

Infant Learning Lab Newsletter

2013 In Review



Dear Parents and Friends,

Thank you so much for participating in the language 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 7 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!

A handwritten signature in black ink, appearing to read "Jenny Saffran".

Jenny Saffran, Ph.D. – Principal Investigator
Erin Long, BA – Laboratory Manager



Our 2013 Studies

HOW DO BABIES PERCEIVE TONAL LANGUAGES?

Research has shown that babies are fast language learners. They can find patterns in a new language really quickly. To explore the mysteries of early language learning, I developed my senior honor thesis on the topic of tonal language acquisition. My interest in this topic stems from the fact that infant speech perception research has typically focused on the phonetic properties (e.g. consonants and vowels) of speech sounds in non-tonal languages, such as English. However, I am interested in whether infants are able to learn from natural tonal languages, like Mandarin Chinese, which have an extra layer of tonal information. Do 7- to 8.5-month-olds treat words with different tones as unique words? Can they learn from a completely new language after hearing it for only a couple minutes?

During the study, 7-8.5 month old infants listened to about two minutes of Mandarin, then heard individual Mandarin words that were either brand new, or had occurred in the initial two minutes of Mandarin. We measured how long babies listened to the new words versus the old ones. If they listened longer to the new words, that would indicate that they had become familiar with the old words when they heard them in speech, and as a result were less interested in listening to them again.

The data suggest that 7- to 8.5-month-olds are not able to pick out individual words from tonal speech, suggesting that unfamiliar tones may disrupt babies' ability to find patterns. Babies are most likely unable to do this because English and Chinese are two typologically different languages, as English words usually have multiple syllables whereas Chinese words often consist of only one or two syllables. Thus, prior English exposure may play an important role in facilitating infants' ability to learn words from foreign languages that are similar to English (e.g. Italian, Dutch) but not languages that are dissimilar to English (e.g. Chinese). In addition, the changes of word patterns in natural languages are highly unpredictable, thus might lead to a lot of interference.

Although my results were not what I expected, I believe my findings are important because they demonstrate that tone perception is a much more complicated process than people used to believe. The question of when and how infants start to discriminate tonal sounds requires further investigation. A revised version of this study is currently in progress. We hope to give you more updates in the next newsletter!

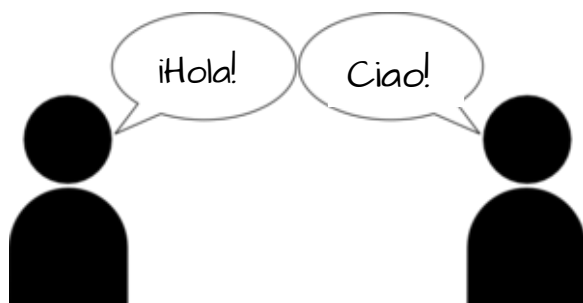
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HOW DO BABIES REACT WHEN PRESENTED WITH TWO LANGUAGES?

As the majority of the world's population is multilingual, I have become interested in investigating how infants might begin to process multiple streams of speech. For instance, how does a child growing up in a bilingual home know that his or her parents are speaking two different languages? How does a child know that it is not simply one language with a lot of variability? To investigate this question, I set out to see how infants growing up in both monolingual and bilingual environments would react to a change in language.

The first step in setting up this study was to see whether infants could first learn just one of the languages we would present them with. During the study, 8-10 month old babies came into the lab and went into the sound proof booth with their parent. They listened to about two minutes of Italian. We used blinking lights to get children's attention, while playing them words they heard in the Italian sentences, as well as completely new Italian words, to see whether the babies preferred to listen to the words they had heard before, or to the completely new words. Based on their interest in the words, we will be able to tell whether the infants are able to learn from the language. Once we know if babies can learn from the Italian stimuli, we will intersperse Spanish sentences at random intervals into the



Italian, to see whether babies notice the change in language. This second part of the study is still in the design process, but you and your baby will be able to participate in it soon!

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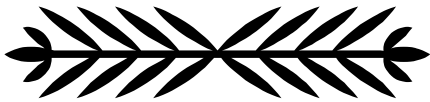


HOW DO BABIES INTERPRET THE SAME WORD SPOKEN AT DIFFERENT PITCHES?

