Winter/ Spring
2004

The Laboratory for Developmental Studies
at Harvard University

Greetings from LDS! Recently, your baby participated in one of our studies. We appreciate your interest and support, and want to share with you what we've found! We have included in this newsletter summaries of the baby studies that we've run over the last few months. Some are new, some you might recognize from our last newsletter. Many are still in progress, but some are finally finished! None of them, however, could be possible without your help. Therefore, this newsletter is first and foremost our way of saying THANK YOU.

If you have any questions about these studies or the lab in general, please feel free to call us at (617) 384-7930 or (617) 384-7777. We also have a webpage for the lab where you can find out more about us and our studies (and also view copies of past newsletters):

www.wjh.harvard.edu/~lds

We hope to have you come visit for more studies soon!

Thank You!

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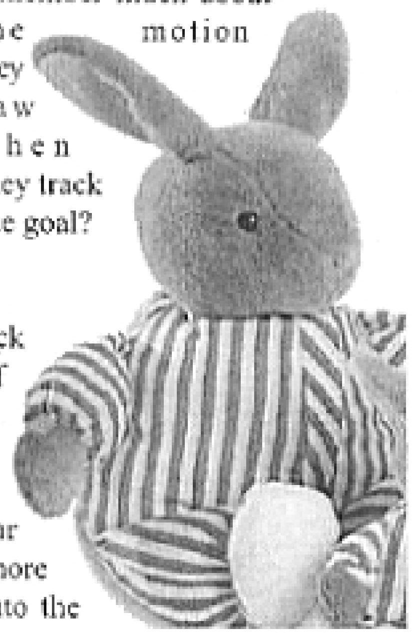
Actions vs. Goals

Laura Wagner, Visiting Research Fellow

This study is looking at what kinds of information babies can keep track of in a motion event. When your baby watches you move around the house, is he or she thinking, "Mom's going into the kitchen" (the goal of your motion) or instead thinking "Mom's walking" (the way you were moving)? We're interested in whether babies can keep track of both of these kinds of information and if they have a preference for tracking one over the other.

In the study, we showed the babies a little play in which a bunny moved to one of two goal locations (either a yellow tub or a purple platform). For some babies, the bunny hopped and for others, he slid to the goal. We showed this play to the babies many times, until they became accustomed to it. Then, we switched the location of the two objects. During the test phase, the bunny either moved to the same object (though it was now in a new location), or to the other object (which was now in the old location). We timed how long the babies looked at each event. If the baby was tracking the goal of the bunny's motion, he or she should consider the motion to the new object as novel, and therefore look at this option for a longer time than when the bunny was at the same old object.

So far, our results show that 9-month-old babies do not track the goal of the bunny's motion, but 11-month old babies do. We're still doing a lot of work with this study, and over the next semester, we hope to find out more about 11-month-old's abilities in this area: Can they track the goal in the presence of different manners of motion? Do they remember much about the motion they saw when they track the goal? Do they prefer to track goal or manner of motion information? We hope to be showing off our bunny to many more babies coming into the lab.



Flashing Dots

Justin Wood, Graduate Student

In a set of studies, we investigated the speed at which infants process numerical information, and also how they construct numerical representations. There are two possibilities regarding the second question. First, infants might enumerate individuals one after the other. Second, infants might enumerate all of the individuals at one time. We found that infants successfully discriminate 4 vs. 8 dots when a new array appears every 2 seconds, but fail when those arrays appear every 1 or 1.5 seconds. They still succeeded with a 2 second refresh rate in an 8 vs. 16 comparison, however, suggesting that infants enumerate all of the individuals at one time. We also found that infants become faster in processing numerical information from 9 to 11 months, rather than earlier in development. This is interesting, because it suggests that the precision of representation, and the speed at which those representations are created, follow different developmental trajectories.

