in the Intentional/ Same-Speaker condition to the responses of children in the Different-Speaker condition. Consistent with the pragmatic account, only 1 (4%) of the 24 children in the Different-Speaker condition chose the target object when asked to find the teega (see Table 1). This number is significantly less than the number of children who chose the target object in the Intentional/Same-Speaker condition, $\chi^2(1, n = 48) = 9.55, p < .005$.3

Discussion

The present study compared two general accounts of word learning by testing their different predictions.

Table 1 Number (and percentage) of children who selected the fourth object or the other objects as referent of the novel name

<table>
<thead>
<tr>
<th>Study/Condition</th>
<th>Fourth object</th>
<th>Other</th>
<th>Total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akhtar et al. (1996)4</td>
<td>10 (42%)</td>
<td>14 (58%)</td>
<td>24</td>
</tr>
<tr>
<td>Samuelson &amp; Smith (1998)</td>
<td>13 (54%)</td>
<td>11 (46%)</td>
<td>24</td>
</tr>
<tr>
<td>Present study</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intentional/Same-Speaker</td>
<td>10 (42%)</td>
<td>14 (58%)</td>
<td>24</td>
</tr>
<tr>
<td>Accidental</td>
<td>3 (13%)</td>
<td>21 (87%)</td>
<td>24</td>
</tr>
<tr>
<td>Different-Speaker</td>
<td>1 (4%)</td>
<td>23 (96%)</td>
<td>24</td>
</tr>
</tbody>
</table>

Note: 4 Number of children who selected the fourth object in response to the comprehension question in Akhtar et al.’s (1996) Experimental condition of Study 2. 5 Number of children who selected the fourth object in response to the comprehension question in Samuelson and Smith’s (1998) Experimental condition.

3 Despite developmental psychologists’ common use of puppets as ‘sentient beings’ in experiments, we wanted to ascertain that the findings regarding speakers’ knowledge would hold also in a case where both actors were human beings. For that purpose, we tested two additional groups of 16 2-year-olds in modified versions of the Intentional/Same-Speaker and Different-Speaker conditions. The main change was that in these conditions, instead of a puppet, a second experimenter played the role of the different speaker. We found that 9 of the 16 children in this Intentional/Same-Speaker condition chose the fourth object as the referent for the novel name – a number significantly larger than what would be expected by chance, $\chi^2(1, n = 16) = 8.33, p < .005$. In contrast, only 5 of the 16 children in this Different-Speaker condition chose the fourth object – a number not significantly different than expected by chance ($p = ns$).
regarding a specific naming phenomenon. One account—the social-pragmatic account—portrays the word learning child as primarily a psychological being involved in a social task. The task is to understand the referential intent of a speaker, and to that end the child recruits his or her capacity to understand other people's minds. The other account—the mechanistic account—portrays the word learning child as an associationist being involved in a statistical task. The task is to determine which object gets associated with a novel name, and to that end the child is driven by non-strategic mechanisms of perception, attention and memory.

The phenomenon investigated was one originally documented by Samuelson and Smith (1998), in which a change in context led children to associate a name with the object presented in a novel context. Based on their study, the authors concluded that 2-year-olds associate names with objects based on the relative contextual novelty of the object, and the consequent attentional pull of the object. The present study systematically investigated an alternative interpretation. The study revealed that 2-year-olds' responses to changes in context depended on the nature of the change, and the involvement of the speaker in the change. Specifically, children associated the novel name with the object presented in a new context only when the contextual change resulted from an intentional, as opposed to an accidental, behavior on the part of the speaker providing the name. Moreover, children interpreted the novel name as referring to that object only when the original experimenter was the one providing the name, but not when a different speaker who was new to the scene did so.

