

# The Center for Early Childhood Research



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Newsletter

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## Gesture and Learning

### Gesturing to Help Label Numbers

Even after young children learn to count, they frequently have a hard time labeling quantities with number words. Past research has shown that preschool-aged children often verbally misidentify sets of objects. We hypothesized that children's gestures might communicate greater knowledge of number concepts than their speech. Susan Levine's Cognitive Development Lab and Susan Goldin-Meadow's Lab collaborated to examine 3- to 5-year-olds' use of number words and gestures to label small set sizes exactly (1-4) and larger set sizes approximately (5-10). Experimenters asked children to identify how many pictures were on a page using either their fingers or number words. We found that children who did not yet know how to verbally identify sets with two or three objects in them were often able to correctly gesture "two" or "three" with their fingers. These findings show that children can convey numerical information in gesture that they cannot yet in speech, and raise the possibility that number gestures may play a functional role in children's development of number concepts. This striking pattern of results demonstrates that children frequently develop basic understandings

of concepts before they are able to communicate them through speech.

Currently, Talia Berkowitz and Dominic Gibson are studying ways to help children improve their numerical understanding. One study examines the role number talk has on children's numerical development. Another study is attempting to facilitate children's learning of number concepts and number words by comparing and contrasting groups of objects.



### Mental Rotation

In another collaboration between the Susan Levine's Cognitive Development Lab and Susan Goldin-Meadow's Lab, we are studying ways to use technology to help improve children's mental rotation ability. Mental rotation is related to many important spatial skills that are crucial for success in STEM fields (science, technology, engineering, and math). In this study with 4-to 5-year-olds, some children are taught to use gesture to determine which way a rotated animal would be facing if it were standing on its feet, whereas other children are taught to either virtually manipulate the animals on an iPad or physically manipulate the animals by turning actual pictures. We are interested in how different types of action help improve children's spatial visualization skills.



## Gesture and Learning

### Learning Through Gesture

We know touching and exploring things in the world is great for learning! But, are there some cases where acting on objects directly might actually inhibit learning? In a collaboration with Amanda Woodward's Infant Learning and Development Lab and Susan Goldin-Meadow's Lab we looked at the difference between talking about an object while touching it, compared to talking about an object while gesturing about it. In this study 3 year-olds were given three toys: a small box, a medium box, and a large box. The experimenter also had three toys – a medium box, a large box, and an extra large box. In the task, the experimenter hid a button under one of the child's toys, and then encouraged the child to look for it. She also gave a clue about where the button was, by showing the relative location in her toys. That means that if the experimenter hid the button under the child's small toy, the experimenter would show the child, by touching her own small toy. But since the experimenter only had a medium, large, and extra-large, she would have to use the medium box (her small box) to give the clue.

We looked at how well 3-year-olds were able to figure out this tricky rule. In one condition, the experimenter would directly touch the clue box. In another condition, the experimenter would hold her hands in the space above the box, and produce a gesture that represented the relative size. We found that children who saw gestures were more likely to pick the correct answer than children who saw the experimenter actually touch the object. That's probably because touching the object draws the child's attention to that specific object, and gets in the way of their ability to think about what that object should represent.

Our next step is to see whether touching the objects themselves, or learning to gesture themselves, will have the same effect. Be on the lookout for the next version of this study!





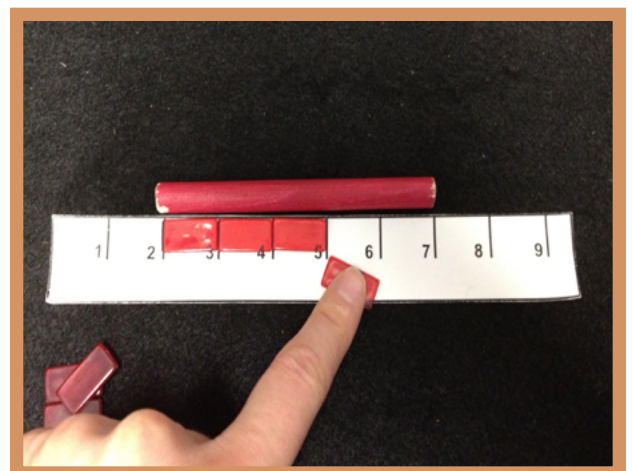
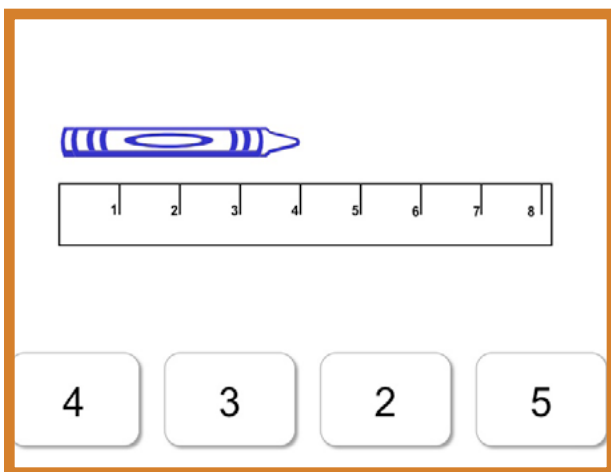
# Cognitive Development Lab

