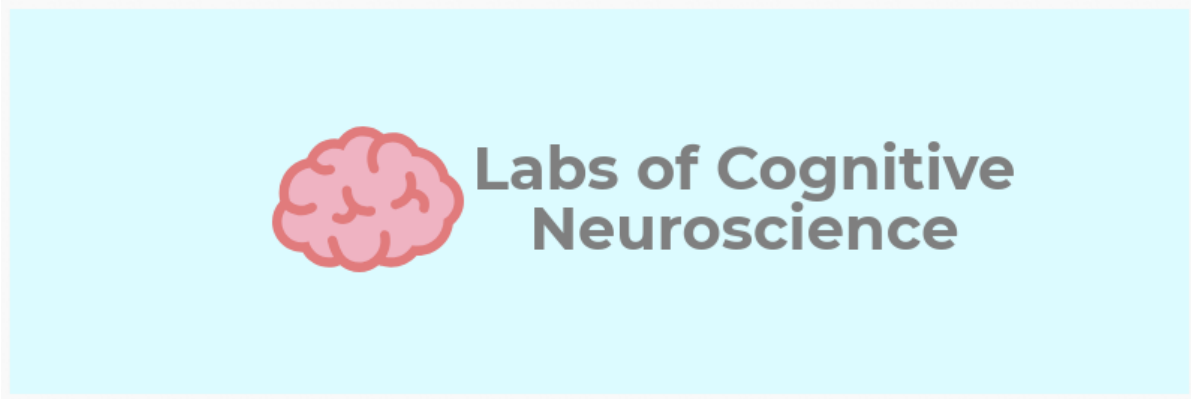
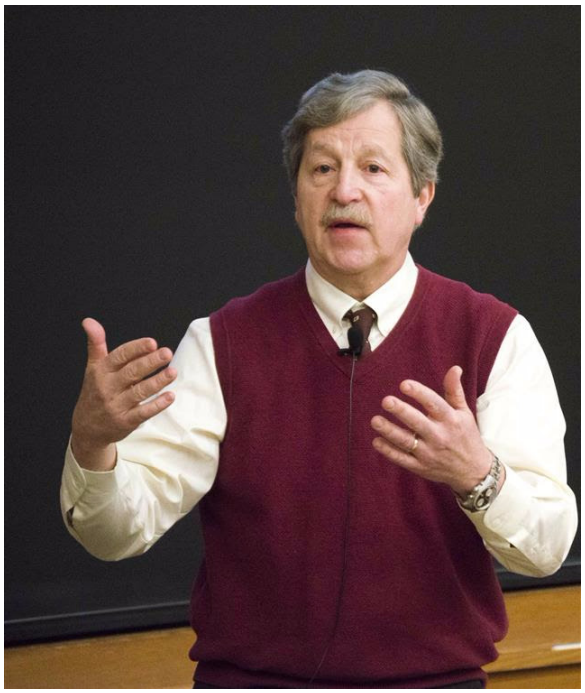
SPRING 2019



THE EMOTION PROJECT

The Emotion Project is a longitudinal study looking at the development of facial emotion processing and its relationship to later outcomes.



An introduction from our Principal Investigators, Dr. Charles Nelson and Dr. Michelle Bosquet Enlow

Hello everyone and happy spring! Here in the Laboratories of Cognitive Neuroscience at Boston Children's Hospital, we have many exciting projects underway studying both typical and atypical brain development and the many factors that shape it. From Bangladesh to Puerto Rico, our studies take place all over the world with children from many different backgrounds. We aim to understand how certain early environments and genetic factors shape how the brain grows and changes, while also providing intervention to support healthy outcomes for all children.

The Emotion Project, which takes place here in Boston, is a study including 807 participants (including your child) that examines the development of emotion processing using neuroimaging, clinical, behavioral, cognitive, and physiology measures. We began seeing participants at 5, 7, and 12 months of age. While we are no longer recruiting new infants for our study, we have been working hard conducting our 3- and 5-year follow-up visits. We are also in the process of planning the 7-year follow-up visits to begin this spring! Starting at the 5-year time point, we include a parent interview portion that takes place here in the lab or over video chat so that our participants who have moved out of the state are still able to contribute to the project.

