

WHAT AND WHERE IN 12-MONTH-OLD INFANTS' ABSENT REFERENCE
COMPREHENSION

By

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CHAPTER I

INTRODUCTION

The ability to talk about the absent and abstract is a core property of human language that has enabled the advances in science and technology that characterize our species. Engaging in conversations about perceptually unavailable entities requires that speakers converge on a shared set of mental representations that are independent of the current context. For example, a child will only understand a reference to an absent shoe if they consider the representation of the particular shoe that is being mentioned (rather than shoes in general or an entirely different shoe). As a result, the strength of infant's object-based representations may constrain their comprehension of references to absent objects.

Previous research offers preliminary support of the possibility. In particular, several factors that might influence the quality of infants' representations of absent things seem to influence their comprehension. For one, several studies have suggested that the spatial and temporal proximity of referents influences infants' performance (Saylor & Baldwin, 2004; Ganea, 2005; Ganea & Saylor, in prep). For example, results across separate studies suggest that as infants near their first birthday they show comprehension for absent familiar people when they have accompanied babies to the lab (and are both spatially and temporally proximal), but not when the absent people familiar people were last seen earlier in the day. (Gallerani, Saylor & Adwar, in press; Ganea and Saylor, in prep; Saylor & Baldwin, 2004). Relatedly, babies are less likely to show comprehension of references to objects when the objects are hidden close to babies than when they are hidden further away (Ganea, 2005; see also, Liszkovski, 2009;

Liszkovski, Carpenter, & Tomasello, 2007). Next, differences in the familiarity of the test environment have lead to differences in infants' performance. In particular, "at home" studies have registered comprehension of absent reference to familiar objects in 10.5-month-old infants (e.g., J.Huttnelocher, 1974). However, it is not until 15 months of age that babies can display robust comprehension of objects in an unfamiliar laboratory environment. Finally, the presence of reminders of the absent thing supports infants' comprehension. In one study, hearing a target word during the delay period enhanced 13.5-month-old babies' performance (Ganea, 2005; see also Saylor, 2004).

All together this work suggests that babies' ability to comprehend absent reference depends on the quality of their object-based representations. When objects are recently seen, nearby, and familiar infants seem to show more robust comprehension. This is consistent with the notion that occasional failures or successes on behavioral tasks can be explained by the relative strength of the representation being tested and the difficulty of the task (Munakata, 2001). Insufficiently robust representations are less likely to be accessed and to trigger a successful response. The data from separate studies described above suggest that the strength of mental representation can affect infants' response to absent reference. The purpose of the current study is to examine this possibility directly within a single paradigm.

One of the factors that should affect the strength of a mental representation is the relative familiarity of a stimulus. As babies see an object over and over again, the representation of it is being enhanced and becomes more robust over time. Previous research has shown that the familiarity of an object enhances preverbal infants' ability to reach for objects in the dark (Shinsky & Munakata, 2005). One crucial component that reaching for occluded objects and responding to absent reference share is planning a response on mental representation. If

familiarity with a referent strengthens mental representation and representational strength matters for absent reference comprehension, our prediction is that babies should be more likely to display comprehension with highly familiar objects than with less familiar objects.

Another question that we asked in this study is whether there is any interaction between contextual and representational factors. One study mentioned above suggests that babies' absent reference comprehension is dependent upon proximity and accessibility of referents (Ganea, 2005). With this in mind we ask whether a stronger representation of a target object helps babies display comprehension in unfavorable contextual layouts (e.g., when the referent is not accessible).

In order to test the role of representational strength in infants' absent reference comprehension in different contexts we compared babies' performance with two types of referents: a familiar stuffed animal brought from home and an unfamiliar stuffed animal from the lab - in two conditions: accessible and inaccessible hiding locations.

CHAPTER II

EXPERIMENT 1

Method

Participants

Twenty-four 12-month-old babies participated in the experiment ($M = 12$ months, 5 days; range from 11 months 21 days - 12 months 29 days; 10 girls). Three additional babies participated but were omitted because of parental interference (1), fussiness (1), and experimenter error (1). Participants were recruited by phone from a database of interested families and were full-term at birth, had normal development and hearing, and heard English as their primary language.

