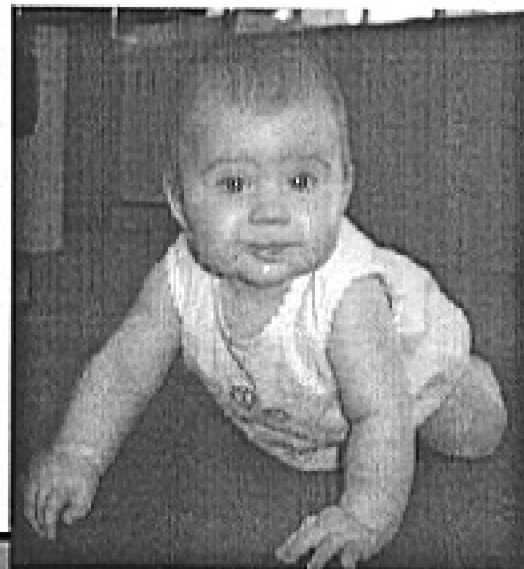

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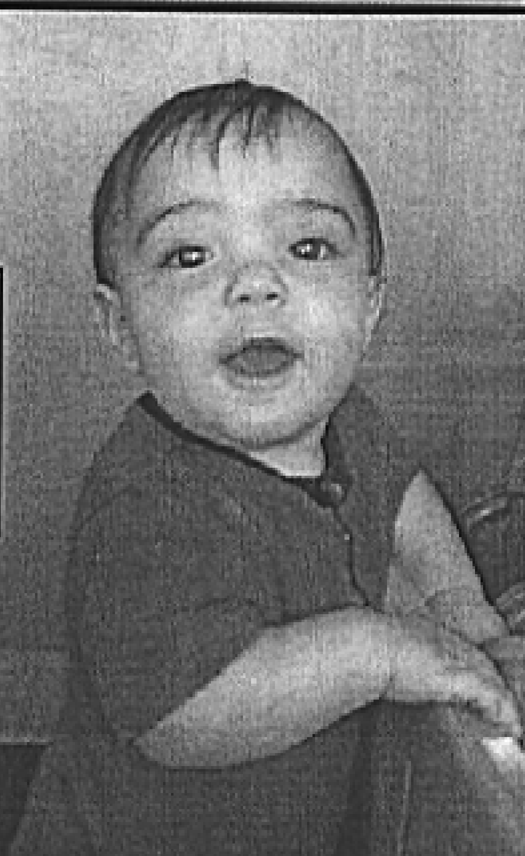

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Summer/ Fall 2004

Angel Study

Rebecca Saxe, Post-Doctoral Fellow
Tania Tzelnic, Research Assistant

In the Angel study, we were interested in the kind of knowledge very young infants have about people and things. We already know that infants have rules about how solid objects are supposed to behave. For example, they know that two solid objects can't pass through each other. Previous research has also shown that infants don't always treat people as if they were bound by the same rules as solid objects. Since the adults in their lives can do all sorts of "magic" things, they might just expect people to be special. We combined these two questions to ask if infants would be surprised if a person passed through a solid object. In other words, do infants expect people to be solid, or do they think people are more like ghosts or angels?

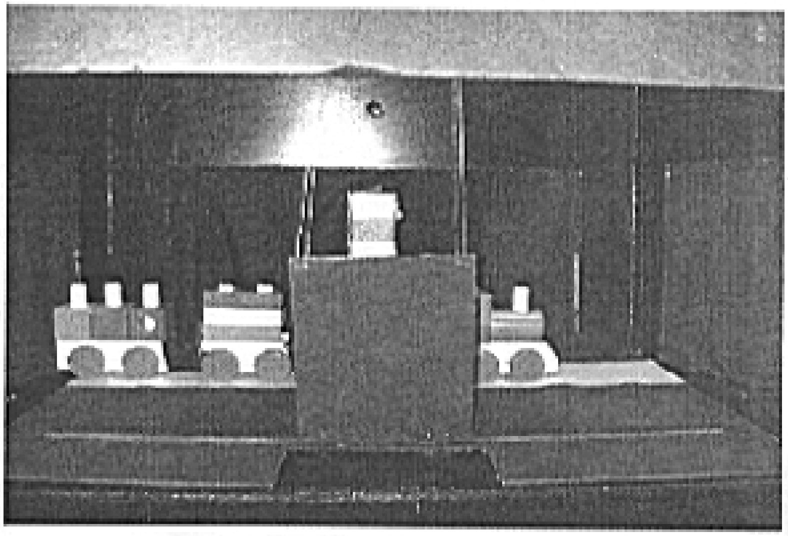
We showed infants a hand extending across a stage. When they got bored, we showed them two scenarios: the hand appearing to pass through a wall, or the hand appearing to pass in front of a wall. We reasoned that if they thought that hands were solid, they would be surprised when the hand seemed to go right through a wall. We also ran another set of kids on the same type of trials, but used a toy train instead of a hand. This was to make sure that they really were surprised when solid objects went through walls.

