Bauer Memory Development Lab Newsletter

ISSUE 2 SPRING 2012

INSIDE THIS ISSUE:

Greetings and Thank You from the Bauer Lab!

Greetings from Ayla, Aylin, Cory, Elizabeth, Felicia, Jackie, Jenni, Jessica, Maria, Marina, Nicole, Theo and Shala, the researchers in Dr. Patricia Bauer's laboratory!

We thank you for your involvement in our work! The generosity each family has shared with us has allowed our lab to conduct exciting studies aimed at understanding how memory skills develop and how new knowledge is created.

This current newsletter summarizes the studies we have been working on over the last two years. Since our last newsletter in 2010, we have been extremely busy conducting research on several different topics - with various age groups of children, college students, and even parents as our participants! We are particularly proud that we've had the opportunity to share some of our findings with colleagues at several national conferences, including the Society for Research in Child Development (Montreal, Canada 2011), Cognitive Development Society (Philadelphia, PA 2011) and the Cognitive Neuroscience Society (Chicago, IL 2012). Many members of the lab had the chance to present our research through poster presentations and/or leading discussions with colleagues on exciting new topics on child development.

In addition to the expansion of our research, over the past two years we have also welcomed several new members to our lab. Aylin (Fall 2010), Nicole (Fall 2010), and Maria (Fall 2011) all began their graduate studies here at Emory. Shala, a graduate student who had previously done work at the Yerkes Primate Research Center, joined our lab in the Spring of 2011 to finish her PhD research. Jenni, Cory, and Theo, graduate students from labs of several Emory colleagues, joined us for collaborative projects. We also welcomed a new lab coordinator, Ayla, who joined our lab after graduating from Wellesley College in May 2011. While we don't like saying goodbye, several members of the lab have moved on to new adventures -Jeni defended her PhD dissertation at Emory in December 2010, and she is currently doing her Postdoctoral research at the Center for Mind and Brain at the University of California at Davis. Ayzit, a former lab coordinator, started her graduate research program in cognitive neuroscience at Vanderbilt University in the Fall of 2010. We are also proud to report that Felicia will be moving this summer to pursue a PhD in Clinical Psychology at Stony Brook University.

Eyeblink Study

We often take it for granted that infants are making associations every day. For instance, the sight of a bottle means feeding time is near. In our study of infant associative learning, we are looking at 5-, 7-, and 10-month old infants' ability to associate, or link, one event with another. In the case of this study, we are interested in how they associate a brief tone followed by a very gentle puff of air. We can determine whether infants are associating these two events by observing the timing of infants' blinks. This simple yet amazing method is unique in that it provides a glimpse into the development of one of the brain structures crucial for memory: the hippocampus.

We are excited about this study because it is the first to look at hippocampal development in infants using this unique method. Since we know from other research that the hippocampus develops considerably during the early years of life, we expect to see an increased ability in older infants, compared to younger infants, to time their blinks after hearing the tone. The ability to associate the two events implies that the hippocampus is rapidly maturing during this period of infancy.

In order to see how these brain developments compare to advances in other types of memory, 7- and 10-month old infants also participated in an "elicited imitation" task on their second visit. Infants first explored some special objects, and then watched an experimenter (either Ayzit or Felicia) use these objects to "go for a ride" and "make a shaker." Ten minutes later, infants were given the objects and asked to reproduce the actions. Since the hippocampus plays a crucial role in the encoding and retrieval of memories for specific events, we expect that older infants will remember more than younger infants.

Thank you to all of the families who have participated! We are currently in the final stages of this study, and are excited to gain a better understanding of how the brain develops in the first year of life!