Materials

Two leather covered ottomans were used as hiding locations. The ottomans were identical in shape and size, but one was dark brown, and the other one was black.

Target objects were familiar and new stuffed animals. Familiar animals were brought from home by parents, and new animals were from the lab. Parents were instructed to bring an animal of a moderate size, with no electronic functions, and with a common noun as a name for it. They were also asked not to show the toy to the baby on the day of the experiment. The new animals were a dog or a bear (depending on which label parents reported infants' understood the best).

Design

Accessibility (contextual factor) was manipulated between subjects. Babies were randomly assigned to two conditions: accessible hiding location and inaccessible hiding location. In the accessible hiding location condition the ottoman where the toy was hidden was on the floor near a cabinet approximately 6 feet from the baby. In the inaccessible hiding location condition the ottoman was on a 4 feet high cabinet 8 feet away from the baby (Figure 1).

Familiarity (representational factor) was manipulated within subjects. Babies in each of the accessibility conditions played with a toy brought from home by their parents and with a new toy from the lab. The order of the new and the familiar toy conditions and the position (left/right) of the ottoman was counterbalanced.

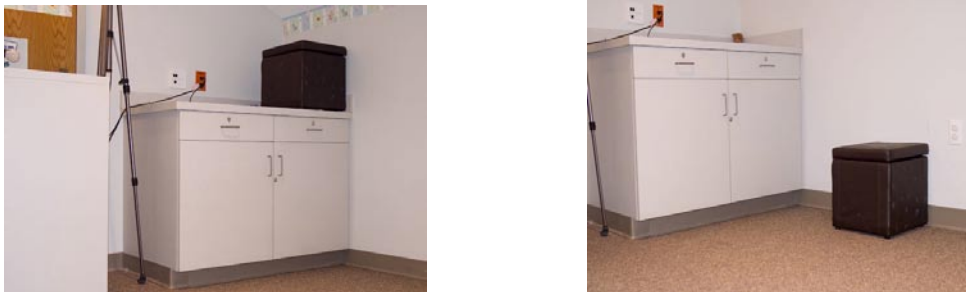


Figure 1. Inaccessible and accessible hiding locations.

Procedure

There were three phases in the procedure: a *play phase*, a *time delay phase* and a *test phase*. The purpose of the *play phase* was to give participants experience with the stimulus object and its label. During the play phase the experimenter mentioned the toy 8 times (e.g., “Look, it’s a dog! Do you like dogs? I like dogs!”). Babies were free to move around the room and to handle the toy. The play phase lasted a little over a minute ($M = 81$ seconds). There were no differences in the length of the play phase across conditions. At the end of the play phase, the baby was placed on her parent’s lap. The experimenter clapped her hands and called the baby’s name to attract her attention, and then put the toy in the ottoman.

The purpose of the *time delay phase* was to distract babies’ attention from the hiding location. In the time delay phase experimenter sang “twinkle twinkle little star” and pointed away from the ottoman. The duration of the time delay phase was around one minute ($M = 55$ seconds) and there were no differences in the length of the play phase across conditions.

In the *test phase* babies’ absent reference comprehension was probed. The baby remained on her parent’s lap, and the experimenter sat in front of them. The experimenter attracted the baby’s attention by calling her name and clapping hands, and asked her about the hidden toy by asking about it 8 times first indirectly (e.g., “What about the dog?, Have you seen the dog?”), and then directly (“Where is the dog?”).

The experimenter retrieved the toy from the ottoman at the end of the test phase and allowed babies to play with it while she was switching the ottomans. She then repeated the procedure for the other object.

Coding

Our measure of absent reference comprehension was whether infants searched for the absent thing by looking at, pointing at, or approaching the ottoman. If infants showed any of these behaviors they were given a score of 1, if they did not they were given a 0.