We found that infants were extremely surprised when the hand appeared to pass through the wall. In fact, they were just as surprised when they saw the hand go through the wall as they were when they saw the train go through the wall.

One question we had, though, was whether we'd learned something about agents (people, animals, or anything else that can cause things to happen in the world) or whether we'd isolated something specific to humans. So we designed another study that asked whether infants would be surprised when they saw a novel agent pass through a wall.

The novel agent is a 4 inch high puppet who is furry and has googly eyes. Infants got to see him walking around on the stage (he's controlled from above, like a marionette) at the beginning of the study. In this study, he appears to walk through a wall, or walk under an overhang. This way, we can find what infants do know about people.

We're still running kids in this condition, and we're really curious about the results!



Wind-Up Toy Studies

Kristin Shutts, Graduate Student

In our Summer 2003 newsletter we told you about a set of studies investigating how infants learn about self-propelled motion. In the learning phase of these studies we showed 7-month-olds two different events: In the "self-propelled event" we showed babies a wind-up toy (e.g. a hippo) moving across the stage by itself. In the "hand-moved event" we showed babies a wind-up toy (e.g. a snail) moving across the stage by an experimenter's hand. In the test phase of these studies, we put both wind-up toys next to one another on the stage and the experimenter removed her hands. Neither one moved for 20 seconds while we monitored which toy infants spent more time looking at. We predicted that if infants had learned about which animal was self-propelled in the learning phase, they would look at it longer in the test phase because it was the only one that might move again. That is exactly what happened! Babies showed this effect (longer looking at the previously self-propelled object) whether the stimuli were wind-up animals, vehicles, or unfamiliar "blobs," suggesting that infants are very good at learning about self-propelled motion and that they are willing to learn about it for any kind of object (not just animals, for example).

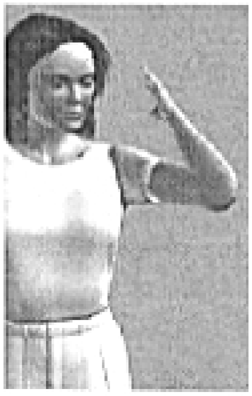
Recently we did a follow-up study to ask what would happen if we made the "hand-moved event" in the first phase of the study as interesting as the "self-propelled event." We were wondering if babies' looking in the test trials of these studies was really motivated by an expectation that the object might move again, or if in the test trials they were just looking at the previously self-propelled object because it was the most interesting thing from the first phase of the study. To this end, we created a really interesting "hand-moved event": instead of just moving the object across the stage, the experimenter bounced it around the stage floor and had it move in several directions. When we examined the test trials, we found that this time babies looked equally long at the previously self-propelled and previously (super-interesting) hand-moved object. This was surprising to us initially because we thought babies would still look longer at the self-propelled object.

However, our interpretation of all the previous studies using this method is still that babies are motivated to look longer at the previously self-propelled animal because they think it might move, not just because it was the most interesting object in the first phase of the study. If it were the latter case, then babies in the most recent study should have looked longer in the test trials at the previously hand-moved object, because it was the most interesting thing in the first phase.

Human Bodies and Impossible Movements

Jonathan Beier, Graduate Student

This study investigated what infants know about the range of possible movements that a human body can make. We showed 5- and 12-month old infants computer-animated movies of an adult woman swinging her arms and legs back and forth. In some of the movies, her limbs would bend at the elbow and knee joints as expected. In the other movies, her limbs would bend backwards against the joint- an impossible movement. Adults watching the movies can easily recognize the impossible ones, and will often look longer at the unusual movie in disbelief at what they're viewing. We measured infants' looking times to each of the two movies, to see if infants also had an expectation that bodies should only move in certain ways.



