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Infants' Use of Shared Linguistic Information to Clarify Ambiguous Requests

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Do infants use past linguistic information to interpret an ambiguous request for an object? When infants in this research were shown 2 objects, and asked for 1 with an indefinite request (e.g., ''Can you get *it* for me?''), both 15- and 18-month-olds used the speaker's previous reference to an absent object to interpret the request. The 18-month-olds did so even when the request was made after a 2.5-min delay. When the request was made by a person who did not participate in the conversation, the infants did not use the previous verbal information. These results demonstrate infants' ability to use language as a source of information in ambiguous contexts and indicate an early appreciation of the shared nature of conversation.

Successful communication depends, among many things, on our ability to determine which entity another person is referring to. This can be straightforward in situations in which the speaker is directly pointing out the referent for us, as in ''Can you bring the key with the red chain?'' However, speakers often use indefinite expressions, such as ''it,'' ''one,'' ''that,'' and ''those'' to ask for referents. These expressions can be confusing without the ability to use other sources of information to disambiguate the speaker's intended meaning. For instance, to clarify what ''it'' means, one often has to reflect back on what the speaker previously said in the conversation. If a speaker had mentioned earlier that she was trying to find her car key, then we can appropriately infer that ''it'' from her subsequent request—''Can you give it to me?''—must refer to her car key. The ability to use linguistic information from a shared conversational background to make inferences about others' references is an essential pragmatic skill (e.g., Clark & Marshall, 1981), which enables us to participate effectively in dialogue. Very little is known about the emergence of this ability in infants.

In a classic theoretical paper on adults' pragmatic skill, Clark and Marshall (1981) discussed several strategies for interpreting reference in ambiguous communicative situations. One strategy involves reflection about the other person's direct *physical experience* with referents (copresence between a speaker and an object or event). In other words, by observing the objects that a person has seen or interacted with, we can make appropriate inferences about what the person's intended referent might be in an ambiguous context. Recent research has shown that infants in the second year can successfully use this strategy—they can track a person's physical contact or experience with objects in the environment to determine her intended referent (Akhtar, Carpenter, & Tomasello, 1996; Liszkowski, Carpenter, Striano, & Tomasello, 2006; O'Neill, 1996; Saylor & Ganea, in press; Tomasello & Haberl, 2004). For example, in Akhtar et al. (1996), 24-month-olds played with three novel toys with their parent and two experimenters. After the parent and one experimenter left the room, the remaining experimenter showed the children another novel toy and then placed all four objects in a transparent box. Upon returning to the room, the second experimenter looked inside the box and said ''Look, I see a gazzer!'' When she later asked for a ''gazzer,'' the children selected the object that was novel from the experimenter's perspective. Thus, although multiple objects were present, the children understood that the object the experimenter was referring to was the one she had not previously interacted with. Tomasello and Haberl (2004) provided evidence that even 12-month-olds can determine what is new for another person based on her previous interaction with objects in the environment.

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Infants can also interpret others' referential intentions based on *nonverbal communicative cues*. For example, in word-learning situations, 18- to 24-month-old infants use nonverbal cues provided by the speaker (e.g., gaze direction, facial expressions) to identify the referent of a word in difficult contexts, that is, when referents are not in view at the time the label is provided (Baldwin, 1991, 1993; Tomasello, Strosberg, & Akhtar, 1996) or when there are multiple possible referents present (Baldwin, 1991, 1993; Tomasello & Barton, 1994). Baldwin (1991, 1993) reports that, in cases of discrepant attention—when the adult and the infant are attending to different objects at the time the label is uttered—infants from 18 months of age associate a label with the object on which the adult is focused, not with the object on which they are focused when they hear the label. Thus, infants in these studies understood that the referent the person was labeling was the object that she was attending to at the time of labeling.

Another important strategy for interpreting an ambiguous verbal reference is to consider information from the speaker's previous speech (Clark & Marshall, 1981). There are situations in which tracking others' behaviors or nonverbal cues in relation to objects in the environment would not provide relevant information about the speaker's intended referent. For instance, in a situation in which the speaker is talking about an absent object or event, tracking the person's physical contact with the referent would not be possible. Thus, if the person is subsequently using the term "it" to refer to the referent that she had previously introduced in the conversation, we would have to use information from her past speech as a cue to her intended meaning (i.e., if the person had previously mentioned a lost key, we would infer that "it" from her subsequent request for an object would apply to the "key"). Resolving this type of ambiguous situation involves reflection about more indirect verbal copresence between a person and a linguistic event (Clark & Marshall, 1981).

