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When Familiar Is Not Better: 12-Month-Old Infants Respond to Talk About Absent Objects

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Three experiments that demonstrate a novel constraint on infants' language skills are described. Across the experiments it is shown that as babies near their 1st birthday, their ability to respond to talk about an absent object is influenced by a referent's spatiotemporal history: familiarizing infants with an object in 1 or several nontest locations before the study interferes with their ability to respond to talk about the object when it is out of view. Familiarity with an object may not always strengthen infants' object representations and therefore facilitate their ability to appropriately react to the mention of absent objects. On the contrary, early in development, irrelevant information about prior location may be bound to representations of familiar objects and thus interfere with infants' ability to respond to talk about absent things.

Keywords: conversational competence, memory, context, familiarity, mental representation

The ability to represent absent objects affects the scope of conversations. Without this skill people would be unable to do simple, everyday things like telling their spouse where to find their children's shoes. Engaging in conversations about absent things requires speakers to converge on a shared set of mental representations that are independent of the current context. For example, infants genuinely comprehend a reference to an absent pet (e.g., "Where is that silly dog?") only if they appreciate that their mother intends to elicit shared attention to a representation of the (absent) dog. In particular, infants must recognize that their parent is referring to a particular dog that is specific to the parent's experience. Infants will be unable to comprehend and react to the discussion of absent topics if they fail to access the target representation from memory.

Previous research has suggested that infants start to engage in conversations about absent things in the middle of their second year. For example, by 15–18 months infants have begun to mention absent things (Sachs, 1983; Scollon, 1979; Veneziano & Sinclair, 1995) and have shown robust comprehension skills in experimental tasks probing their comprehension. Infants will point or look at the latest location of an absent referent in response to an experimenter's talk about the thing (Saylor, 2004; Saylor & Baldwin, 2004) and locate the absent thing that matches their experience with a particular person to interpret ambiguous requests (Saylor & Ganea, 2007). Prior to 15 months, infants' skills are somewhat more variable. Although they possess all the necessary communicative skills (they can point, look, approach, or bring the mentioned present referent; Saylor & Baldwin, 2004), they show robust responses to talk about absent things only when the referents have been recently seen and are proximal to the discourse context (Gallerani, Saylor, & Adwar, 2009; Ganea, 2005; Huttenlocher, 1974). One explanation for younger infants' fragile ability to respond to others' queries about absent objects is that their ability to bring the absent referent to mind might be constrained by immature representational skills (Ganea, 2005). This possibility seems plausible because it is only in situations where referents are distant from the current context (and may thus have weaker representations) that infants show a tendency to fail to respond to talk about absent things.

One factor that may allow for robust representations of absent things is the familiarity of referent objects. Support for this claim comes from the object representation literature. The graded representation approach to infants' successes and failures on tasks involving absent objects suggests that infants' performance depends on the strength of the underlying object representation (Munakata, 2001; Munakata, McClelland, Johnson, & Siegler, 1997). According to this approach, infants develop stronger object representations through experience (Fischer & Bidell, 1991; Haith & Benson, 1998; Mareschal, 2000). One prediction that follows from this account is that it should be easier for infants to represent a hidden object when it is familiar than when it is new. Work on infants' ability to search for hidden objects has supported this prediction (Shinskey & Munakata, 2005, 2010). Although infants prefer to reach for new objects over familiar ones when objects are present, their novelty preference reverses to a familiarity preference when objects are hidden/occluded. In the case of an absent reference, this may translate into infants' being more likely to

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respond to an absent toy's name when it is familiar than when it is new. Research in this area has offered some support for this possibility: Across separate studies, babies have shown an earlier and more robust tendency to respond to others' comments about highly familiar referents (like their parents) than less familiar referents (Gallerani et al., 2009; Saylor, 2004).

