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Contextual Factors Affect Absent Reference Comprehension in 14-Month-Olds

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How do infants come to understand references to absent objects? 14-month-old infants first learned a name for a novel toy, which was then placed out of view. The infants who listened to a story mentioning the nonvisible object, looked, pointed, and searched for it more often than did infants who heard a story using a different name. Their behavior was affected by minor changes in context; they responded to the name of the out-of-view toy less often when it was not easily accessible or after a delay. These findings indicate that the development of absence reference comprehension depends on the interaction of representational and contextual factors.

The ability to refer to and convey information about absent objects and events is an essential feature of the human language (Deacon, 1997; Hockett, 1960; Langer, 1949; Werner & Kaplan, 1964). The representational function of language enables us to think and communicate about an immense variety of topics, from nonobservable physical entities, like atoms, and abstract entities, such as numbers, to concrete objects, animals, and people. Developing the ability to understand references to absent objects and events is thus a major cognitive achievement, one that enables children to communicate about what is not perceptually present.

Observational studies of language *production* have shown that children begin to use words to refer to absent objects and people at about 18 months of age (Sachs, 1983; Veneziano & Sinclair, 1995). According to a diary study by Sachs (1983), her daughter started to request objects that were out of sight at 17 months of age. At 22 months, she first commented on something that was out of view—''Where's Daddy? Daddy's in work?'' (p. 6). Thus, by 22 months of age, she had begun to use words as a means for exchanging information about objects and situations not in the immediate context.

It is well known, however, that production measures can underestimate children's early knowledge about language (Adamson, 1996; Bloom, 2000; Goldin-Meadow, Seligman, & Gelman, 1976; Huttenlocher, 1974; Ninio, 1993; Woodward, Markman, & Fitzsimmons, 1994;). Thus, it is possible that children may understand references to absent objects earlier than 18 months of age.

The evidence on infants' *comprehension* of references to absent objects is not conclusive in this regard. Based on naturalistic studies, the age at which infants begin to look or search for mentioned absent objects ranges from as early as 11 months (Huttenlocher, 1974) to as late as 17 months (Sachs, 1983). For instance, Huttenlocher (1974) observed four infants longitudinally over a period of 6 months, beginning between 10 and 13 months. She observed that, at 11 months, one infant would just look around the room until her gaze came upon the object that was mentioned. Later, between 13 and 14 months of age, the behavior of two of the infants indicated that they retained information about the permanent or temporary location of an object by going directly to its location, without an initial random search. For example, when one infant was asked ''Where is the mirror?'' she crawled to her parents' bedroom and looked into the mirror in the closet. When another infant was asked, ''Where is the dog?'' she turned directly to its temporary location. Similarly, Lewis (1936) observed a 13-month-old who turned around and crawled toward an out-of-view ball when he heard the phrase, ''Where's ballie?'' Thus, the findings of Huttenlocher and Lewis suggest that by 13 months of age infants have the ability to understand references to absent objects.

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However, other naturalistic findings suggest that infants' comprehension may be limited to the present context until later in their second year of life. For instance, Sachs (1983) reports that her daughter did not begin to search for objects that were out of sight until she was 17 months of age. At that age, she would search for absent objects only in the context of conversational routines that included references to highly familiar objects or people (e.g., "Where is daddy?").

Some recent experimental attempts have been made to pinpoint the onset of infants' comprehension of references to absent objects. In 1 study, Saylor (2004) showed that 12- and 13-month-olds appreciate a reference to an absent object in a supportive context. When a reminder of the absent object—something which was previously associated with the referent and had the same color as it—was still present in the environment, infants responded appropriately to the name of the absent object. For instance, when asked about an absent toy car that they had previously seen, the infants looked and gestured more to a color panel that matched the color of the absent referent than to a panel of a different color.