Can infants use this verbal strategy to interpret an ambiguous reference to an object? As discussed above, there is plenty of evidence that early in their second year, infants are capable of using information about a person's past behavior to make inferences about her intended referent (Akhtar et al., 1996; Liskowski et al., 2006; O'Neill, 1996; Saylor & Ganea, in press; Tomasello & Haberl, 2004). However, it is not clear what to expect with respect to infants' ability to use information from a person's past speech—in particular a reference to an absent object—to interpret ambiguous reference. One reason is that recent research suggests that even older preschoolers have some difficulty when they have to rely mainly on the verbal information provided by another person as opposed to their physical contact with objects (Saylor & Carroll, 2007).

Study 1

In this research, we asked whether infants could use verbal information from the shared conversational background to interpret an ambiguous request for an object. To investigate this, an experimenter mentioned an absent object (e.g., telephone) several times while looking around for it. After the experimenter searched for the object, she opened a door to another room where she found two objects (e.g., telephone and duck) on a table. She then looked at the child and said "Can you give *it* to me?" To be successful in this task, the child had to (1) understand the initial reference to the object when it was absent, then, at the time of the request, (2) recall the experimenter's previous reference to the object, and (3) infer that the object that she wanted was the one that she had previously talked about.

There is evidence that infants begin to comprehend references to absent objects soon after their first birthday (Ganea, 2005; Huttenlocher, 1974; Lewis, 1936; Saylor, 2004). For example, infants who hear the name of an absent familiar toy will go look or point to its location, or even go in search of it, indicating that hearing the name of the toy activated the child's mental representation of it. However, infants' initial understanding of references to absent objects is quite fragile and dependent on contextual support (Ganea, 2005; Saylor, 2004). Infants' ability to understand absent references becomes stronger between 15 and 18 months of age (Huttenlocher, 1974; Lewis, 1936; Miller, Chapman, Branston, & Reichle, 1980; Sachs, 1983; Saylor, 2004; Saylor & Baldwin, 2004; Shimpi & Huttenlocher, 2004; Veneziano & Sinclair, 1995). Therefore, during this time frame, infants may be able to use others' references to absent objects to make inferences about intended referents during communication. We address this possibility in the current study.

Method

Participants

Participants were 36 infants in two age groups that ranged in months from 15.4 to 16.8 ($M = 15.9$, 7 boys and 11 girls) for a younger group and from 17.6 to 20.0 ($M = 18.7$, 11 boys and 7 girls) for an

older group. Infants and parents were recruited by phone using a database of families interested in research participation. Infants who participated were full term at birth, developing normally, and heard English as their primary language at home. Data from an additional 11 infants were excluded for experimenter error (one 15-month-old, three 18-month-olds), never selecting test objects (three 15-month-olds, three 18-month-olds), and parental interference (one 15-month-old). The participants for all three studies were middle class and mostly Caucasian.

Materials

During the study, infants were presented with three pairs of objects: a banana with a shoe, a kitty with a cup, and a puppy with a car. The objects were chosen so that they were small, easily manipulable, and had labels likely to be known by infants. A phone questionnaire that was administered to parents before participating was used to confirm that infants comprehended the labels for the test objects. If infants did not know the labels in the target object set, an object with a known label was substituted from the following set: duck, plane, key, spoon, and phone. Four medium-sized throw pillows were used as search locations. A small plastic bucket and rabbit hand puppet were used, as needed, to retrieve test objects from infants during test trials. Two digital video cameras were used to record infants' responses during the experimental session.

Procedure

The procedure had three phases—familiarization, absent reference, and test. The *familiarization* and *absent reference* phases took place in one room, and the *test* took place in a different room. During the *familiarization* phase, the door to the test room was open so that infants could become acquainted with the full test space. The door was closed during the *absent reference* phase.

Familiarization phase. The purpose of this phase was to expose infants to the test objects and to familiarize them with the testing procedure, the room, and the experimenter. Upon arrival, parents and infants were seated on the floor in the large outer room directly across from the doorway to the small room. One experimenter (E1) talked to the parents about the study, while another experimenter (E2) encouraged the infants to explore the test objects (e.g., banana, shoe, kitty, cup, puppy, and car). No object labels were provided during this phase. After the infants had explored each object for about a minute, E2 took the test objects into the smaller room and shut the door. E2 remained out of sight in the small room for the rest of the session.