The present experiments investigate whether familiarity affects infants' tendency to respond to talk about an absent thing. Infants' ability to do so was measured by noting whether they showed any behavior indicating their understanding of the label for the absent thing (looking, pointing, or approaching the toy). These behaviors are the same behaviors that infants engage in when showing understanding of references to present things and have been used widely in previous research as a measure of infants' ability to respond to talk about absent things (e.g., Huttenlocher, 1974; Miller, Chapman, Branston, & Reichle, 1980; Sachs, 1983; Saylor & Baldwin, 2004). These measures likely index infants' ability to access the target representation after hearing a label rather than index label comprehension or a general motivation to respond. For example, it is unlikely that infants are not motivated to respond to their absent parent's name; nevertheless, they sometimes fail to in tests of absent reference understanding (e.g., Gallerani et al., 2009; Miller et al., 1980; Saylor & Baldwin, 2004). Our suspicion is that label comprehension, like object representations, is graded in nature (Munakata, 2001; Munakata et al., 1997). In other words, the likelihood that the name of an absent entity will call the target representation from infants' memory and instigate an overt behavioral response may be affected by various contextual and representational factors, including referent familiarity (Ganea, 2005).

In the current research, infants' ability to respond to absent reference was tested with objects with different degrees of familiarity: Some were infants' familiar toys brought from home, and some were toys from the lab that were either introduced before the experiment or not. Across three experiments, we show that familiarity with an object actually impaired infants' ability to respond to absent reference when they had encountered that object in a location other than the experimental room.

Experiment 1

Method

Participants. Twelve 12-month-olds participated (six girls; $M = 12$ months 15 days; range = 11 months 23 days to 12 months 29 days). Three additional infants were omitted because of parental interference (1), fussiness (1), or experimenter error (1). Participants for this and all subsequent experiments were primarily Caucasian and from middle class families. They were recruited from the Greater Nashville area by phone from a database of interested families, were full-term at birth, were developing and hearing normally, and had English as their primary language.

Materials. Two ottomans that were identical in shape and size (one brown, one black) were used as hiding locations. Target objects were familiar and new stuffed animals. Familiar animals were brought from home, and new animals were from the lab. Parents were asked to bring one of their infant's stuffed animals that the child knew by a common noun (e.g., a dog rather than Jimmy) and that was of moderate size with no electronic functions. The label reported by the child's parents upon arrival was used in the experiment. Parents were also asked not to show the toy to the baby on the day of the experiment. The new animal shown was a dog, a pig, a bear, or a frog depending on which label parents reported infants understood the best. We chose the toy with the more familiar name so that the label used during the test was not less familiar in the new toy condition than in the familiar toy condition.

Procedure and design. There were three phases: play, time delay, and test. The purpose of the minute-long play phase was to give participants experience with the stimulus object and its label. During the play phase, the experimenter mentioned a toy eight times, using infant-appropriate speech (e.g., "Look, it's a dog! Do you like dogs? I like dogs!"). Infants were free to move around the room and to handle the toy. At the end of the play phase, infants were placed on their parent's lap. The experimenter clapped her hands and called the infants' name to attract their attention and then hid the toy in an ottoman, saying, "Look! It's going right here! Bye!" The ottoman was on the floor 7.5 feet away from the baby.

The purpose of the time delay phase was to divert infants' attention from the hiding location so that they would not react reflexively to the researcher's request in the test phase. The experimenter sang "Twinkle, Twinkle, Little Star" and pointed to decals on the ceiling. The time delay phase lasted for 45–50 s.

In the test phase, infants' ability to respond to the label for the absent toy was probed. After attracting the infants' attention, the experimenter asked about the hidden toy eight times, first in a hintlike manner (e.g., "What about the dog? Have you seen the dog?") and then directly (e.g., "Where is the dog? Could you find the dog?"). If infants looked and/or pointed at the toy's location, the researcher continued with the prompts. If infants began to approach the ottoman at any time, the researcher stopped talking, because they were no longer engaged with her and had terminated the test session naturally by approaching the target. With rare exceptions, infants responded to the hintlike requests.