A Possible Movement

An Impossible Movement

So far, the results of the study have been inconclusive. On average, both 5- and 12-month old babies look about equally long to normal and impossible body movement movies. This could mean that infants' initial knowledge of how a body should appear is rather sparse- in fact, another group of researchers suggests that infants are not sensitive to this sort of visual body violation until nearly 18 months. It is also possible that, while infants may not have any expectations about elbow or knee bendings, they may indeed have very specific knowledge about other aspects of the physical body such as orientation of the face with respect to the rest of the body, number of limbs, limb proportion, or other features. We plan to continue to explore these possibilities in future studies.

Lines and Beeps

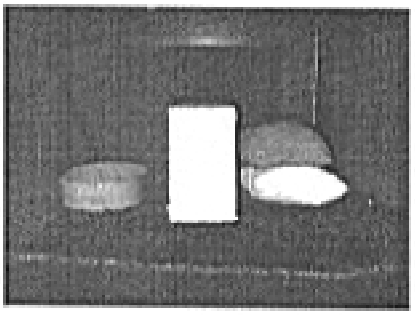
Julie Goldman, Undergraduate Thesis Researcher

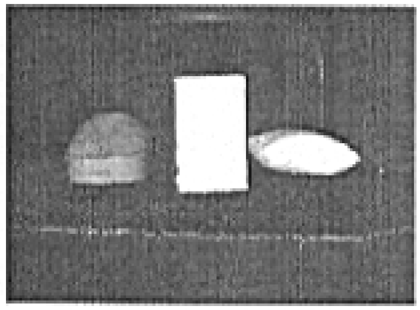
By early childhood, children begin to become proficient at using and understanding space-time metaphors: words that adults use to describe entities in terms of both space and time, e.g. *long*, *short*, *before*, and *after*. These special metaphors exist in virtually every language. Is this because humans are predisposed to think about time in terms of space? Is there something inherently 'the same' about a long line and a long event? To find out, we are exploring infants' reactions to pairings of lines and tones that are consistent (i.e., long line with long tone and short line with short tone) and inconsistent (i.e., long line with short tone and short line with long tone). If babies look longer at the inconsistent pairings, we can assume that they find these more surprising. This could mean that, even before they begin to speak, infants find length to be somehow related to duration, possibly explaining the widespread existence of space-time metaphors.

WAS Study

Rebecca Saxe, PhD
Lindsey Powell,
Undergraduate Research Assistant

Adults tend to see the world not as a jumble of incoherent movements, but instead as a well-coordinated series of actions. In addition, we assume that most of these actions are carried out with a goal or a purpose in mind. Past studies have suggested that by 5 months of age infants have started to see the world in terms of goal-directed actions as well. For example, after watching an experimenter reach for one object over and over again, the babies are surprised to see the experimenter reach for a new object, even if it's sitting where the old one was. They had assumed that the old object was the experimenter's goal, and thus expected the experimenter to adjust where they reached to match the old object's new location.



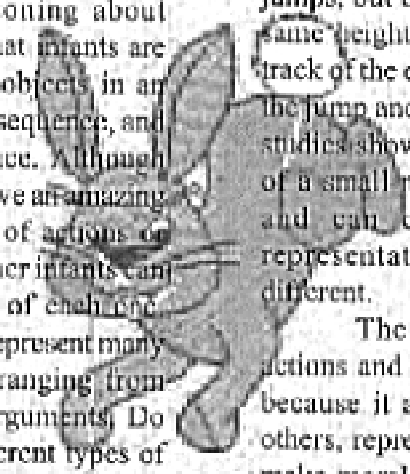


The current study is attempting to extend the previous research to new actions that indirectly connect the experimenter with the goal. Starting with 12-month-olds, we are showing infants a stage on which a hand consistently throws a bean bag at one target and not another. We then switch the targets, and look to see if the infant is more surprised when we throw the bean bag at the old target or at the new target, which is now positioned where the old target was. Hopefully the results of the study will shed more light on how infants break down the world into actions and goals.

Jumping Puppet Study

Justin Wood, Graduate Student

Long before children learn verbal counting or symbolic arithmetic, very young infants (as young as 5 months!) have a remarkably sophisticated system for reasoning about number. These studies reveal that infants are able to "count" the number of objects in an array, the number of sounds in a sequence, and the number of actions in a sequence. Although these studies reveal that infants have an amazing ability to represent *the number* of actions or events, we do not yet know whether infants can form individual representations of each one. Human adults, for example, can represent many different types of individuals, ranging from flocks of bird, to homeruns and arguments. Do infants also represent many different types of individuals, as do adults, or does this ability depend on language, enculturation, or experience?