Dr. Susan Levine  
[cogdevlab.uchicago.edu](http://cogdevlab.uchicago.edu)

## Measurement

Understanding measurement concepts is crucial to mathematics and science, but most young students find it very difficult. In early elementary school, children learn to use rulers by aligning objects with the start of the ruler. However, using this activity alone leaves children with a shallow understanding of measurement units. We found that kindergarteners and second-graders often had a hard time measuring objects when they were not lined up with the start of a ruler, usually making one of two types of errors. Some children used a “read-off” strategy, where they determined the length of an object based on where it ended on a ruler, regardless of whether or not the object was lined up with the zero-point of the ruler. Other children employed a more advanced, yet still incorrect “hatch-mark” strategy, where they counted the hatch marks on the ruler, instead of the actual units. Children were better at measuring shifted objects when they used discrete units, such as pennies. However, when the pennies were replaced with numbered circles, making the tool more similar to a ruler, children were less accurate. These findings suggest that children have a difficult time conceptualizing a ruler as a set of countable, spatial interval units.

We used these findings to develop a training study where we taught children to use either plastic unit chips or a thumb-and-forefinger “pinching” gesture when measuring either aligned or shifted objects along a ruler. Consistent with our previous work, we found that none of the children improved when they only received additional practice on aligned items. Within the shifted training groups, however, we found that children who began the study using a “read-off” strategy benefited greatly from using unit chips but not from using gesture. By contrast, children that used the “hatch-mark” strategy learned from using either unit chips or gesture. Findings suggest that children may learn best through concrete action when first learning a new concept. Eliza Congdon is currently studying whether teaching measurement using both unit chips and gesture in a single training session is better for learning, retention, or generalization than only teaching children one strategy.



# Infant Learning and Development Lab

Dr. Amanda Woodward  
woodwardlab.uchicago.edu

## Imitation and the Brain

In one study, we examined the brain network involved in imitation. To do so, we outfitted 7-month-old infants with a special cap with sensor sponges on it. These sensor sponges passively recorded infants brain activity as they played a fun game with an experimenter.

During this game, an experimenter would pick between two toys. Then, the infant got a chance to pick the toy that they wanted. We measured brain activity when infants observed a person select between two toys. Interestingly, we found that even though the babies were not moving when they watched the actor pick a toy, they sometimes activated the part of their brain that controls movement (motor system). When infants recruited their motor system they subsequently imitated the actor. This suggests that motor system activation in 7-month-old infants can predict imitative behavior.



## The Woodward Lab is starting a special new study

We're beginning a special new study with 9- to 10-month-old infants to investigate the brain network involved in action understanding. In this study, your infant will wear our special cap with sensor sponges and watch a movie of a person performing a simple action. After your infant watches this movie, they will get to reach for some toys themselves. Next, we'll ask your infant to watch a similar movie on our eye-tracking computer monitor. Then you and your infant will play in a room for 10 minutes. This study will take approximately 1 hour.



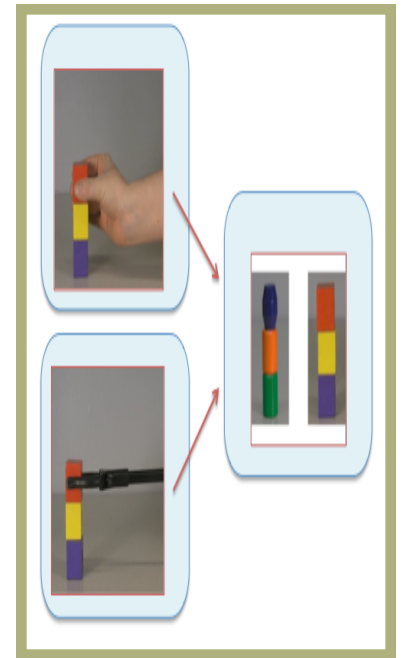
# Infant Learning and Development Lab

Dr. Amanda Woodward  
woodwardlab.uchicago.edu

## What Do Infants Find More Memorable?

What makes something more memorable for infants and young children? Past research in our lab has shown that preschoolers are more likely to remember something (for example, a movie or book) if the event has a person in it than if they are shown the same event without a person. Lauren Howard is conducting a series of studies to see if young infants (8-9-month olds) also show better memory when watching events with people.