In this and all subsequent studies, the initial judgment about the presence and the type of babies' behaviors towards an absent toy was made by the experimenter. A look was coded if infants looked at the ottoman following the mention of a hidden object. A point was coded if infants raised their arm in the direction of the ottoman. Both index finger and full-hand pointing were considered. Approaching the ottoman was coded if the baby moved their body toward the ottoman.

Videotapes were then coded by the second coder blind to the hypothesis of the study, to the side of the ottoman (it was outside of the camera range) and to the condition. Overall agreement across the three studies was almost perfect (Experiment 1, Cohen's kappa = 0.87, Experiment 2, Cohen's kappa = 0.92, Experiment 3, Cohen's kappa = 1)

Results

In this study, we ask whether the strength of a mental representation matters for babies' absent reference comprehension. We predicted that there would be more robust object representations when referents were accessible and familiar. Parametric and nonparametric tests were used to test these predictions. Results are displayed in Figure 2. In this and all following experiments, preliminary analyses revealed no gender effects, age effects, order effects or side biases.

Accessibility

To investigate the overall effect of accessibility we collapsed babies' scores across familiarity in the accessible and the inaccessible hiding location conditions. Responses to both a familiar and a new toy yielded a score of 2, responses to only one of the stimuli yielded a score of 1 and no responses to either a familiar or a new toy yielded a score of 0. Independent samples t-test revealed a marginally significant effect: $t(22) = 1.89, p = 0.07$, (two-tailed). Babies in the accessible hiding location condition were slightly more likely to search for a hidden toy ($M = 1.42, SD = 0.67$) than babies in the inaccessible condition ($M = 0.83, SD = 0.83$).

Familiarity

To analyze the overall effect of familiarity we combined babies' responses for a familiar toy in the accessible and inaccessible conditions and for a new toy in the accessible and inaccessible conditions, thus obtaining two binary variables with 24 observations in each. McNemar change test corrected for small expected frequencies (Siegel & Castellan, 1988) revealed no effect: $p = 0.66$. Overall, babies were equally likely to search for familiar and new toys.

Next we analyzed simple effects of familiarity in the two accessibility conditions. No effect was found in the inaccessible hiding location condition. In general, babies were unlikely to search for either toy: 6 out of 12 babies searched for a familiar toy, 4 out 12 searched for a new one.

In the accessible hiding location condition there was a significant effect of familiarity (McNemar change test corrected for small expected frequencies: $p < 0.05$). However, contrary to our predictions, babies were more likely to search for a new toy than for a familiar one. Babies'

tendency to search for a new toy was very high: 11 out of 12 babies did so. At the same time babies only rarely searched for a familiar toy: only 6 out 12 searched for a hidden familiar toy.

To examine whether this difference was due to babies' greater interest in the new toy versus the familiar toy we coded infants' behavior during the play phase. In particular, we measured the latency of babies' first touch to the familiar versus new toy and the length of time babies held each toy. There were no differences (paired t-tests, $t(11) = 1, p = 0.35$, two-tailed, M (familiar) = 18.44, $SD = 15.27$, M (new) = 12.44, $SD = 8.29$; $t(11) = 1.07, p = 0.30$, two-tailed, M (familiar) = 22.25, $SD = 20.9$ sec, M (new) = 33 sec., $SD = 26$). These analyses suggest that infants had the same level of initial interest in the two test objects.