The experimenter retrieved the toy from the ottoman for all infants at the end of the test phase or when the infants approached it, and she allowed infants to play with it while she switched the ottomans. She then repeated the procedure for the other object. Infants played with a familiar and a new toy in succession. The order of the new and the familiar toy conditions and the side where the ottoman appeared (left or right) were counterbalanced.

Coding. Two types of coding were conducted. First, the persistence of infants' communicative efforts was calculated by coding the total time that infants spent engaged in comprehension behaviors throughout the session. Maintaining a stronger representation should allow infants to look at the target for longer time, as well as to implement complex motor behaviors like crawling or pointing that take more time. Comprehension of the experimenter's reference is required for infants to initiate these behaviors. Therefore, if comprehension is affected by the strength of object representation, there may be more persistent responses in the familiar toy condition than in the new toy condition. Because the new and the familiar toy conditions were run within-subject, infants' individual speed of implementing motor behaviors could not affect the comparison between the two conditions. This coding was conducted from videotapes by two independent coders. The experimenter coded all of the tapes, and a second coder independently coded a random subset of the tapes: 100% of the tapes in

Experiment 1, 50% in Experiment 2, and 50% in Experiment 3. The duration of looking was measured from the moment infants' gaze landed on the ottoman until they diverted their gaze from it. Pointing was measured from the moment infants started raising their hand to implement the behavior to the moment the infants started retracting their hand. Approaching was measured from the moment infants got off their parent's lap to approach the ottoman until they touched it. For four babies the ottoman was out of camera range for part of their approach. The coders ended the approaching time when they heard the infants touch the ottoman. Agreement between the two coders was high: Cronbach's αs = .99 (Experiment 1), .79 (Experiment 2), and .92 (Experiment 3).

Second, infants were categorized according to whether they showed any behavior that indicated they understood the researcher's talk about the absent toy (by looking at, pointing at, or approaching the ottoman). Initial judgments on the presence or absence of target behaviors and their type were made online by the experimenter and recorded for each participant right after the study. A second coder who was naïve to the hypothesis of the study also watched all of the videotapes. The coder reported whether any behavior was seen and whether it was looking, pointing, or approaching. Overall agreement on whether any behavior was present was 92%, 96%, and 100% in Experiments 1, 2, and 3, respectively (Cohen's κ = .84, .92, and 1.00). Regarding the type of behavior, agreement on looks was 92%, 88%, and 100% in Experiments 1, 2, and 3, respectively (Cohen's κ = .83, .76, and 1.00). Agreement on points was 100% in Experiments 2 and 3. In Experiment 1, babies did not point. Agreement on approaches was 100% in Experiments 1 and 3 and 98% in Experiment 2 (Cohen's κ = .96). Disagreements were resolved via discussion, and the experimenter's judgments were used in the analyses in the next section.

Results and Discussion

The purpose of this experiment was to investigate the role of referent familiarity in infants' responses to talk about absent objects. We predicted more robust responses to familiar objects than to new ones. In this and in all subsequent experiments we found no effects of gender, the order of conditions, ottoman position, or toy type on infants' performance. A paired *t* test conducted on the duration of infants' behaviors toward an absent toy (see Table 1) revealed a significant effect of familiarity, $t(11) = 3.02$, 95% confidence interval (CI) [0.4, 2.53], $p < 0.01$, Cohen's $d = 0.91$. However, contrary to our predictions, infants spent significantly more time engaged in communicative behaviors toward new stimuli ($M = 4.14$ s, $SD = 2.67$) than familiar stimuli ($M = 2.68$ s, $SD = 3.34$). This result was confirmed by nonparametric analyses of the number of infants who showed any communicative behaviors (see Table 2) upon hearing the toy mentioned: 11 out of 12 infants responded to a new toy, and 6 out of 12 responded to a familiar one (McNemar's exact test; Siegel & Castellan, 1988; $p < .05$, Cliff's $d = 0.42$).