In a series of studies, I showed that human infants represent individual puppet jumps. In Experiment 1, infants successfully discriminate sequences of 2 jumps from 3 jumps, but only when all of the jumps are the same height. This suggests that infants keep track of the event properties, such as the size of the jump and the duration of the jump. Further studies show that infants can only keep track of a small number of jumps (up to about 3), and can compute number from these representations if all the individuals are different.

The ability to represent individual actions and events in the world is important, because it allows us to learn verbs, imitate others, represent causation in the world, make moral judgments, and so on. Future studies will investigate how infants' system for representing events and actions is the same as adults, and also how it is different.

FIMO Study

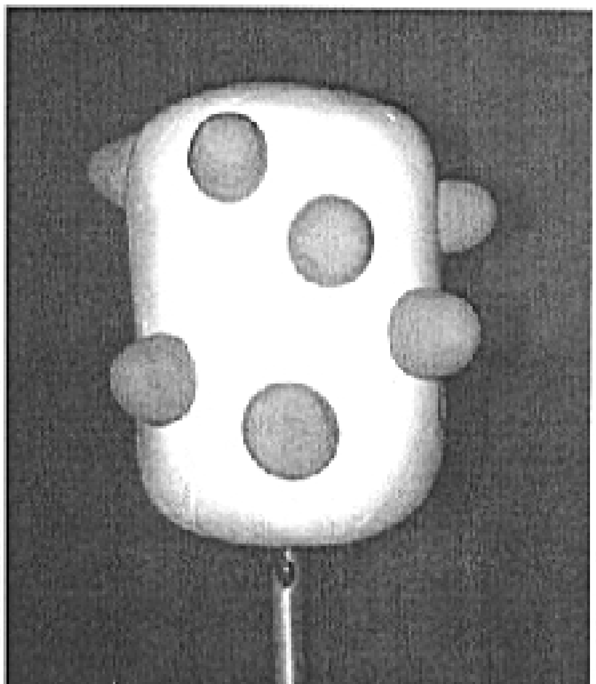
Rebecca Saxe, PhD
Krupa Bhojani, Undergraduate Research Assistant

The FIMO study looks at the development of knowledge about animacy and agency in young infants. It is a follow-up to the Secret Agent Study, which found that infants do have some idea that inanimate objects cannot move on their own. However, at what specific age does this develop? Do infants aged six months automatically assume that an animate object (such as a hand) causes the motion of an inanimate colored blob, and not vice versa?

In the FIMO study, six- to seven-month old infants were sat in front of a stage, in a high chair, and habituated to a hand and an inanimate object moving ambiguously together. The stimulus was made of brightly-colored modeling clay and specifically unclear, with surface bumps made to look completely random, but allowing the possibility of the hand holding on to one of them to move the object. The stage was designed so that the inanimate object could be moved from behind, without the infant knowing.

Using the standard measure of infants' looking-time, it was possible to measure infants' expectations about the source of the movement. This was done by first habituating them to the two objects moving together, and then surprising them by showing each of the objects seeming to move on its own, separately. The theory was that if infants clearly understood how inanimate and animate objects interact then they would be more surprised to see an inanimate object appear to move on its own.

Results of this study indicated that infants were not exceedingly surprised by the inanimate object's solo motion, contrary to our expectations. This could be because the inanimacy of the stimulus was less clear than we expected, with the stimulus itself being small and the stage somewhat deep. Alternatively, perhaps understanding of animacy and agency is only forming in infants aged six to seven months, and thus the ability required to successfully pass this task has not been adequately developed.



FIMO: Do infants think that it can move on its own?

Actions vs. Goals

Laura Wagner, PhD

These studies are looking at what kinds of information babies and toddlers can keep track of in a motion event. When your baby watches you move around the house, is he or she thinking, "Mom's going into the kitchen" (the goal of your motion) or instead thinking "Mom's walking" (the way you were moving)? We're interested in whether babies and toddlers can keep track of both of these kinds of information and if they have a preference for tracking one over the other.

For the babies who participated in this study, we showed them a short play in which a toy bunny moved to one of two goal locations (either a yellow tub or a purple platform) using some characteristic action (hopping, scooting, or gliding). We timed how long the babies looked at the bunny while it was performing one motion event, and then we changed it so that the bunny went to a different goal. We were interested in whether the new goal would attract the babies' attention and cause them to look at the display longer. So far, we have found that 11-month-old babies do track goal information (that is, they notice when the bunny changes goal objects) but only so long as the action used to get there wasn't too interesting: when the bunny scoots along on its bottom to the goal, babies don't seem to notice the goal change. In an ongoing follow-up study, we are looking to see which actions babies distinguish from each other to try to determine what makes an action more interesting than the goal of the event.