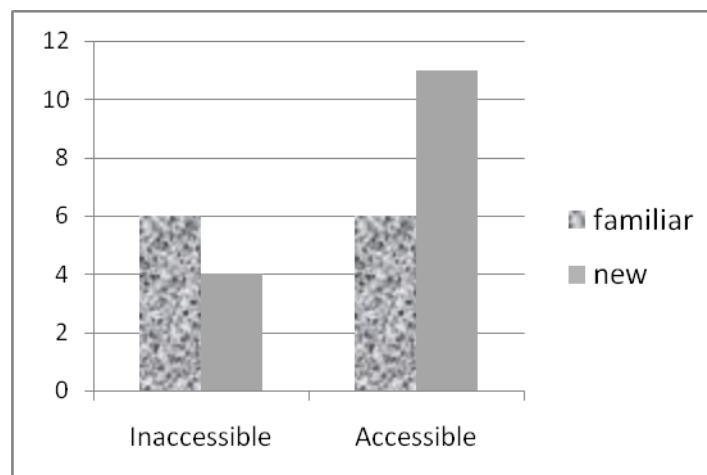


Figure 2. The Number of Infants Searching for the Absent Object

Discussion

The current study revealed partial support for our hypotheses. First, babies showed a tendency to search more for accessible than inaccessible hidden objects. This is consistent with previous findings that infants' absent reference understanding is initially limited to those referents that are the most proximal and easily accessible (Ganea, 2005; Ganea & Saylor, in prep.). In this experiment the effect of accessibility emerged clearly only in the new toy condition.

There are several possible accounts for babies' performance in the inaccessible hiding condition. First, babies are less familiar with the part of the space that is above their reach and therefore it was harder for them to remember the inaccessible location. Second, babies might not have been encoding the hiding event in the inaccessible hiding location condition as strongly as in the accessible condition: due to the impossibility to reestablish the contact with the target object babies might have considered that information irrelevant for future retrieval. Further explanation concerns the possibility that it was simply more difficult for them to direct behaviors to the space above their head. Which of these accounts is more plausible is to be addressed in future research.

When referents were accessible, the familiarity of a referent made it more difficult for babies to comprehend absent reference. There are two possible processes that might account for this puzzling effect. In each case the argument is that there was interference between the past and current object representations.

One possibility is that a novelty preference accounts for babies' higher search rate for new toys from the lab than for familiar toys from home. Recent findings by Shinsky and Munakata suggest that by 12 months, infants display novelty preference in reaching for hidden

objects (Shinsky & Munakata, 2010). This shows that babies' ability to act on mental representations can be supported by their motivation and interest in the referent. Coding of the overall interest in the objects revealed no differences, and this makes the "novelty preference" account unlikely. However, a cleaner test of this possibility is needed. In the next study we address this possibility by equating the features of the stimuli in the familiar and new condition and varying the length of exposure to each object to contrast novelty and familiarity.

One additional possibility is that babies had a representational conflict between a familiar object's prior location (home) and its new location (lab). By 12 months of age infants can perceive and encode different object features such as color, shape, and location, and form bound object representations that integrate all that information (Oakes et al., 2008; Oakes et al. 2006; Wilcox, 1999; Newcombe et al., 1999; Kaldy & Leslie, 2003). The possibility that location information is a part of a bound object representation may suggest that when a familiar object is encountered in a new place babies recall the previous location of that object. The memory about an object's prior location may interfere with the oncoming information about the object's current location. This representational conflict might have impacted the strength of object representation as well the memory of object's most recent location. In Experiment 2, we test for this possibility by introducing a toy to infants in either the same location as where they are later tested or in a different one.

CHAPTER III

EXPERIMENT 2

Method

Participants

Twenty-four 12-month-old babies participated in the experiment ($M = 12$ months 11 days; range: 11 months 22 days to 12 months 21 days; 8 boys). Subjects were recruited as in Experiment 1. Data from two additional infants were omitted: hyperactivity and failure to attend to the stimuli (1), failure to attend to the hiding event (1).

Design

Mixed effects 2 X 2 design was used with one between subjects factor (the presence or absence of location conflict: location conflict versus no location conflict) and one within subjects factor (the degree of familiarity with a toy: familiarized vs. new toy).

Materials

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

Procedure

The procedure was the same as in Experiment 1 except that a *familiarization phase* was added before the *play phase*.

The purpose of the *familiarization phase* was to introduce babies to one of the stimulus toys in either the same location as the test phase (for the “no location conflict” condition) or a different location (an adjacent room, for the “location conflict” condition). Thus, this phase was used to create a conflicting location representation in the “location conflict” condition. During familiarization the experimenter and a baby played with a stuffed animal, but the experimenter did not label the object. The familiarization phase lasted for around 2 minutes ($M = 138$ seconds) with no differences between conditions. Following the familiarization phase, babies participated in the *play phase*, *the time delay phase* and *the test phase* – as in Experiment 1.