In this and the subsequent experiments, infants did not engage in the target behaviors prior to the experimenter's verbal request. Most infants who produced any target behaviors did so after having been asked three to five times. This means that looking, pointing, and approaching the location of the hidden object is not what infants would spontaneously do in a hide-and-seek game. Rather, these behaviors represent infants' communicative abilities.

To examine whether infants' greater responsiveness to a new toy originated from their greater overall interest in the new versus the familiar toy, we coded infants' behavior during the play phase. In particular, we measured the latency of infants' first touch to the familiar toy ($M = 19.5$ s, $SD = 15.96$) versus new toy ($M = 13.4$, $SD = 8.57$) and the length of time they held each toy (new: $M = 33.58$ s, $SD = 25.33$; familiar: $M = 22.25$ s, $SD = 20.93$). There were no significant differences: paired *t* tests, $t(11) = 1$, $p = .35$; $t(11) = 1.14$, $p = .28$, and none of these measures predicted the presence or absence of response in the test phase (logistic regression, latency: $b = 0.05$, $z = 0.9$, $p = .37$; the length of time infants held the toy: $b = 0.03$, $z = 1.38$, $p = .17$).

Contrary to our predictions, the familiarity of the referent reduced infants' ability to respond to references to it when it was not in view. This finding raises a further question about infants' responses to talk about absent things: Is their failure to display comprehension of the absent reference motivational, or representational, in nature? One possibility is that infants' novelty preference makes familiar toys less attractive, decreases infants' motivation to reestablish contact with them, and thus leads to poor responsiveness (the novelty preference hypothesis). Another possibility is that infants' memory about a familiar object's prior location (e.g., home) interferes with their ability to respond to absent reference to that object in the lab (the location conflict hypothesis). In Experiment 2 we test these two hypotheses.

Experiment 2

The two variables in Experiment 2 were prestudy exposure to an object (no exposure or some exposure) and the location where the object was introduced before the study (in the test room or in an adjacent room). If the novelty of a toy leads to more responses, infants should perform better with a toy they had no exposure to before the study than with a toy they had some prior exposure to.

Table 1
Duration (in Seconds) of Infants' Behaviors Toward an Absent Object by Experiment and Object Type

Object type	Experiment 1	Experiment 2: Location conflict	Experiment 2: No location conflict	Experiment 3
New	4.14 (2.67)	6.03 (3.96)	6.94 (3.66)	5.10 (3.25)
Familiar/introduced	2.68 (3.34)	2.42 (3.24)	8.17 (7.23)	2.77 (3.15)

Note. Standard deviations are in parentheses.

Table 2
Percentage (and Number) of Infants Engaging in Target Behaviors During Mention of Absent Object by Experiment and Object Type

Object type	Experiment 1	Experiment 2		Experiment 3
		Location conflict	No location conflict	
New	92% (11 out of 12)	83% (10 out of 12)	83% (10 out of 12)	93% (14 out of 15)
Familiar/introduced	50% (6 out of 12)	42% (5 out of 12)	100% (12 out of 12)	53% (8 out of 15)

However, if the prior location of a toy affects infants' ability to respond to that toy's name, they should perform better with a toy they had seen only in the test room than with a toy they had seen in the adjacent room before the study.

Method

Participants. Twenty-four 12-month-old babies participated in the experiment (eight boys; $M = 12$ months 11days; range = 11 months 22 days to 12 months 21 days). Participants were recruited as in Experiment 1. Data from two additional infants were omitted for inattentiveness (2).

Materials. Materials were the same as in Experiment 1 except that two stuffed animals from the lab (a dog and a bear) were used as the stimuli.

