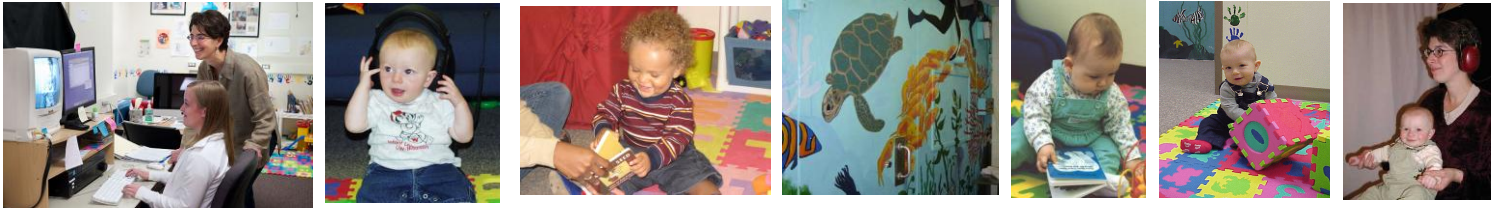


The Infant Insider

Infant Learning Lab Newsletter 2012 in Review



Dear Parents and Friends,

Thank you so much for participating in the language and music research studies being conducted at the University of Wisconsin's Infant Learning Lab!

Even though many of our participants are not yet talking (we have studies with children as young as 6 months of age), all of our participants are paying close attention to the sounds, syllables and words that surround them. With your and your child's help, we are able to address important questions related to language acquisition. Answering these questions will help us to better understand how typically-developing infants process and learn language, information that could lead to a better understanding of what happens in cases where children don't acquire their first language as readily.

Many families participated in one or more studies over the last year, and we have been busy collecting data for all of these studies! As always, we have had some very interesting and exciting results. This newsletter is intended to highlight the findings of some of the different studies we have been conducting over the last year. In addition to the study highlights, you can find a list of recently published work at the end of this newsletter.

We hope that you and your child had an enjoyable visit to the Infant Learning Lab. Thank you again for your participation! Without your help, this important research could not happen. If you would like copies of any of the papers we are writing or have any additional questions or comments, please feel free to call us at 608-263-5876 or email us at babies@waisman.wisc.edu.

Thanks again!

Jenny Saffran, Ph.D. – Principal Investigator
Brittany Thomson, BA – Laboratory Manager



Studies in brief

A Toothbrush in the Kitchen? How Context Affects Children's Understanding of Words

When you talk to your child, you might notice that you use certain words in certain places. For example, when you're in the kitchen, you typically use words that have to do with eating, such as "apple," "spoon," or "banana". If you're out at a park, though, you're less likely to use those words. Instead, you might talk about the flowers, grass, and sticks that surround you. I'm interested in how this type of contextual information—the information provided by the surrounding scene—affects how children represent and process words. To ask this question, I am bringing 18-month-olds into the lab and showing them short movies. Although the screen that plays the movies looks like a normal TV monitor, it is actually an eye-tracker. As children watch the movie, the eye-tracker automatically records where they are looking at each frame. This is very useful because kids' eye movements provide a window into what they're thinking.

The movies in this particular study start with a picture of a scene. For example, a child might first see a kitchen. Then, two objects appear, such as a spoon and a toothbrush. The child hears a sentence, such as "Where's the spoon?" Using the eye-tracking system, we can see how long it takes for kids to look at the correct picture after they hear the sentence. In some movies, children are directed to find objects that match the background scene (for example, a spoon in the kitchen). In other movies, they are directed to find

objects that do not match the background scenes (for example, a toothbrush in the kitchen). By comparing how fast it takes for children to find objects in their typical and atypical contexts, we can see whether context affects young children's processing of words. While we are still looking at the data, the study looks promising.

Erica Wojcik, M.S.
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Congratulations, Erica!

Erica was presented with the Paula Menyuk Travel Award and gave a talk on her research findings at the 37th annual Boston University Conference on Language Development!

Do Bilingual Children Have an Advantage in Differentiating Words Spoken by Different Speakers?