Secret Agent Study

Rebecca Saxe, Post-Doctoral Fellow

Children seem to know a wide variety of things about how people are different from other material objects by a very young age. For instance, even 6-month-olds know people make goal-directed actions, while inanimate objects do not. By the same age, infants are also beginning to recognize and understand causal interactions. The Secret Agent Study was designed to test whether (and when) infants could combine these two kinds of knowledge – about causality, and about the difference between people and other objects. We asked whether preverbal infants already know that it typically takes a person to move an inanimate objects. If babies do know that it takes a person to move an object, then will they expect to find a person at the source of an object's motion?

Recently Finished!

We ran several versions of the Secret Agent study all based on the same idea. First, we tossed a bean bag over a wall and out onto the stage from an hidden starting point. Once the kids were used to seeing the same pattern over and over, we let infants see into the hidden starting points. On some trials (SAME side trials), infants saw that there was a human hand in the same place from which the bean-bag was thrown. On the other trials (DIFFERENT side trials), there was no hand where the bean-bag came from, but there was a hand on the opposite side of the stage.

We predicted that infants who knew that *somebody* must be throwing that bean-bag would expect to see a hand in the SAME position, and would be surprised to see the hand in the DIFFERENT position. To measure this surprise, we compared how long the children looked at the hand in the SAME and DIFFERENT positions. Since infants generally look longer at something that surprises them, we expected infants to look longer at the hand in the DIFFERENT position.

This is exactly what we found! After testing many, many 7-, 10-, and 12-month-olds, we have found that infants in all of these age groups do seem to know that objects are usually moved by people. And, based on this knowledge, they do expect a person (or at least a hand) where they have seen an inanimate object move. We are very excited about these answers to our original questions, and the Secret Agent Study has inspired a lot of new ideas for great follow-up studies!

Jumping Puppets

Justin Wood, Graduate Student

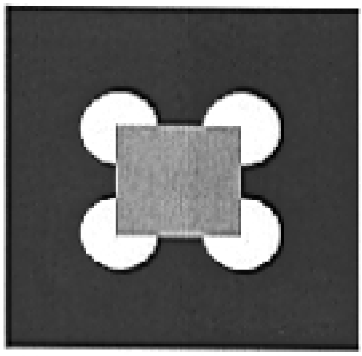
Long before children learn verbal counting and symbolic arithmetic, very young infants (as young as 5 months!) have a remarkably sophisticated system for reasoning about number. In the Jumping Puppets Studies, we asked whether infants enumerate different types of individuals in the world. Specifically, we looked at whether infants represent the number of actions in a sequence (puppet jumps). Interestingly, at 6 months, infants noticed a difference in the number of puppet jumps when the difference was large (4 vs. 8 jumps), but failed when the difference was smaller (4 vs. 6 jumps). At 9 months, however, infants succeeded with the 4 vs. 6 comparison, suggesting that infants become more precise in representing numbers with age. Further studies found that infants fail to discriminate small numbers altogether. This pattern of successes (and failures) is very similar to the levels of performance found in past studies with sounds and dots, suggesting that infants have a single, abstract system for representing number.

Perceptual Completion in Infants

Ariana Ornelas, Undergraduate Researcher
Kirsten Condry, Post-Doctoral Fellow

We have recently completed three studies that explore how four-month-old infants perceive objects that are occluded by other objects. This is a central issue in visual perception because humans live in cluttered environments in which the complete shapes of objects are rarely fully visible.

How do infants perceive an object that is partly hidden behind another object? We showed infants a display in which a bright red box was supported in front of four small white circles (one at each corner of the box) and recorded their looking times until they were habituated (or bored, as evidenced by their decreased looking times). Once infants were familiar with this display, we showed them two test displays to ask how they perceived the shapes of the partly-occluded circles. One test display showed a complete white circle, which is what adults perceive in these displays. The other test display showed a "pac-man" figure (a circle with a quadrant removed), which mimicked the visible shape of the circle when it was partly-occluded during habituation.