To familiarize infants with the testing procedure, E1 told them that she wanted to find one of the test objects (''I really want to find the shoe! Can you help me find the shoe?''). Then she told infants that she knew just where the object was (''I know where it is! The shoe is in here!''), as she pointed to the door to the smaller room. She then attempted to bring the infant to the door, opened the door, and revealed two objects placed on opposite sides of the table: the object that she had been looking for (the shoe) and a distractor object (the banana). E1 then looked at the middle of the table (to avoid biasing responding) and asked the infant to retrieve the test object (''Can you get the shoe?''). She repeated her request three times. If infants failed to select the test object (most often because they would not approach the small room), E1 took the test objects from the table, showed them to the infants, and repeated her request. If infants selected both test objects, E1 held out her hand and asked for the target object again (e.g., ''Can I have the shoe?''). Infants were praised for selecting the correct test object (e.g., ''Good job, you found the shoe!'') and offered feedback and a chance to correct for selecting the wrong object (e.g., ''That's not the shoe! Find the shoe!''). At the end of the *familiarization* phase, E1 placed the objects back on the table and shut the door to the small room. The banana and shoe were the target pair for the *familiarization* phase and appeared approximately equally often on the left and right side.

Across the three studies, there were nine infants (out of 104) who did not make a choice during the *familiarization* phase. However, their lack of response during the *familiarization* phase did not seem to index a lack of understanding of the task as these infants did go on to respond during the *test* phase of the study: six of them responded correctly to both test questions, and the other three responded correctly to at least one test question.

The remaining infants selected the target object in response to the first request of the experimenter at above-chance levels, according to binomial tests (25 out of 31 trials correct in Study 1, 24 out of 35 trials correct in Study 2, and 25 out of 29 trials correct in Study 3), $ps < .05$.

Absent reference phase. During this phase, infants heard E1 mention an absent object eight times (according to an exact script) while she was looking for the object around the room. This phase began

immediately after the *familiarization* phase, with E1 telling the infant that she wanted to find a lost object (''I really want to find my puppy! Can you help me find my puppy?''). She then began looking around the room, searching under two of the four throw pillows while repeating her intention to find the lost object each time (''Is my puppy under here?'') and verbalizing the result of her search. (''No, there's no puppy here.'') After looking under the second pillow, E1 lamented that she could not find her lost object (''Oh well, I guess I can't find my puppy. I can't play with my puppy!''). During each search, E1 tried to involve infants in the search (e.g., by leading them to the pillows when she looked under them, by assuring that they were looking at her, by calling their name when she searched under the pillows), and included nonverbal signals of her search intention (e.g., by shrugging her shoulders when she did not find the object under the pillows, by sounding sad when she finally could not find it). Immediately following the search phase, E1 started the *test* phase.

Test phase. To begin this phase, E1 excitedly said that she knew just where her lost object was without using the object label. Instead, she used the pronoun ''it'' (e.g., ''I know where it is! It's in here!''), so that infants would have to think back on E1's previous reference to the absent object to interpret her reference. E1 then opened the door to the small room revealing two objects on either side of the table (e.g., the puppy on the left and the car on the right), and asked infants for the object (e.g., ''Can you get it for me?''). The left–right position of the objects during the *test* phase was counterbalanced, so that each infant received one test trial with the target object on the left and one test trial with the target object on the right. The identity of the target object was roughly counterbalanced across infants (because this depended on infants' label knowledge). The requesting procedure was similar to that used in the *familiarization* phase, with the exception that no feedback was offered in this phase. Instead, once infants gave E1 an object she said ''thank you'' or ''you got it'' with a neutral tone. After the first test trial, the *absent reference* phase and the *test* phase were repeated for another trial with the next pair of objects (e.g., the kitty and the cup). For the second trial, the researcher searched for the target object under the other two pillows that she had not yet looked under.

Coding

Data from 5 trials were omitted across all three studies (2 trials because the infants did not know the label for the distractor object, 1 trial because of experimenter error, and 2 trials because of parental interference). For the remaining trials, infants' selection of objects was coded by E1, who recorded infants' object selection immediately following their response to the test question. In cases where infants chose both objects at once, their response to the experimenter's clarification question was coded as the response (e.g., if the child chose both the puppy and the car and then gave the experimenter the puppy in response to her request for ''it,'' the puppy was coded as their response). If infants did not respond to the clarification question, the first object infants looked at upon hearing the initial request was determined from the videotape and coded as their response. Choices coded on looking behavior were rare (two trials in Study 1, nine trials in Study 2, and five trials in Study 3). Separate analyses without the looking data (trials on which infants did not make a choice were omitted) revealed the same pattern of results as the one reported here.

