Did you know that by 3 months, a baby can already identify goal directed actions? That at 16 months, infants use different strategies to learn novel words than they do at 19 months? That by 4 years, children use stress patterns of their language to predict word meaning?

These are just a few of the recent findings from researchers at the University of Maryland that have been made possible by your participation in our infant and child studies. The Linguistics department’s Project on Children’s Language Learning, the Maryland Infant Studies Laboratory in the department of Psychology, and the Language Development Laboratory in the department of Hearing and Speech Sciences 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 child again soon!

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Feel free pass on our contact information to friends or post it on a list-serve! We welcome new participants ☺
Here in the Infant Studies Lab in the Psychology Department, we study 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 is just a selection of some of the studies we are working on to answer this question:

**Goal-Directed Actions**

**Infants Reach for Their Goals (With "Sticky Mittens")!**

The first study many of you came into the Psychology Department for was concerned with three-month-old infants’ ability to understand others’ goal-directed actions. Infants of this age are not yet skilled at producing planful object-directed reaches and also do not understand another’s reach as object-directed.

One group of infants in this study had the chance to wear “sticky mittens” (with Velcro on them), allowing them to pick up and move toys when they touched them. Past research has shown that, having received this experience producing object-directed actions, infants of this age can come to understand another person’s reach as object-directed. In order to determine whether producing these actions oneself was necessary for learning or if infants could gain the same knowledge from viewing someone else interact with the toys and a mitten, a second group of infants viewed an experimenter move the same toys around using a large Velcro mitten. A third group of infants received no training with mittens but had the chance to play with the toys using their bare hands.

Infants’ understanding of others’ actions was assessed in a looking time paradigm. Infants saw a hand wearing a mitten reach for one of two toys on a stage until they were bored with watching this action. The placement of the toys was then switched. In test trials, infants saw the hand reach in the same place for a new toy (new-goal trial) or in a new place for the same toy (old-goal trial). When infants look relatively longer at the new-goal trials, this indicates that they are attending to the goal-relation in the event and view the reach as goal-directed.

Our findings indicate that self-produced actions provide a unique source of information for infants. Infants with sufficient experience producing object-directed activity with “sticky mittens” understood an experimenter’s reach as goal-directed in the looking time paradigm, whereas infants who gained passive experience with mittens or had no experience with mittens did not.

-Sarah Gerson
Sequential Actions
Pulling the Cloth from Our Infants' Eyes…and Toys?

By 8 months, infants are already quite good at both producing and understanding simple object-directed actions. However, previous research from our lab suggests that at this age they do not yet understand actions that are imbedded in a sequence such as pulling on a cloth to get an out-of-reach toy. Further, we know that coming to understand embedded events is highly related to an infant’s own experience with this type of action.

In a cloth-pulling study we gave some infants a lot of practice pulling on cloths to retrieve out-of-reach toys. Other groups of infants either observed an experimenter pulling on the same cloths to retrieve the same toys, or played with the toys and the cloths separately. With these three groups, we varied the type of experience infants had with an action embedded in a sequence.

In the second part of the study, all infants saw a new experimenter pull on a cloth to retrieve an out-of-reach toy in our looking time room. The experimenter pulled on the same cloth to retrieve the same toy over and over until the infants got bored of watching the action. Then the two toys switched places, and the experimenter either touched the new cloth with the old toy, or the old cloth with the new toy. By measuring which event infants looked longer at, we could assess whether the infants viewed the cloth pulling action as an embedded event (the cloth was a means to an end), or if they viewed the event as two separate goals.

We found that the infants who had a lot of experience pulling on the cloths to retrieve the out-of-reach toys were more likely to understand the cloth pulling action as an embedded event. Infants who either watched an experimenter perform this action or played with the toys and cloths separately did not understand the action as embedded. This study, along with the “sticky mittens” study, provides more evidence that infants’ own goal-directed actions play an important role in their understanding of others’ goal-directed actions.

-Laurie Eisenband and Neha Mahajan

Predicting Actions
Can Infants Predict the Future?

Adults are very skilled at predicting the behaviors of others. We are also masters of modifying our own actions in order to achieve a goal. This year we have been able to investigate the predictive abilities of infants with our new eye tracker. We wanted to investigate the development of the anticipatory system. In particular, we asked: Do infants predict other people’s actions within the first year of life? To study this, over the past year we showed adults, 6-month-olds and 12-month-olds a short film clip of a person putting balls into a bucket. Each participant viewed the film clip 9 times.