As always, we want to thank you for all of the time and enthusiasm you and your child have given to this project. Without you, the exciting research and findings you will see in this newsletter would not be possible. You and your children are the reasons we love this work so much.

We look forward to staying in touch and seeing you at upcoming follow-up visits. Enjoy the

beautiful spring weather!

Dr. Charles Nelson and Dr. Michelle Bosquet Enlow,
Principal Investigators

POSTERS, PAPERS, AND SYMPOSIA

Individual Differences in Event-Related Potentials to Emotional Faces from Infancy to 3-years: Developmental Stability and Relation with Risk Factors for Anxiety

Laurie Bayet

People tend to pay more attention to angry and fearful faces than they do to neutral faces. While researchers previously thought this attention bias was telling of an adaptive evolutionary trait, there is some evidence suggesting that this response might be different from person to person as early as infancy, and that these differences help to explain behavioral anxiety.

Dr. Laurie Bayet wanted to know if individual differences in how young brains process threat are stable from infancy to toddlerhood. She also wanted to use our EEG measure to know if infants who respond more strongly to negative emotional faces are subsequently at a greater risk for developing internalizing symptoms as toddlers. Internalizing symptoms refer to negative symptoms like nervousness or social withdrawl that are felt more internally than displayed externally (like attention or hyperacitivity symptoms).

To answer these questions, she used questionnaire data collected at both the infant and the three-year follow-up visit regarding maternal anxiety from The State Trait Anxiety Inventory along with information about temperament data collected from the Infant Behavior Questionnaire and Early Childhood Behavior Questionnaire. She also used data from our electroencephalogram (EEG) measure to see how infant and toddler brains respond to happy, angry and fearful faces.

She found moderate stability in the way infant and toddler brains react to emotional

faces in several areas of the brain (Figure 1A). She also found that the differences in how much attention infants pay to happy and angry faces depends on their internalizing behavior scores (Figure 1B). She found that infants who paid more attention to angry faces displayed more internalizing behavior as toddlers than infants who paid less attention to angry faces. Similarly, infants who paid more attention to happy faces displayed less internalizing behavior as toddlers than infants who paid less attention to happy faces.

These results are exciting because they link differential patterns of neural response towards emotional stimuli to behavioral differences in internalizing behaviors later on in development.

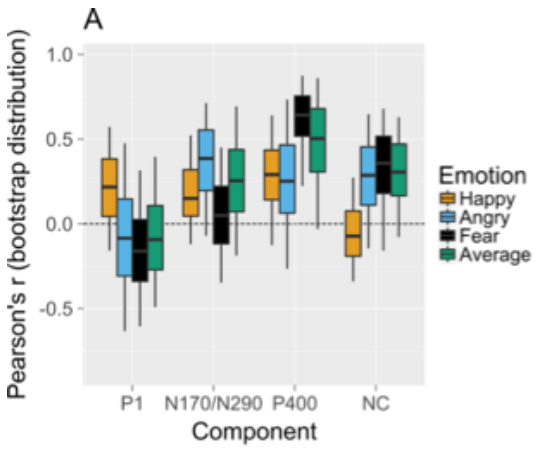


Figure 1A

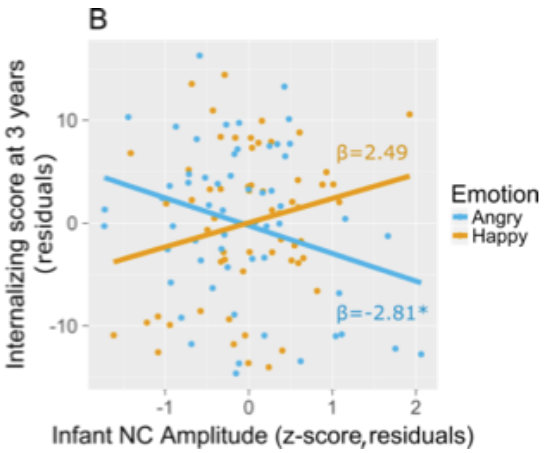


Figure 1B

Neural Correlates of Facial Emotion Processing in Infancy

Wanze Xie, Sarah A. McCormick, Alissa Westerlund, Lindsay C. Bowman, Charles A. Nelson

At their first Emotion Project visit, infants of five, seven, or 12 months age viewed images of angry, fearful, and happy female faces while wearing an EEG net to examine how the infant brain responds to different emotions. This task provides useful information on the typical development of the neural mechanisms involved in facial emotion processing.