A second coder who was naïve to which object was the target coded the responses of 24 of the infants in Study 1. Infants were randomly selected from videotapes where a clear view of infants' choice or gaze was available. Intercoder reliability was high—the two coders agreed on 94% of the trials (44 out of 47), Cohen's $\kappa = .85$, $p < .001$. The disagreements were easily solved through discussion.

Results and Discussion

Test responses were analyzed as an average proportion of correct responses on the number of total test trials available. For example, the proportion score for a child who answered correctly on one trial out of two was 0.50, and the proportion score for a child who answered all questions correct (either out of one or two total) was 1.00.

Our primary question was whether infants at 15 and 18 months would use previous references to an absent object to interpret a subsequent ambiguous request for the object. Preliminary analyses revealed that 15- and 18-month-old infants had identical levels of performance, responding correctly on average on 0.69 of the trials ($SD = .35$ for the 18 month olds and .30 for the 15 month olds). The first two bars in Figure 1 show the average percentage of correct responses in Study 1. To evaluate whether infants had a reliable tendency to choose the target object in response to E1's request, the proportion correct was compared with chance levels (0.50). One-sample t tests at each age group indicated that performance was above chance level for both age groups, ts$(17) \geq 2.36$, ps$< .05$. Table 1 shows the pattern of

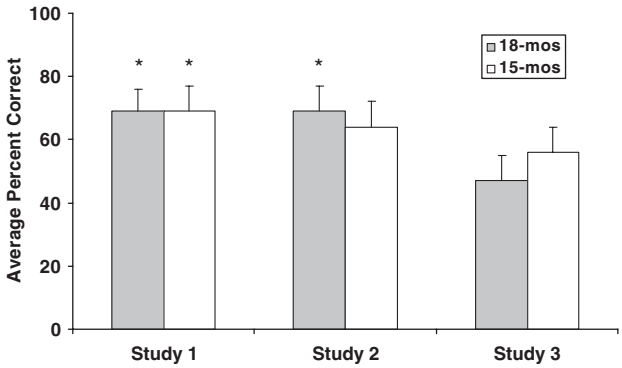

Figure 1. Average percentage of correct responses as a function of age group in each of the three studies (chance level = 0.50).

responses across trials (infants were categorized according to their proportion of correct responses). According to a chi-square test of association, both age groups revealed similar patterns of performance, $\chi^2(2, 36) = .64$, *ns*.

These results indicate that in the second half of their second year, infants can use a person's previous reference to an absent object to interpret her ambiguous request for an object. Thus, by 15 months of age, infants have the ability to think back to their previous experience with a person and reason that what a person is referring to must be something that she had previously mentioned.

Nevertheless, the situation in Study 1 was very supportive: The infants heard the request immediately after the person had referred to the target object. It is possible that infants' representation of the object, which was previously elicited by the label, was still active when they heard the experimenter's ambiguous request. Thus, infants could have selected the correct object by virtue of a mental representation that was still active at the time of the request, without any reflection upon what the person had previously said.

Table 1
Number of Infants in Each Age Group Who Scored an Average 0.00, 0.50, or 1.00 Across the Two Trials in Each Study

	Average of correct trials					
	15-month-olds			18-month-olds		
	0.00	0.50	1.00	0.00	0.50	1.00
Study 1	1	9	8	2	7	9
Study 2	3	7	8	2	7	9
Study 3	1	12	3	4	9	3

The goal of Study 2 was to eliminate this possibility, by inserting a delay between the *familiarization* phase and the *test* phase. Thus, the experimenter requested the object 2.5 min after she had talked about the absent object. During the delay, infants were engaged in a different play activity. By doing this we aimed to focus infants' attention on something else and, thus, to extinguish their representation of the target object. At the time the infants heard the ambiguous request in Study 2, they had to recall the relevant information from the shared conversation with the speaker and, then, use the information to decide which object the experimenter was asking for.

