The Elison Lab for Developmental Brain and Behavior Research

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Dr. Elison, Director of the ELAB, is an Assistant Professor at the Institute of Child Development, with affiliations with the Department of Pediatrics and the Graduate Program in Neuroscience. His research examines the intricate developmental processes that contribute to individual differences in social cognition and communication during the infant and toddler period. Current work in the lab is focused on using neuroimaging data to inform a better understanding of individual differences in complex social behavior and cognitive functioning.

Inside this issue:

Happy 2018 from the ELAB!

The first five years of life are a time of immense growth and development in children. Not only do children learn how to crawl, walk and talk, they also learn how to interact with their environment. The ELAB has been busy discovering how children develop into social beings by assessing brain and behavioral development. Through a multitude of studies in the lab, we utilize a combination of eye tracking, behavioral assessments, and brain imaging to dive into this period of rapid development in infants and toddlers. Due to involvement of countless devoted families, we are able to collect robust sets of data from children in order to gather further knowledge in the field of developmental research. Without the time and commitment of your family, we would not be able to conduct this research! In this newsletter, you will find updates from studies that are currently in progress, or were recently completed, in the ELAB.

Thank you for your commitment to our research!

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BABY Connectome Project
a UNC / UMN collaboration

The Baby Connectome Project (BCP) is a multi-year, multi-site, study designed to provide a more comprehensive understanding of the structural and functional connectivity of brain circuits during the first 5 years of life. This study will ultimately provide an unprecedented characterization of brain development during the early years of development, a time of rapid and dynamic change. We are actively recruiting typically developing children between 1- and 60-months-of-age (between birth and 5 years). To date, we have recruited ~ 150 infants to be part of this study, but we hope to enrolled ~300, so please tell your friends!

One of our youngest participants still fast asleep on the MRI table after his scan

Since beginning the study, ~50 families have provided behavioral data at 6 time points and ~30 have brought their child in for a final visit between 30-36 months-of-age. We have truly been privileged to watch these children grow up! This study depends on the commitment of our families – and our families have delivered to what will be an exceptionally unique and rich database that promises to yield novel insights to brain and behavioral development over the first 3 years of life. As an example, we have collected ~300 successful infant and toddler brain imaging sessions. **These data will teach us about aspects of brain development that will have important implications for the health and wellbeing of children.** We are currently preparing our first scientific papers that will summarize our results. We will share updates with families via our Facebook page and through this newsletter, so please stay tuned. We thank you for your commitment to our lab and our research.

A participant playing developmental games with grad student Angela Fenoglio

Flip to the next page for updates on the extension studies of Baby Connectome Project: Baby Connectome Project-Enriched, and a maternal eye tracking study, started in the fall of 2017 by one of our grad students.

Baby Connectome Project-Enriched

The research team for Baby Connectome Project-Enriched (lovingly referred to as "Mother Gut" around the ELAB), has been unbelievably busy! We are lucky to have enrolled 80 wonderful families so far with little ones from 1-month to 3-years-old. Without them this work wouldn't be possible! We have collected 228 fecal samples, 150 milk samples, 46 formula samples, and nearly 500 diet records! As this is a longitudinal study, and the kiddos only grow so fast, we are still in data collection mode. We have sent most of the fecal samples to the University of Minnesota Genomics Center for analysis and will have preliminary results for the next newsletter. We are also gearing up to send our first round of milk samples all the way to Italy for analysis! **Combined with the behavioral and neuroimaging data we will be able to look at the complex development of the gut-brain axis during the first three years of life.** Again, we have to thank all of our fabulous participants!!

For more information about the gut-brain axis see this great website: http://psychscenehub.com/psychinsights/the-simplified-guide-to-the-gut-brain-axis/.

How do parents influence the development of their child's social attention?

A large part of our lab's research focuses on how infants and toddlers develop into social beings. This includes learning more about their preferences for social and non-social images and objects over time. We often try to answer this question by characterizing the looking patterns of children based on the images presented on our eye tracking screen (faces vs. non-faces, happy vs. sad faces, etc.). **In this study, we aim to specifically explore what parents' looking preferences and patterns during eye tracking can tell us about the patterns of their child's social looking.** We will be examining the differences and similarities between looking patterns in parents and their children, as measured during eye tracking tasks.