Procedure and design. The design of Experiment 2 is summarized in Table 3. The prior location of infants' exposure to a toy was manipulated between-subjects. There were two conditions: location conflict and no location conflict. The procedure consisted of two parts—familiarization and main part. Familiarization took place in either the same location as the main part (for the no location conflict condition) or a different location (an adjacent room, for the location conflict condition). During familiarization, the experimenter and baby played with a stimulus object (introduced toy). The experimenter did not label the object by referring to it as "a toy," "this one," or "it." This was necessary to hold constant the number of times the toy's label was mentioned in the introduced and the new toy (see later) conditions. The familiarization procedure lasted until infants lost any interest in the object and oriented toward other objects in the lab. This was crucial because if infants' exploration of toys is interrupted, they can reverse their novelty preference (Hunter, Ross, & Ames, 1982). On average the familiarization phase lasted about 2–3 min. The main part followed the familiarization. Infants participated in the play, the time delay, and the test phase, as in Experiment 1.

Prestudy exposure to an object was manipulated within-subject. Infants in the no location conflict condition were tested with an introduced toy and a new toy. The new toy condition was identical to that in Experiment 1: Infants had not seen the toy before the play phase.

Table 3
Experiment 2 Design

Condition	Familiarization	Main part
Location conflict		
Introduced toy	Room A	Room B
New toy		Room B
No location conflict		
Introduced toy	Room B	Room B
New toy		Room B

To control for general distraction due to being taken from one room to another and less familiarity with the test room in the location conflict condition, we tested this group of infants with a new toy as well. Thus, the new toy conditions were identical for both groups of infants.[1] Should any of the aforementioned factors interfere with the performance in the location conflict group, this would be reflected in the difference between the two new toy conditions.

The order of the new and introduced toy conditions and the toys that were used in each was counterbalanced. Coding was conducted as in Experiment 1.

Results and Discussion

To test if the novelty of a toy affects infants' responses (the novelty preference hypothesis), we compared infants' responses to the new and introduced toy in the no location conflict condition. Infants did not reliably differ in the amount of time they engaged in target behaviors to introduced ($M = 8.17$ s, $SD = 7.23$) and new ($M = 6.94$ s, $SD = 3.66$) toys, paired t test, $t(11) = 0.65$, 95% CI [–2.96, 5.42], $p = .53$, Cohen's $d = 0.19$ (see Table 1). All 12 babies responded to an introduced toy, and 10 babies responded to a new toy (McNemar's exact test, $p = .25$; see Table 2). Therefore, infants' novelty preference does not appear to influence their ability to respond to the name of a hidden familiar toy.

To test if a toy's location history affects infants' responses to its name when it is absent (the location conflict hypothesis), we compared infants' responses to the introduced toy in the location conflict condition and the no location conflict condition. This analysis revealed a significant effect of location history. Infants spent more time engaging in target behaviors with a toy introduced in the test room ($M = 8.17$ s, $SD = 7.23$) than with a toy introduced in an adjacent room ($M = 2.42$ s, $SD = 3.24$), Mann–Whitney $U = 118$, $p < .01$, Cohen's $d = 1.07$ (see Table 1). This pattern was confirmed by the analyses of the number of infants who showed any communicative behaviors. While all 12 infants responded to hearing the name of a toy in the same room in which the toy was originally introduced, only five out of 12 infants

[1] Note that Experiment 2 does not represent a mixed model between-by-within design. A new object is by definition such that it has not been encountered before, and prestudy exposure was not manipulated for the new toy. For this reason, main effects and the interaction cannot be assessed, and a 2 × 2 analysis of variance is therefore not an appropriate analysis in this case.

responded to the name of a toy they initially encountered in an adjacent room (see Table 2; exact test on small-sample two independent proportions: $p \leq .01$; Agresti, 2002; Cliff's $d = 0.58$).