We predicted that if young infants are like adults, they will perceive the complete circle behind the box (even though it was not fully visible), and find the pac-man test display to be unfamiliar or implausible. Instead, four-month-olds looked equally to the two test displays, suggesting that they are uncertain about the shape of the unoccluded circle, and find both test displays equally plausible or familiar. These agnostic results are similar to previous research suggesting that young infants do not perceive the complete shapes of partly-occluded objects.

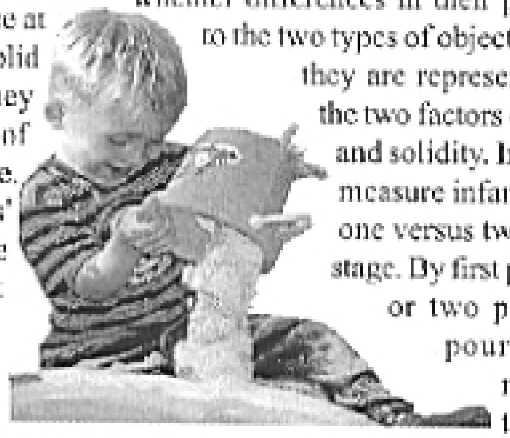
However, it is possible that infants' equal looking during the test indicates that they found both test displays equally unfamiliar (rather than familiar). To test this possibility, we repeated the experiment, but during the test session we compared a possible object (the circle or pac-man from Experiment 1) to an impossible, but similarly-shaped object (a moon). Our prediction in this study was that infants will look longer at the moon test display as unfamiliar if they find it to be an implausible or impossible shape. Our results confirmed this prediction: infants looked longer at the moon after being habituated to the original display of a box occluding four circles, indicating that they saw the moon as unfamiliar.

In a final follow-up study, we examined whether infants at the age of 4 months have an inherent preference for moons that could account for the differences we found in Experiment 2. However after habituation to an unrelated display, infants looked equally at the moon as compared to the circle or pac-man. This indicates that their preference in Experiment 2 was a result of their perception of the habituation display, not a native preference for moons.

Together these studies indicate that young infants perceive partly-occluded objects differently from adults. When infants are shown a simple occlusion display in which one object occludes another, they do not perceive the partly-occluded object as complete in the same way adults do. An adult shown these displays would perceive a box resting atop four complete circles. Although 4-month-old infants were able to discriminate a possible from an impossible shape for the occluded figure, they had no preference between two possible shapes, as long as the test display matched the visible portions of the habituation display. Thus we conclude that at the age of 4 months, infants are still developing the ability to perceive partly-occluded objects in an adult-like manner, although they are capable of discriminating possible from impossible completed shapes.

Baby Sand Study

Rebecca Rosenberg, Graduate Student



While we know that young infants are sensitive to many properties of solid, cohesive objects, it is unclear what they understand about objects that do not fit into this category. For example, infants understand that solid objects cannot occupy the same space at the same time and that they will remain solid and cohesive when picked up. Further, they can distinguish between small numbers of objects, i.e. one versus two toys on a stage. However, the few studies testing infants' knowledge of non-solid, non-cohesive objects suggest that young infants may not yet understand the properties of such materials. For instance, previous research has suggested that when shown a solid object that falls apart when lifted, infants are surprised. Yet when a pile of sand is lifted and either falls apart or magically appears to lift as a solid, cohesive, sand pile-shaped object, infants have no expectation about which outcome should occur.

This set of studies seeks to further examine infants' reasoning about non-solid, non-cohesive objects. In one study, infants are encouraged to reach for both an actual pile of sand as well as a sand pile-shaped solid object. We are examining whether differences in their patterns of reaching to the two types of objects might suggest that they are representing differences in the two factors of interest: cohesion and solidity. In a second study, we measure infants' looking times to one versus two piles of sand on a stage. By first presenting either one or two piles of sand being poured onto a stage multiple times (until the infant bores of the event), we can then present the novel number of piles and see whether the infant will notice the difference. While infants will generally look longer at the novel number if the objects are solid and cohesive, it is not clear that they will do so with substances like sand. These studies are currently in their early stages, but we will keep you posted on any results we find!