Only one of the test objects was introduced during a familiarization phase (the familiarized toy). The second object (the new toy) was seen only in the main part of the experiment. Varying the length of the exposure to the two test objects enabled a test of the hypothesis that infants’ tendency to do search for new objects more often than for familiar objects was the result of novelty preference. See Table 1 for a summary of the conditions in Experiment 2.

The order of the new and familiarized toy conditions and the toys that were used in each was counterbalanced.

Between subjects	Within subjects	Familiarization	Main Part
Location conflict	Familiarized	Prebriefing room	Test room
	New		Test room
No location conflict	Familiarized	Test room	Test room
	New		Test room

Table 1. Experiment 2 design

Results

The two questions we addressed in this experiment were whether infants' low tendency to search for familiar toys from home in Experiment 1 was the result of a novelty preference or of interference from objects' prior location. Results are presented in Figure 3.

Infants' search for the new versus familiarized toys in the "No location conflict" condition is the most direct test for the novelty preference hypothesis because the only difference between the new and familiarized objects in this condition was whether infants saw the object during a familiarization phase. No effect of exposure (familiarized vs. new toy) was found. All twelve babies searched for a familiarized toy and all but one searched for a new toy. There was also no difference in how quickly babies searched for the familiarized versus new toy (paired t-test, $t(10) = 1.6$, $p = 0.14$, two-tailed, M (familiarized) = 15.45, $SD = 17.8$, M (new) = 6.72, $SD = 5$). Therefore, a novelty preference alone does not seem to be the factor that affects babies' absent reference comprehension.

Babies' performance with a familiarized toy in the "location conflict" versus the "no location conflict" conditions is the test of the "representational conflict" hypothesis. A toy introduced to babies in a different room before the main session has a conflicting location representation associated with it, while a toy introduced to babies in the same room does not have one.

The analysis of babies' performance with a familiarized toy in the "location conflict" condition and in the "no location conflict" condition revealed a significant effect of location conflict (Exact test on small sample two independent proportions, $p \leq 0.007$ (Agresti, 2002, Chapter 3), Fisher exact test, $p = 0.002$). Babies were more likely to search for a toy that has been introduced to them in the same room as where the main session took place (12 of 12) than for a toy introduced to them in a different room (5 out of 12). This was not due to differences in babies' interest on one of the stimuli during the play phase: no difference was found in babies' latency of grabbing the familiarized toys (t-test, $t(22) = 1.63$, $p = 0.12$, two-tailed, $M(\text{loc. conflict}) = 17.75$, $SD = 12$, $M(\text{no loc. conflict}) = 10.08$, $SD = 11$), and the amount of time they spent holding each toy (t-test, $t(22) = 0.89$, $p = 0.3890$, two-tailed, $M(\text{loc. conflict}) = 20.77$, $SD = 18.5$, $M(\text{no loc. conflict}) = 18.5$, $SD = 20.8$).

In the "location conflict" condition babies were also less likely to search for a familiarized toy than for a new toy (McNemar change test corrected for small expected frequencies, $p < 0.05$). Babies had a longer exposure to the familiarized toy than to a new toy, and there was also a conflicting location associated with a familiarized toy. Therefore, it is difficult to attribute the difference in babies' response patterns in this condition to either factor alone.

However, babies' tendency to search for a new toy in the "location conflict" condition (10 babies out of 12 did so) controls for two potential explanations of Experiment 2 results. One is that babies in the location conflict condition were more distracted than babies in the no location conflict condition because they were taken from one room to another during the experiment. The other is that babies in this condition were less responsive overall than the babies in the "no location conflict" condition. If babies responded poorly to a familiarized toy due to one of these reasons we would expect them to perform poorly with a new object as well. However, this was not observed.