However, in another study, Saylor and Baldwin (2004) found that 13-month-olds did not respond to hearing their absent parent (e.g., "daddy") mentioned in an unfamiliar lab environment. Only at 15 months of age did the infants show some appreciation of references to absent people: When they heard the name of the absent parent, they looked toward the door, gestured away to the distance, and sometimes even searched for the person. The 13-month-olds tended to look at the experimenter when the absent parent was mentioned.

The existing data suggest that infants respond to a reference to an absent object only in a familiar and supportive context. For example, in the naturalistic studies by Huttenlocher (1974) and Lewis (1936), the entity referred to was out of view at the time of speaking, but infants could easily access it in their familiar home environment. Similarly, when the 13-month-old infants in Saylor's (2004) laboratory study had some form of contextual support (e.g., a present reminder of the absent object), they did seem to understand the reference to the absent object. In contrast, in the experimental study by Saylor and Baldwin (2004) in which the entity referred to was completely absent from an unfamiliar environment, infants did not respond to its name.

The aim of the research reported here was to investigate 14-month-olds' comprehension of references to an absent object as a function of contextual factors. In Study 1, the object referred to was easily accessible; although the infants could not see the object at the time they heard it labeled, they could easily turn around to see it. In Studies 2 and 3, the object was less readily accessible. In addition, a short delay was introduced in Study 3 between the time that infants last saw the toy and the time that they heard it mentioned.

Study 1

Study 1 involved two parts. In the familiarization phase, infants were taught a proper name for a novel stuffed animal. In the test phase, as a natural way to expose them to references to the absent object, the experimenter read a simple, specially made picture book. The infants in the matching condition heard a story that frequently referred to the toy that they had played with before, whereas those in the nonmatching condition listened to a story in which a different name was used. As it was crucial that any behaviors toward the out-of-view target animal would be triggered by the mention of the toy, neither the target animal nor any other character was ever depicted.

The question was whether hearing the nonvisible object named would trigger a response, indicating that hearing the name had brought its referent to mind. Specifically, would infants in the matching condition respond more often by looking, pointing, or approaching the out-of-view object than would infants in the nonmatching condition? The nonmatching condition provides a baseline of infants' tendency to initiate contact with the target toy without hearing it referred to.

Method

Participants

Twenty-eight 13- and 14-month-old infants (16 girls and 12 boys) participated (age range = 13.0 to 14.9 months). Equal numbers of boys and girls were randomly assigned to two conditions (matching: $M = 13.8$, nonmatching: $M = 13.9$). Seventeen additional infants were not included in the final data set: 3 who did not want to play with the animal in the familiarization phase and 14 who did not want to sit down and read the book in the test phase. Another 3 infants were excluded because of experimenter error or technical problems. Infants for all studies were recruited through a database of birth records published in the local newspaper. Parents were contacted by phone and invited to participate. The participants were middle-class infants and 94% of them were Caucasian, 3% African American, 1%

Asian, and 1% Hispanic. These percentages are representative of the volunteer pool typically responding to phone invitations to participate in laboratory research in the Charlottesville area.

Materials

Materials included two stuffed animals (a pig and a monkey), two baskets, two small blankets, and six simple toys (wooden round blocks tied together, cup, plate, and plastic fruit) that were used as props during the familiarization phase. Half the infants in each condition received one set of toys (e.g., a stuffed animal, a book, a blanket, a basket and three manipulative toys), and the other half received the remaining toy set.

Two specially constructed cardboard picture books were used. Each book contained pictures (e.g., a park scene, a kitchen), but none were of the target animal or any other characters. The text of the book described the target animal or another character doing various things (e.g., going to the park in one book or doing things in the kitchen in the other book).

Procedure

Every session included two phases—familiarization and test. Both took place in the same room, and the entire session was videotaped.