We agree with Samuelson and Smith's (1998) analysis that a full version of the social-pragmatic view has to take into account children's memory and attention mechanisms. The 2-year-olds in the present study had to remember which object the experimenter played with at the table, and had to shift their attention towards it after a name was provided. However, we do not agree with their assertion that all that is needed to explain 2-year-olds' smart word learning is an account of children's memory and attention mechanisms. The social-pragmatic account postulates that what children attend to and how they encode what they have attended to, depend on children's understanding of the people and contexts to which they are exposed. Thus in the Accidental condition, although 2-year-olds presumably remembered that the fourth object was presented at the table, they also noticed that the move to the table was accidental. In other words, children seem to have encoded the accidental move differently from how they encoded the deliberate move, and responded accordingly in their interpretation of the experimenter's naming. In Akhtar et al. (1996), 2-year-olds remembered that one of the experimenters was not in the room when they saw the fourth object, and because of that their attention focused on the fourth object as the one that experimenter likely named. The cues 2-year-olds rely on to infer a speaker's intent are varied, but they are interpreted by the same underlying understanding of mind. Ultimately, to explain how 2-year-olds interpret a naming event, one has to enlist such understanding.

Samuelson and Smith (1998) argued that their mechanistic account provides a more accurate explanation than the social-pragmatic one of what children in Akhtar et al. (1996) did because, among other things, it relied on mechanisms known to exist in 2-year-olds. While it is probably true that a 'complete' understanding of mind is not in place by 2 years of age, we do not believe that such a complete understanding is needed to explain 2-year-olds' performance in the present tasks. A rudimentary understanding of intentions and knowledge states may suffice. And there is a growing body of research supporting the idea that such an understanding is in place by 2 years of age (Carpenter et al., 1998; Golinkoff, 1993; Meltzoff, 1995; Moses et al., 2001; O'Neill, 1996; Woodward, 1999; Zelazo et al., 1999). It is nonetheless plausible that the general mechanisms of attention and memory postulated by Samuelson and Smith (1998) do play a more influential role in younger, than in older, children's mapping of words to referents (see for instance, Hollich et al., 2000; Moore et al., 1999).

Before we conclude, a qualification and a couple of questions still remain. Despite our intention to replicate Samuelson and Smith's (1998) experimental procedure as faithfully as possible, we had to make some changes, such as the use of a puppet, slightly different phrasings, and of course different objects and experimental settings. We do not know whether these changes had any effect on children's answers. Nonetheless, the fact stands that we statistically replicated their findings with our Intentional/ Same-Speaker condition, and the differences between that condition and the other two conditions are meaningful and important, the replication notwithstanding.

The questions that remain are how to best describe what makes an action 'intentional', and what was the crucial factor in the Different-Speaker condition. Regarding intentionality, it has been suggested that children may intuitively parse human actions into structures that closely correspond to actors' goals (Baldwin, Baird, Saylor & Clark, 2001). If so, then 'natural' human movements may be perceived as intentional (e.g. Woodward's, 1999, 'grabbing' movements, and the present Intentional/Same-Speaker condition), and lack of intentionality may need to be somehow marked (e.g. the present Accidental condition) (see also Baron-Cohen, 1995; Gergely, Nadasdy, Csibra
& Biro, 1995). This latter issue calls for a more detailed examination of whether and how accidents influence children's performance on a given task (see for instance, Moore & Frye, 1986, on how accidents distract preschoolers in number conservation tasks; but see also Baldwin, Markman, Bill, Desjardins, Irwin & Tidball, 1996).

Regarding the attributions made with respect to the different speaker, we have no direct evidence as to whether children indeed attributed a different epistemic state of knowledge to the speaker. Nonetheless, the fact that children in the present, and similar, scenarios were sensitive to a speaker's involvement in or connection to the discourse context, is indicative of their emerging socio-cognitive understanding (see also Akhtar et al., 1996; Birch & Bloom, 2002; O'Neill, 1996).

In conclusion, the present findings that 2-year-olds' responses vary depending on the nature of a speaker's action, and the relation between the speaker and the action, support the idea that children determine the referents of words based on cues about what speakers intend to label.

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