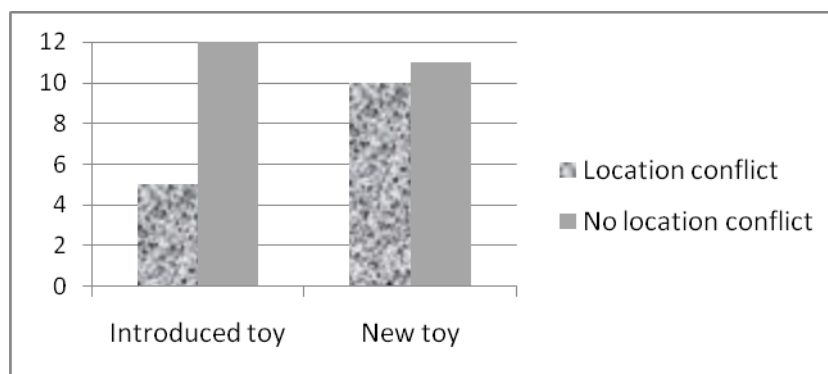


Figure 3. The Number of Infants Searching for the Absent Object

Discussion

The main finding of Experiment 2 was that babies' ability to comprehend absent reference is not affected by their novelty preference, but rather depends on the referent's spatiotemporal history. Indeed, babies' tendency to search for toys that they had seen in only one

place was quite robust, whereas as little as 2-3 minutes of exposure to a toy in an adjacent room before the test greatly reduced the likelihood that babies would search for it.

This result provides further evidence that babies may have an association between an object and its location. Thus, the initial context where an object was encountered may support the representation of the object and could serve as an aid for retrieving it from memory when the object is out of view. Our next question is whether seeing an object in multiple locations could reduce the strength of association between that object and a specific place. After tracking an object across different places babies may expect to see it anywhere, therefore prior location information becomes less important, and this may improve babies' ability to memorize the most recent location of that object. One way to test this hypothesis is to investigate babies' performance with an object that they encounter naturally in different places. We chose keys because they are taken to different places naturally and babies might expect to see them anywhere. Thus, here we expect no location binding, as location is not a relevant object feature in case of keys.

CHAPTER IV

EXPERIMENT 3

Method

Participants

Sixteen 12-month old babies participated in this study ($M = 12$ months 10 days; range: 11 months 24 days to 12 months 25 days; 8 girls). Data from 4 additional infants were omitted due to experimenter error (1), equipment failure (1), distracting event (1), parents' failure to follow the instructions (1).

Design, materials and procedure

The procedure was the same as in Experiment 1 (there was no familiarization phase). There were two within-subjects conditions in this study: new object (a toy from the lab) versus familiar object (keys brought from home). Parents were asked to show keys to their babies in many different locations (at home, in the car, on the playground, at the store, etc.) 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.

The order of conditions and the side of the hiding location were counterbalanced.

Results and Discussion

In this study we asked whether seeing an object in different places before the experiment can reduce the interference from prior location information and improve babies' ability to find it in a new location.

Results are presented in Figure 4. Contrary to our predictions, babies were significantly less likely to search for keys than for a new toy (McNemar change test corrected for small expected frequencies, $p < 0.05$). Nine out of 16 children searched for keys and 15 out of 16 searched for a stuffed animal from the lab. This was not due to babies' lower interest in the keys than in a stuffed animal. In fact, during the play phase (which took place in the same room as the test phase) babies in this study spent more time holding the keys than a stuffed animal (paired samples t-test, $t(15) = 2.83$, $p < 0.05$, two-tailed, M (keys) = 44.19, $SD = 21.85$, M (new toy) = 26, $SD = 20.85$). There was no difference in the latency of the first touch (paired samples t-test, $t(15) = 1.1$, ns; M (keys) = 8.9, $SD = 12$, M (new toy) = 6.3, $SD = 13.8$). This suggests that interference from prior locations of an object is robust even if there are many of them. This finding can be explained by the possibility that babies' tendency to bind location information with object features is so strong that even a number of different locations does not facilitate segregation. Any prior location information appears to be attached to object representation which interferes with babies' memory of the current location of an object.