Familiarization phase. The familiarization was identical for the matching and nonmatching conditions. The purpose of this phase was for the infant to learn a proper name (Max or Lucy) for a stuffed animal. The name of the toy was randomly assigned across children. To make the familiarization phase as natural as possible, the experimenter engaged the infant in various play activities with the stuffed animal (e.g., pretending to feed the animal, playing peek-a-boo). She also asked the infant to perform different activities (e.g., ''Can you give Max/Lucy to mommy?'', or ''Can you put Max/Lucy in the basket?'') to ensure that the infant has learned the name of the animal. To maximize the infant's comfort and to help ensure that he or she learned the name of the toy, the infant's parent was told that he or she should feel free to interact with the infant and to mention the name of the toy during the play session.

Because of its naturalistic nature, the familiarization phase varied in length and number of mentions of the name of the animal, primarily as a function of how attentive and interested the infant was in playing with the toy. However, according to regression analyses, the length of time of the familiarization phase and number of times the label was said did not affect how infants responded during the test phase in each of the studies reported here. In Study 1, the average length of the familiarization phase was 7 min, and it was virtually identical for the two conditions. The name of the animal was said on average 86 times, including both the experimenter's and parent's labeling. The mean number of labels across conditions did not differ, according to a t test.

At the end of the familiarization phase, the infant was told that the stuffed animal was sleepy. The experimenter put the animal and the other toys in a basket, covered them with a blanket, and placed the basket to one side of a couch. To make sure that the infant saw the toy in the basket, she invited the infant to come say ''Good night'' to the animal. Then she told the infant that they would read a story together.

Test phase. The test phase was designed to see whether infants who heard the familiar name of the target toy with which they had just played would look toward, point at, or search for the toy more often than would infants who heard a novel name. As shown in Figure 1, the experimenter and the parent sat on the floor, with the infant on the parent's lap. They were located in front of the couch such that the infant could not see the stuffed animal or the basket without turning toward it.

The experimenter read the book while the infant looked at the pictures in it. Infants in the matching condition heard the familiar name (Max or Lucy) used 12 times to refer to the familiar toy that was out of sight in the basket. Infants in the nonmatching condition heard a story that used a novel name (Rosie) 12 times. The pictures in the book were of locations (e.g., park scene); none included the target animal or any other character. If an infant got up and went to the basket during the story, the experimenter

Figure 1. Experimental setup in Study 1.

went after the infant and encouraged him or her to come back and continue reading.

Coding

The coding was the same across all three studies reported here. The videotapes of the test sessions were analyzed to identify instances of three kinds of specific target behaviors initiated by the infants during the story phase: looking toward the toy/basket, pointing to it, and getting up and approaching it. Only behaviors that were directed to the target toy and were judged to occur in response to the story were counted. ''Looking'' was counted if the infant turned his or her head to look in the direction of the target toy. ''Pointing'' was counted if the infant pointed to the location of the target toy. If looking and pointing occurred together, only ''pointing'' was counted. ''Approaching'' was counted if the infant stood up and approached the basket. If ''pointing'' and ''approaching'' occurred together, they were coded as two separate behaviors.

Two people coded the videotapes, both of them naïve to the condition that the infant was in. One person coded all the tapes; the other coded 50% of randomly selected tapes in each study. The level of agreement between the coders ranged across the three studies from 92% to 97% (Cohen's κ ranged from .75 to .92). The few disagreements were resolved by discussion.

Results and Discussion

The main question of the study was whether infants comprehended references to an out-of-view object whose name and location they knew. The analyses compared the number of infants in the two conditions who responded at least once toward the out-of-view object when they heard its name mentioned, as well as the mean number of behaviors initiated toward the out-of-view object. The specific type of behaviors (e.g., looking, pointing, and approaching) were also compared across the two groups.