For the toddlers who participated in this study, we used small stuffed animals to act out a motion event, such as having a bunny hop into a bowl and having a frog swim across a board. Then we gave the animals to the toddlers and asked them to imitate what we had done. This study is still ongoing, but so far, it looks like 16 - 18 month olds are able to act out both the action and the goal part of the event. However, they have difficulty combining those parts into a single event. Usually, they act out just one element of the event (just the action, or just the goal) and sometimes they even act them out in the reverse order (putting the animal on the goal and then removing it to show the action)! We are continuing to work on this imitation study, and we're especially interested in how learning verbs might influence

The Spanish-English Study

Katie Kinzler, Graduate Student

We know a lot already about infants' early understanding of different languages. Previous research shows that within the first few days of life, infants prefer their native language to a foreign language and even distinguish between two sufficiently different foreign languages. This is certainly remarkable. However, we know little of how this early linguistic preference may preface a later social and cognitive understanding of other humans. We were interested in whether infants' early preference for a native language generalizes to a preference for a speaker of that language over a speaker of a foreign language.

Three, six, and eleven-month-old infants were familiarized with movies of one speaker who spoke in English, and one who spoke in Spanish. Both speakers were actually bilinguals, so that way half of the babies saw each speaker speaking one language, and half saw them speaking the other language. The speakers read the children's book *Curious George* to the babies. Then, babies were shown movies where the speakers stood next to each other smiling, yet no longer speaking. We measured which person the babies preferred to look longer at: it turns out that they prefer to look at the English speaker over the Spanish speaker!

This finding suggests that infants: (1) are able to pair a language to a face during the familiarization trials when the speakers are speaking, (2) remember that pairing later on when the speakers are no longer speaking, and (3) prefer to look at the face of someone who spoke their native language, relative to someone who spoke a foreign language. Future studies will investigate whether this early preference for a speaker of one's native language is specific to human faces and to natural languages, how it develops from early infancy through later childhood, and whether it supports cultural learning by predisposing infants to attend to, interact with, and learn from those who share their language. This research aims to further our understanding of infants' burgeoning social cognition, and how infants may use language as a cue for social understanding.

We are now attempting to replicate this finding with forward and reverse speech instead of Spanish and English. We are currently showing babies movies of a speaker who speaks in English, and one who says they same thing, yet the movie is played in reverse. Stay tuned for results from Forward/Reverse!

The Occluder-*Motion* Study

Kirsten Condry, PhD

The Occluder-Motion study was conducted with infants aged 3.5 to 4.5 months old. This study was presented on video, and your baby was seated on your lap in front of a large video screen whose center was covered by a long blue occluder box. For some infants, the box was Wide (13 cm tall), for other infants, the box was Narrow (6.5 cm tall). The figure below shows an example of the video set-up.

In the first, habituation part of the study, we showed each baby a yellow and red-spotted stick that moved up and down behind the occluder box. Some babies saw both ends of the stick moving together, as if they were connected. Other infants saw the two ends of the stick moving in opposite motion, as if they were not connected. After your baby watched this habituation motion until s/he was bored, we showed 6 test trials. On each test trial, we showed either the same type of motion as before (Old motion), or the opposite type of motion (New motion). We wanted to know whether infants could discriminate the two types of motion, and, if they could, whether the size of the occluder box would make a difference. We predicted that if babies could tell the New motion from the Old motion, they would look longer at the New motion because they were already bored with the Old motion.

What we found was that infants in the Narrow box condition looked longer at the New motion during the test trials, which suggests they could discriminate the two types of motion. Babies in the Wide box condition looked equally at the New motion and the Old motion during test trials, suggesting they could *not* tell the difference in this condition. Together these results tell us that babies are very good at detecting different motions when the two types of motion occur close together in space (as in the Narrow box condition), but not when they have to put together motion information over a large gap (like in the Wide box condition).

These results fit with our prediction that infants' ability to detect and discriminate motion differences depend on the size of the gap over which they have to notice the similarity (or difference) between the two types of motion. These results also fit with and help us to understand a series of previous studies that presented occluded objects with both Wide and Narrow occluders. Thank you to all the parents and babies who helped with this study!

Messy Food Studies

Kristin Shutts, Graduate Student

In a past newsletter we introduced a line of studies aimed at addressing what young infants know about food. At that point we only had preliminary results, but now – thanks to the participation of so many infants and parents over the past year — the studies are almost complete!