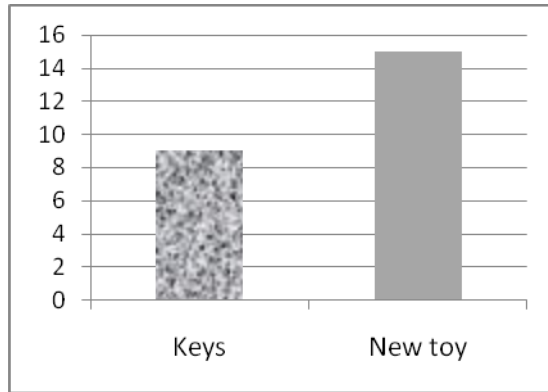


Figure 4. The Number of Infants Searching for the Absent Object

CHAPTER V

GENERAL DISCUSSION

The primary goal of this study was to investigate the possibility that the nature of representations about absent things constrains 12-month-old babies' comprehension of absent reference. Several novel contributions have been made. First, the present research shows that information about the prior locations of absent referents influences how well 12-month-old babies can comprehend absent references. In particular, a brief exposure to an object in a different location reduced infants' ability to show comprehension of absent things. This location conflict was so robust that attempts to reduce it by using an object that typically appeared in other locations failed to lead to comprehension. This suggests that although at 12 months babies are able to comprehend displaced speech in some situations, their understanding is still very fragile and context specific, and is constrained by babies' representational capacities.

Additionally, the effect of location conflict suggests that familiarity is not likely to strengthen babies' object based representations for the reason that objects rarely stay in one place. This pattern of findings adds to the previous research on babies' search development. For example, in a recent study Shinskey and Munakata showed that in contrast to 7-month-old babies (Shinskey & Munakata, 2005) 11-month-old babies search more for new objects than for familiar objects because their memory capacity is already robust enough to support search for more interesting objects rather than for familiar objects for which they have stronger representations (Shinskey & Munakata, 2010). Our findings suggest that novelty preference is not the only factor

that influences babies' search patterns. In natural situations they would search less for familiar objects because of the interference from objects' prior locations.

The nature of the interference from objects' prior locations in babies' search can be explained in two ways. One explanation concerns the possibility that babies' representations of familiar objects encountered in a new location are in fact weaker than representations of new objects. It could be due to overall high level of memory specificity in the first year of life (Hayne, MacDonald, & Barr, 1997; Hartshorn et al., 1997; Butler & Rovee-Collier, 1989): differences in the initial context of object encoding and a test context negatively affect retention of a target representation and retrieval process. It could also be due to representational conflict between prior locations and the current location suggested by the phenomenon of feature binding. If infants integrate location information into their object representation then prior location information attached to an object interferes with the encoding of a new location.

The other possibility is that familiar objects with disrupted spatiotemporal history present babies with a numerical identity problem (Moor & Meltzoff, 2004; Xu & Carey, 1996). In our experiments babies did not have a chance to track objects' displacements. Therefore, when they saw a familiar item in the study room the identity of that item might not have been clear to them. Resolving the identity ambiguity might have imposed greater processing demands on them. This may account for the interference from prior non-matching locations in babies search. Distinguishing between these two possibilities is the current focus of research in our lab.

Taken together, findings reported here highlight the relation between language and cognitive development and suggest that absent reference comprehension is restricted by the development of domain-general representational capacities. At 12 months babies can comprehend displaced speech unless they can represent the referent.