Study 2

Method

Participants

Participants were 18 infants at 15 months (range = 14.8–16.8, $M = 15.8$, 11 girls and 7 boys) and 18 infants at 18 months (range = 17.0–20.0, $M = 18.5$, 12 girls and 6 boys). Participants were recruited as in Study 1. An additional two infants participated, but their data were not included due to fussiness (one 18-month-old), and never selecting test objects (one 15-month-old).

Materials

Materials were the same as in Study 1, with one exception: A shape-sorter and nail pounding board were used to keep infants occupied during the delay period. The room setup was the same as in Study 1.

Procedure

The procedure and design of Study 2 were identical to Study 1, with one exception. A 2.5 min delay was inserted between the *absent reference* and *test* phases. During this delay, E1 left to go into the small room and E2 came out to play with the infant with an unrelated toy. E1 then returned (and E2 left closing the door behind her), and the *test* phase proceeded as in Study 1.

Coding

The coding proceeded as in Study 1. A second coder naïve to which object was being requested independently coded the trials from 18 infants. E1 and the second coder agreed on 84% of the selections

(27 out of 32), Cohen's $\kappa = .68$, $p < .001$. Disagreements were solved through discussion.

Results and Discussion

The second two bars in Figure 1 show the average percentage of correct responses in Study 2. The results demonstrated that, in a situation in which infants heard the request after a delay, only the 18-month-olds revealed above-chance selection of the object that the speaker had previously referred to, $t(17) = 2.36$, $p < .05$. The average percentage of correct responses for the 18-month-olds was .69, $SD = .35$. In contrast, the 15-month-olds chose the object that was previously mentioned by the experimenter on only .64 ($SD = .38$) of the trials, $t(17) = 1.57$, $p = .14$. Nevertheless, an independent samples t test on the percentage correct responses failed to reveal differences in responding between the age groups, $t(34) = .46$, *ns*. Also, as can be seen in Table 1, both the 15- and the 18-month-olds had a similar pattern of responses across the two trials, $\chi^2(2, 36) = .26$, *ns*.

These results indicate that by 18 months of age, infants can use linguistic information—in the form of references to absent objects—to interpret a person's request even after a short delay. Infants in Study 1 heard the request soon after the reference to the absent object was made and both age groups used the shared information to disambiguate the experimenter's request. The situation in Study 2 was more processing intensive: Infants presumably had to recall from memory the object that was previously mentioned by the experimenter to interpret the ambiguous reference. In this more demanding situation, the 15-month-olds did not reveal reliable responding as a group.

An important issue to address next is the extent to which infants take into account not only the previous language but also the source of the linguistic information. To participate effectively in a dialogue, one needs to pay attention not only to what is said in the conversation but also to where the information comes from, that is, to who says what. Linguistic information will only be relevant to interpreting ambiguous reference if the information comes from or is offered in the presence of the person making such a request. That is, it would be a mistake to think that my "it" is the same as another person's "it."

In Study 3, we asked whether infants consider the source of the information when processing an ambiguous request for an object. The infants heard one experimenter (E1) mention an absent object and then another experimenter (E2) making the request. The prediction was that if infants were responding based solely on what was previously said (and not considering the source of the information), they should continue to choose the object that E1 mentioned even when E2 makes the request. On the other hand, if infants interpreted the request in light of the shared conversation with the speaker, then they should be at chance in selecting the object that was previously mentioned by E1 (because they had no relevant information with which to interpret E2's request). In other words, because E2 had not participated in the conversation and thus did not refer to any of the two test objects, infants could not use information from the previous conversation as a cue to solve her request.

Study 3 also addressed an alternative explanation for the findings reported so far. We proposed that, at the time of the request in Study 2, infants had to recall the object that was mentioned by the experimenter during the *absent reference* phase. An alternative interpretation is that seeing the target object during the *test* triggered a representation of it and, thus, infants' choice of the target object was based on this passively activated representation of the target object. Study 3 will provide a test for this alternative explanation. Although it is possible that seeing the target object during the test functioned as a memory cue for the previous conversation, infants still had to determine whether the target object was the speaker's intended referent based on her participation in the previous context. If infants simply base their responses on having the representation of the target object passively activated during the test, without any reflection on the person's previous participation in the conversation, they should continue to select the target object even when E2 makes the request.

