

# Infant & Child Studies

AT THE  
UNIVERSITY OF  
MARYLAND



## Did you know that...

by 2 months, babies can combine auditory and visual speech information? That infants can recognize patterns of musical sounds? That by 9 months, infants know that language is a conventional system? That 14-month-olds understand how to collaborate? That 3-year-olds remember events with people in them better than those without?

These are just a few of the recent findings by researchers at the University of Maryland that have been made possible by your participation in our infant and child studies. Our research groups - made up of professors, graduate students, post-doctoral fellows, undergraduate students, post-baccalaureate fellows and full time lab managers - wish to thank you for your support by sharing some of the exciting progress we've made this year.

We hope you find it as interesting as we do, and we look forward to seeing you and your children again soon!

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We have a wide range of studies  
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may be interested in participating  
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contact information or post it on a  
listserv. We welcome new  
participants!

Thank you

Thank you

Thank you



Thank you very much for your participation!

Questions?

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Want more copies of our newsletter?

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We look forward to seeing you again soon!

Where are they  
now?

Many of our researchers that  
you have met in our offices  
have finished their time at  
the University of Maryland:

Psychology: Maryland Infant Studies Lab

Annette Henderson -- Lecturer, University of Auckland, New Zealand  
Laurie Eisenband -- Graduate student, Vanderbilt University, Nashville, TN  
Joni Saby -- Graduate student, Temple University, Philadelphia, PA  
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Linguistics: Project on Children's Language Learning

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# The Language Development Laboratory

At the Language Development Laboratory in the Department of Hearing and Speech Sciences, we study how infants acquire spoken language and how their perception of language changes with development. We look at how well infants can follow a speaker's voice in noise, plus how they take fluent sentences and figure out where one word ends and another begins. We also explore language perception in older children and adults, looking to see how listeners adjust for variability in the speech signal and how both listeners and speakers find the appropriate words from the thousands that they know.

## Differentiating Between Multiple Sounds

*you can say that again...*

A primary focus of our lab's research is to understand infants' ability to hear in noisy environments. In our last two newsletters we reported that infants are far more susceptible to noise than adults are. While infants under 1 year of age are able to understand speech and pay attention in low levels of noise, they fail to do so in noise levels comparable to those found in most daycare settings! Moreover, while adults do better when there is a single person talking in the background than when there are multiple people talking, infants show the reverse pattern. If the overall noise level is kept constant, infants perform much better with multiple people talking (what we refer to as "multitalker babble") than when there is a single voice in the background.

This is particularly problematic because infants are probably faced with situations where there are only a couple of people talking far more often than they are faced with situations with large numbers of people talking; while parents may sometimes take their children to gatherings with lots of people, it's probably much more common for them to talk to their infant while a sibling is playing in the next room or the other parent is on the phone. Yet these settings seem particularly hard for infants. Why might this be, and what do infants use to get around this problem?

One thing that differentiates multitalker babble from a single voice is the variation in amplitude. When we talk, there are naturally periods that are louder and periods that are softer. But when lots of people are talking at the same time, those

variations tend to even out – the quieter moments from one talker aren't likely to be the same as the quieter moments from another, so the average amplitude level stays more constant.

Adults can "listen in the gaps" – when the background noise varies in amplitude level, they can focus their attention on the quieter times, allowing them to pick out what the main voice is saying during those moments. What we've found recently is that infants cannot do this – they don't seem to be able to focus their attention in that manner. We've been playing speech to infants with "white noise" in the background – this is noise that sounds like machine noise or air conditioner noise. When the noise was at a constant level, infants did not have as much trouble hearing people speak as when the background noise turned on and off, or varied in its level. The variation seemed to make it harder for infants to tune out the noise. This poor attention ability may be the primary reason why infants have such trouble when there is a just a single voice in the background.

What things make it easier for infants in these settings? In our prior research, we found that there are two major cues that infants can use to help them attend to one speaker when there's someone else talking in the background. First, infants do better when they know the voice that is talking to them: they can make out the speech far better when the voice is that of their own mother than when it's the voice of someone else's mother. Second, infants do better when they can see the person talking to them: if they're watching the person's face, they are far better able to understand what the person is saying.