The results indicated that 14-month-old infants can understand references to absent objects. When they heard references to an out-of-view animal that they had learned a name for and knew the location of, almost all (12 out of 14) of the infants in the matching condition directed at least one target behavior toward the out-of-view animal. In contrast, only half of the infants (7 out of 14) in the nonmatching condition responded toward the toy. This difference was significant, $\chi^2(1,\ 28) = 4.09,\ p < .05$. Almost half (5 out of 12) of the infants who responded to the name of the out-of-view toy in the matching condition initiated multiple target behaviors toward the toy, whereas only 1 infant in the nonmatching condition did so. With respect to the number of infants who engaged in each type of target behavior, in the matching condition 8 infants approached the toy, 8 looked toward it, and 4 pointed to its location: whereas in the nonmatching condition 4 infants approached the toy, 4 looked toward it, and 1 pointed to it. (As part of the procedure, the experimenter always followed a child to the target toy in order to bring him or her back to the story. However, the experimenter never followed the infant's point or look during the story; 3 parents followed their infant's point or look during the story in the matching condition, and 1 parent did so in the nonmatching condition.)

The number of target behaviors directed to the out-of-view stuffed animal differed for the two conditions (see Endnote) ($t = 2.58$, $p < .05$). Infants in the matching condition initiated more than 3 times as many target behaviors during the course of the story ($M = 2.28$, $SD = 2.01$) than did infants in the nonmatching condition ($M = .71$, $SD = 1.06$). This difference was primarily due to approaching: Infants in the matching condition tended to approach the target toy more often ($M = 1.28$, $SD = 1.59$) than those in the nonmatching condition ($M = .28$, $SD = .61$), $t = 2.03$, $p = .06$. Looking or pointing did not differ significantly across the two conditions.

An interesting question to consider is whether the infants who responded to the name of the out-of-view toy did so in a communicative manner. Saylor (2004) reported that infants younger than 15 months of age did not accompany their behaviors toward the object associated with the mentioned absent referent with communicative looks to the speaker. In the current study, 5 of the 12 infants in the matching condition who responded to the name of the toy accompanied at least one of their behaviors with a look to the experimenter or the parent (1 before looking toward the toy, 1 after looking at it, 2 after pointing to it, and 1 while approaching the toy). In the nonmatching condition, only 1 infant looked at the parent before approaching the toy.

In summary, most 14-month-old infants who heard the name of an out-of-view object made an effort to re-establish visual or physical contact with the mentioned object: The infants looked, pointed, or even searched for the out-of-view object. Thus, hearing the name of a familiar object apparently brought the object and its location to mind, indicating that at 14 months of age infants can understand references to an absent object.

How robust is this ability? It is possible that in the early phases of understanding, responses to references to absent objects are relatively fragile and affected by contextual factors. Study 1 shows that infants can respond to the name of an out-of-view toy in an extremely supportive context. Studies 2 and 3 address whether changes in the spatial and temporal context influence infants' responses to references to absent objects.

Study 2

In Study 2, we examined whether 13- and 14-month-old infants would respond to hearing the name of a familiar object when it was less easy for them to gain access to it. The toy was still present in the environment, but not visually accessible simply by turning toward it, as it had been in Study 1. Study 2 thus provides a more stringent test of infants' understanding of references to absent objects, because the infant had to exert more effort to re-establish contact with the out-of-view object.

With two exceptions, the procedure was the same as for Study 1. First, the target toy was made less accessible by placing it further out of sight; it was again beside the couch, but farther back in a corner of the room. To see the toy at all, the infant had to get up and walk around to the side of the couch.

Second, the experimenter asked the infant directly about the target toy at the end of the test phase. This was done to ensure that some infants did not respond to hearing the name during the story because they were engrossed in the book. Asking the infants directly about the out-of-view toy could provide some support for infants' ability to focus their attention on the absent mentioned object. The more direct references made by the experimenter to the absent toy after the picture book phase ranged from general (''What about Max? Max is ready to play now.'') to more specific (''Where is Max?'').

Method

Participants

Thirty-two 13- and 14-month-old infants participated ($M = 14.0$, range = 13.1–14.9). Equal numbers of boys and girls were randomly assigned to two conditions: matching and nonmatching. Nine additional infants were not included in the final data set, because of failure to complete the familiarization phase (2) or failure to complete the test phase (7).