To investigate the robustness of infants' skills, we tested infants in Study 3 in the most difficult test condition they showed reliable responding in the previous two studies. Because Study 2 revealed that 15-month-olds did not tend to respond reliably after the delay period, in Study 3 they received the *test* phase immediately after the *absent reference* phase (as in Study 1). The 18-month-olds received the more challenging condition, in which E2 placed the request after a delay of 2.5 min (as in Study 2).

Study 3

Method

Participants

Participants were 32 infants in two age groups: 15 month olds (range = 15.2–16.4, $M = 15.8$, 8 girls and

8 boys) and 18 month olds (range = 17.9–20.0, $M = 18.6$, 9 girls and 7 boys), who were recruited as in the previous studies. Four infants were excluded for fussiness (one 15-month-old), never selecting test objects (one 15-month-old), and parental interference (one 15-month-old, one 18-month-old).

Materials and Room Setup

The materials and room setup were the same as in Study 2.

Procedure and Design

The procedure and design of Study 3 were the same as in Study 2, with the following exceptions. First, to investigate whether infants were sensitive to the source of the linguistic information, E2, rather than E1, requested objects during the *test* phase. Once E1 had completed her search for the absent referent, she went into the small room where she remained out of sight for the remainder of the study. E2 came out to be with the infants and to administer the *test* phase. Fifteen-month-olds received the *test* phase immediately after the *absent reference* phase, and 18-month-olds received E2's request after a 2.5-min delay. For both age groups, E2 began the *test* phase by saying, ''Wanna see what's in here?'' She then opened the door, looked at the center of the table (to avoid biasing responding), and said, ''Can you give it to me?'' The remainder of the *test* phase proceeded as in the previous studies.

Coding

The coding proceeded as in the previous studies, except that E2, rather than E1-recorded infants' responses. As in the previous studies, a second coder, naïve to which object was being requested, independently coded the sessions for 27 infants. The two coders agreed on 92% of the selections (48 out of 52), Cohen's $\kappa = .85$, $p < .001$.

Results and Discussion

The central question addressed in Study 3 was whether infants recognized that the source of previous linguistic information is critical to interpreting an ambiguous request. If they did, we predicted that their responding would be at chance when E2 (rather than E1) requested the test objects. The last two bars in Figure 1 show the average percentage of correct responses in Study 3. As in the previous studies, the responding of the 15-month-olds (0.56 on average, $SD = .25$) and of the 18-month-olds (0.47 on average, $SD = .34$) did not differ, $t(30) = 0.89$, *ns*. Tests against chance revealed that both age groups selected the object at levels not differing from chance, one-sample $t(15) < 1.0$, *ns*.

This result indicates that infants at 15 and 18 months are sensitive to who the ambiguous request came from: When E2 (who had not previously shared the conversation) made such a request, they did not reliably select the target object. In addition, infants' performance during the test was not based on having the object representation passively activated at the time of the request. Although seeing the object during the test may have triggered infants' memory of the previous conversation, the infants seemed to appreciate that information from the previous conversational context could not serve as a cue to E2's request (because E2 did not take part in the previous conversation). Together with the results from the previous studies, this finding indicates that infants at 15 and 18 months can determine the intended referent of a speaker in light of the of the shared conversation with the speaker.

General Discussion

The question addressed in this research was whether infants at 15 and 18 months use the shared linguistic information from the previous conversation to interpret an ambiguous verbal reference. The current findings established that they do. When infants were shown two objects, and asked for one with an ambiguous request (e.g., ''Can you get it for me?''), they used the speaker's previous reference to the object to interpret her request. Infants at 18 months revealed a reliable tendency to use the previous linguistic information even when a delay of 2.5 min was interposed between the time the information was received and the time of the request. These results demonstrate that by the middle of their second year, infants have begun to treat language as a source of information in ambiguous communicative situations.

Infants' ability to respond to references to absent objects, and to use those references during communication, may be partially dependent on their memory skills (Ganea, 2005). An important goal for future research will be to explore the effects of delay on infants' representations of absent objects. One question is how delays affect their ability to use those representations during communicative tasks. For instance, it is possible that with longer delays than the one used in the current research, even the 18-month-olds might have difficulty using the

information from the shared conversational background to clarify ambiguous references.