## Methodology: Head Turn Method



Long before children are old enough to tell us what they know about language, we can gain clues based on actions as simple as a turn of the head.

In this task, the infant sits on a caregiver's lap in a three-sided test booth. In front of the infant is a light that flashes to get the child's attention, as well as a camera to record the infant's behavior. The walls on the sides of the infant also have lights mounted at eye-level, and there are speakers behind the lights. At the start of each trial, the light in the front of the booth flashes to get the child's attention. That light goes off when the child focuses on it, and then a light on one of the side walls begins to blink. When the infant looks towards the blinking light, sounds are played from the speaker on that same side. The sounds continue until the infant looks away for more than two seconds. Thus, the infant controls how long he or she hears each sound file.

A strong preference for one type of sound over another is used as evidence that infants can detect the difference between the sounds. For example, infants will listen longer to their name than to other children's names by 4 months, suggesting they can tell the difference between them.

## Hearing and Speech

2009 Newsletter



## Memory for Sounds

### tweets and whistles

In order to successfully learn language, infants must be able to store information about what they are hearing. They must be able to keep sounds in mind long enough to be able learn about sound patterns and to match words to an appropriate referent in the world. This type of memory, called working memory, is likely to be particularly important for word learning.

We've been exploring how much information infants can keep in memory. To examine this, we play infants a series of notes from musical instruments. We then repeat this series over and over. On some trials the series repeats exactly – so infants might hear a flute, then a tuba, then a piano, then a whistle, and then again hear a flute, a tuba, a piano, a whistle, etc. On other trials, one item changes with each repetition; infants might first hear the flute, tuba, piano and whistle, but then hear a flute, tuba, oboe and whistle, then a flute, saxophone, oboe, and whistle, etc. Infants typically listen longer when things change slightly, but noticing such a change requires that infants remember the series from one repetition to the next. We've been exploring how long of a sequence infants can remember.

In a series of three studies, we compared sequences of sounds that varied in the number and length of the notes. Across these studies, infants were able to

remember any sequence that was less than 1 second in length; but when the sequence became longer than one second, they stopped noticing these changes.

So it appears as if infants have a working memory capacity of about 1 second's worth of sound. This is about 3-4 syllables worth of speech, which may place limits on the kinds of words young infants can learn.



## Possibilities for the Future

Sometimes parents ask us what the results of these infant studies mean for the infants – what the implications might be for individual children. That's a very hard question to answer. But lately we've been finding that some of these laboratory studies actually predict children's later language outcomes.

For example, one type of laboratory task explores how infants can find the boundaries between words – whether they can identify where one word in a sentence ends and another begins. We found that performance at these tasks (at 7-12 months) is correlated to vocabulary size at 2 years of age, and grammar and vocabulary in kindergarten. Also, being able to listen in noise (see article to the left!) is correlated with measures of attention at age 5. These findings suggest that in the future we might be able to develop these types of infant tests to predict which infants might be at greater risk for later language impairment and then intervene proactively.

This year we began a major longitudinal study in which we are examining infants on a number of different perceptual tasks during their first year, and then following the children over time so that we can evaluate their language outcomes later on. We'll be exploring vocabulary and grammar, working memory, general cognitive skills, and speech production skills.

If you know of anyone who might be interested in taking part in a longitudinal study like this, please contact us at [infantstudies@umd.edu](mailto:infantstudies@umd.edu).

## Hearing and Speech

2009 Newsletter

# The Neurocognitive Development Lab




**Who can participate in these studies?**

We currently have studies for children between 3 and 6 years of age so we will contact you if your child is eligible. If you know of other families with kids in this age range, they can reach us at 301-405-5922 to learn about participating.

**Can I stay with my child throughout the study?**

Yes. Inviting parents to stay close to their children throughout the visit creates a pleasant environment for everyone.



## Who we are:

### The Neurocognitive Development Lab,

directed by Dr. Tracy Riggins, in the Department of Psychology at the University of Maryland opened in Fall 2008. The goal of our research is to learn more about how cognitive abilities, such as memory, develop in infants and children. We are especially interested in how these changes are related to brain development. Our research includes measures of children's behavior and brain function (such as recording of brain waves).