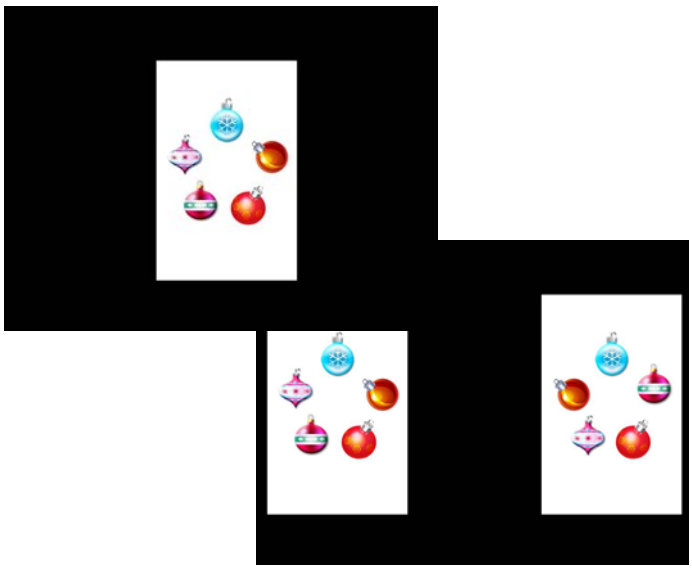
Eyetracker Studies

This past fall we have been using eyetracking with infants. In this study, 20-month-olds watched a video of an experimenter performing various actions on novel toys. We repeated the video multiple times so the infants could learn the actions. Immediately after the video viewing, infants were given the toys that the experimenter used in the video.

In a previous study, we found that infants imitated the actions that they saw on the video -telling us that they learned the actions over video. Further, on subsequent viewings of the video, infants often anticipated the next action the experimenter would make on the video, by moving her/his eyes to that location on the screen (even before the experimenter's hand moved there!). This fall, we have been challenging infants even more, by letting them see the video only 2 times. We don't know yet, but it looks as if we are seeing similar results as before – infants imitate the actions s/he saw on the video and the eyetracker shows that they were anticipating actions while watching the video. These are the first studies to relate eye-movements while learning to behavioral recall at a later point in time.

In another study with older children, 4- and 8-year old children saw a series of pictures on the eyetracker. Sometimes, a group of five objects was shown on a computer screen. After having some time to look at the five objects (learn them), two pictures were presented side by side. One picture was of the same five objects as the previous screen. The other picture was of different objects. Other times, children saw a single object on a special background. After having some time to learn it, they were again shown two pictures. One picture was a new object or new special background and the other picture was the familiar object or familiar special background. If children remembered the old picture, they are more likely to spend time looking at the new picture when they are presented side by side. Finally, we showed children a picture of a room (e.g. living room) with five objects in it. After the children studied the room, they were presented with the same room but some of the objects in the room were either replaced or change location. If the children remember the original layout of the room, they are more likely to spend time looking at the objects within the room that change.

Using these different types of pictures, we can tell whether children are able to detect novelty when the objects themselves were new (memory for "item"), when the same objects were presented in a different spatial location (memory for "location"), and when the background component of the image changed (memory for "context"). Memory for item, location, and context are important features of our memory. The study is ongoing, but we predict that memory for location and context develops more slowly than memory for item.



Infants and Emotion

How do infants use emotional information?

Infants encounter new events and situations almost every day. Near the end of the first year of life, infants begin to look to adults for information about new situations and will use that information to guide their behavior. A rich source of information comes from facial and vocal expressions of emotion. For example, when the parent expresses a negative emotion such as fear or disgust, the infant will often avoid or withdraw from the situation. In contrast, when the parent expresses a positive emotion such as happiness, the infant is more likely to approach the situation.

In one of our studies we examined the effects of parent-provided emotional information on changes in infants' behavior, and also changes in their brain activity. Parents provided an emotional expression (happy, fearful, or neutral) toward each of three novel objects, and we recorded infants' brain activity in response to these objects, both before and after the emotional information was provided. The results were very exciting! We found that infants' neural response increased following the fearful expression, decreased following the neutral expression, and remained unchanged following the happy expression. This tells us that infants have specific behavioral and neural responses to different kinds of emotional information.

ERP and Emotional Experiences in Kids

In an ongoing study, we are looking at how children think about different kinds of emotional events and experiences. Specifically, we're interested in children's brain activity when they think about emotional experiences from their own lives, and when they look at pictures that represent everyday emotional scenes (such as a cute animal or a gross bug). We're also interested in how children talk about their experiences, and how they rate the pictures of the scenes. We are currently in the process of analyzing data, and we hope to have results to share with you and the scientific community soon!

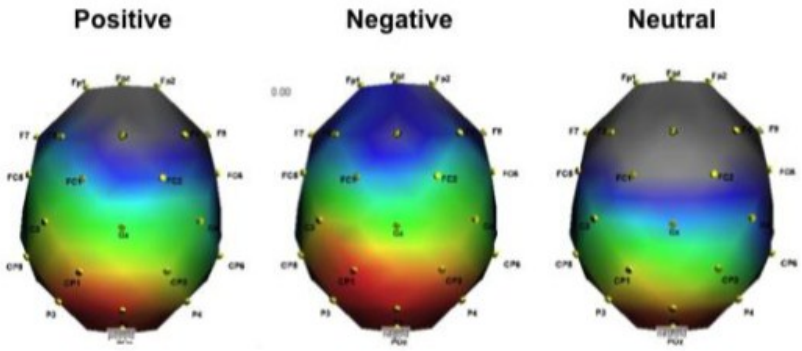
Memory for Emotional Photographs and ERP

Are children's memories influenced by their emotional responses to new experiences? Adults typically have better memory for experiences that were emotional, relative to non-emotional everyday events. We predicted that children would similarly form better memories of positive and negative events than neutral events.