Dr. Wanze Xie was particularly interested in examining the detection of fearful faces in infancy, as it is hypothesized that the detection of fear may be critical for development. Data analysis revealed that the detection of fearful faces in the infant brain can happen as early as 200 - 290 milliseconds after a face is shown to the infant, as identified through electrical activity in the brain.

In addition, the findings identified two areas of the brain that may be associated with attention to negative emotions: the right FFA and the PCC/Precuneus. This neuroimaging task is repeated at the three-year and the five-year visit and will help identify the typical development of facial emotion processing over time. It will also help us better identify differences in atypical emotion processing.

Recognition of Facial Emotions of Varying Intensities by Three-year-olds

Laurie Bayet, Hannah F. Behrendt, Julia K. Cataldo, Alissa Westerlund, and Charles A. Nelson.

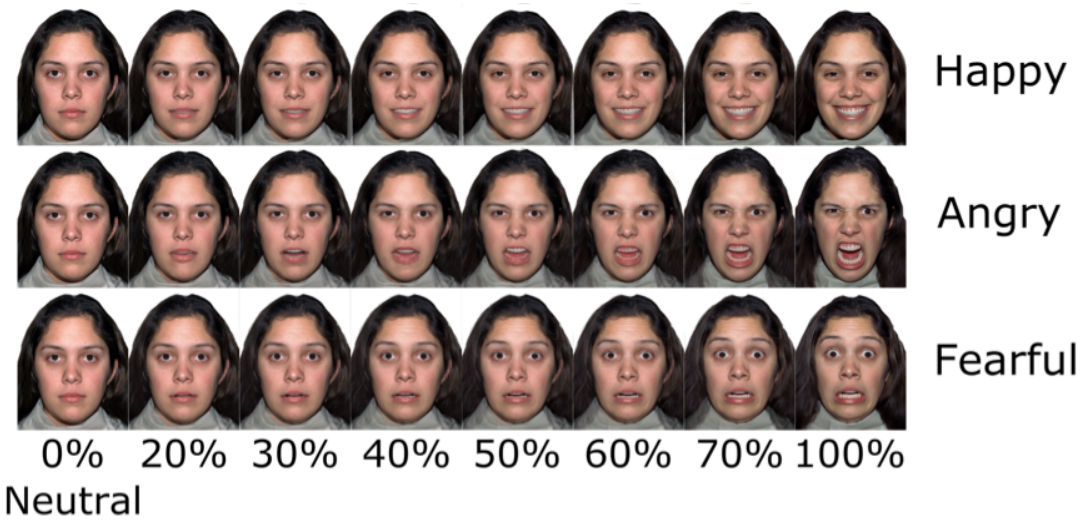
During our three-year visit, children sort cards displaying different emotional faces into four cardboard houses labelled with the emotions happy, angry, fearful/scared, or calm/neutral. The 22 cards sorted during the task show female faces displaying varying intensities of these emotions, as well as one completely neutral face (see below).

Dr. Laurie Bayet was interested in determining how intense an emotion needs to be in order for preschoolers to be able to sort it accurately. This has larger

implications, as early facial emotion recognition is hypothesized to be important for later social functioning and communication. Bayet found that preschoolers were less accurate when sorting high intensity scared faces compared to the other higher intensity emotions, and more frequently confused fearful and angry faces.

In addition, the three-year-olds tended to sort the neutral face as happy. Similarly, they had a bias against sorting lower intensity faces as a negative emotion, such that they would sort more ambiguous faces as either happy or calm.

Overall, all emotional faces at an intensity level of 60% and above were sorted with the same accuracy as 100% intensity faces. This emotion sorting task is also completed during our fiv-year visit and longitudinal data will be essential for further understanding the early development of emotion processing.