Materials

Materials used during the study were a stuffed animal and a stuffed toy airplane with a face drawn on it, a small blanket, and a basket. Infants were asked to choose between the animal and the airplane, and then their choice was used during the experimental session to increase the infants' interest during the familiarization phase. However, as indicated by their performance during the test, infants' choice of the toy did not lead them to initiate more behaviors toward it than the infants in the previous study who did not choose the target toy. Only one of the books from Study 1 was used in this study.

Procedure

The procedure was the same as in the previous study, with every session including two phases—familiarization and test.

Familiarization phase. The familiarization was identical for the matching and nonmatching conditions. The experimenter and infant played with a stuffed toy and the infant was taught a proper name (Max) for it. The length of the familiarization phase was on average 6-min long and the name of the toy was said an average of 70 times. The mean number of labels said during the familiarization phase in the matching condition ($M = 75$) was larger than in the nonmatching condition ($M = 65$), $t = 2.51$, $p < .05$; however, a regression analysis indicated that the number of times that the toy was labeled did not affect the behaviors performed by the infants during the test phase, F (1, 31) = .51, $p = .83$.

As in the previous study, the toy was put in a basket and the basket was placed to one side of a couch. The only difference was that the basket was placed so that infants could not see it during the test phase.

Test phase. The test phase was the same as in the previous study.

Poststory references. To examine the possibility that some infants might think about the toy but not react to hearing its name while listening to the story, the experimenter made two references to it after finishing the book. She first made a general nondirective reference (e.g., ''What about Max? Max is ready to play now''), and if infants did not respond to this reference, she asked a specific question (e.g., ''Where is Max?''). The experimenter made these references for the children in the nonmatching condition as well. It is important to note that for the infants in the non-matching condition, the experimenter's reference at the end of the picture book

phase was the first reference to the toy that they heard since the toy was put out of view.

Results and Discussion

Study 2 provides further evidence that 13- and 14-month-old infants can understand references to objects that are out of sight. Hearing the name of an out-of-view familiar toy triggered many of the infants to respond to the toy, indicating that the mention of the toy made them think about it.

Half (8) of the infants in the matching condition directed at least one behavior toward the out-of-view toy animal, whereas only 2 infants in the nonmatching condition did so. This difference was significant, $\chi^2(1, 32) = 5.23$, $p < .05$. With respect to the target behaviors, 6 infants in the matching condition approached the toy, but none in the nonmatching condition did so (Fisher test, $p < 05$). There was no difference between the number of infants who looked at or pointed to the toy across the two conditions.

The two groups also differed significantly in the number of responses toward the target toy[1] ($t = 2.34$, $p < .05$). The infants in the matching condition who heard the name of the out-of-view toy during the story responded toward it more often ($M = .75$, $SD = 1.06$) than did infants in the nonmatching condition ($M = .13$, $SD = .34$).

Infants' responses to the references made by the experimenter at the end of the story were also coded in terms of looking, pointing or approaching the target toy. With respect to the matching condition, 88% (7 out of 8) of the infants who had initiated a behavior toward the toy during the test phase also responded to the mentions of the toy by the experimenter at the end of the story: 5 infants approached the toy when they heard the general reference, and 2 responded to the more specific question by looking toward or pointing to the toy. Two infants who had not responded to the name of the familiar toy during the story approached the toy when the experimenter directly asked about it (1 infant responded to the general reference, and 1 to the specific reference). Thus, combining the infants' responses for the test phase and the poststory phase, 63% (10 out of 16) of the infants in the matching condition responded to hearing the name of the out-of-sight toy by looking, pointing, or approaching it.

Interestingly, 50% (8 out of 16) of the infants in the nonmatching condition responded to the name of the familiar toy when the experimenter mentioned its name at the end of story. All of them responded to the first general reference that the experimenter made about the out-of-view toy: 4 approached the toy, 3 pointed, and 1 looked toward it. Thus, after listening to a story that featured the name of a different character, these infants still remembered the out-of-view toy and responded to hearing its name by looking, pointing, or approaching it.