In this study infants see one of two possible videos: either a person building a simple 3-block tower or the same block tower being built by an inanimate reaching tool. After allowing the infant to watch the video three times, the experimenter shows them a still picture of the tower they just saw being built (the “old” tower) right next to a similar looking new tower that has different colored blocks (the “new” tower). We find that infants who viewed a person building the tower look much longer to the new tower than the old tower, suggesting that they remembered the tower they already saw in the video and would prefer to look at the item that is new and exciting. In contrast, infants who viewed the reaching tool building the block tower in the video look the same amount to the “old” tower and “new” tower still pictures. These results demonstrate that infants who see a person building a simple object remember more about the object than those that see an inanimate tool completing the same actions.



## Prediction Speed and Social Interaction

Skilled social interactions require knowledge about others' intentions and the ability to implement this knowledge in real-time to generate appropriate responses to one's partner. The current study investigates the possibility that developments in social competence during the second year are related to increases in the speed with which infants can employ their understanding of others' intentions. 22-month-old infants viewed videos of goal-directed actions on a Tobii eye-tracker and then engaged in an interactive perspective-taking task. Infants who quickly and accurately anticipated another person's future behavior in the eye-tracking task were more successful at taking their partner's perspective in the social interaction. Success on the perspective-taking task was specifically related to the ability to correctly predict another person's intentions. These findings highlight the importance of not only being a "smart" social partner but also a "fast" social thinker.

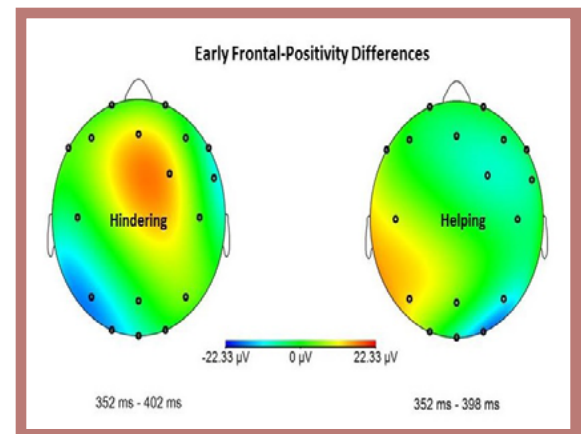


# Child NeuroSuite

Dr. Jean Decety  
childneurosuite.org

## Moral Judgment

Infants, toddlers, and children routinely make snap decisions about whether something is good or bad. While we have learned a lot about children's moral judgments, we still do not know how their brains process this kind of information. Our lab is currently using a special type of cap that allows us to record brain waves when children watch actions of others. In the past year, over 100 infants, toddlers, and preschoolers have worn this cap while looking at cartoon characters help or hinder others. After watching these characters, children were given a chance to share with another person. Even in the youngest children, there was an immediate difference in their brain responses (within 200 milliseconds) when they viewed the cartoon characters helping or hindering. Interestingly, nearly a half a second later, children's brain responses showed a return to thinking about the moral action, and it was this re-thinking that predicted children's own sharing behaviors. These results shed important light on how young children's brains guide moral judgment and moral behavior.



**Come join us for a new study at the CNS!**

The Child Neurosuite is beginning a new project looking at children's conceptions of fairness and how they perceive vulnerability in others. In this study, 4-to-8 year old children will wear our special cap that records brain waves while they watch stories about other people in need. They then will make decisions about who they want to help and why.



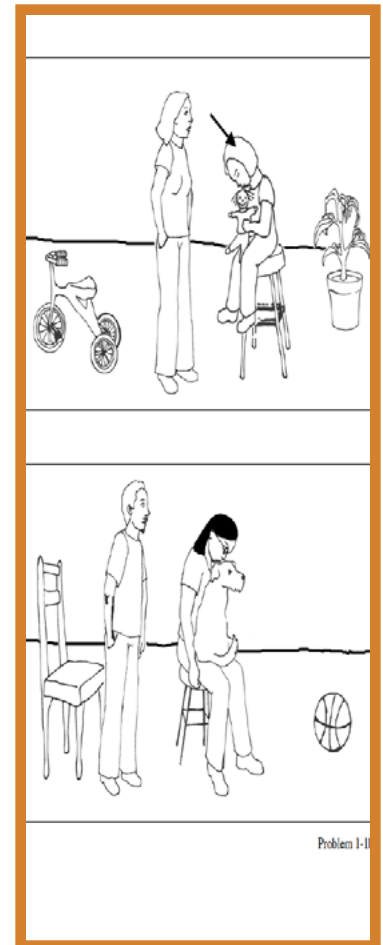
# Learning Lab

Dr. Lindsey Richland  
[Learninglab.uchicago.edu](http://Learninglab.uchicago.edu)