## What we do:

### Recording brain waves and what they mean...

The brain contains billions of cells (called neurons) and even more connections between these cells. When neurons communicate with each other they produce electrical activity. The electrical activity of neurons spreads throughout the head and can be non-invasively recorded from the scalp using specialized sensors.

Recording this electrical activity for a continuous period of time is called the electroencephalogram or EEG. An event-related potential (or ERP) reflects the brain's response to a specific event, such

as the presentation of a picture. This method allows us to present different pictures to infants and children and examine the brain's response to them. For example, we may show children a picture of a toy they have never seen before and a picture of a toy they play with all the time. We then measure the difference in the brain's response to each item. When the brain responds differently to the new versus the old toy, it shows us that the child's brain is differentiating these two toys based on the child's previous experience with the items. It's a "neural signature" that shows us they remember!



### Methodology: EEG


EEG has been used to examine brain activity in infants, children, and adults for over 50 years. It is a safe, non-invasive method for measuring brain activity. By placing recording sensors near the head we can pick up brain activity that is naturally emitted from the scalp. Recording brain activity from sensors is like recording a voice with a tape recorder: we simply hold our recording device close enough to the signal and we are able to capture it. The participant is not even aware the recordings are being taken. They just feel as though they are wearing a hat.

**Psychology**  
2009 Newsletter

# The Project on Children's Language Learning

## The Project on Children's Language Learning

in the Linguistics Department studies fundamental questions about how children learn their first language. Because so much of this learning process takes place before children are 2 years old, we rely on clues like infants' attention to videos and images to study how they learn the sounds, words and sentence structures of their language.

Wh-Words	Why?	Who?	What?
 <p>Questions, questions...</p>	<p>Understanding questions is a complex process. It involves knowing what question words (like <i>which</i>, <i>what</i>, and <i>who</i>) mean, and, at least in English, knowing that the word order in a sentence is different if you are asking a question or making a statement.</p> <p>It is interesting to look at when infants can first understand simple questions, as this can give us clues as to what other rules about the language they have acquired.</p>	<p>Previous research has shown that 20-month-olds can understand both subject questions (e.g. <i>Which cat fed the dog?</i>) and object questions (e.g. <i>Which cat did the dog feed?</i>), but that 15-month-olds can understand only subject questions.</p> <p>This research used a video of inanimate objects floating across the screen bumping into one another, and then showed the two objects side by side with the question.</p>	<p>Our study improves upon this design by using three animate participants (lovable puppets) and more trials to give the infants a chance to adjust to the task demands. With this improved methodology, we have found that both 15- and 20-month-old infants can understand both subject and object questions. Preliminary research also shows that infants as young as 15 months can understand subject and object relative clauses as well (e.g. <i>Show me the cat that fed the dog and Show me the dog that the cat fed</i>).</p>

## Methodology:

### The Preferential Looking Method

The preferential looking method involves videotaping children's eye movements as they watch short movies on a large TV screen. The child sits on a caregiver's lap, and the caregiver wears a visor so that he or she does not know what the child is seeing and so cannot influence the child's behavior.

The movies use a split screen to show two different objects or events at the same time. When the child hears a sentence, word or sound that matches one side of the screen, we expect the child to spend more time looking at the matching side than the non-matching side. For example, if the screen has a picture of a cup on the right and a picture of a ball on the left, children will direct their gaze to the ball when they hear the question, "Where's the ball?"





Children are given time to adjust to the new setting so they are comfortable before starting the studies.

### The audio-visual connection I see what you're saying...

Research suggests that the visual component of speech greatly influences how well we hear a person speaking, and that it can even create illusions in what we hear. Because the visual aspect of speech, like how our lips move, is so important, we are trying to find out what infants know about the connection between what they hear and what they see.

Even at 2 months of age, infants prefer to look at the face that is mouthing the vowel that they hear if they are given the choice

between looking at a video of a matching face or looking at a face that is mouthing a different sound.

We tried to challenge infants with sound combinations by pairing the sounds "wee" and "ee". Infants clearly preferred to look at the face that matched the sound they heard! The next challenge was "see" and "she", which did confuse our littlest ones - they looked at both faces equally, regardless of which sound we played. Now we get to move forward and discover why "see" and "she" was harder, and at what point in development infants become able to discriminate this pair.