This pattern of results cannot be attributed to differences in infants' interest in the stimuli during the play phase. If such differences were to arise, they could have yielded differences in infants' encoding of the toys, and differences in responses to absent objects could have been attributed to differences in encoding. However, no significant difference was found in infants' latency of grabbing the introduced toys (no location conflict: $M =$ 10 s, $SD = 11.09$; location conflict: $M = 17.75$ s, $SD = 11.92$; Mann–Whitney $U = 45$, $p = .12$) or the amount of time they spent holding the introduced toys (no location conflict: $M = 31.08$ s, $SD = 22.82$; location conflict: $M = 18.08$ s, $SD = 15.9$; Mann–Whitney $U = 97$, $p = .16$). None of these measures predicted the presence or absence of response in the test phase (logistic regression: latency: $b = -0.05$, $z = -1.23$, $p = .22$; the length of time infants held the toy: $b = 0.03$, $z = 1.19$, $p = .24$).

Also, infants in the location conflict condition responded less than did infants in the no location conflict condition neither because they were more distracted nor because they were less familiar with the test room. If this were the case, infants should have performed poorly with the new toy as well. However, this did not happen. Infants in the location conflict group spent more time engaging in the target behaviors toward a new toy than toward an introduced toy: paired t test, $t(11) = 3.43$, $p < .01$, Cohen's $d =$ 1.03. Ten out of 12 infants responded to a new toy, and five out 12 did so for an introduced toy (McNemar's exact test, $p < .05$). Infants in this group also responded to the new toy as robustly as did infants in the no location conflict condition (location conflict, new toy: $M = 6.03$ s, $SD = 3.96$; no location conflict, new toy: $M = 6.94$ s, $SD = 3.66$), t test, $t(22) = 0.58$, $p = .56$.

To summarize, Experiment 2 showed that infants' tendency to respond more to new than familiar toys is affected by the referent's spatiotemporal history. Their tendency to respond to toys that they had seen in only one place was quite robust, whereas as little as 2–3 min of exposure to a toy in an adjacent room before the main part of the study greatly reduced the likelihood that infants would respond to its name.

Experiment 3

In the next experiment, we ask whether infants' exposure to an object in different locations may ameliorate the effect of location conflict. In Experiment 2 infants saw a familiar object only in one location before the main part of the study: the reception room. One possibility is that infants may attend less to object–location relationships after encountering an object that typically appears in many different locations. This reduction in the relevance of location information may reduce the interference infants experienced in Experiment 2. A similar effect is reported in the A-not-B literature. Infants are less likely to perseverate if the toy has been hidden and found in several different locations prior to being moved to location B (e.g., Cummings & Bjork, 1983; Wellman, Cross, & Bartsch, 1987).

In the next experiment, we assess infants' responses to talk about an absent thing that they have previously encountered in multiple places prior to their trip to the lab to investigate whether such an object will enable them to understand talk about a familiar absent thing. A natural test of this hypothesis is to use an object that is familiar to infants (as the object in Experiment 1 was) but that typically appears in multiple different locations. We chose to use infants' parents' car keys because they are familiar, portable, and must be included in travel so that they appear frequently in many locations.

Method

Participants. Fifteen 12-month-old infants participated in this experiment (eight girls; $M = 12$ months10 days; range = 11 months 24 days to 12 months 25 days). Data from three additional infants were omitted due to experimenter error (1), lost recordings (1), or sibling interference (1).

Design, materials, and procedure. The procedure was the same as in Experiment 1 (no familiarization phase). There were two within-subject conditions: new object (a stuffed animal from the lab) versus familiar object (parents' keys). Parents' keys were chosen as the target object for this experiment because keys naturally appear in many places. To strengthen the manipulation, we instructed the parents to show the keys to their babies in different locations (e.g., at home, in the car, on the playground, at the store) before coming to the study. Parents were also instructed to allow infants to hold the keys and to mention them by name in each location. When parents arrived at the lab, the researcher asked them if they had followed the instructions. In our sample, all parents had. The order of conditions and the side of the ottoman were roughly counterbalanced.