## Executive Function and Analogies

The process of comparing one relationship to another, otherwise known as analogical reasoning, is important for thinking and learning. In educational fields, children can use analogies to infer and flexibly apply new knowledge. This project asks how children's executive functions – that is, the ability to regulate their own thinking – influence their ability to reason analogically. This relationship could have important implications, because recent work has shown that executive function skills can be improved by training, which may in turn strengthen children's ability to learn and reason from analogies. In this study, 5- to 11-year-olds' executive function skills were measured using computer games in which they had to control their responses to conflicting information, hold and manipulate information in their mind, and flexibly shift from one task to another. Then they completed an analogical reasoning game that asked them to find the same event structure across two pictures (e.g., a girl kissing a doll in one picture and a mom kissing a dog in another picture). Some of scenes had more complex events than others, and some of the pairs had similarities that were irrelevant to the event similarities.

We found that for the younger children, the ability to control inappropriate responses predicted performance on all types of analogical problems, and the ability to store information in their minds predicted performance for the problems with complex events. For older children, the ability to hold and manipulate information in their minds predicted performance on all types of problems. These results suggest that executive functions are important for children's ability to reason analogically, but that different components might be most important at different ages. We are currently extending this project to children as young as 3-years-old, to see how the executive functions of younger children relate to their analogical reasoning performance.



## Have you recently moved?

Do you have a new baby?

Let us know so we can update our database!

Email: [babylab@uchicago.edu](mailto:babylab@uchicago.edu)

Phone: (773) 834-9791

Website: [babylab.uchicago.edu](http://babylab.uchicago.edu)

Do you have friends who might be interested in our program?

We are always recruiting new participants. We have a wide range of studies for infants and children between the ages of 5-months through 11-years-old. If you have friends and family who may be interested in participating in our studies, please pass on our contact information or pick up a brochures in one of our labs.



# Learning Lab

Dr. Lindsey Richland  
[Learninglab.uchicago.edu](http://Learninglab.uchicago.edu)

## Early Socialization of Attention to Different Kinds of Information

In any situation, there are many pieces of information that a child might notice and think about. In this project, we are interested in discovering how social and cultural experiences influence what types of information children attend to, and how this may change with age. For instance, prior research from the Learning Lab and other labs has shown that younger children tend to focus on individual objects and their properties, such as color or shape. As children get older, they are better able to also think about relationships between objects and the roles that objects are playing in a larger context. For example, a cat chasing a mouse is like other cats that are furry, four-legged, and so on; however, it is also like a non-furry, two-legged boy who is chasing his sister, because they are both chasers.

Children from different cultures may also tend to focus on different types of information. Young Japanese children, for example, tend to pay more attention to relations between objects compared to US children. In this project, we want to explore how differences in children's early social experiences may influence what they find interesting and worthy of attention. In the lab, parents and children work together on a problem-solving task that involves both object properties and relationships between objects. We are looking at how parents and children talk about objects and relations during the task, in particular whether parents encourage attention to some types of information over others. We expect differences in parents' talk about objects and relations to predict whether their children tend to focus on object properties or relations between objects on a separate task. We will also be looking at interactions from families from different cultures to explore how these early social interactions may differ across cultures.



# Development of Social Cognition Lab

Dr. Katherine Kinzler  
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## Funky Foods

What do children think about people who eat different kinds of foods? Is it okay to eat a hot dog with chocolate sauce? Are bugs food? In their research, Jasmine DeJesus, Emily Gerdin, and Casey Sullivan are interested in learning how children think about other people's food choices and when they learn their culture's rules and beliefs about eating. We are currently asking these questions in a series of studies with 5-year-old children. We show children pictures of people and the foods that they like to eat, and ask children to tell us their opinions about the foods and the people who eat them. Children strongly prefer conventional foods (e.g., apples, hot dogs with mustard) to unconventional foods (e.g., apple cores, hot dogs with chocolate syrup), and also use that information to decide whether they want to be friends with a person.