In English, we can say the word “doggie” with a high or low pitch depending on the mood we are in. And since some people's voices are higher than others, a baby could be hearing “doggie” at different pitch heights all the time. However, English-learning kids still know that in all these cases people are referring to the same four-legged furry animal. Interestingly, the situation can be very different in languages that use tones. In Southern Min (a language spoken in southeast Mainland China and Taiwan), a high flat “di” means *pig* while a low flat “di” corresponds to *chopsticks*. Though English-speaking adults find it tremendously difficult to recognize the contrasts with this kind of tonal register 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 from 12-14 months of age might do when pitch height becomes informative in a word learning task. In this tonal register study, we paired two novel objects with two sounds, where the only difference in the sounds is their pitch height. After having a baby listen to it until he/she gets bored, we switched the pairings to see if the baby noticed the mismatch. Thus far, while baby girls preferred listening to the original mapping of the sounds and objects, baby boys favored the mismatched mapping instead. The results suggest that all babies picked up on the tonal register (pitch height) difference, though the exact reason for why there exists a sex difference is still under investigation.

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HOW DO BABIES LEARN VISUAL PATTERNS?

For young children, there is a lot of unfamiliar information in the world. They see shapes and items they have never seen before all the time, and they have to figure out things like the fact that while some of them go together, others do not. As an example, bowls and spoons often belong in the same place, but bowls and teddy bears are less likely to appear together. Past studies, both in our lab and other places, have shown that even babies are very good at figuring out what goes together. For instance, we know that they are very good at learning what sounds may go together to make words, long before they

learn to talk or even know what those words mean.

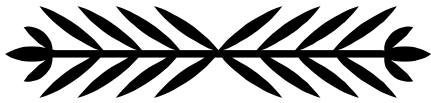
We wanted to ask if babies could learn complex patterns of visual information, the way they can with language. To do this, we showed them brightly colored, abstract shapes that appeared on a screen in patterns. Certain shapes always followed other shapes, and certain colors also always went together, and we wanted to see if babies could learn these overlapping patterns and pay attention to many cues at once. For example, they might see a blue triangle and then an orange square one time, a yellow triangle and a red square another time, and later a blue star and an orange circle. From this, they could learn that blue and orange things go together, triangles and squares go together, or, specifically that blue triangles go with orange squares.



In this study, we let children watch the shapes appear over and over until they got tired of them. Some children got tired of them quickly, while others wanted to watch the shapes for ten minutes or more. Once they were tired of the shapes, we showed them new streams of shapes that either followed the patterns they previously saw or did not follow those patterns (e.g., blue triangle followed by red circle). We expected that children would find these changes in the pattern more interesting than what they had already been watching. However, we found that some children did prefer the new shapes, while others were happier to look at things they had already seen. This suggests that when there is a lot of information to keep track of at once, different children think different cues are important, and when there is overlapping information, it may be hard for children to learn a single pattern. We hope to continue to explore how children make

decisions about what is likely to be important and how they sort through the wide variety of information available at any given time.

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HOW DO CHILDREN WITH AUTISM LEARN NEW WORDS?

Autism is characterized by social communication impairments and repetitive behaviors and restricted interests. Many children with autism spectrum disorders (ASD) have considerable language delays, and this project examines potential sources of these delays. When learning new names for objects, it is sometimes difficult for children to immediately tell which word describes which object. Infants as young as 12-14 months can learn new words by picking up on co-occurrences between auditory and visual information across these ambiguous learning situations (Smith & Yu, 2008), but before this study little was known about this ability in children with ASD. Results show that some children with ASD are able to learn new words by tracking statistics across ambiguous situations but that others have a more difficult time. The ability to learn new words in this way is related to children's existing vocabulary knowledge.

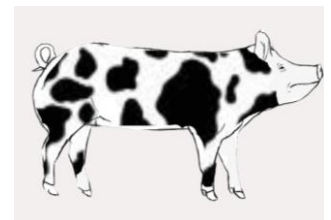
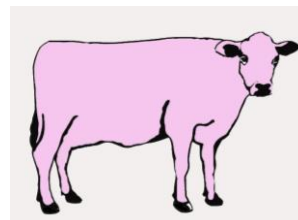
Some children with ASD also have difficulty disengaging their attention from an ongoing stimulus to look at something new—a phenomenon known as 'sticky attention.' This

study also examined how patterns of visual attention impact word learning. Preliminary results indicate that children who have higher levels of sticky attention also have a more difficult time learning new words from ambiguous contexts.

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DO BABIES PAY MORE ATTENTION TO SHAPE OR TO COLOR?

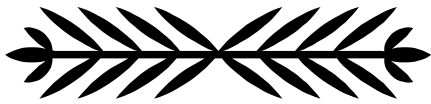
What do children really know when they learn a word? Is your child's meaning of pig the same as yours? Do some children pay more attention to the pig's pink color or to its shape? In this study, we are investigating whether children between 20-22 months of age pay more attention to the shape or the color of familiar objects. We showed children pairs of pictures of familiar animals and foods—such as a cow and a pig. Sometimes, the pictures were their normal colors and their normal shapes (i.e. a pink pig and a Holstein patterned cow). But other times, the colors were switched, so that the cow was pink and the pig had a Holstein pattern. The children were then asked to find one of the pictures on the screen (e.g. "Where's the cow?")