We examined the memory formation process using ERP to record 5- to 9-year-old children's brain activity while they viewed photographs of positive, negative, and neutral situations. We also measured children's heart rate, breathing rate, and sweating response. These responses allowed us to measure the physiological element of children's emotional responses to the photographs. Emotional responses also include cognitive elements, such as children's conscious assessments of whether they felt good or bad when viewing a particular photograph. We measured children's cognitive reactions to the photographs by asking them to rate how pleasant or unpleasant each picture was, and the strength of their emotional reactions to each picture.

Children devoted increased brain processing resources to photographs that evoked greater physiological and cognitive emotional responses. The increase in brain processing was observed on the back of the head, and reflects an increase in visual attention to the emotional photographs. When children's memory of the photos was tested one day later, they accurately remembered more negative photos than positive or neutral photos. This is consistent with previous studies of adults.

This is the first study to examine children's brain activity during emotional memory formation. We have learned that emotional reactions influence the strength of memory formation for children as young as 5, and have characterized the pattern of brain responses to emotional stimuli in healthy development. These findings lay the groundwork for future research identifying changes in brain processing of emotional events in children at risk for developing future psychiatric disorders. Our findings also attest to the ability of children to act as witnesses in court, even when testifying about a negative emotional event.

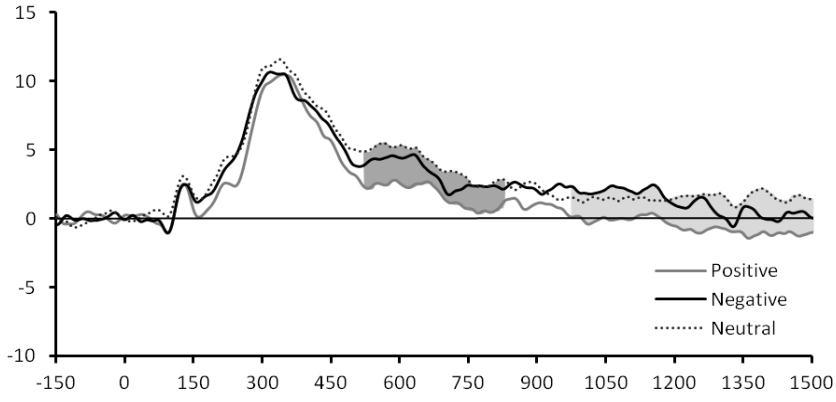


Brain responses to the emotional and neutral photos. Color scale ranges from red (greater amplitude) to blue (lesser amplitude). Top of plot: front of the head; bottom of plat: back of the head.

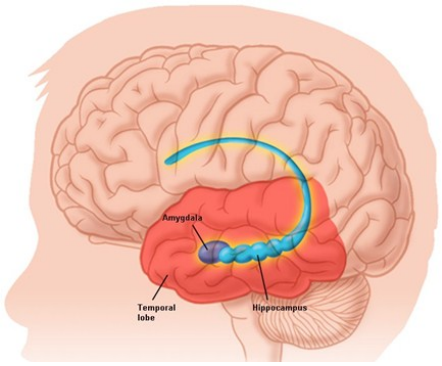
The Neuroscience of Autobiographical Memories (ERP)

How do school-age children remember different emotional events from their lives? To ask this question, we asked children to tell us about different events in their lives. We gave children simple words (for example bus or cheese), and asked them to tell us about events when they were happy or unhappy.

Then, we looked at children's brain activity as they remembered the events using event-related potential, or ERP. Utilizing this ERP technique, we investigated the brain's response to these memories. Interestingly, boys and girls differed in their brain activity in response to emotional memories. We also found that memories for emotional events resulted in brain activity in posterior sites (area of the brain near the back of the head). The manuscript describing our findings in detail has recently been accepted for publication in the journal, *Cognitive, Affective, and Behavioral Neuroscience*! A huge thank you to everyone who participated! Your involvement led to a new discovery in our understanding of emotional memory in childhood, and is now being shared with scientists all over the world!



fMRI and Children's "Brains in Action"



Hippocampal activation in children to the retrieval of emotional autobiographical memories

Technological advances allow us to literally peek in on brains in action. With functional magnetic resonance imaging (fMRI) researchers are able to see which areas in the brain are most active when performing certain tasks. We are interested in seeing which areas of the brain are most active when children are trying to remember.