## Learning Pronouns

Me, Myself and I

1. She's going to the store.
2. She's patting Katie.
3. She's patting her.



Picture 1



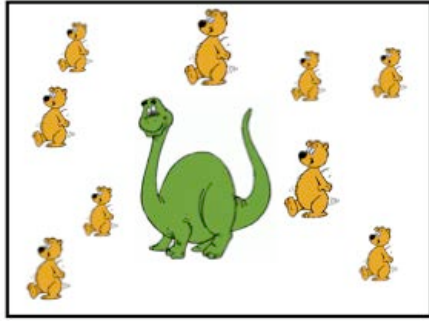
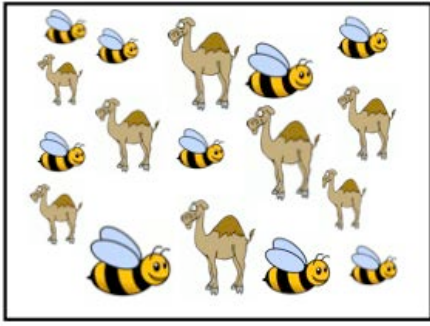
Picture 2

We're interested in finding out when children know who pronouns can refer to in different types of sentences. Most sentences are like sentence (1), where the pronoun can refer to anyone at all. However, in some sentences, like (2), the pronoun can only refer to people other than the person mentioned at the end of the sentence: in this case, Katie. In other words, sentence (2) can't mean that Katie is patting herself and so it can't describe picture 1. Since this seems like a pretty obscure fact about language, we're curious how early children know this and the related fact that sentences like (3) can also only describe situations like that shown in picture 2.

Over the past year and a half, we've run a series of studies aimed at finding out what children know about these sentences. We found that they know that sentence (2) must describe a picture like 2, but that they have more trouble with sentences like (3). Our next step is to create a simpler version of our experiment in order to find out whether children actually don't know that (3) cannot refer to picture 1, or whether it's just difficult for them to demonstrate that knowledge in the task we've given them.

## Linguistics

2009 Newsletter



## Most and More

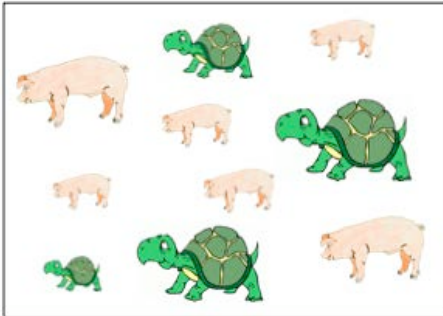
when you can't count on counting

Previous studies have shown that children learn to count long before they learn the meanings of number words. We're interested in finding out how children learn other words that have meanings that rely on numerical concepts. Do such words depend on the prior acquisition of number words? In this study we have been examining children's knowledge of the meaning of the word "most". In order to know, for example, whether most of the crayons are broken, you have to know whether there are more broken crayons than unbroken ones. And knowing that

would seem to depend on knowing how many of each there are.

In the first part of this study, children are shown cards with animals on them and are asked to count the animals and to say how many there are. Then in the second part of this study, children are shown cards with two kinds of animals, perhaps turtles and pigs. We ask them to count each kind separately, saying "How many turtles are there? How many pigs?" Finally, we ask them whether most of the animals are turtles or pigs.

So far, we have found that understanding the number words is independent of understanding "most". Many kids know what the number words mean without knowing what "most" means. But surprisingly, many others know what "most" means even if they don't know what number words like "five" or "nine" mean. Our current work is exploring how kids can represent the meaning of "most" without being able to represent precise number concepts.



## Methodology:

As you've read for our infant studies, we can learn about cognitive development through indirect measures of what children understand by recording where infants look when we ask a question. With preschoolers and older children the studies are often more interactive since they speak so much more. We can tell stories or play games, and learn about how children interpret sentences by asking questions and recording what they say or where they point. In this study, to learn about children's knowledge of words with numerical meanings, we simply ask them to make judgments about whether a word applies to a scene during a fun counting game.