We are currently recruiting families for our continuing longitudinal study, the Baby Connectome Project (BCP). Because our participating families are also part of our longitudinal study involving brain scans, we will be able to examine how relationships between parent and child looking patterns relate to changes in infant and toddler brain structure and function. Recruitment started this past fall, and is continuing throughout the BCP study.

Social Brain Development in Preterm Infants

Photo: American Pregnancy Association

According to recent estimates, approximately 1 in 9 U.S. infants are born preterm. Medical advances have led to an increased survival rate for preterm babies, but this has been accompanied by increased rates of medical and psychiatric complications. Impaired social functioning is key to many of the mental, emotional, and behavioral disorders adversely affecting this group, and the brain circuits involved in processing social information may be particularly vulnerable to prematurity due to the timing of their development and the ways these circuits are connected to other brain regions. Unfortunately, we know little about how social development and social brain circuitry may be affected by preterm birth. For her doctoral dissertation study, Angela Fenoglio has been working with Dr. Michael Georgieff and the team in the Neonatal Intensive Care Unit Follow-Up Clinic at the University of Minnesota Medical Center, Fairview, to assess early social-cognitive behaviors and brain development in preterm infants. She has enrolled 81 NICU grads and recently began enrolling infants from the Institute of Child Development registry who were born between 32 and 36 weeks of gestation. She also received a grant to conduct brain imaging studies with a small sample of these moderate- and late-preterm infants. **The long-term goal for this research is help identify targets for strategic prevention and intervention in preterm infants and other clinical populations at increased risk of mental illness.**

Attention, executive function & social behavior, in preschoolers

The ability to perceive threat in an efficient manner has been critical for the survival of the human species. A small structure in the brain known as the amygdala has been consistently implicated in the automatic and non-conscious processing of fearful stimuli within the environment. One current task designed to test amygdala function uses eye tracking to measure the speed of eye movements when primed with specific images (e.g. happy or fearful faces), followed by a target. This task has previously been used with infants, teens, and adults, but this ELAB study used the task with 145 children between 3-5-years-of-age. Previous research has shown that older children and adults show quicker responses to threatening cues than younger children and infants. **The goal of this study is to measure age-related change in the efficiency of processing of briefly presented salient information, allowing us to make inferences about amygdala circuitry during the preschool years.** This study was conducted by Laura Thomas, for her Undergraduate Honors Thesis project and was funded by the Autism Science Foundation.

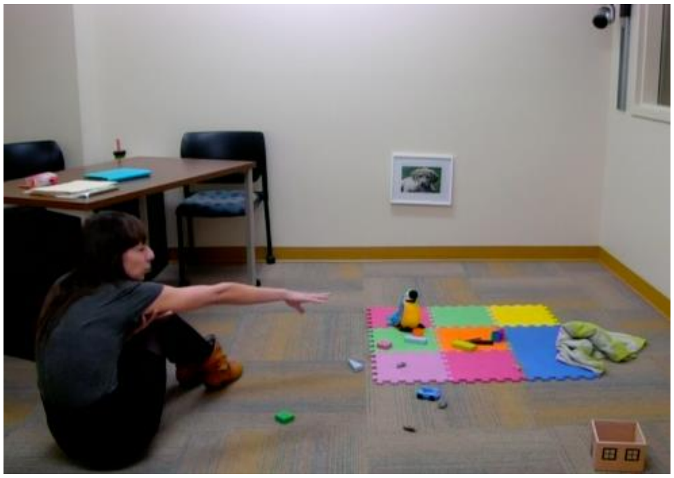
Early Prosociality: The Development of Helping in Toddlers

Cooperative behaviors are fundamental to human society. We care about each other, help others in need, share resources, and sometimes give up our own comfort for the comfort of others. Where do such abilities come from? How are they transmitted and internalized? One way to investigate these questions is to study children's earliest helping behaviors. Recent developmental studies have demonstrated that children engage in a variety of other-oriented, so-called *prosocial* behaviors already at young age.