The goal of Study 2 was to examine infants' response to the name of an absent object when the object was not readily accessible. Comparing across studies indicates that an infant's response to the mention of an absent object can be affected by how easy it is to gain access to the object. The infants in Study 2 responded less often to the name of an absent object than did the infants in Study 1: only 50% of the infants in the matching condition in Study 2 compared to 86% in Study 1, $\chi^2(1, 30) = 4.24$, $p < .05$. Thus, the test situation in Study 2, with the animal placed completely out of sight, provided a more stringent test of infants' understanding of references to absent objects.

In summary, the results of this experiment replicated those obtained in the first study in that 14-month-old infants who heard the familiar name of an absent toy during the story (matching condition) responded toward the toy more often than did infants who heard a novel name (nonmatching condition). Also, significantly more infants in the matching condition initiated at least one behavior toward the toy. These results suggest that at least some 14-month-olds can understand references to an absent object.

Study 3

The results of the previous studies show that some 14-month-olds respond to the name of an absent object by looking at, pointing toward, or even approaching the object. However, they tend to respond more when the object is easily accessible than when more effort is required to see it. This suggests that infants' performance can be easily disrupted by the context in which they hear the name of an absent object. The goal of Study 3 was to examine the influence of a change in the temporal frame—inserting a delay between the time that infants last saw the toy and the time that they heard it mentioned again.

The procedure in Study 3 was the same as in Study 2, except that after the target toy was put out of sight, the infant and his or her parent left the laboratory for a short time. Then they returned to the same room and started the test phase. Infants were tested only in the matching condition.

Method

Participants

Thirty-two 13- and 14-month-olds participated, with 16 (8 boys and 8 girls) in each of two delay conditions: 5-min delay ($M = 13.9$, range: 13.0–14.9) and 15-min delay ($M = 14.1$, range: 13.3–14.8). Nine additional infants were not included in the final data set: 3 who did not want to play with the animal in the familiarization phase, 3 who did not pay attention to the book, 2 who became distressed, and 1 whose mother interfered with the procedure.

Materials

Materials were the same as in Study 2.

Procedure

The only difference from Study 2 was that there was a delay period between the familiarization and test phase. The familiarization phase was on average 6-min long, virtually identical for the two conditions, and the name of the toy was said an average of 82 times. At the end of the familiarization phase, after the target toy was put beside one side of the couch, the experimenter, infant, and parent left the laboratory for either 5 or 15 min. The name of the target toy was never mentioned during the delay phase. At the end of the delay period, they returned to the same room, and the experimenter began the test phase. The test phase was the same as in Study 2.

Results and Discussion

To examine the effect of delay on infants' responses to hearing the name of an absent object, we compared the results from this study to those for the matching condition in Study 2. Although some infants did respond to hearing the name of the out-of-view toy, overall the infants were less likely to do so when there was a delay between when they had last seen the toy and when they heard it named again.

Only 3 of the infants initiated one or more behaviors toward the out-of-view toy after a 15-min delay and 5 of the infants did so after a 5-min delay. Comparing across studies, the infants in this study in the 15-min delay condition tended to respond less to the name of an absent object than did the infants in Study 2, who heard the name of the absent toy right after it was put out of sight, $\chi^2(1, 32) = 3.46$, $p = .06$. The number of infants who responded after a 5-min delay did not differ significantly from the number who did so with no delay. The mean number of behaviors initiated by infants in the two studies during the course of the story was not significantly different (no delay: mean = .75; 5-min delay: mean = .69; 15-min delay: mean = .50).

As in the previous study, infants' responses to the references made by the experimenter at the end of the story were also considered. Combining the infants' responses for the test phase and the poststory references, 32% (5 out of 16) of the infants in the 15-min delay condition and 44% (7 out of 16) of the infants in the 5-min delay condition responded to hearing the name of the absent toy, compared to 63% (10 out of 16) in Study 2. These results suggest that infants' responses to the name of an absent toy are affected by the length of time between when they last saw the toy and the time when they hear it mentioned again.