REFERENCES

- Agresti, A. (2002). *Categorical data analysis*. John Wiley & Sons, Inc., Hoboken, New Jersey.
- Butler, J. & Rovee-Collier, C. (1989). Contextual gating of memory retrieval. *Developmental Psychobiology*. 22, 6, 533 – 552.
- Gallerani C., Saylor M.M. & Adwar S. (under review). Mother-Infant Conversation about Absent Things.
- Ganea, P. A. (2005). Contextual factors affect absent reference comprehension in 14-month-olds. *Child Development*. 76, 989–998.
- Ganea, P. A., & Saylor, M. M. (in prep). Talking about the near and dear: Proximity and absent reference comprehension.
- Hartshorn, K., Rovee-Collier, C., Gerhardstein, P., Bhatt, R.S., Klein, J. Pamela, Aaron, F., Wondoloski, T.L., Wurtzel, N. (1998). Developmental changes in the specificity of memory over the first year of life. *Developmental Psychobiology*. 33:1, 61-78.
- Hayne, H., Macdonald, S., Barr, R (1997). Developmental changes in the specificity of memory over the second year of life. *Infant Behavior and Development*. 20:2, 233-245.
- Káldy, Z. & Leslie, A.M. (2003). Identification of objects in 9-month-old infants: integrating ‘what’ and ‘where’ information. *Developmental Science*. 6,3, 360-373.
- Liszkowski, U., Carpenter, M., Tomasello, M. (2007). Pointing out new news, old news, and absent referents at 12 months of age. *Developmental Science*. 10, 2, F1 - F7.
- Liszkowski, U., Schaefer, M., Carpenter, M., & Tomasello, M. (2009). Prelinguistic infants, but not chimpanzees, communicate about absent entities. *Psychological Science*. 20, 5, 654-660.
- Moore, M. K., & Meltzoff, A. N. (2004). Object permanence after a 24-hr delay and leaving the locale of disappearance: The role of memory, space, and identity. *Developmental Psychology*, 40, 606–620.
- Munakata, Y. (2001). Graded representations in behavioral dissociations. *Trends in Cognitive Sciences*. 5, 309 – 315.

- Newcombe, N., Huttenlocher, J., & Learmonth, A. (1999). Infants' coding of location in continuous space. *Infant Behavior & Development*, 22, 483–510.
- Oakes, L.M., Messenger, I.M., Ross-Sheehy, S., & Luck, S.J. (2008). New evidence for rapid development of color-location binding in infants' visual short-term memory. *Visual Cognition*, DOI: 10.1080/13506280802151480.
- Oakes, L. M., Ross-Sheehy, S., & Luck, S. J. (2006). Rapid development of feature binding in visual short-term memory. *Psychological Science*, 17, 781-787.
- Sachs, J. (1983). Talking about the there and then: The emergence of displaced reference in parent-child discourse. In K. E. Nelson (Ed.), *Children's Language*. Hillsdale, NJ: Erlbaum.
- Saylor, M. M. (2001). Understanding talk about the absent: An investigation of infants' comprehension of absent reference from 12 to 31 months. Unpublished doctoral dissertation, University of Oregon.
- Saylor, M. M. (2004). 12- and 16-month-old infants recognize properties of mentioned absent things. *Developmental Science*, 7, 599 – 611.
- Saylor, M. M., & Baldwin, D. A. (2004). Discussing those not present: Comprehension of references to absent caregivers. *Journal of Child Language*, 31, 537 – 560.
- Saylor, M.M., & Ganea, P.A. (2007). Infants Interpret Ambiguous Requests for Absent Objects. *Developmental Psychology*, 43, 3, 696-704.
- Siegel, S., Castellan, N.J. (1988). Nonparametric statistics for the behavioral sciences (2n ed.) McGraw-Hill, Inc.
- Shinsky, L.J., & Munakata, Y. (2005). Familiarity breeds searching. Infants reverse their novelty preference when reaching for hidden objects. *Psychological Science*, 16, 8, 596 – 600.
- Shinsky, L.J., & Munakata, Y. (2010). Something old, something new: a developmental transition from familiarity to novelty preferences with hidden objects. *Developmental Science*, 13, 2, 378 – 384.
- Huttenlocher, J. (1974). The origins of language comprehension. In R. Solso (Ed.), *Theories in cognitive psychology*. (pp. 331 – 368). Hillsdale, NJ: Erlbaum.

Wilcox, T. G. (1999). Object individuation: Infants' use of shape, color, size, pattern, and *Cognition*, 72, 125–166.

Xu, F., & Carey, S. (1996). Infants' metaphysics: The case of numerical identity. *Cognitive Psychology*. 30, 111–153.