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Can Infants Predict the Future? - Part2
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We measured the time in which the ball arrived into the bucket in relation to the time one’s gaze arrived to the bucket. Therefore, if gaze arrived before the ball, we considered this a predictive look, whereas if gaze arrived after the ball arrival, we considered this a reactive look. We found that adults consistently made predictive looks and 6-month-olds consistently made reactive looks. An interesting note about the 6-month-olds: we found that prediction did not seem to be something that could be learned over several trials. This age group did not improve or learn to predict over trials. Our 12-month-olds seem to have mixed results: Some were predictive, some reactive, and many were sometimes predictive and sometimes reactive. We are now conducting a follow-up study with the 12-month-olds investigating if their interest, skills and strategies for putting toys into containers themselves is related to how they watch (and predict!) the actions of another person doing that same action.

-Linguistic Conventions

Word Meanings: Infants Don't Like To Share

Previous research by our group showed that 13-month-old infants expect two people who speak the same language to mean the same thing when they use the same word. This characteristic of language is referred to as conventionality and is one of the main reasons why words are such useful communicative tools. Do younger infants at eight to ten months possess the same understanding?

In this study infants watched as an experimenter repeatedly associated an unfamiliar word with an unfamiliar object. After this training phase, infants and parents went into the looking time room and watched again as the same experimenter continued to use the same label to refer to the same object. Infants were shown this until their looking times suggested that they were bored with the labeling event.

At this point, the side that the toys were on was switched and the testing phase began. There were six trials in which the experimenter produced the new word and either picked up the same object that had previously been linked with the new word, or the other object that had not been labeled. Half of the infants saw the same person during the training and test events. For the other half of infants, the person who was present for the test trials was different than the one they saw during training.

We predicted that, if infants expect that people who speak the same language use the same words to mean the same things then the speaker present during the test events should not matter. Both groups of infants should be surprised (i.e., look longer) when the speaker uses the same word to refer to a different object.

Our findings suggest that 9-month-old infants do not expect conventionality – while infants in the same speaker group looked longer when the same person used the newly learned word to refer to a different object, infants in the different speaker group did not. Thus, these findings suggest that somewhere between 9- and 13-months infants develop the understanding that different people from the same linguistic community use the same words to convey the same meanings.

-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 can 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).

-Annnette Henderson
The Project on Children's Language Learning 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.

This year, we have learned about how 8-month-olds sort patterns in a brand-new language, how 15-month-olds interpret question words, how 18-month-olds group words into phrases, and how 2-year-olds learn the meanings of verbs. Read on to learn about the details of these studies.

Noun Learning
I used to know that…

Do children use a word's position in a sentence to figure out what it means? Imagine that you see a hand using a truck to push a block across a table. While you see this, someone says, “It’s a vimble.” What does vimble mean? Hand? Truck? Block? Table? Now imagine that you see the same thing, but this time you hear, “She’s pushing with the vimble?” Are you more sure this time that the vimble is the truck? If you are, then you are as smart as a 16-month-old! We showed 16-month-olds, 19-month-olds and 28-month-olds videos like the one just described. Some of the infants heard sentence (1) and the others heard sentence (2):

(1) “She’s pushing with the vimble.”
(2) “She’s pushing the vimble.”

After this familiarization experience, we showed a picture of a truck and a picture of a block and asked, “Which one is the vimble?”

We found that 16-month-old infants were able to use sentence structure to figure out which one was the vimble. The children who heard sentence (1) looked more at the truck, but the children who heard sentence (2) looked more at the block. But, 19-month-olds didn’t do this. They always chose the block. And the 28-month-olds behaved like the 16-month-olds. So, it looks like children at different ages are using different learning strategies.

-Jeff Lidz
Phrase Structure
Running in the my dog is garden??

Sentences are composed of smaller units called phrases. For example, in the sentence, *My dog is running in the garden*, [my dog] and [is running in the garden] each form a phrase. Knowing how sentences are decomposed into smaller units is crucial in acquiring a language.

We conducted a head-turn procedure study to find out when infants become aware of these units and how they might acquire them. We created a miniature artificial language in which the only clue to the phrasal units was statistical distribution. That is, in this made-up language, words in a phrase appeared together much more frequently than words across phrases.

We played audio clips of sentences from the made-up language for about 2 minutes for a baby to be familiarized with. Then we presented two different made-up languages and tried to see which language infants preferred. One of the languages presented was the same made-up language they heard during the familiarization, the other was new. The new language involved the same vocabulary, but the phrasal units were different from the original language.

We found that 18-month-old infants listened longer to the new language than the familiar language. This tells us that 18-month-old babies can learn phrasal units of a made-up language based on the statistical distribution and that they can use this knowledge to distinguish the two different languages.

- Eri Takahashi and Jeff Lidz

Recognizing Speech Patterns:
The Possibilities are Endless!

We are currently running a study with 8 month olds where we investigate how sensitive they are to rules in the world's languages. Some kinds or rules are possible and occur cross linguistically, for example "put stress on the first syllable". Other kinds of rules never seem to occur, for example: "put stress after the letter b".