A lot of research has been done on the idea of Statistical Learning, both in our lab and by other researchers. Statistical learning is the idea that infants are able to figure out which syllables create words and which ones are at word boundaries in a fluent stream of speech. As adults, when we hear somebody speak in a foreign language, it sounds like one really long word without breaks between each individual word, and children feel the exact same way! So how is it exactly that they are able to figure out words? Research, both in our lab and done by others, has found that children use statistics to figure out which syllables are more likely to



come together – therefore those that make up words – and which ones only happen occasionally – at word boundaries. What happens though when infants hear words from more than one speaker?

The question then is whether infants consider the same word spoken by two different people to be the same or different. To find out whether this is the case or not, we have infants in a soundproof booth listen to a man and a woman having a conversation in Italian at a normal speed. After they hear the conversation, the infants are tested on words they heard from one speaker or the other to see whether they consider the words the same or different. A post-doctoral student in our lab ran this study with monolingual infants aged 8.5 to 10.5 months, and didn't find a significant pattern in how children responded to the words. This time around, we are running the study with children who have had exposure to a language besides English. We are interested in seeing if infants who have as little as 10 hours a week of exposure to another language, or as much as full time exposure to a language besides English, are able to tell us more about how infants distinguish words from multiple speakers. This study is currently underway, but we hope to be able to provide more information on the results in the next newsletter.

Federica Bulgarelli

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What do babies do when they first hear a tonal language?

In English, if you say “cat?” vs. “cat!” you would be using different intonations (i.e., a rising vs. falling of your voice) to denote whether it's a question or a statement. However, English-learning kids still know that in both cases you are referring to a four-legged furry animal. Interestingly, the situation is completely different in languages that use tones. Take Mandarin Chinese for example; the sound “bah” with a high flat tone vs. a falling tone would mean “eight” and

“father,” respectively. And while the sound “mah” with a high flat tone means “mother,” it is understood as “horse” when pronounced with a low dipping tone.



Though English-speaking adults find it tremendously difficult to recognize the contrasts in this kind of tonal information, previous research has shown that young babies outperform adults in telling non-native sounds apart, suggesting flexibility in their speech perception.

In response to these observations, we wanted to see what babies might do when tones become part of speech. In this tonal statistical learning study, we designed an artificial language to incorporate tones into a syllabic string of sounds. After having a baby listen to it for three minutes, we played several different segments from the artificial speech (basically “words” in the artificial language) to see if they had picked up on some of the tonal patterns from the speech. The same task was run on different groups of adults, including a monolingual English group, a monolingual Mandarin group, an English/Mandarin bilingual group, and an English/non-tonal (i.e. Spanish, German) bilingual group. Thus far, monolingual English adults have shown difficulty in taking advantage of the cues provided by tones. Though the results are inconclusive right now, we are interested in seeing if the results from our baby study will show a different pattern.

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Congratulations, Tianlin!

This work was presented as a poster at the 37th annual Boston University Conference on Language Development

Word Learning and Visual Attention in Children with Autism

When learning new names for objects, it may sometimes be difficult for children to immediately tell which word describes which object. For example, there are many situations wherein two objects may be labeled at the same time, without any information indicating precisely which is which. Consider this scenario:

A toddler is playing in the sandbox, building a sandcastle. The child's father says, *Look! You have a **shovel** and a **pail**!*



This child does not yet know the word *shovel* or the word *pail*. He is very focused on his play and not tuned in to other cues his father might have provided while labeling the objects, such as looking at or pointing to the shovel and pail separately. So, in this learning context the child has been exposed to two

new words (*shovel* and *pail*), but he does not yet know which word describes the object that digs up the sand, and which word describes the object that holds the sand.

The next day, the child is again playing outside with his father, this time gathering rocks and putting them into a bucket. The child's father says, *Look! You put a **rock** in the **pail**!* The child may or may not notice, but the hollow object with a handle was present both times the father said the word *pail*, suggesting that this word and object go together.

Across these learning situations, and many more just like them, it would be possible for the child to discover the meaning of *pail*—and many other words—by picking up on the statistics of the auditory labels and visual objects.