## Linguistics

2009 Newsletter

## Sequential Learning

how agents affects memory

Around age 3, children are often very good at recalling events that have happened in their lives. Interestingly, verbal recall of these memories often centers around agents (such as people) and the goals that these agents possess. In this study, we looked at how a similar event is remembered depending on if there is an agent present or not.

Using picture books, we read 3-year-old children two stories that showed how various pieces could go together to create an object (either a bunny or a tree). In one condition, children viewed a person (Sally)

in the pictures and saw her hands assembling the pieces throughout the book. The children in this condition also heard sentences accompanying the book such as "Look, this is Sally!," "I wonder what Sally is going to make!" or "Now Sally puts this piece like this!". In another condition, children viewed the same pictures only without Sally or her hands, so that the pieces seemed to self-assemble. The sentences heard with this condition included phrases such as "Look at these things!," "I wonder what these things are going to make!" or "Now this piece goes like this".

After a 10-minute play period, children were given the pieces seen in the book and asked to recreate the object. Interestingly,

we found that children in the person (Sally) condition remembered and replicated more steps than those in the no-person condition. This may mean that the idea of a person (who has a goal of putting something together) makes the Sally condition more interesting, relevant and memorable for children. Future studies will look into what other aspects of these books affect children's memories.

## Psychology

2009 Newsletter



# Maryland Infant Studies Lab, Psychology Department



The Infant Studies lab in the Psychology department studies what infants understand about their social environment. Specifically, we're interested in what infants know about other people's actions. For example, when you see someone open a closet door, you may expect them to retrieve something such as a coat. You may also form some ideas about why they're performing this action. Maybe this person is feeling cold, or maybe they're getting ready to run some errands. Human adults are very good at inferring goals as well as possible mental states while observing an event, and this ability helps to make sense of the very confusing sea of action that surrounds us! The question we ask is how babies begin to form this understanding. The following pages show just a selection of some of the studies we are working on to answer this question.

## Goal Setting and Multi-Stepped Action

*I think I can I think I can....*

As adults, we are able to understand others' actions both in terms of their goals in the moment and in terms of longer range plans. For example, if you see your spouse pick up the car keys, you understand this action as directed at the goal of getting the keys. You also see it as a step in a bigger plan, like going to the store or heading to work. In a recent set of studies, we asked whether infants engage in this kind of reasoning, and if this reasoning affects how they imitate others' actions.

In the first study, 13-month-old infants viewed an adult who opened a container in order to retrieve a toy. Our question was whether infants understood that the toy was the adult's ultimate goal, even though she had also acted on the container. We gave infants the choice between the container and the toy. Infants were not required to imitate the observed actions, but rather to simply select either the container or the toy. Our prediction was that if infants understood that the adult's goal was the toy, then they would choose the toy rather than the container. In line with this prediction, infants systematically chose the toy.

Infants in a control condition saw an experimenter open the box and pick up the toy from next to the box rather than from within the box. Because there was no

## Methodology: Baby See

The ability to recognize that other people's actions are directed at goals is important in both adults and young children. As adults, when we watch someone reach up to grasp a toy off of a high shelf, we see more than the motion of that person's arm; we know that the person has a goal of retrieving that toy.

causal relationship between opening the box to retrieve the toy, the goal was ambiguous, and as we expected, infants to choose randomly between the toy and the box. This result shows that infants' responses in the first condition were based on their analysis of the adult's goals, rather than due to a preference for the toy.

In addition to these group trends, we observed an unexpected sex difference: girls imitated the goal in the experimental condition robustly, but boys did not. Girls and boys did not differ in the control condition, so this difference is unlikely to be due to preferences for the box versus the toy. We hypothesized that it might derive from sex differences in infants' own ability to complete the actions they saw the adult perform. The toys and boxes were small, and required the adult to use a pincer grasp to retrieve the toy. The pincer grasp, the use of the index finger and thumb to pick up smaller objects, is a fine

## Baby Do

Young children's understanding of others' goals is expressed in the ways they imitate others. Children selectively imitate others' goals, while varying parts of the action that seem less relevant to the goal. In these studies, we asked whether infants, like older children, imitate others' goals.

motor skill that varies widely at this age range and is a skill that girls tend to acquire slightly earlier than boys. Indeed, in a follow-up study we found that when we gave infants the same boxes and toys to play with, girls were more likely to use a pincer grasp to try to retrieve the toy than the boys.