Picture Book Study

Luke Butler, Undergraduate Researcher

In the Picture Book Study, we are interested in how 15- and 18-month-olds behavior towards pictures is correlated with their understanding of pictures as symbols. First, the child is seated in an infant seat and we show him or her a book of photographs depicting familiar objects. Children at this age show a variety of behaviors towards photographs and pictures, including grasping and pointing, and we want to see how often children show such behaviors.

Second, the child sits on a couch between their parent and the experimenter. Children then see a second book of photographs, which in this case includes pictures of both familiar and unfamiliar objects. We talk about each of the photographs, and label each, including one of the unfamiliar objects, which we call a "blicket." In the test trial we present the child with the picture of the blicket and the real blicket, and ask thechild to show us the blicket. We wish to see whether children's behavior towards the pictures in the first phase of the study is correlated with their understanding of how the picture refers symbolically to the real object.

Angel Study

Rebecca Saxe, Post-Doctoral Fellow

The Angel Study investigates the very earliest concepts that infants have of people. What kinds of "things" do infants think people (adults) are: A special kind of material object, or more like a ghost or an angel?

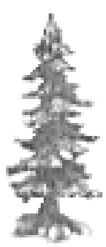
One of the most basic rules that infants have about objects is that two solid objects cannot pass through each other. We know from our own and others' previous data, that by the time infants are five months old, they're surprised if one object (e.g. a train) appears to pass right though another (a wall).

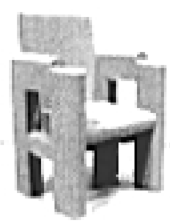
If infants see people as a kind of object, then they should be just as surprised to see a hand apparently pass right through a wall. On the other hand, if infants think people are omnipotent, more like angels, then they won't be surprised by a hand passing through a wall. After all, the adults in their lives CAN do almost anything!

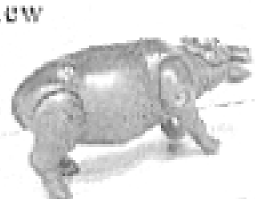
Animal Goals

Kristin Shutts, Graduate Student
Lysett Babocsai, Visiting Graduate Student

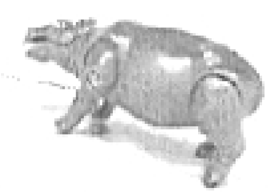
Recent research in our lab has shown that infants pay attention to the goals of human adults. For example, when infants see an adult reaching for a doll, they seem to interpret the event as a goal-directed reach rather than a meaningless hand motion. In the Animal Goals study, we are interested in asking whether 7-, 9-, and 11-month-old infants have similar expectations about the behavior of nonhuman animals. Babies are seated on a parent's lap in front of a puppet stage. The study is divided into two parts: a familiarization phase and a test phase. In the familiarization phase, a wind-up hippo toy walks several times toward a particular goal object (e.g. a tree). In the test phase that follows, the hippo walks alternately to the same goal (the tree) on the stage or to a new goal (a chair). The new goal object appears in a familiar location (where the hippo walked before in the familiarization phase), while the old goal object appears in a new location (where the hippo never walked before in the familiarization phase).







We predict that if infants can learn and remember an animal's goal, then they will look longer in the test phase at the trials where the animal approaches a novel goal object. So far it seems that 7-month-old infants do not show evidence of learning about the goals of an animal. They look equally long in the test phase at new goal trials and old goal trials. We have also begun testing groups of 9- and 11-month-old infants to see if older infants show a different pattern of results.



Some scientists have proposed that one thing that might make humans different from other animals is that we can reason about the goals and intentions of those around us. By conducting this study and others in the lab, we hope to learn about the development of this perhaps uniquely human capacity.