Researchers have found that infants as young as 12-14 months can learn new words in this manner—a mechanism referred to as ‘cross-situational word learning,’ because it requires children to gather statistics about auditory and visual information across learning situations (Smith & Yu, 2008).

It is not known, however, whether children with autism spectrum disorders (ASD) can use this word-learning mechanism. ASD is characterized by social communication impairments and repetitive behaviors and restricted interests. Many children with ASD have considerable language delays, and it is critical to determine the sources of these delays. Much work has focused on social word-learning deficits in these children, but relatively little is known about their non-social learning difficulties.

Courtney E. Venker, a speech-language pathologist and doctoral student in Communicative Disorders, is currently conducting a project to address this question. Her study, called LINGO (Listening and Interpreting Nouns through Good Orienting), uses eye-tracking methods to examine cross-situational word learning in children with ASD (4-7 years of age), as well as typically developing children matched on receptive vocabulary (2-7 years of age).

In the LINGO study, children are first taught four new words, two at a time, on an eye tracker. Within a single trial, no information is provided about which word goes with which object. The appropriate word-label associations only become clear if children are able to track label-object contingencies across trials. After the teaching phase, children are presented with a series of questions on the eye tracker (e.g., *Where's the toma? Do you see it?*) to determine whether they learned the new words.

In addition to determining whether children with ASD are capable of cross-situational word learning, Courtney is also interested in how patterns of visual attention may impact word learning in this population. To address this question, participants in her study also participate in a visual orienting task that captures how long it takes children to look at new things that appear in their environment. This is an interesting question because some children with ASD demonstrate difficulty disengaging their attention from an ongoing stimulus to look at

something new—a phenomenon known as ‘sticky attention.’

Courtney is conducting this project in conjunction with the Language Processes Lab, directed by her advisor, Dr. Susan Ellis Weismer, and the Infant Learning Lab, directed by Dr. Jenny Saffran. The study is supported a National Research Service Award from the National Institute of Deafness and Other Communication Disorders (NIH F31 DC12451).

Because the LINGO study is ongoing, eye-tracking data has not yet been analyzed. Behavioral results from a pointing task suggest that some children are able to learn the new words in the cross-situational task quite easily, whereas other are not. This is the case for children with ASD as well as typically developing children, meaning that there appears to be much variability in learning across both groups.

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Finding the Important Information

What kinds of patterns do people notice first? And do children pay attention to the same cues as adults? We know that for the most part, children have an easier time learning language compared to adults, and we wanted to see if one of the reasons for this is that children are able to zero in on one piece of information at a time. In continuing work on the differences between children’s and adults’ learning, we wanted to know how children decide what is important when they are presented with complex and even conflicting information.

Languages, like so many other aspects of the world, are full of patterns, and some of the patterns may overlap or conflict. For example, a child could learn that in English, when you add “-s” to a word like

“apple”, it becomes plural. However, there are exceptions to this rule, such as plural words like “children”, making the language system hard to learn and forcing learners to pay attention to different kinds of information.

To explore the way people choose between different kinds of information, we showed children pictures that appeared in a complex visual and spatial pattern. Past work with adults had shown that when adults see shapes that appear according to different patterns, they tend to pay more attention to *where* on the screen it is than *what shape* it is, but in general, the presence of two overlapping patterns makes it hard for them to learn either one. Other research has also shown that sometimes, children can learn things that adults cannot, possibly because adults try too hard to figure things out. We wanted to see if that would be the case in this task.

However, what we found is that children also struggle when there is too much information to process. To try to make the task more engaging for them, we used pictures of Sesame Street characters and found that toddlers pay far more attention to faces than to abstract shapes. However, they were still not able to show that they were learning either pattern, so we are now trying new ways to both make the task more interesting and simplify it so that toddlers are not so overwhelmed by the complexity. We hope to use this task to see if there are ways that children and adults differ in how they choose what information is important and if these differences help us understand why children typically have an easier time learning a language than adults do.

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*Chris Potter was awarded the
National Science Foundation
(NSF) Graduate Research
Fellowship this year!*

Can English Learning Infants Learn Words from Mandarin Speech?