Therefore, we hypothesized that perhaps the boys, who were still, on average, acquiring the pincer grasp skill, may have had a harder time making sense of the adult's pincer grasp actions. As a test of this hypothesis, in a final study we showed another group of infants events like in the first study, but this time with boxes large enough so that the toy could be grasped with the whole hand. In this study, both boys and girls systematically imitated the goal of the sequence. Taken together these findings suggest that the motor details of an action can affect infants' ability to infer the goals behind the action.



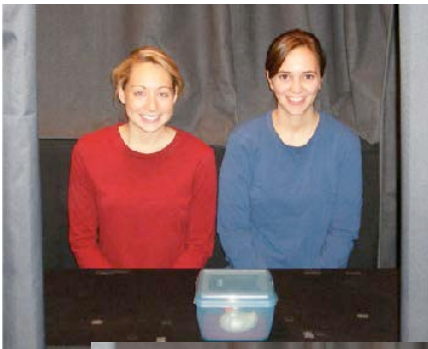
# Psychology

2009 Newsletter

# Collaboration

Let's work together!

As members of the human species, much of our everyday functioning relies on our abilities to collaborate with each other on some level or another. For example, it would be nearly impossible for us to successfully buy our groceries without the cooperation of many individuals (e.g., farmers, grocers, cashiers, etc.). In addition to being an important part of our everyday lives, collaboration plays an important role



in children's social and cognitive development. A growing body of evidence suggests that the propensity to engage in collaborative activities emerges early in development, however, much less is known about infants' understanding about such activities.

Our group has been investigating whether infants understand one of the fundamental characteristics of collaborative action – that the actions of collaborative partners are directed at the attainment of a common goal. To investigate this, we showed infants a simple collaborative activity in which two individuals worked together to get a toy out of a container. During this action sequence, one experimenter grasped and opened a container while a second experimenter removed the duck that was inside. Infants watched this action sequence until their looking times suggested that they were bored with the event.

At this point, the experimenter who had been interacting with the duck left the stage area, the container and the duck were placed on opposite sides of the stage, and the testing phase began. There were six trials in which the experimenter who had been interacting with the container either picked up the container, or the duck.

We predicted that, if infants understand that people who are engaged in a collaborative activity are completing their actions to attain a common goal, then infants should have viewed the actions of both experimenters as ultimately being directed at the attainment of the duck. That is, infants should have interpreted the actions of the experimenter who had been interacting with the container as ultimately being directed at the duck even though she did not physically touch the duck. If this were true, we would expect infants to be surprised (i.e., look longer) at the test events in which the experimenter retrieves the container.

The 14-month-olds, but not 10-month-olds, performed as we expected. That is, 14-month-olds looked longer when the experimenter grasped the container than when she grasped the duck. These findings suggest that somewhere between 10 and 14 months infants develop the understanding that the actions of two individuals engaged in a collaborative activity are ultimately directed at attaining the same goal.

## Methodology:

### Habituation

The visual habituation paradigm is a non-verbal way of testing infants' expectations. It uses the fact that everyone tends to look longer at events that are new or unexpected.

Habituation refers to any event in which an organism gets used to a stimulus so that the perceptual system stops responding to it. In other words, if you perceive one stimulus repeatedly, you will notice it less and less with time (for example, you don't really notice the sensations of your clothes on your skin by the end of the day).

Infants who watch an event repeatedly will stop responding to or looking at it after a while. Then we make a change to the event. If that change is meaningful to the infant, they will increase their looking time once more (called dishabituation or recovery).

This means they have noticed or encoded the difference. If they continue to look only for a very brief amount of time, they have not noticed the change (or the change is not significant or meaningful to them).



## Psychology

2009 Newsletter

## Methodology:



### Eye Tracking

We are currently running several studies using our eye-tracker to understand what babies attend to while watching short movie clips. The infant sits on the caregiver's lap in front of a special computer screen that can track a baby's eye movements. To do this, a bit of infrared light is emitted from various points around the monitor. This light is hardly detectable, and equivalent to the natural daylight experienced when walking outside.