We looked at whether infants are aware of these facts about language, and whether they use them when hearing new linguistic materials. We looked at this by playing infants words from a made-up language that would let them consider various stress rules in the first part of the study, and then switched to words that only follow a possible or impossible kind of rule.

The neat finding is that even at 8 months, after only 2 minutes of exposure, infants listen longer to the words following the possible rule! It seems that even our young not-quite-speaking infants have a sense of what kinds of patterns are in the realm of possibilities for language.

- Elka Bergelson and Bill Idsardi
Verb-Learning: Three Studies

Action-Word Pairs
The Penguin Is Doing What?!

Infants are amazing word learners, aren't they? Even when they are hardly saying any words, they understand quite a bit. At 14 months old, they can learn brand new words, even for objects that they've never seen before. We know they can learn nouns already, but verbs seem more complicated. And since children don't start using lots of verbs until around their 2nd birthdays, we wanted to know just how early infants would be able to learn new verbs. To explore this, we paired actions with made-up verbs - for example, when an animated penguin jumps up and down and we say "it's doking!", but when the penguin spins around, the video says that "it's praching!" But then if we call jumping "praching," will they be surprised?

When kids are 21 months old, they are very surprised when we change the action-word pairing, suggesting that they've formed a link between the verbs and the events. It is also beginning to look like 14-month-olds are also surprised by the change - but we need a few more participants to know for sure if they are already learning the verbs at this young age.

-In Rebecca Baier

Intransitive Verbs
The flower can blick, can you?

Have you noticed that the words your toddler says are more likely to be nouns than verbs? As we mentioned earlier, children do not begin producing large numbers of verbs until after their 2nd birthday. We’re interested in finding out how verb learning differs from noun learning. In a series of experiments, we tried to teach toddlers around 2 years old new verbs in different sentences to see what helps them learn versus what could hinder learning. We showed videos, for example, of a flower spinning. While they saw this video, some children heard sentence (1) and some heard sentence (2).

(1) The flower is blicking.
(2) It is blicking.

After introducing the verb, we presented two different videos side by side – one shows the flower jumping and the other shows a sprinkler spinning. While they see these two videos, we ask them, “Which one is blicking?” We measure the amount of time they spend looking at each video in order to determine which video they think has blicking in it. We found that children who heard sentence (1) looked longer at the spinning sprinkler than the children who heard sentence (2). So, it looks like hearing a more descriptive sentence helps the children learn the unknown verb.

-In Jeff Lidz

Causative Verbs
Results about results

We’ve had a lot of studies about verbs! As we study when children understand verbs, and what helps them learn verbs, we also want to know what meanings they assign to new verbs. For this, we introduce them to Causative verbs – for example, they hear “She’s pimming the ball!” when they see a girl bouncing a ball with a tennis racket. As adults, “pimming” means that the girl causes the ball to bounce. That is, if the girl doesn’t touch the ball, she isn’t pimming the ball and the same if she tries to bounce the ball but it deflates instead! Do 2-year-olds learn both parts of this meaning, and if not then what do they most pay attention to?

We showed toddlers videos of the girl “pimming” the ball and measured their attention when we made a little change to the video. We learned that the children were very surprised when the ball started to deflate! They were less surprised when the girl stopped touching the ball, suggesting that children focus on the result of the action more than the cause of the action.

-Ann Bunger and Jeff Lidz
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 talker’s voice in noise, and 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.

Identifying Emotions
Be Afraid, Be Very Afraid...

One important skill for a young infant is to be able to discriminate among different emotions in a speaker – if you say “don’t touch that!” in an angry or frightened tone-of-voice, it means something very different than if you say it in a resigned sort of voice!

Part of that skill involves matching the tone of voice to the emotion portrayed on the face. Most research in the past has focused on children’s ability to distinguish between emotions – to tell that they’re different. But infants also need to figure out which tone of voice goes with which emotion – that is, not only to tell that someone’s voice sounds different from one occasion to another, but to identify what that difference actually means.

To explore this, we have been looking at children’s ability to match tone of voice with a particular facial expression. Infants can successfully match faces to voices when the emotions are extremely different (i.e. happy and sad). But what about more subtle differences?

In these studies, we tested infants in two age groups: approximately 10 months and 16 months of age. In the first two studies, infants saw two TV screens, each of which showed a woman displaying a different facial expression. On one screen the woman appeared to be happy, while on the other she appeared to be surprised. At the same time, we directed infants to look at the screen, saying things such as “Look! Over there! Do you see?” in either a surprised, or happy tone of voice. But infants did not look any longer at the face that matched the voice they were hearing than at the face that mismatched.

In our most recent study, we developed a slightly easier matching task, using the emotions of happiness and fear. While being afraid is very different conceptually from being happy, the tone of voice used to convey these emotions is similar in duration, pitch, and rate. In this study, infants saw only one face at a time: the face was either happy or afraid. The tone of voice of the woman speaking sometimes matched the face on the screen, and other times did not. Infants in this study still did not show a preference for looking at the screen when the emotions matched as compared to when there was a mismatch.