While seventy percent of the world's languages are tonal and over half of the world's population speaks a tonal language, people from non-tonal language backgrounds (i.e., English, Spanish) often find it difficult when they try to figure out the tones. In tonal language such as Mandarin Chinese, pitch height and pitch contour are integral features of word meaning. This means that Chinese syllables that have the same consonant and vowel, but different tones, convey different meanings. This seems to bring new challenges for our young language learners. But is tonal information really making a language harder to learn? Can babies pick out high frequency words from fluent tonal speech?

We all know that babies are really good at learning languages. A lot of previous studies done on non-tonal languages, such as English, Spanish, and Italian have shown that kids are really good at picking out words from natural speech and they learn new words from foreign speeches quite rapidly. So what about replacing non-tonal speech with tonal speech? Can kids still learn?

Related research using Thai tone types has shown that 4- and 6-month-old English- and French-learning infants were able to tell the difference between Thai low and rising tones after they listened to these two tone types for just 30 seconds. In contrast, 9-month-old infants failed to distinguish these two tones. Babies are definitely capable of learning tone types if they receive early exposure and this developmental pattern is similar to their learning of consonants and vowels. However, natural language is much more complicated than



just tone types. In this study, I am interested in using natural Chinese speech to investigate whether 7 to 8.5-month-olds can distinguish Chinese words that are not only different in consonants and vowels but also different in tones. If babies successfully discriminate these words, we will then increase the difficulty level of the task by using words that consist of the same consonant and vowel but different tones. This is to investigate whether babies can differentiate tonal words solely based on different tonal information. This study is currently in progress, we hope to show you the results in the newsletter next year.

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Language Comprehension in Children with Neurodevelopmental Disorders

Fragile X syndrome is a developmental disability that results from a mutation of a gene on the X-chromosome. It is the leading inherited cause of intellectual disability and tends to affect boys more severely than girls. Some boys with fragile X syndrome are also considered to have autism spectrum disorder (ASD) because some symptoms of ASD and fragile X syndrome overlap.

Symptoms of ASD can include repetitive speech and difficulty with aspects of nonverbal communication, such as eye contact. Most boys with fragile X syndrome have impaired language; however, little is known about what aspects of language are most challenging for boys with fragile X syndrome—and the same is largely true for boys with ASD. We assessed the comprehension of single words, simple sentences, and complex sentences using an eye-gaze task as a first step towards understanding more about the language comprehension profiles of boys with fragile X syndrome and boys with ASD.

Participants included 25 boys with fragile X syndrome between the ages of 5 and 12, 17 boys

with ASD between the ages of 4 and 12, and 31 typically developing boys between the ages of 2 and 7. Participants saw sets of pictures accompanied by a sentence that matched one of the pictures. Pictures of animals tested single word comprehension (e.g., *dog*). Pictures of animals acting out sentences that differed in word order tested simple and complex sentences (e.g., *The mouse pushes the bear* vs. *The bear pushes the mouse*; *The bear is pushed by the mouse* vs. *The mouse is pushed by the bear*). Participants' comprehension was measured in terms of whether they looked at the pictures that matched the sentences.

For boys with fragile X syndrome, single word comprehension was related to performance in other tasks, including those that assessed nonverbal cognitive ability and vocabulary ability. On average, all three participant groups demonstrated comprehension of simple sentences. For typically developing boys, simple sentence comprehension was related to nonverbal cognition and single word comprehension. Participants with typical

development, on average, demonstrated comprehension of complex sentences during the eye-gaze task. Complex sentence comprehension was related to age and nonverbal cognition for boys with typical development and boys with ASD.

Results were based on relatively small subsets of participants and should be interpreted cautiously; however, this research was a step in demonstrating the utility of eye-gaze measures for studying comprehension in children with neurodevelopmental disorders. Although the focus of the study was on sentence comprehension, results regarding comprehension of nouns suggest that word processing might tap theoretically important aspects of ability, even in school-age children with neurodevelopmental disorders. Possible future directions include extending this research to children at different developmental levels or children with other sources of language impairment.