In one of our current ELAB studies, we specifically focus on aspects of helping behavior, namely empathetic and instrumental helping, to understand what influences the early development and growth of helping, and what influences some children to behave more (or less) prosocially than others.

In this study, children observe an experimenter who is having a tough time. Sometimes she has dropped or misplaced something, sometimes she's cold or sad. The experimenter then provides children with various kinds of information about her problem and how they can help. Altogether, she gives up to eight progressively more explicit cues (i.e. from gesturally to explicit verbal requests) about her need or emotion and what the child can do to help her. **Will children know how to help?** How much information do they need to intervene? How do such skills change between one and two years of age?

Postdoc Nadja Richter gives a participant (not pictured) a nonverbal cue to bring her a blanket in her prosocial task



While this experiment is still ongoing in 24-month-olds, we are currently conducting detailed analyses of the 18- and 30-month-olds' responses to each helping scenario from video records. This preliminary analysis is promising in that we are able to capture age-related differences: the general propensity to respond prosocially increases significantly between 18- and 30-months-of-age. Moreover, we are replicating findings from other studies that previously showed that 18-month-olds' helping required significantly greater communicative support and scaffolding from the experimenter than that of 30-month-olds, whose prosocial behavior was more autonomous and demonstrated greater social understanding.

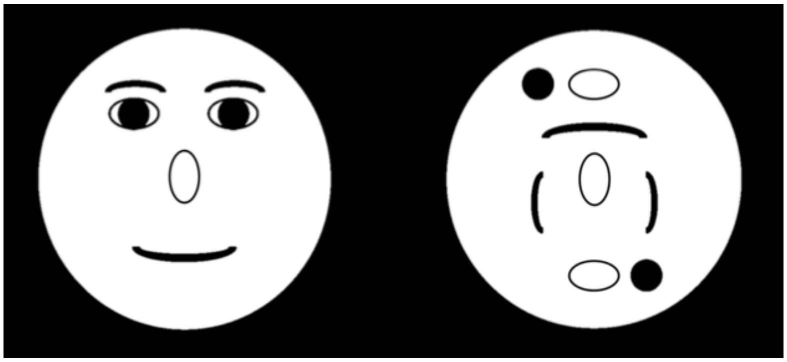
Eye Tracking

Photo: Tobii Pro

In the ELAB, we use a sophisticated, non-invasive eye tracking unit called the Tobii TX300. The eye tracker sits at the base of our monitor and follows your child's gaze and determines how long they are looking at the stimuli presented on the screen. The eye tracker is able to provide a reliable measurement of a complex human behavior, helping us assess gaze and attention in infants as young as 1-month!

Which side of the brain drives our early interest in faces?

Infants show an interest in faces from birth. In both children and adults, face processing happens predominantly in the right side of the brain**. In this study, we are asking whether the right side of the brain also drives infants' early interest in faces.** To answer this question, 3-month-olds were recruited to watch moving schematic faces paired with scrambled faces on a computer screen. Infants were randomly assigned to use both eyes, just the left eye, or just the right eye. Research shows that early in infancy visual information travels mostly from one eye to the opposite side of the brain, so the infants in our study who had both eyes open should process the stimuli with both sides of the brain, while "left eye open" infants should process the stimuli with the right side, and the "right eye open" infants with the left. So far, our results are promising! Infants with both eyes open prefer the faces over the scrambled faces. Interestingly, our "left eye open" infants also like looking at faces more than scrambled faces, but the "right eye open" infants have no preference. In other words, infants processing the stimuli with the right side of the brain demonstrate a preference for faces, while infants using the left side only do not! This effect did not hold true to objects, meaning that it reflects something special about faces. So to answer our question: it seems that infants' early interest in faces is mediated by the right side of the brain, the same side that processes faces later in life.