Do children look more at the picture that matches the color of the named object, or at the picture that matches the shape of the named object? This study will help us understand how

children come to understand the meaning of the words they learn.

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WHICH WORDS GO TOGETHER?

Learning about words from speech

While we typically think of word learning as figuring out what individual words refer to, there are other parts of what a word means that young children also need to learn. As adults, we know more than just individual word meanings. For example, we also know about word relationships. Part of our knowledge of the word “cat” is that it is in the same category as the word “dog”, and that it is often used with the words “lick” and “milk”. This type of information helps us to understand and produce language more quickly and accurately. How do toddlers start to build this type of word relationship knowledge?

One potential source of information about word relationships comes from how words are used in sentences. There are lots of patterns in speech that can help us figure out what words mean. Once we start to learn the structure of our language and the meanings of some words, we can use that knowledge to figure out the meanings of new words. If you hear the sentence,

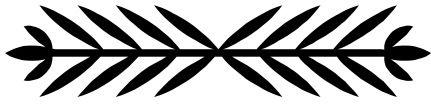


“I *meeped* you the ball,” you can figure out a lot about what “meeped” means even though you’ve never heard it before. (It’s a verb that probably means something like “throw” or “pass”.) In fact,

toddlers are very skilled at figuring out what novel verbs mean when they hear them in informative sentences like the one above. Less is known, though, about whether toddlers can learn about the relationships *between* new words just from hearing them in sentences. One of my studies in the lab this year examined this question.

For this project, we first played two-year-olds a couple of minutes of sentences that were a mix of new words and familiar words, such as “the tursey broke the coro” and “the blicket opened the pif”. In the sentences, the new words were each used consistently in the same sentence as another word (such as “tursey” with “coro” in the example above) and consistently in the same sentence position (either before or after the verb). We then tested the types of word relationships that were learned from these sentences. Specifically, we were interested in whether toddlers learned 1) which pairs of words are used within the same sentences and 2) which pairs of words are used in the same sentence positions—either always before or always after the verb. Noticing and encoding both of these types of relationships could help with learning about meaningful word relationships.

We found that two year olds do learn about which pairs of words are used within the same sentences. We also found that initially, children do not encode which words are used in similar positions *across* sentences. However, as they learn more words and use more complex sentences, they begin to learn this type of relationship, too. This study shows that children can glean lots of information about words just from hearing them in speech, and that they are able to learn more complex information as they learn more about their language. In other words, learning leads to even more learning! Future studies will explore the other types of relationships toddlers can learn from speech.



SHHH...I'M TRYING TO LEARN
HERE!



How noise in the environment
influences a child's ability to learn
words

Children are exposed to a variety of environments that influence what and how they learn. The young learner must learn how to handle all of the information in the environment by paying attention to what is relevant while ignoring what is not. This can be particularly difficult for young children when learning new words in noisy environments.

Recent research in our lab has looked at toddlers' ability to learn words when the environment is noisy. In this study, children are taught the labels for two unknown objects and then later tested on their ability to recognize the objects when labeled. To look at whether background noise would impact their ability to learn words, 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 found that both younger (22- to 24- month olds) and older (28- to 30- month olds) toddlers are sensitive to the volume of background speech in their environment; children were able to learn the words when the background speech was quieter, but when the speech was only 5dB louder, they were no longer able to learn.

While louder background speech may hinder a toddler's ability to learn words, there are cues in the environment that may help them overcome this difficulty. Hearing the new words in fluent speech, without background noise, and before they are taught the word-object pairing may be one way to help children overcome the effect of background speech.

To test this we taught 28- to 30-month old toddlers four new words. Toddlers first heard two of the new words in sentences (e.g., "The coro is under the tree. The tursey is on the table"). Then, we taught toddlers what object the words they had previously heard, as well as the other two new words, corresponded to. During this training phase toddlers heard the same background speech that we had previously found prevented toddlers from learning the words. Finally, we tested whether infants learned the new words. We showed infants 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. We found that toddlers were able to learn the words that they were initially exposed to in fluent, quiet speech, but they were unable to learn the words if they

did not have this previous exposure. Therefore, while children have difficulty learning words if background noise is too loud, hearing the words in quiet before they learn the word-object pairing may help children overcome this difficulty.