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Sara Kover is currently a postdoctoral fellow in Communicative Disorders at the University of Wisconsin-Madison. She received a Ph.D. in Educational Psychology in May 2012; this research was a portion of her dissertation (NIH F31 DC010959)



Learning Through The Noise

In order to learn new words infants must connect the words they hear in their environment to the matching object. Infants often hear words when there are lots of things going on in their home—for example the television might be on while they hear you say the word “ball” and watch you point to a ball.



How do infants know that the word you are saying and not what they are hearing from the television is the name for the object?

Nowadays homes are filled with

potential distractions to word learning, such as television, radios, and multiple people talking, and yet children are great at learning words. Previous studies have found that infants can learn words with very little training, but they have not looked at how the environment may impact this ability.

We have begun investigating how well fairly novice word learners, 22- to 24-month-olds, as well as more experienced word learners, 28- to 30-month olds, are able to learn words when there is background noise present during word learning. To do this we first introduce children to two novel words, “coro” and “tursey”, by having them watch a video while listening to sentences with the words in them (e.g., “The doctor picked up the coro” and “A tursey is on the table.”). We then taught the infants what object the novel words correspond to. Infants

saw a video of an object move up and down the screen while they heard it labeled by the words they had previously heard (e.g., “Look, it’s a coro. Wow.” or “See the tursey? That’s cool.”). After training we then tested whether infants learned the new words. We showed infants the two pictures side-by-side and asked them a sentence directing their attention to one of the pictures (e.g., “Where’s the coro?” or “Find the tursey.”). If infants learned the words, then they should look longer at the correct picture.

To see how noise in the environment impacts children’s word learning infants heard



background noise while learning the new words. To do this we created two-talker babble by overlapping two sentences produced by a male speaker. This babble speech was played on the speakers to the side of the infants, while the speech that was teaching them the words was played from the speakers in front of them. By playing this babble speech at the same time as the word learning speech infants must choose which speech stream they want to listen to.

We used two different volumes of background noise to test infants’ ability to learn words when noise is present. This study is still underway, but preliminary results are promising. So far it appears that both age groups are able to learn words when the background noise is quieter. However, increasing the volume of the background noise by 5 dB makes it difficult for children to learn words. With the louder background noise, younger children, 22- to 24- month-olds, were unable to learn the words. Older children, 28- to 30-month-olds, are great at learning new words, and continue to do so even when there is louder background noise, but they have more trouble doing so than in quieter noise. The preliminary results from this study indicate that the volume of background noise influences a child’s ability to learn words, as does the age of a child. This study is ongoing and it will be interesting to see if this difference in age group performance persists.

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Babies Use Known Words



to Learn New Words

Your baby hears millions of speech sounds over the first year of life. Every time you say something, sounds and syllables make their way from your mouth to your baby’s ears, and your baby has to figure out where the words are and what you are trying to communicate. This task is not trivial. How is your baby supposed to know where to chop up a sentence into words? How does your baby figure out where each word begins and ends?

If you listen to yourself or to other parents, you will probably notice that you sometimes say long sentences, and you sometimes say single words. For example, if a dog walks by, you might say to your baby, "Doggie! Look at the little doggie over there!" According to estimates, up to 10% of things parents say consist of just one word. A postdoctoral researcher in our lab, Casey Lew-Williams, has been trying to figure out how these single words might help babies learn about language.

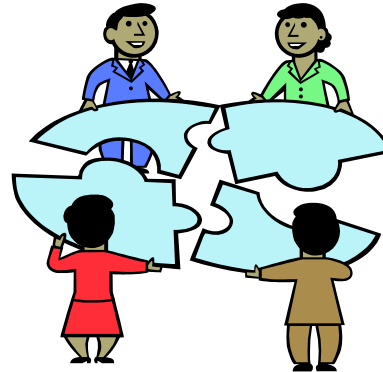
In a series of experiments, English-learning babies in Madison listened to an unfamiliar language -- Spanish -- for two minutes. They heard words both by themselves ("Casa!") and in longer sentences ("Mira la casa grande y vieja"). The question was whether the single words would help babies find the boundaries of other Spanish words. After hearing the word *casa* by itself, would it pop out at babies in

longer sentences? And would babies use it to discover the word *grande*, which appeared next to it in the longer sentence?