A special camera at the bottom of the screen uses the reflection of light on the baby's cornea to project where on the screen the baby is looking.

Because all sets of eyes are unique, we start with a calibration phase to teach the machine what it looks like when the baby looks at 9 different locations on the screen. This information allows the computer to precisely compute where each baby is looking while watching the movie clips that follow.

This is a technology that has been used with adults for years, but just recently has been made easier to do with infants (i.e., it is no longer dependent on keeping the head very still), so we are excited about the addition of this methodology in our lab!

We are currently using eye-tracking to understand differential looking patterns during the first year of life, as well as during language acquisition.

## 12-month-olds' Prediction Skills

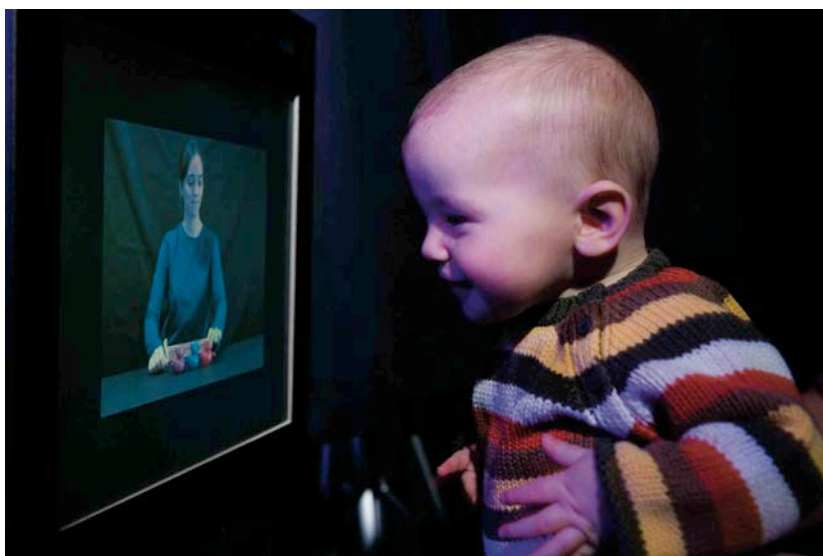
### Paving the Way for Smooth Social Interactions

In our center, one of the focal questions guiding our research is what do infants understand about other people's actions, and how do they acquire this understanding? One approach we are using to ask this question is to look at predictions infants make in the first year of life. The ability to make simple predictions about others' behaviors is thought to aid in one's understanding of a situation. We know adults and young children make many predictions during social interactions. For example, in situations where you are collaborating with your child, such as in stacking blocks, if you see your child moving with a block in hand, you can predict he is heading to the top of the stack. If you were about to place a block atop the stack at the same time, you may then modify your intended behavior to avoid collision. Predicting others' behaviors allows for smooth social interactions.

We investigated 12-month-olds' prediction skills using eye-tracking technology to look at visual anticipation, that is, looking ahead to the endpoint or goal of an action. We chose a target action that we knew 6-month-olds do not predict, but 12-month-olds are variable at, and adults and toddlers are good at predicting: putting balls into a bucket. We particularly wanted

to know if one's own interest in putting objects into containers influenced whether they anticipated the action when watching someone else. We gave infants a session to play with some toys and containers, and also a session of watching a video of a person putting balls into a bucket. We found a strong relationship between one's own actions and their predictions, but only when the infants engaged in the behavioral task before watching the video. Infants who were interested in putting many toys

Although some infants did predict the person's actions, it did not make these infants more likely to perform the action themselves. We believe this suggests an important role for how one's own experiences can influence one's action and social understanding. We are following up this work by testing younger infants, and also testing whether this relationship applies to only human actions, or if it transfers to similar actions made by non-human agents (e.g., machines).



into containers were more likely to anticipate the person putting balls into the bucket (i.e., they looked ahead to the bucket before the hand arrived), whereas those who were less likely to put objects into containers were less likely to anticipate the person's actions. However, we did not find this relationship when infants viewed the video first, followed by the action task.

## Psychology

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