Non-Obvious Properties

Stella Christie, Undergraduate Researcher

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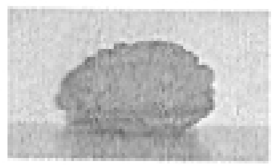
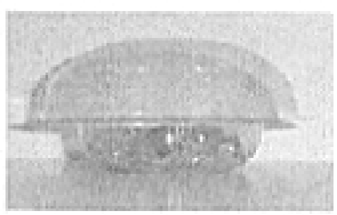
We acquire all kinds of new information in our everyday lives. Perhaps some of our innate tendencies are engineered especially to make this information acquisition process easier. One approach is to consider the kind of information acquired in a given way: perhaps humans are differentially adept to pick up properties of novel objects based on the utility content of the property. Information that is irrelevant with respect to categorization - such as the box something came in or the sound it makes when dropped - is virtually useless, and thus less important to remember. Based on this, we hypothesize that young children will show a better learning ability for category-relevant object properties, such as object function, as compared to category-irrelevant information.

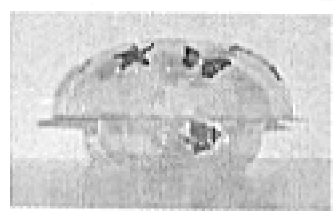
In our study we first show a novel object to the children, and then demonstrate the function of this object, for example shaking an egg-shaped object that makes a rattling sound. The beads inside this object are the property that is responsible for the objects' function. However, during the function demonstration the beads are concealed so the children cannot see this property, and must infer it by observing the function. After this demonstration we bring a pair of objects to the table. The object pairs look very similar to the previously demonstrated object, and to each other, in shape and color, except that one of the objects is missing the functional property. Following the example, we show the children two egg-shaped looking objects, one with beads inside the egg, and one with the beads glued outside (on the surface of) the egg. The egg-shaped objects, unlike the object demonstrated in the beginning, are see-through objects - the children can see the beads inside. We then tell them that "now it is their turn to do it" and we expect the children to choose the object with functional property - the eggs with beads inside - to check whether they are sensitive to objects' properties.



Original Rattle



Functional Rattle



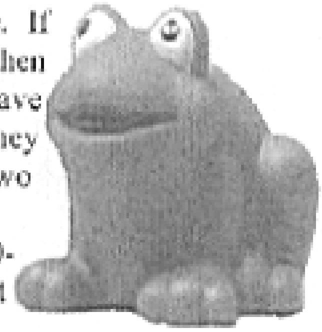
Non-functional Rattle

Children in our study did quite well in this task. They saw four different pairs of objects and more than 60% of them chose the correct functional object 3 or 4 times in 4 trials. One could suggest, however, that this result merely shows that the correct functional object is simply inherently a more interesting object for the children to choose out of the pairs. Hence, we follow up this study by conducting another study, in which the children saw the exact same pairs of objects as those in the original study. This time, however, we simply showed one object in the beginning, without demonstrating its function. We also ask the children to "pick one" (instead of telling them to "do what I did," as in the original study). The children in this study, unlike in the original study, pick the object at random. This suggests that there is nothing inherently more salient about the correct functional object, and that it supports our earlier hypothesis. All in all, we learn that young children are sensitive to objects' functions when they are cued to pay particular attention to them.

Object Individuation Box Task

Liz Baraff, Research Assistant

Infants can use a variety of cues to count and track the number of objects with which they have interacted. We have found that 12-month-olds can use kind information (what the objects look like) and time-place information (if two objects are present at the same time) to track small numbers of objects. In this study, infants are shown either one or two identical objects, with the object(s) either on top of the box or on each side. The objects are then placed inside the box, and the infant is allowed to reach for the objects (without being able to see inside). If they reach again after having already found one object inside the box, then it can be inferred that the infant has decided that two objects were put inside. If they don't reach again, then the infant must not have realized earlier that they were being shown two individual objects.



Surprisingly, 10-month-olds succeed at our reaching task *only* when both kind and time-place information are present. In other words, they do not succeed at tracking two objects presented at the same time when the objects are identical in appearance. Our task investigates some possible cues that may help 10-month-old infants encode and remember the number of objects they have seen; thus, our research helps define developmental changes between 10- and12-months that facilitate this ability.

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