During the test portion of the study, we measured babies' interest in listening to words like *grande* (which always appeared next to the word *casa*), versus words like *vieja* (which never appeared next to *casa*). Babies' listening times showed that they successfully found the boundaries of the adjacent words, but not of the other words in the sentences. Single words became familiar to babies, and they recognized them in longer sentences. From there, babies figured out where *other* words begin and end in longer sentences. This study shows an impressive uptake of information, and helps us understand how babies progress from knowing very few words to knowing exponentially more words.

**The results of this project were
presented at the 37th annual
Boston University Conference on
Language Development!**

It is important to note that saying single words is not necessary for successful language development -- babies are very good at picking up on patterns, and very good at figuring out which syllables cluster together into words. But these results indicate that single words can help babies begin to



make sense of language. They are one piece of the puzzle, and over time, more and more pieces of sentences will start falling into place. As babies accumulate lots of

play time with caregivers and hear a diversity of sentences and words, they will go from being lost in a sea of sounds to showing remarkable comprehension abilities.

● ● ●
Dr. Lew-Williams is now an Assistant Professor at Northwestern University in the Department of Communication Sciences and Disorders. You can email him at caseylw@northwestern.edu.
● ● ●

Looking for more research opportunities?

There are other labs in the Waisman Center that are looking for families with kids to participate!

<http://www.waisman.wisc.edu/socialkidslab/socialspacelabs/Parents.html>

♥ **The UW S.P.A.C.E. Lab** - Studying the development of children's memory for visual features and locations of objects.
Vanessa Simmering 890-2670 arpatterson@wisc.edu

♥ **The Social Kids Lab** - Studying the cognitive and social development of young children.
Kristin Shutts 263-5853 socialkids@psych.wisc.edu

Sign-up online for either lab:

http://www.waisman.wisc.edu/socialkidslab/socialspacelabs/Sign_Up.html

♥ **Child Emotion Research Laboratory** - Exploring children's emotional development and the relationship between early experience and mental health.

<http://www.waisman.wisc.edu/childemotion/parents.html>

Barb Roeber 890-2525 childemotion@waisman.wisc.edu

♥ **Binaural Hearing & Speech Lab** - Studying how children learn to locate sounds in their environment. Visit the following website for current studies...

http://www.waisman.wisc.edu/bhl/patients_participants.html

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Shelly Godar 262-7483 godar@waisman.wisc.edu

Recent Publications

Please visit our website for direct links to these and other lab publications:

<http://www.waisman.wisc.edu/infantlearning/Publications.html>

Abbeduto, L., Kover, S.T., & McDuffie, A. (2012). Studying the language development of children with intellectual disabilities. In E. Hoff (Ed.), *Guide to Research Methods in Child Language* (pp. 330 – 346). Oxford: Wiley-Blackwell.

Brandon, M., Terry, J., Stevens, C., & Tillmann, B. (2012). Incidental learning of temporal structures conforming to a metrical framework. *Frontiers in Psychology: Auditory Cognitive Neuroscience*, 3:294.

Hay, J.H., & Saffran, J.R. (2012). Rhythmic grouping biases constrain infant statistical learning. *Infancy*, 1-32.

Kover, S.T., McDuffie, A., Abbeduto, L., & Brown, W.T. (2012). Effects of sampling context on spontaneous expressive language in male adolescents with fragile X syndrome or Down syndrome. *Journal of Speech, Language, and Hearing Research*, 55, 1022-1038.

Lew-Williams, C., & Saffran, J.R. (2012). All words are not created equal: Expectations about word length guide infant statistical learning. *Cognition*, 2012, 241-246.

Know someone with a baby?

We are ALWAYS looking for more babies to participate in our studies!

Our current studies involve infants between 6 months and 30 months of age. Please pass on our phone number (608-263-5876) and/or e-mail address (babies@waisman.wisc.edu) to any parents who might be interested in participating in our research studies.

If you are involved in programs with infants or expectant parents, including: child care programs, play groups, or child-birth classes, and would be willing to post a flyer or distribute articles describing our research, please let us know!



*Thank you for your continued interest in and support of our research.
We could not do it without you!*