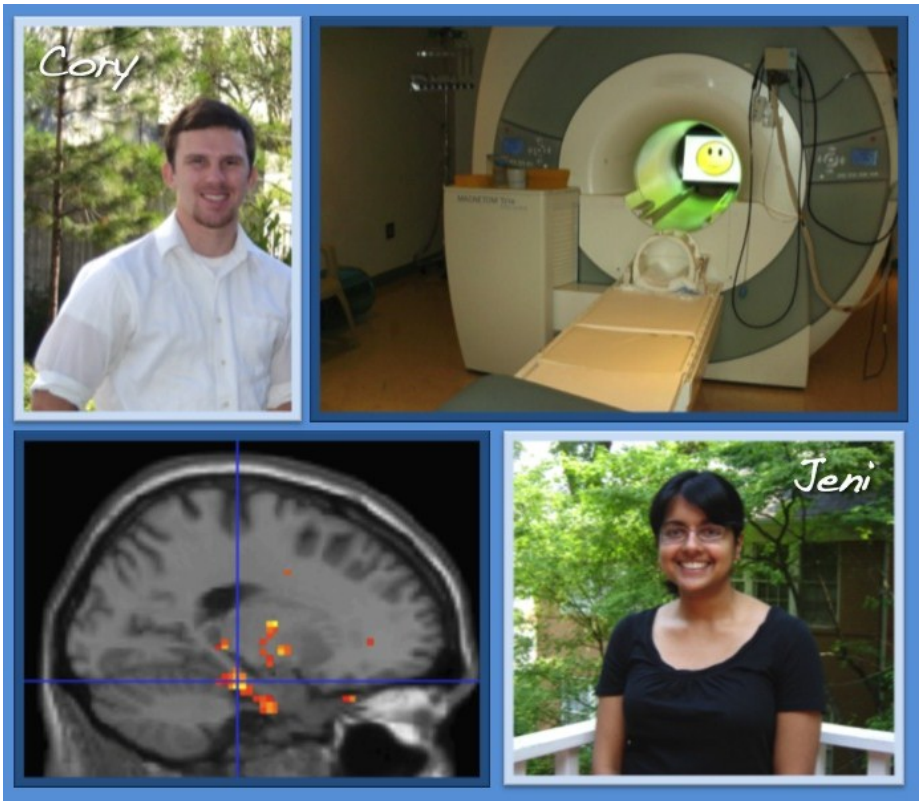
Although this is a very cool technology, one that can give us a lot of insight into the development of memory, it isn't something that we see every day. Going into a scanner can be quite a unique experience. In order to be able to take clear images of "brains in action," children need to stay very still. This, as you parents know, can be quite a challenge for young children!

So in order to help children experience what it would be like in the scanner and to help them practice staying still, families came into the lab to play a game called "opposite bowling." In this game, children laid down on the floor, with soft bowling pins surrounding their head. Unlike bowling in a bowling alley, the point of our game was to not knock down any of the pins. We made this task more challenging by asking children to balance a ball on their foreheads.

Although these games seem silly, they helped children practice laying still. We also played the sounds of the scanner, and showed children pictures of the scanner, so that they would know what to expect if they chose to participate in the fMRI portion of the study.

Our fMRI studies have been completed; with over 20 children successfully participating and we think they all fully enjoyed the experience. The children were especially excited when they get to see what their brains look like after their scan!! Thanks to all of those who participated!

The results so far are very exciting, with children and adults both activating regions of the brain known to be involved in memory, like the hippocampus and amygdala (Figure 1). Interestingly, it seems that these brain regions activate faster in adults than in children. We are continuing to explore this interesting data and hope to reveal much more about the development of memory from childhood through adulthood!



Memory for Stories: How Do Children Build a Knowledge Base?

As children begin formal schooling, they are taught lots of facts about many different topics, and they are expected to remember much of this information. To do this effectively, children must build an organized knowledge base to which they can continually add new information over time. One of the goals of this research is to better understand how children learn and remember information in order to promote these fundamental skills in the classroom setting. We began these studies during spring 2009 using picture books to teach children new facts. For example, in one story children learn a fact about flowers (e.g., a corolla is a bunch of flower petals). Then, after a short break, we read them a story that includes a related fact (e.g., flower petals are used to make perfume). After the children have heard both facts, we ask them to put the two facts together to create a third, "new" fact (e.g., what is the corolla used to make?).