It is unlikely that the generally low level of responses to the name of an absent object in Study 3 was due to forgetting either the name of the toy or its location; even after a 24-h delay, 13-month-olds can remember a novel name in the presence of the target object (Woodward, Markman, & Fitzsimmons, 1994), and 14-month-olds can remember the location of a hidden object (Moore & Meltzoff, 2004). One explanation for the decrease in children's responses to hearing the name of the absent object after the delay period is that the strength of the representation in infants' memory degraded over time. Elaboration of this explanation is provided in the general discussion.

In summary, the results of this experiment show that infants' responses to the name of an absent object can be affected by the length of time since the object was removed from view. The infants in this study responded less to the name of the out-of-view toy when they had not seen it for some time compared to the infants in the previous study who had seen the toy recently. Together, these results indicate that although 14-month-olds have the ability to understand references to an absent object, their tendency to respond to such references can be affected by changes in the temporal context.

General Discussion

The research reported here provides strong evidence that 13- and 14-month-olds are capable of comprehending references to absent objects. When the infants in this research listened to a story that mentioned an out-of-view toy, they took some action to establish visual or physical contact with it: they looked toward it or pointed to its location and even searched for it. However, the infants' responses to

the name of the out-of-view object were influenced by minor changes in context; they looked or searched for the toy less often when it was not easily accessible and when some time had elapsed since they had last seen it. The pattern of results across the three studies indicates that at around 14 months, infants' ability to respond to references to absent objects is fragile.

The fact that young infants do not respond to references to absent objects consistently across various contexts suggests that the development of absent reference comprehension depends on the interaction of multiple factors. Thus, a model of this important developmental step will require several components.

First, infants' comprehension of references to absent objects is dependent on their *general representational capacity.* With development, there is a dramatic increase in the amount of information that infants can represent (e.g., Case, 1992). Especially important is their increasing ability to represent information about the spatial location and properties of objects (Huttenlocher, 1974; Spelke, Breinlinger, Macomber, Jacobson, 1992), as well as information about word sounds and their relation to objects (Huttenlocher, 1974; Jusczyk & Hohne, 1997; Tincoff & Jusczyk, 1999). This general increase in representational capacity should make responses to references to absent objects increasingly likely with age.

A second component is the strength of the *word–object relation*—the relation between the name of the object referred to and the infant's memory representation of the object. The strength of this relation is a function of experience; the more exposure the infant has to the name–object relation, the more likely it is that hearing the word-sound will activate a representation of the referent. Thus, hearing the name of an absent object may lead an infant to think of the referent only if the word–referent relation is strong enough in the infant's memory. If the word–referent link is weak, the infant may recognize the word-sound without it bringing to mind the particular object associated with it. In this research, if the infants had heard the name of the object only a few times during training, they would probably have responded less when the object was out of view. More generally, a testable prediction is that the longer an infant has known the name of an object, the more likely the infant should be to respond to hearing its name when it is not present.

A third component is the strength of the specific memory *representation of the object* itself and the associated likelihood that this representation will instigate an action. Only when infants have a relatively strong representation of an object do they initiate an action toward the object when it is hidden (Munakata, 2001; Munakata, McClelland, Johnson, & Siegler, 1997). The strength of the object representation is a function of experience (Munakata, 2001). Thus, in the case of absent reference, we would expect that the more experience an infant has had with an object, the more likely it is that he or she will respond to the name of the object in its absence.

Another factor that plays an important role in infants' comprehension of references to absent objects is the degree of *contextual support*. Contextual factors include the familiarity of the environment in which the object is mentioned, the degree of association between the object and the context, the accessibility of the object referred to, and the length of time since it was last seen. Relevant results come from previous studies suggesting that 13-month-olds respond to names of absent objects when they are in a familiar home environment (Huttenlocher, 1974; Lewis, 1936) or when the context provides reminders of the absent referent (Saylor, 2004).