Results and Discussion

Infants' performance in this experiment demonstrated that seeing an object in different places before the experiment does not fully reduce the interference from prior location information and does not improve infants' ability to respond to the object's name when absent. Infants tended to spend more time engaging in communicative behaviors for the new object ($M = 5.10$ s, $SD =$ 3.25) than for the familiar object ($M = 2.77$ s, $SD = 3.15$), paired t test, $t(14) = 1.87$, 95% CI [–0.35, 5.02], $p = .08$, Cohen's $d =$ 0.5 (see Table 1). Indeed, eight out of 15 infants responded to keys, while 14 out of 15 responded to a new stuffed animal (see Table 2; McNemar's exact test, $p < .05$, Cliff's $d = 0.4$). These findings suggest that the location conflict effect observed in Experiment 2 is robust and cannot be fully ameliorated by encountering an object in multiple locations.

This pattern was not due to infants' greater initial interest in the stuffed animal over the keys. On the contrary, infants were more attracted by the keys than the stuffed animals. During the play phase, infants in this experiment spent more time holding the familiar object ($M = 45.6$ s, $SD = 21.85$) than the new one ($M =$ 26.45 s, $SD = 21.49$), paired t test, $t(14) = 2.82$, $p < .05$, Cohen's $d = 0.88$. Infants were also reluctant to give the keys back to the experimenter when it was time to hide them. No significant differences emerged in the latency of the first touch to the object (familiar: $M = 8.93$ s, $SD = 6.52$; new: $M = 12.33$ s, $SD = 14.20$), $t(14) = 1.13$, $p = .28$.

The fact that infants searched less often for the more attractive object than for the less attractive one suggests that the absence of responses in the absent reference task likely reflects difficulty retrieving the target representation from memory rather than the general lack of motivation to respond or the lack of interest in and attachment to the object.

General Discussion

The present findings suggest that familiarity with a referent does not necessarily facilitate infants' ability to respond to references to nonpresent objects. Infants in this research were less likely to respond to talk about familiar objects than they were to talk about new objects (Experiment 1). Infants' reduced performance with familiar referents compared with new referents is more likely to be caused by exposure to the referent before the test in a different location rather than by infants' general bias to respond more to new things (Experiment 2). The effect of the prestudy location of the referent persisted when infants were introduced to test objects in an adjacent room (Experiment 2) and when they were tested with objects typically appearing in different locations (Experiment 3). This pattern of results suggests that the context-specific nature of young infants' object representations may adversely affect their ability to display absent reference comprehension.

Previous research has shown that location information matters for infants' object representations. For example, infants' ability to find an object in a new location is subject to interference from prior hiding locations, as shown in the classic A-not-B task (Diamond, Cruttenden, & Niederman, 1994; Marcovitch & Zelazo, 1999; Munakata, 1998; Piaget, 1954; see Ganea & Harris, 2010, for additional relevant evidence). More generally, research has demonstrated the important role of spatiotemporal information in infants' ability to individuate objects (Káldy & Leslie, 2003; Moore & Meltzoff, 2004; Newcombe, Huttenlocher, & Learmonth, 1999; Oakes, Messenger, Ross-Sheehy, & Luck, 2009; Oakes, Ross-Sheehy, & Luck, 2006; Wilcox, 1999; Xu & Carey, 1996). Our research adds to these findings by showing that children's ability to respond to talk about absent objects can also be affected by the spatiotemporal history of an object. In our task, the probe that infants were presented with was a verbal request to engage with the experimenter about the object. Infants' ability to successfully engage in this conversational context was influenced by the spatiotemporal history of the object. One interesting question for future research is whether this effect is specific to references to object location ("where" questions) or can also be found with references to other object properties like color and size.