In the first studies examining whether children are able to combine learned facts, we found that both 4- and 6-year-olds are very good at this task. As you would expect, six-year-olds were able to answer the questions more readily. Since then, we have examined different ways of presenting information to aid the learning process. Thus far, the results from these initial studies have been published in two papers and presented at several conferences!

In a recent study we gave 6-year-olds the chance to combine information from stories and asked whether they remembered the stuff one week later. As expected, children who successfully produced the new fact during the initial study session were able to remember this information after a delay. In another experiment we changed things up a bit. Instead of presenting stories and asking whether children could use them to produce new knowledge, we made them wait between these steps. This research has taught us that test questions can encourage children to organize information which aids memory for constructed knowledge.

Continued on next page

Memory for Stories (cont.)

Another way we used this picture book task was to see if "hinting" to children to use the stories would aid them in answering the questions. As we expected, the hint helped children use the information from the stories to create new knowledge. One of our current studies changes *when* the hint is given to see when it is most helpful to the children. Some 4 and 6-year-olds received the hint between hearing the two stories and others received the hint right before the questions were asked. In this study, we are trying to understand how *placement* of the hint influences a child's ability to produce new knowledge.

Lastly, a small group of 5-year-olds participated in a modified story-reading study where we were interested in how children remember specific features of an object. During the first visit to the lab, in addition to reading stories and answering questions about them, an experimenter modeled 4 different sequences of toys (doing the chores, working on the farm, etc).

We then asked the children to tell us, given a choice of several toys, which toy was used for each sequence. We made it difficult by making the choices similar in nature, only differing in their size or color! We were interested in how children remember the specific features of the objects and if remembering these features helps them to choose the correct object. Children came back a week later and were given the opportunity to demonstrate the sequences the experimenter modeled in the first session. Overall, we found that children were extremely good at both recognizing which objects were used and recalling the actual actions of each sequence even after a week delay!

Moms' Memories from Childhood

How do moms remember events from their childhood?

One of the ongoing studies in the lab shifts our focus from infants, and children, to moms. We have done studies investigating how children remember events from their lives, and with this study, we are interested in how moms remember emotional events from their own childhoods. Specifically, we are interested in differences in mothers' brain activity while recalling positive or negative events from before they were 13 years old.

To do study this, moms are fitted with an ERP cap (reads, records, and translates the brains electrical activity at the scalp) and are asked to reconstruct their memories from childhood.

Spending time reminiscing about childhood and having their brain activity recorded has been a lot of fun for moms. If you (or a family member, friend, or neighbor) are interested in participating in this study, please give us a call at (404) 712-8318 or send us a message at memoryatemory@emory.edu! We appreciate your help!

Thank You to Our Undergraduate Research Assistants!

We also want to take this opportunity to thank all of our undergraduate research assistants who have worked with us since Spring 2010. The students were/are involved in the lab while receiving research credits, conducting honors projects or participating in the Emory Undergraduate Research programs. They make a great contribution to our work, helping with all aspects of our research, from scheduling participants and running testing sessions to transcribing and coding, among many other lab activities!

Thank you!

Alicia Nelson
Anne Hermes
Anum Dhukani
Ashley Chennault
Ayanna Groves
Ben Johnson
Brittany Kim
Caitlin Ridgewell
Cameron Oddone
Cecily Krumholz
Eli Kalika
Emily (Sul Ki) Lee
Hayley McCausland
Jamie Levine
Jessie Rector
Jillian Edelstein
Joseph Dixon
Katherine Miller
Khaliliah Smith
Laura Donnan
Laura Morris
Manas Winfield
Mansi Upadhyay
Maria Jones
Michael Kestenbaum
Michelle Elliott
Mikhaila Smith
Nicole Hembree
Rachel Mullen
Rebecca Groff
Samantha Medile
Simone Wilson
Toby Glazer
Tori Barlow
Zach Babin

child study center
EMORY UNIVERSITY

Do you know any families who might be interested in participating in child development studies at the Emory Child Study Center? Please visit the Child Study Center website at:

www.psychology.emory.edu/childstudycenter

or Call/Email:

404-727-7432/childstudies@emory.edu

Bauer Memory Development Lab ♦ Emory University ♦ 36 Eagle Row ♦ Atlanta, GA 30322
Phone: (404) 712-8330 ♦ E-mail: memoryatemory@emory.edu