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Brianna was awarded the Alvin L. Berman and Ruth Bleier Memorial Research Award this year, and is also a Morse Society Scholar.
Congratulations, Brianna!

HOW DO CHILDREN FIGURE OUT WHO IS SPEAKING THE SAME LANGUAGE?

Many children grow up in homes or communities where they hear more than one language. How do children figure out which people are speaking the same language and which people are speaking a different language? Sometimes speakers sound more similar to each other, while others are more different. For example, two people may have different regional accents, or a man may have a lower speaking voice than a woman. Also, some languages may sound more alike than others. Spanish and Italian, for example, share sounds and even words, while Mandarin Chinese sounds very different from Spanish.

In a study conducted at the Madison Children's Museum, we showed preschool age children pairs of monsters on a screen and had them wear headphones so that they could hear the monsters

speak. Children heard each monster say a short sentence. Then they heard a third sentence, and had to guess which monster said it. Some children heard monsters that spoke similar languages, Spanish and Italian, while others heard very different languages, Spanish and Chinese.



As expected, it is easier for children to tell Spanish and Chinese apart than it is for them to tell the difference between Spanish and Italian. However, we found that when children hear passages of speech in *either* Italian or Chinese before having to tell the languages apart, it helped them tell Spanish and Italian apart, compared to listening to music. In contrast, children telling the difference between Spanish and Chinese were equally good at the task, regardless of what they heard before. This suggests that hearing a new language may change the way children pay attention to unfamiliar languages, regardless of whether or not they have heard a particular language before. Therefore, children who are growing up in bilingual homes may perceive unfamiliar speech differently than those that only hear one language at home. Ongoing research will try to address why hearing speech may change children's perception of new languages, as well as how knowing multiple languages may influence what children think is the same and what is different.

Chris Potter, M.S.
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🌀 Looking for more research opportunities? 🌀

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

- ✓ **The SPACE Lab** - Studying the development of children's memory for visual features and locations of objects
 - Sign up online! www.waisman.wisc.edu/socialkidslab/socialspacelabs/Sign_Up.html
 - Dr. Vanessa Simmering: spacelab@psych.wisc.edu
- ✓ **The Social Kids Lab** - Studying the cognitive and social development of young children
 - Sign up online! www.waisman.wisc.edu/socialkidslab/socialspacelabs/Sign_Up.html
 - Dr. Kristin Shutts : socialkids@psych.wisc.edu
- ✓ **Child Emotion Research Laboratory** - Exploring children's emotional development and the relationship between early experience and mental health
 - Sign up online! www.waisman.wisc.edu/childemotion/parents.html
 - Barb Roeber: childemotion@waisman.wisc.edu
- ✓ **Binaural Hearing & Speech Lab** - Studying how children learn to locate sounds in their environment
 - Visit the website for current studies!
http://www.waisman.wisc.edu/bhl/patients_participants.html

🌀 Recent Publications 🌀

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

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

Wojcik, E. H., & Saffran, J. R. (2013). The Ontogeny of Lexical Networks: Toddlers Encode the Relationships Among Referents When Learning Novel Words. *Psychological Science*, 24(10), 1898-1905. doi: 10.1177/0956797613478198

Wojcik, E. H. (2013). Remembering new words: Integrating early memory development into word learning. *Frontiers in Developmental Psychology*. 4, 151.

Lany, J., & Saffran, J. R. (2013). Statistical learning mechanisms in infancy. In Rubenstein, J. L. R. & Rakic, P. (eds.) *Comprehensive Developmental Neuroscience: Neural Circuit Development and Function in the Brain*, Volume 3, pp. 231-248. Amsterdam: Elsevier.

Willits, J. A., Wojcik, E. H., Seidenberg, M S., & Saffran, J. R. (2013). Toddlers activate lexical semantic knowledge in the absence of visual referents: Evidence from auditory priming. *Infancy*. doi: 10.1111/inf.12026.

Romberg, A. R. & Saffran, J. R. (2013). All together now: Concurrent learning of multiple structures in an artificial language. *Cognitive Science*. doi: 10.1111/cogs.12050.

Romberg, A. R. & Saffran, J. R. (2013). Expectancy learning from probabilistic input by infants. *Frontiers in Psychology*. doi:10.3389/fpsyg.2012.00610

☞ Know someone with a baby? ☞



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

Our current studies involve infants between 7 months and 34 months of age. Please pass on our phone number (608-263-5876) and/or email address (babies@waisman.wisc.edu) to any parents who might be interested in participating on our research studies.

If you are involved in programs with infants or expectant parents, including child care programs, play groups, or childbirth 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!