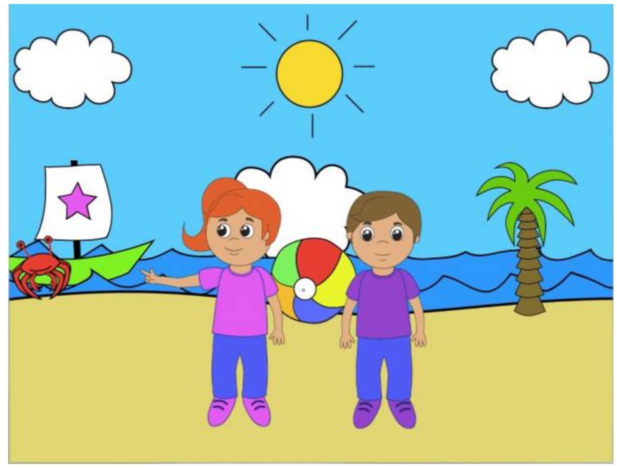
Pictured on the left is the schematic face and on the right is the scrambled face that the infants watched on a computer screen during this eye tracking study.

How does attention to social stimuli change across development?

How do our preferences for certain types of images develop and change over time? When do we begin to follow certain in-person social cues, and can we use those developments to predict looking patterns in similar eye tracking tasks later in development?

Over the past two years, 60 families helped us answer these questions and more! This study involved families visiting the lab three times over two years, providing extensive data both in person and through questionnaires. From November of 2015 to August of 2017, ELAB families came in into the lab to play behavioral games, watch eye-tracking videos, and complete tablet-based tasks to help us learn more about the development of social attention from 9-15 months, and what it can help us predict about social behavior and development at 2-years-of-age.

Not only did we collect a wealth of longitudinal data from this project, but it was also incredible to get to know families over a longer period of time: sometimes we would meet a family before their baby took their first steps or said their first word, and would then catch up with them and see that their toddler is running and chatting up a storm! We expect to publish a paper outlining our findings from this study in time for next year's newsletter.



Children watched while "Joseph" and "Maria" directed their attention to different objects on the screen and the eye tracker followed their gaze.

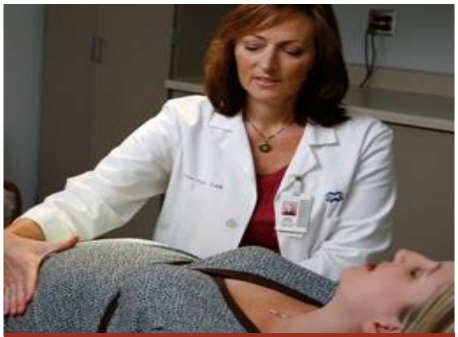
Cross-cultural study on the effect of child rearing practices on basic perception

A Tajik infant laying in a gahvora

As infants become more mobile, their perceptual experiences expand, and in turn promote their ability to act on the world. One challenge with investigating the bidirectional influence of action and perception is that these abilities develop together, preventing us from studying the relative influence of one on the other. **A traditional childrearing practice in Tajikistan, Central Asia, offers a rare opportunity to study effects of early immobility on perceptual development in humans.** Caregivers use a "gahvora" cradle during infants' first two years to sleep, toilet, and keep infants throughout the day. Infants' legs, arms, and torso are swaddled, with heavy drapes placed over the entire cradle. Daily gahvora use is extensive, especially during younger ages (average 18 hours/day), and decreases with age (average 7 hours/day by 24 months). Previous research by our collaborators at CUNY Staten Island has shown that onset ages for sitting, crawling, cruising, and walking are delayed in Tajik infants relative to Western norms. **In this study, we ask whether partial visual and motor restriction affects the development of basic perceptual competencies such as pairing sights and sounds, and perceiving motion.** We will collect data from 3-, 6-, 9-, and 12-month-old infants in villages in Tajikistan and compare it to data collected from infants of the same ages in the Twin Cities area. This study is in early stages, but could have far-reaching implications. Most of our knowledge of human development is based on research done on Western populations, so this cross-cultural comparison could call into question what we think we know about human perceptual development. Furthermore, this study could provide information about the interaction between the development of perception and action in infancy.