In one study, we simply asked whether babies could tell the difference between two different substance foods (e.g. orange juice in a glass and green sugar in a glass). To do this, we showed babies a person eating one kind of substance (e.g. orange juice in a glass) over and over again. Then, in "test trials," we asked whether babies could remember the initial substance and distinguish between that and a completely new substance. We showed babies trials of a person eating the old substance (e.g. orange juice in a glass) alternated with trials of a person eating the new substance (e.g. green sugar in a glass). Babies looked longer at the trials where the person ate the new substance, providing evidence that they remembered the initial substance and eating event.

In additional studies, we were interested in whether babies could track the familiar substance over a change in container. For example, we again showed babies a person eating orange juice in a glass over and over again. Then, in the "test trials," we showed babies trials of a person eating orange juice in a bowl (same substance, but new container) alternated with trials of a person eating green sugar in a bowl (new substance and container). Babies looked equally long at these events, suggesting that they had trouble using color and texture information to track the old substance across a change in container.

The results of these studies are provocative because they are so different from how monkeys, young children, and adults think about foods. For example, adults have no trouble recognizing orange juice in a glass, bowl, or completely novel container because when analyzing events involving food they pay attention to color and texture.

We are currently interested in whether studies that use solid foods rather than substances as stimuli will show the same pattern of results. Rebecca Rosenberg's sand studies (see "Baby Sand Study" on page 11) suggest that babies have trouble reasoning about substances in general. Therefore, we want to know whether our results would be different if we taught babies about solid food objects instead of substances. We'll let you know what we find in the next newsletter!

Baby Sand Study

Rebecca Rosenberg, Graduate Student

I am continuing to investigate how young infants reason about non-cohesive substances. Through observing their looking and reaching behaviors, I hope to gain insight into the differences between their knowledge of solid, cohesive objects (e.g., toys, people), and materials in the world outside that category (e.g. sand, water).

In one study, babies repeatedly observe one or two piles of sand being poured onto a stage. In the second phase of the experiment, they are presented with the same number of piles and a new number of piles in alternation. In similar studies using solid objects, infants have been shown to look longer or "dishabituate" to the novel number of stimuli, suggesting they have the ability to keep track of small numbers of objects. It is not yet clear, however, whether they can do so with substances, and if so, whether they are using the same strategies to solve the task that they do when the stimuli are solid objects. Several new variations of this study still need to be run to find the answers to these questions, and I will let you know as soon I have a clear result!

In a second study, infants between the ages of 14 and 18 months are given the opportunity to reach for and grasp at a pile of sand and a solid object designed to look perceptually similar to the actual sand. In the sand condition, the experimenter pours a pile of sand back and forth between two beakers and then on to a stage. She then models a "picking up" behavior with a bit of the sand, and encourages the child to copy her action. In the solid object condition, the experimenter dangles the object from a string and then places it on the stage and demonstrates a "two-handed-tapping" behavior on the object. Again, the child is encouraged to copy her behavior. After four such modeling trials, the experimenter gives the child four opportunities to grasp the stimuli without any prior modeling. Performing the correct action on this task requires that the child understand the difference in cohesion between the two types of stimuli, and maps the corresponding action to each. Results from this summer indicate that infants tend to start solving this task consistently around the age of 16 months, despite evidence that infants can perform predictive, distinctive reaches and grasps on solid objects based on their attributes by approximately six months of age. These data therefore suggest that reasoning about non-cohesive substances shows up at a much later age than reasoning about solid objects. I am now considering why this difference exists, and how children eventually come to an adult-like understanding of non-cohesion.

As always, I am truly grateful for your and your child's participation!

Baby MOT

Bailey House, Researcher

"MOT" stands for Multiple Object Tracking. Past research has shown that adults have difficulty keeping track of objects under certain circumstances, such as when the objects are too numerous, or when the objects behave strangely. When adults are asked to track a small number of objects as they move around on a video screen, they're able to do so with high accuracy, even if the objects are moving in and out from behind occluding barriers. That is, they're able to track the objects even when they're out of sight. However, when the objects disappear and reappear in an odd way, such as shrinking away to nothing and exploding back into existence, adults have much greater difficulty performing the task. In the Baby MOT study, we're trying this with 10 month old infants, to see if their object tracking abilities are similar to those of adults.

It's still too early in this study to tell if infants respond to this study like adults, or if their object tracking abilities are unique, but we'll keep you updated in future newsletters!

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