Early Development of Attention to Threat-related Facial Expressions

Jukka M. Leppanen, Julia K. Cataldo, Michelle Bosquet Enlow, Charles A. Nelson

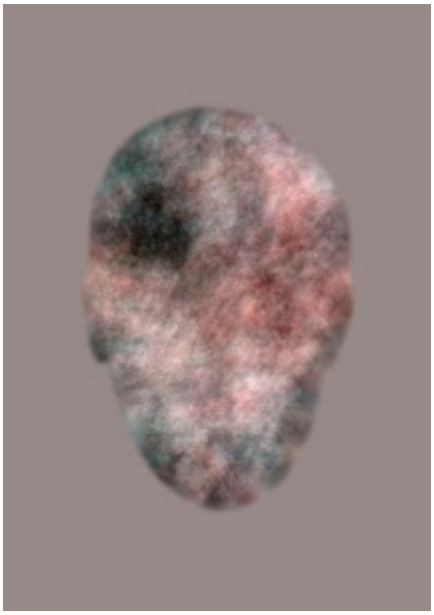
The Emotion Project's disengagement measure is the only task administered at all time points other than our EEG and fNIRS brain measures. This task uses eye tracking to assess how long it takes a child to shift attention (i.e. "disengage) from a face in the center of the screen to a distracting pattern presented milliseconds later on either side of the face. The faces that appear are happy, angry, or fearful and a control "scrambled" image is also presented (see below). This non-face control image consists of mixed up features of faces so that it is not recognizable as a

face, but still shares the same visual characteristics (e.g. color, contrast etc.) as the emotional faces presented. The fearful and angry faces are thought of as “threat alerting,” since people usually encounter these emotions when some sort of threat is present in the immediate environment.

In a recent paper, Jukka Leppanen, a collaborator on the Emotion Project, investigated if infants 5, 7, and 12 months of age, and three-year-olds in our study look longer at certain emotional faces before disengaging to the distracting pattern. He also wanted to examine if anxiety and depression symptoms in mothers had any influence on time spent looking at certain emotions (i.e. angry and fearful faces) and not others (i.e. happy faces and non-face controls). He thought that because experience with certain emotions allows infants to be more aware of such emotions in their environment, children of mothers experiencing such symptoms may look at angry or fearful faces in a different way than children whose mothers do not experience them.

He found that infants in all age groups spent less time looking at the non-face control images than the happy faces before disengaging. He also found that 7 and 12-month-old infants spent less time looking at happy faces than fearful faces before disengaging. The three-year-olds looked significantly less at non-face controls than any emotional face and also spent significantly less time looking at the happy faces than the threat alerting angry or fearful faces.

Leppanen was unable to show that differences in how long a child spent looking at certain emotions is related to any anxious or depressed symptoms reported by the mothers. However, his results suggested that in infancy, babies begin have a sensitivity to fearful faces. This in turn develops into a general sensitivity to threat alerting faces.



Patterns of Neural Response During Emotional Face Processing in 3- year-old Children: A Functional Near-infrared Spectroscopy Study

Julia Cataldo, Katherine Perdue, Ruby Almanza, Hannah Behrendt, Charles A. Nelson

In March 2018, Julia Cataldo, the previous project coordinator for the Emotion Project, presented data on emotion processing in the brain at the Cognitive Neuroscience Society's annual meeting. She looked at how emotional faces activated different areas of the brain, sometimes more strongly depending on the intensity of the emotion being viewed, in our three-year-old participants.

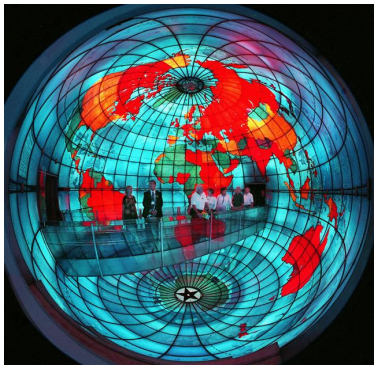
When a child comes in for our three-year visit, he or she will view 300 happy, angry, fearful, and neutral faces while either wearing our EEG net or our fNIRS cap. Our fNIRS cap allows us to see blood flow in the brain. When certain areas of the brain are active, they require more oxygen that comes from the bloodstream. Because of this, our fNIRS cap can help us see these active areas by measuring the amount of oxygenated blood in different areas all over the brain.

Julia found that the processing of happy and fearful faces is localized to one part of the brain, while the processing of angry faces was localized to a different part. She also found that the brain worked more to process lower intensity faces that it did when processing higher intensity faces.