Women and Infants Study of Health, Emotions, and Stress (WISHES)

Today, research suggests that many of our individual characteristics may be influenced by the interplay of our genes and the prenatal environment that we experience before birth. **The goal of our WISHES study (the Women and Infants Study of Health, Emotions, and Stress) is to learn more about how women experience and cope with stress during pregnancy, and how these experiences may influence their children's development before and after birth.**



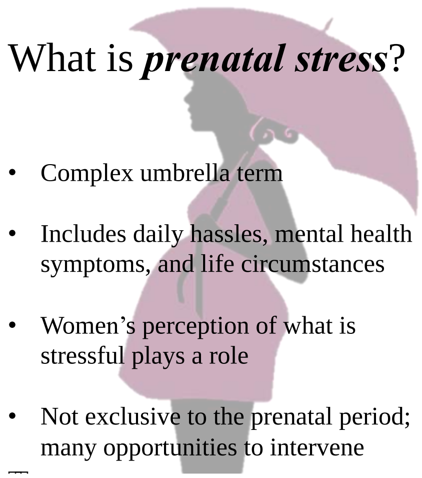
Midwife Ann Forster Page, a collaborator of the WISHES project, examines a patient at the Women's Health Specialists Clinic.

https://www.mhealth.org/locations/buildings/riverside-professional-building/womens-health-specialists-clinic

Why are we studying prenatal experiences? All women experience some amount of stress during pregnancy. Research has linked different levels of "prenatal stress" (PS) experiences to both positive and negative outcomes for women and their children. While mild levels of PS have been linked to enhanced motor and cognitive development in infancy, more intense or chronic experiences of PS have been associated with increased risk for an earlier birth, as well as problems with learning and controlling emotions during childhood. The mechanisms that link women's PS experiences to long-term child outcomes are complicated and not completely understood.

How does prenatal stress influence child development? Recent research suggests that PS experiences might influence child outcomes by impacting brain development before birth. PS can affect a woman's health during pregnancy in two ways, which in turn can influence her child's development. First, PS can affect behaviors that are important to maintaining good health during pregnancy (e.g., getting enough sleep, eating right, exercising, and getting good prenatal care). Second, PS can affect a woman's biological functioning during pregnancy, including her hormones, blood pressure, and immune system. The placenta, which regulates the prenatal environment, likely plays a major role here.

What's involved in the WISHES study? Animal research suggests that PS influences offspring brain development before birth. To study this question in humans, the WISHES study is following women and their children, beginning early in pregnancy. Women enroll in the study between 8-16 weeks of pregnancy, and complete questionnaires on stress, emotions, and health during pregnancy. *(Continued on the following page…)*



At several time points, women also complete fetal monitoring sessions, which involve placing electrodes on the woman's belly to measure her baby's resting heart rate. We look at fetal heart rate because it is a safe and noninvasive way to examine fetal development. Women also provide a small hair sample, which allows us to measure production of an important hormone called cortisol. Cortisol helps our body cope and respond in challenging situations. During pregnancy, cortisol also helps mature fetal tissues, such as the lungs, and may impact the development of the central nervous system and brain. Finally, women also complete a short computer game while we track their eye movements. This game allows us to understand how differences in attentional styles may play a role in whether or how women experience stress during pregnancy. Following delivery, women and children enrolled in the WISHES study are invited to participate in the Baby Connectome Project and continue doing research with our lab through the first years of life. This design will allow us to increase our understanding of how prenatal development and women's experiences during pregnancy provide a foundation for children's brain and behavioral development after birth.

Prenatal Stress N.U.T.S. Ingredients

- Novel
- Unpredictable
- Threat to survival or sense of self
- Sense of lack of control

Is my baby developing in the right way?

Work obligations are piling up.

I can't pay all my bills.

Will my birth plan be respected?

How will things change with my partner once we become parents?

I have to change my son's first diaper alone.

I want to get back to work but relatives think it is too early for me to return.

We want to thank the 60+ women and their children who have already enrolled in the WISHES study! With the help of our participants, we are learning more about how experiences during pregnancy may play a role in a child's growth and development.

Big discoveries from little people!

From the ELAB, we thank you for your participation in our studies! We look forward to another great year of research!

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