Given the relevance of multiple factors to the emergence of absent reference comprehension, we can predict that whether an infant responds to a reference to an absent object will be determined by the complex interaction of these factors. For example, the gradual increase with age in infants' representational capacity will moderate the effect of contextual factors, which should be most important early on. The higher the developmental level of the infant, the less dependent on the familiarity of the context his or her responses will be. Presumably, children older than the 13- and 14-month-olds in the research reported here would not be affected by the small changes in context that had an impact in this research.

Representational factors—the strength of the specific word–object relation and of the object representation itself—should also interact with contextual factors to influence infants' performance. For instance, an infant who has a weak representation of the relation between the word and the object will be more likely to comprehend an absent reference in a familiar setting in which he or she was originally exposed to the word–object relation than in a novel context. Similarly, if an infant has a weak representation of the object itself, he or she may initiate an action toward the object only in a very supportive environment.

In the current research, 13- and 14-month-olds responded to references to an absent object when the object was readily accessible and was mentioned very soon after they had recently interacted with it. Presumably, the fact that their representations of the object and the object–name relation had recently

been active made it easier for those representations to be reactivated by hearing its name. The proximity and accessibility of the toy may have further contributed to a positive response. However, when the strength of the infants' representation was diminished by a delay between seeing the object and hearing its name again, and when it was less easy to reestablish contact with the object, responses to the name decreased.

This analysis also offers an explanation for the failure of the 13-month-olds in Saylor and Baldwin's (2004) study to respond to hearing the name of their parent in a novel lab environment. Although these infants presumably had strong representations of their parents, the absent parent was not associated with the lab and the infants had not seen that parent for some time before they heard him or her mentioned. We would expect that infants should more often respond to references to an absent parent when the parent is mentioned in a familiar rather than in a novel environment with which the person has never been associated. Further, the sooner the infants hear the parent's name after he or she has left the room, the more likely they should be to respond. Finally, the pattern of results should be different for a less familiar person (e.g., an experimenter the child only recently met). The predicted interactions among temporal, environmental, and representational factors are currently under investigation.

The model outlined here primarily has to do with factors involved in the emergence of infants' absent reference comprehension. With further development, a mature understanding of references to absent objects and events develops as infants come to appreciate the representational nature of words—that word sounds are used to signify concepts or representations of things in the world (Deacon, 1997; Huttenlocher & Higgins, 1978; Werner & Kaplan, 1964). When can infants' early responses to the name of an absent object be assumed to be based on a symbolic interpretation of words? The analysis presented here suggests that it is not until their responses are relatively independent of context that we can be confident about the nature of their understanding.

The clearest evidence that a word is symbolic is that the word enters in combinations with other words; that is, when the word is part of a formal symbolic system (Deacon, 1997; Huttenlocher & Higgins, 1978). Based on this criterion, evidence that infants process new linguistic information about an absent referent would provide a strong basis for inferring symbolic comprehension. Research is currently underway to examine when infants can incorporate new information they hear about an absent object into their representation of the object (Ganea, DeLoache, Shutts, & Spelke, 2005).

In conclusion, at the beginning of their second year of life, infants are sensitive to one of the core features of language, the use of words to communicate beyond the here and now. In this research, after learning a novel name for a toy, most of the 13- and 14-month-olds spontaneously responded to hearing its name when the object was out of sight. Nevertheless, their ability to do so was fragile, as it was affected by how accessible the toy was and by a short delay since it was last seen. As proposed here, understanding and responding to references to absent objects depends on the interaction of many factors, including the context in which the reference is heard.

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ENDNOTE

1. Because the scores were not normally distributed, we conducted a permutation test of the difference between the experimental means (Efron & Tibshirani, 1994) in both studies 1 and 2. For each study, a computer randomly reassigned children to conditions 10,000 times, and a *t*-value was computed in each randomly permuted sample. The observed *t*-values between the matching and nonmatching conditions in each study were compared to the distribution of the 10,000 randomly permuted *t*-values. The probability of obtaining the observed *t*-values between the two conditions in the number of total behaviors directed to the out-of-view animal in each study was less than .05.