By understanding these patterns at a group level, we hope to set the stage to be able to better identify and categorize individual differences in emotional face processing in the future.


FUN IN BOSTON

Coming to Boston for your visit and looking for other fun things to do on your day in the city? Check out some of these great ideas from Mommy Poppins



For even more ideas, see the website below. While most of these activities require an entrance fee or ticket, many Massachusetts public libraries will offer passes to acces these places for free! Go to your local library's website for more information.

VIEW MORE

COMINGS

Finola Kane Grade,
Project Coordinator

Finola graduated from the University of Wisconsin-Madison in 2016 with a comprehensive honors degree in Psychology and Music Performance – Flute. During her undergraduate career, she completed a thesis regarding the effects of positive and negative affect on short-term perceptual learning with Dr. Seth Pollak, and also worked in the labs of Drs. Hill Goldsmith and Richard Davidson. Upon graduation, she accepted a position as a postgraduate fellow at the Yale Child Study Center with Dr. Katarzyna Chawarska, studying early risk markers for autism spectrum disorder. She has presented at research conferences both nationally and internationally. Finola joined the Emotion Project team as the coordinator in June 2018.

Lauren graduated from Williams College in 2018 with a double major in biology and psychology and a concentration in neuroscience. As an undergraduate she worked in a behavioral neuroscience lab and used rodents selectively bred for infantile vocalization rate to study the effects of third trimester restraint stress and juvenile isolation on adult prosocial behavior. For her senior thesis, she used these selectively bred rodents to probe the interplay between maternal care and genetics in shaping juvenile social behavior. Lauren is excited to join the Emotion Project, work with children, and meet all the families involved in the project.

Lauren Steele,
Research Assistant

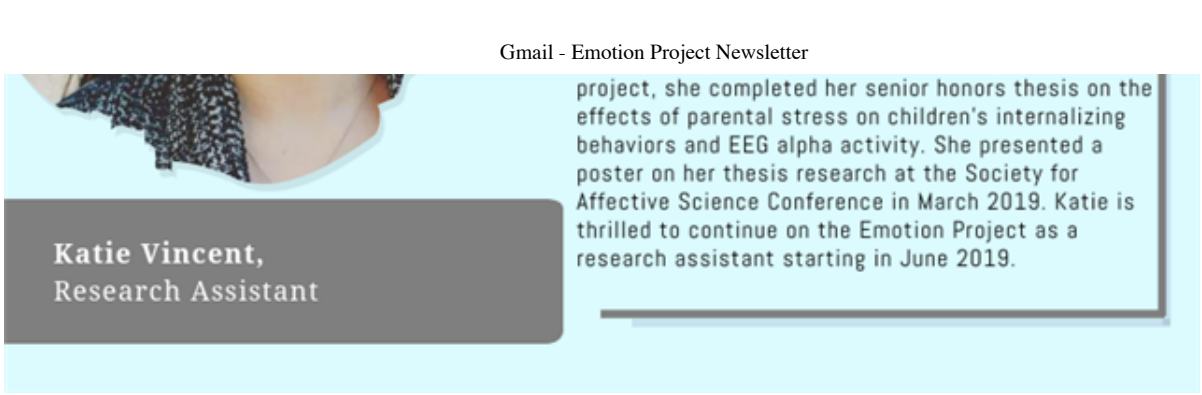
Hilary joined the Nelson Lab after receiving her PhD in Neuroscience from MIT in June 2018. Hilary's dissertation research used fMRI to measure responses in brain regions that are used to think about other people's thoughts and emotions. In particular, she studied how the responses in these brain regions change during childhood, and how changes in these brain regions relate to developmental improvements in social reasoning. To make the fMRI experiment more fun and engaging for young children, Hilary's experiments involved listening to stories or watching short movies. Hilary is excited to join the Emotion Project team, and to learn more about the development of social brain regions and emotion processing in infancy.

Hilary Richardson,
Postdoctoral Fellow

Wanze joined the Nelson Lab and the LCN in October 2017 after receiving his Ph.D. in Experimental Psychology from the University of South Carolina. His dissertation work focused on the development of brain functional connectivity and its relation to infant sustained attention under the supervision of John E. Richards. He now works as a postdoctoral research fellow in the Nelson Lab on the Emotion Project, where he continues to analyzes neuroimaging data.