The findings reported here indicate that infants in their second year are beginning to appreciate the importance of shared knowledge. Shared knowledge is the recognition that speech partners know about the same thing and has been argued to be of central importance for interpreting reference (Clark & Marshall, 1981). Tracking others' experiences with objects is one means for establishing shared knowledge between speakers (Clark & Marshall, 1981). Several past studies have shown that infants can use the past copresence of a person with objects to make inferences about the person's intended referent (Akhtar et al., 1996; Liskowski et al., 2006; O'Neill, 1996; Saylor, 2004; Saylor & Ganea, in press; Tomasello & Haberl, 2004). One question arising from this previous work was whether infants could use verbal contact alone to interpret others' reference.

The current research establishes that they do, by providing evidence on infants' ability to track another person's *verbal* experience alone to make inferences about shared knowledge. The ability to use linguistic information is critical for establishing shared knowledge in situations in which tracking others' experiences with objects is not possible (Clark & Marshall, 1981). For example, upon meeting a new person, I may not have access to their past physical contact with objects, but I can rely on what they talk about to make inferences about what they know about. In this research, infants had to rely on the person's speech to establish shared knowledge. Both the 15- and 18-month-olds used the experimenter's previous reference to the object to answer a subsequent ambiguous request for the object. Moreover, when the request was made by a different person than the one who offered the relevant linguistic information, infants in both age groups did not use the information from the previous situation to answer her ambiguous request. Thus, in a situation where knowledge of the referent was not shared, they failed to resolve on the referent. This finding indicates that infants may have a starting recognition of the shared nature of conversation; the infants in this study appreciated that a person's previous participation in conversation is relevant to her current referential intent.

Infants' ability to keep track of the experiences of the two experimenters in the conversational context may shed light on the early development of source monitoring during communication. Source monitoring skills include the ability to keep track of where information comes from and the quality of the information source. Recent studies have demonstrated that older children can evaluate information from others based on the speakers' relevant past experiences and knowledge states (Birch & Bloom, 2002; Koenig, Clément, & Harris, 2004; Clément, Koenig, & Harris, 2004; Jaswal, 2005; Koenig & Harris, 2005; Sabbagh & Baldwin, 2001; Saylor & Carroll, 2007). For example, 3- and 4-year-old children are more likely to acquire novel words from speakers who are knowledgeable than from speakers who are not knowledgeable (e.g., Sabbagh & Baldwin, 2001). The current studies add to this body of work by demonstrating that by the middle of their second year, infants consider the source of the previous linguistic information to resolve an ambiguous referent.

An important issue to address next is whether infants' appreciation of the shared nature of the conversation is based on an understanding of others' knowledge states. Clark and Marshall (1981) discussed the important role that inferences about others' mental states play in adults' conversations. For instance, speakers often need to evaluate what information the listener shares on a topic before designing their utterances. As a concrete example: My discussion of research design is quite different when talking to other psychologists versus my very intelligent, but nonacademic relatives. On one reading, these differences in my speech content arise because I make different assumptions about what my speech partners know. One question is whether infants in the current research similarly evaluated others' knowledge states when interpreting their ambiguous requests for objects.

Although a large body of research shows that infants in their second year understand the social and intentional nature of communication (Baldwin, 1991, 1993; Campbell & Namy, 2003; Tomasello & Akhtar, 1995; Tomasello et al., 1996), it is unlikely that infants make explicit inferences about others' knowledge states. First, it is not until they are 2 years of age that children recognize that others may know about different things (e.g., Lempers, Flavell, & Flavell, 1977). Next, a large body of previous research indicates that children have some difficulty recognizing the causal link between experiences and knowledge states well into the preschool years (see Montgomery, 1992 for a review). An inability to understand this link would make it quite difficult for infants to recognize that others' verbal or physical contact with objects leads to knowing. A more plausible explanation is that infants' behavior in the current research was based on a lower-level strategy, by which they simply track the presence or absence of others (and of what they say) during events. In doing so, babies may be able to form representations of links between people and

referent objects. O'Neill (1996, 2006) outlined a similar strategy as a possible mechanism for older children's ability to figure out what is new for others when deciding what information to offer during conversations (Clark & Havilland, 1977; Clark & Marshall, 1981). One possibility is that this strategy represents a first step in infants coming to appreciate the role of knowledge states during conversation.

To summarize, infants in this study revealed impressive skill at using references to absent objects during conversation. After hearing a person talk about an absent object, they used her absent reference to determine her intended referent in an ambiguous request. Moreover, infants were sensitive to the source of the linguistic information, as they did not use the previous information provided by one person to answer another person's request. The evidence presented provides information about the early emergence of pragmatic competence and it reveals a basic appreciation of the shared nature of conversation.

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