It appears that matching tone of voice to facial expression is extremely difficult for infants, even infants as old as 16-months. These results suggest that infants may have a very limited understanding of tone of voice at this age. While they can match emotions that differ widely, such as happiness vs. sadness, more subtle differences in facial expressions or tone of voice may not yet be understood.

-Rochelle Newman
Sound Categories
What Gaelic Can Tell us About Geese

Have you ever tried to learn a foreign language? One of the problems many adults face when learning a second language is that they have learned to ignore differences between sounds that are not important in their native language. This makes it very hard to hear the distinctions other speakers are making. For example, say the words “geese” and “goose” – those two “g” sounds are actually very different acoustically. In some languages, such as Irish Gaelic, those two sounds would be treated as two entirely different letters. But as adult speakers of English, we have learned to ignore those differences, and to perceive the two sounds as similar.

Infants come into the world not knowing which sounds will be important in their native language – they can therefore hear distinctions that adult speakers have learned to ignore. (Thus, at first, infants’ ability to discriminate between different speech sounds is actually better than adults!) During their first year of life, infants learn to ignore distinctions that are not important in their language. So, if adult speakers sometimes produce a sound one way, and sometimes produce it another way, infants learn that the distinction isn’t important, and they begin to treat the two variants as being the same thing. This learning seems to take place between 8 and 12 months of age.

But the distinction between the two “g” sounds described above doesn’t vary randomly in English: speakers always use one type of “g” before vowels like “ee” and “ay”, and the other type of “g” before vowels like “oh” and “oo”. We refer to these two different versions of “g” as allophones: two acoustically different sounds that are treated as the same category. This consistency may make it harder for infants to learn that the distinction doesn’t actually mean anything. Indeed, our results so far suggest even 16-month-old infants have not yet learned the pattern for their language. When (and how) infants manage to learn about allophones is something we will continue to explore.

- Rochelle Newman

Stress Patterns
Noun or Verb?

You may never have noticed this before, but nouns and verbs in English happen to “sound different” – nouns tend to be longer, to have different vowels, and to have different stress patterns (think of the noun and verb versions of record & rebel).

Adults use these differences to help them figure out a new word. So take a nonsense word like “cavel”. If you were to hear it pronounced CAH-vel (to rhyme with gavel), you’d be more likely to think of it as a noun; if you heard it as cah-VEL (like kvetch), you’d be more likely to think of it as a verb.

Turns out that children do the same thing – but they only seem to notice some aspects, and not others. We presented 4-year-old children with videos in which an object performed an action (such as a ball rolling off a table). At the same time, a puppet who spoke a different language gave his word for the event. When the word was long, children assumed the word referred to the ball; when the word was short, children assumed it referred to rolling. This follows the typical English pattern of shorter words being more likely to be verbs. But children didn’t seem to be influenced by the stress pattern: saying a word with stress on the first syllable didn’t make it sound any more “noun-like” to young children. This provides some indication of the properties of words that children first cue into in their search for patterns in their language.

- Rochelle Newman
Hearing in Noise:
Can you hear me now?

A primary focus of our lab’s research is to understand infants’ ability to hear in noisy environments. Most research examines infants’ ability to learn new words and comprehend language in the lab setting – but the real world is often a far more chaotic place! How much can infants understand in the types of noise they typically experience?

To look at this, we have been using something infants typically learn very early: their own name. In a quiet environment, infants listen longer to their name than to another child’s name by the time they reach 4 months of age. In our studies, we have been investigating children’s ability to do this when there is background noise, such as the sounds of other people talking.

In last year’s newsletter, we reported that infants are far more susceptible to noise than are adults: while infants under 1 year of age are able to understand speech and pay attention in very low levels of noise, they fail to do so in noise levels comparable to those found in most daycare settings!

More recently, we have been looking at the types of cues infants can use to help them in these settings. And here, too, we find some striking differences from adults. While adults tend to 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 than when there is a single person in the background. In fact, infants appear to be so distracted by a single background voice that even noise levels we would hardly notice can affect their hearing ability. And while adults do better when the background talker and the primary voice come from different locations in space, infants do not: they do not seem to be able to use spatial location differences to help them separate out different streams of speech.

Thus, infants don’t simply have “poorer” hearing than adults – they show a different pattern of response to noise altogether, something worth keeping in mind when evaluating the noise level in an environment!

-Rochelle Newman

In our next newsletter look forward to learning about infants and:

Two-month-old lip-reading
Understanding actions in a sequence
Using emotions to guide understanding of others’ actions
Where infants look when they’re learning a new word
Learning question words
Pronoun comprehension
...and more...

Thank you so much for your participation!!!