Wanze Xie,
Postdoctoral Fellow

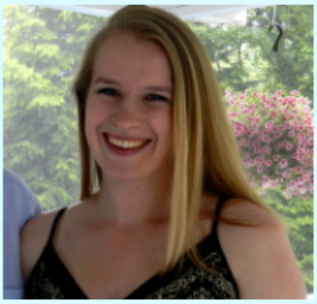
Katie will graduate from Harvard College in May 2019 with a degree in Psychology and a language citation in Spanish. After taking a freshman seminar with Dr. Nelson, Katie began as a student intern on the Emotion Project in February 2017. Using data from the



Katie Vincent,
Research Assistant

project, she completed her senior honors thesis on the effects of parental stress on children's internalizing behaviors and EEG alpha activity. She presented a poster on her thesis research at the Society for Affective Science Conference in March 2019. Katie is thrilled to continue on the Emotion Project as a research assistant starting in June 2019.

GOINGS



Julia Cataldo
Former Project Coordinator

Laurie Bayet
Former Postdoctoral Fellow

Katherine Perdue
Former Research Associate

Ruby Lewis
Former Research Assistant

Meghan Colpas
Former Research Assitant

Anna Fasman
Former Research Assistant

FEATURED FAMILY

The Emotion Project team asked Alice Kaanta, mother of participants Winter and Vesper, some questions about her family, science, and her participation in the study. While her friend, a former researcher on the study team, was the reason she originally became involved with the Emotion Project, Alice discusses some of the other reasons she continues to bring in her daughters for study visits.

Q: Tell us about your family – what do you do for work, what activities do you like to do all together?

A: We're a family of nerds — I work for a data science software company and Brad is a hardware engineer. We enjoy lots of different things together — museums, hiking, cooking. Winter is happy to draw with as many colors and for as much time as she's allowed, while Vesper is a serious climber. Both girls love music, and are fascinated by cooking.

Q: How did you hear about the Emotion Project?

A: One of my good friends was a researcher on the Emotion Project about the time Winter

was born, and when she mentioned this study, we were delighted to get our children involved in science at 7 months. It's never too early!

Q: Why did you want Winter and Vesper to be involved in research as infants?

A: Aside from the general enjoyment of being involved in science, I always enjoy learning how science is being conducted, and by what tests and criteria we're understanding children. There's so much to untangle regarding how we develop and I love seeing what questions are being asked, and how.

Q: What has been your favorite part of participating in the Emotion Project?

A: It's an interesting way to observe my children and see how they react! The eye-tracking software in particular was highly interesting — I got to see what they focused on first in a busy picture, and what items they went back to repeatedly in a short time. What captures our attention in any setting is both learned and instinctive, and seeing it in action in such a young child was an, er, eye-opening experience.

Q: What is one thing you've learned from participating in our research?

A: Designing experiments for young children is challenging! They've got short attention spans, low tolerance for extended tasks, and do not like the cold, wet EEG cap. All of the researchers did a wonderful job leading the kids through the various experiments — for example, the EEG cap startled Winter into tears, and then someone blew bubbles, and everything was okay again. This team knows what they're doing.

Q: What is something you find challenging about participating in our study or research in general?

A: I think the hardest thing for me is waiting for the research to come out — I want to see the results, what we've learned! I'm also quite curious where my children fall on the spectrum of the results. They have different temperaments, but it would be interesting to see it quantified.

Q: What is something you've learned about children, child development, or emotion processing from being a parent that surprised you?

A: Children are much attuned to emotion than we realize, just on a different scale than adults. They're paying attention, and that can be a really interesting part of being a parent!

Additional thanks to our wonderful team of undergraduate students: Alex Kim, Cameron Decker, Gabby Munoz, Loren McCullough, Maggie Reynolds, Miranda Mize, and Tyler LeComer!

CONTACT US!

For any further questions about the Emotion Project or to provide us with any updated contact information, please email us at emotion.project@childrens.harvard.edu

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Anna Fasman <apfasman@gmail.com> Thu, Apr 18, 2019 at 8:27 PM
To: agf2132@columbia.edu, kfasman@comcast.net, jbolfas@comcast.net, barjoy112@comcast.net

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