There are several possible ways that information about an object's prior location may affect infants' responses to absent reference. First, the literature on memory development has suggested an overall high level of memory specificity in the first year of life (Butler & Rovee-Collier, 1989; Hartshorn et al., 1998; Hayne, MacDonald, & Barr, 1997). According to this view, differences in the initial context of stimulus encoding and a test context negatively affect retention of the target representation and retrieval process. Thus, in the current research, seeing a familiar object in a new context may have invoked a sense of familiarity, but it also made it difficult for infants to recognize the object as the same object they had seen elsewhere, a feeling similar to recollection failure described in the adult memory literature (e.g., Henson, Rugg, Shallice, Josephs, & Dolan, 1999; Yonelinas, 2002). Incomplete object recognition in the current study might have affected infants' performance in an indirect way by causing confusion that occupied infants' (already limited) processing resources. This confusion could possibly have affected infants' attention toward the study events (i.e., object-referent mapping and the hiding event) and thus reduced the probability of accessing the target representation from memory allowing them to respond to absent reference.

Alternatively, there is a direct way that an object's prior location could interfere with infants' absent reference comprehension. The literature on object files has suggested that location is an integral part of objects' representations (Kahneman, Treisman, & Gibbs, 1992; Noles, Scholl, & Mitroff, 2005; Richardson & Kirkham, 2004; Richardson & Spivey, 2000). In the early phases of object perception, objects' features like color and shape are bound to object location. When the object's location changes, the memory of the object's features becomes associated with the new location, which is called object updating (see Hollingworth & Rasmussen, 2010, for review). This process may be cognitively demanding (Hommel, 1998, 2004; Leslie, Xu, Tremoulet, & Scholl, 1998), and traces of the initial object-location binding may persist despite the fact that the object has moved—surprisingly, even if it has moved along a consistent spatiotemporal path (Hollingworth & Rasmussen, 2010). In this light, the effect of location change on infants' responses can be explained by the direct interference of the object's initial location of encounter (or several previous locations) with infants' ability to create a new object-location binding. The "direct interference" explanation of the location conflict effect is also consistent with the phenomenon of proactive interference when the learning of new information is impaired by the existence of similar information in memory (Greenberg & Underwood, 1950; Keppel & Underwood, 1962).

Another potential explanation for the location conflict effect is that infants were making an A-not-B error. In the current study, this would have been revealed by infants' directing their behaviors to the previous location (e.g., by looking or crawling to the door). We did not see any reliable evidence of this type of perseverative response. However, it is possible that babies were mentally searching for the object in its previous location. We think this is an unlikely explanation of infants' behavior. First, the design in our experiments is too dissimilar from typical A-not-B tasks. Target objects were never hidden in prestudy locations, and infants could not have developed a habit of retrieving them there (no prior memory of searching for a stimulus object). The locations were of different scales: Location A was a room (or a house, a car, a store, a playground, etc.) and location B was an ottoman. Therefore, the current findings more likely reflect a broader phenomenon related to infant spatial and object memory and cannot be confined to A-not-B error per se.

Questions remain about the generalizability of the location conflict effect to other types of referents. Infants in the present study were presented with a single type of referent—graspable objects. It is possible that infants' ability to respond to talk about other absent entities can tolerate location changes. In particular, larger and self-mobile referents like people and animals may release infants from the location conflict constraint. Indeed, previous research has suggested that infants at 12 months and younger show comprehension of talk about absent people in experimental tasks, even after seeing the person appear in more than one location (Gallerani et al., 2009). One possibility is that location is not stably bound to representations of these types of referents.

Taken together, these findings suggest that at 12 months infants are able to comprehend and appropriately react to displaced speech in some situations. However, their ability to do so is fragile and context-specific. This work highlights the relation between language and cognitive development by showing that young infants' ability to respond to the mention of absent objects is tightly related to the peculiarities of perception and memory.

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Experimental and Clinical Psychopharmacology Special Issue: Psychopharmacology of Attention: The Impact of Drugs in an Age of Increased Distractions

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