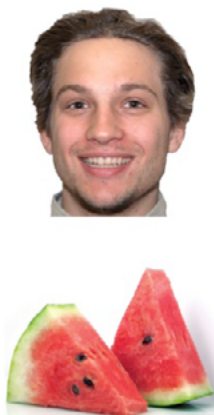
In future studies, we are interested to see what children think about more extreme food preferences – is it okay to eat worms? Is eating an unusual combination of foods, like pancakes with salsa, different from eating something that we don't typically consider to be a food, like grass or newspaper? We also want to learn how children think about the relations between food and culture. If children think that these ideas are related, they might expect people from different cultural groups to eat and enjoy different kinds of foods.



## Language and Perspective

How does exposure to multiple languages influence children's performance on social tasks? In a recent study, Samantha Fan and Zoe Liberman found that children who hear multiple languages are better at taking an experimenter's perspective in a social communication task. Why would exposure to multiple languages improve children's communication abilities?

In current studies we are following up on this finding to learn more about how exposure to multiple languages influences communication development. In one study, we are asking whether the benefits of language exposure are specific to social perspective taking tasks, or whether they also extend to perspective taking tasks that do not require social communication. In another study, we are working with a senior thesis student, Danielle Labotka, to look at whether children who regularly hear multiple languages show advances in other types of communication, such as understanding pragmatics.



## Goldin-Meadow Lab

Dr. Susan Goldin-Meadow

Goldin-Meadow-Lab.uchicago.edu

### Learning Verbs

Word learning can be a difficult task for children. In one of our current studies, we are interested in how different types of experiences impact a child's ability to learn a particular type of words: verbs.

Previous research shows that verb learning can be especially difficult for children, even up to age 8 – an age at which children can communicate fluently with others. One of the aspects of verbs that make them difficult to learn is that the meaning of a verb is not dependent on one particular object, or class of object. For example, a child may learn the word 'stirring' while doing the action of stirring soup with a spoon, but must understand that the word stirring can apply to many situations devoid of these salient parts of the learning event: the spoon and the soup.

In our study, we ask whether children can learn verbs through actions on objects, or through gesturing the same actions (i.e., doing the same action near an object). We think that if children can learn verbs through gestures, this may help them understand that the verb is not tied to the object with which it was originally learned – a hypothesis that we will test in future studies. We also ask whether children learn better by doing the actions or gestures themselves, or watching an adult do the movements. We think that children will learn best if they do their movements while learning. To test our hypotheses, children are asked to learn 4 new words like 'yocking' and 'tiffing' by saying a word while doing an action or gesture, and 4 new words through seeing an action or gesture. They undergo multiple rounds of training and testing so that we can see what the trajectory of learning is: in other words, how quickly a child learns through each type of experience. Our preliminary results show that children can learn through all types of experience, but that learning through doing action leads to the quickest learning and learning through seeing gesture leads to the slowest learning.





## Goldin-Meadow Lab

**Dr. Susan Goldin-Meadow**

Goldin-Meadow-Lab.uchicago.edu

### **Mentally Rotating Pictures**

Mental rotation is the ability to think about an object in your mind, and imagine it turning in space. Mental rotation is important in all sorts of situations, from understanding how to think about molecules in a chemistry class, to thinking through how to move around the suitcases to fit in your trunk before a long trip. In this task, we were interested in 8- to 10-year-olds' ability to mentally rotate pictures they had never seen before.

We showed kids either a two-dimensional picture of a scrambled letter, or a three-dimensional picture of blocks. We then showed them either the same picture rotated, or the same picture rotated and flipped (the mirror image). We asked them to determine whether the second picture was the same, only rotated, or different (the mirror image).

Our findings demonstrated that 8- to 10- year olds are actually very good at mental rotation! Kids in our study performed above chance, suggesting that by this age, kids can manipulate images in their mind. Importantly, girls and boys were equally good at the task, implying that there are not gender differences in mental rotation

as this age. We also learned that kids are better at rotating the 2-d images than the 3-d images, suggesting that the complexity of the picture might affect their ability to hold the image in mind.

Finally, we wanted to know how kids are thinking about mental rotation. During the task, we asked kids to describe how they mentally rotated the objects. We then looked at the words that they said and the way they moved their hands as they spoke. Most kids who were successful at the task used language implying that they were rotating the objects in their mind, and not just looking at the individual features of the object. Also, many kids used their hands to show the rotation that they were imagining, gesturing the way that they would rotate the object if they could move it (even though the pictures were presented on the computer). This suggests that encouraging children to gesture about rotation might support their performance in this task. In future studies, we hope to investigate this question to learn how to best help children improve in this ability.

**Thank you for your participation!**

**You and your child's contribution to our work is vital, and we appreciate every time you visit our labs. Thank you so much for your continued support in our research program!**

**Questions?**

**Please contact us or find more information on our website:  
babylab.uchicago.edu**

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