

Institute of Child Development's Human Developmental Psychobiology Lab

Human Developmental
Psychobiology Lab

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Greetings from Professor Gunnar

During the last year, parents, children and child care providers helped us with one or more of the studies described in this newsletter. This letter is a way of thanking you and keeping you updated with our results. Many of the projects that you have participated in over the last year are not complete and so this newsletter is mostly a progress report rather than a final report. We will send out another newsletter next year with many more results. We would like to thank all of you for your willingness to participate in research.



The Big Picture

Life is full of stresses of different types. Although as parents and teachers we try to shield children from overwhelming stress, we also want them to learn how to manage the normal stresses and challenges of life. In some ways stress is good. A life without any stress would certainly be boring. But we also know that chronic stress contributes to poor health, emotional problems, and early death. Some people manage stress better than others. These people deal with the major life stresses well (losing a job, death of a loved one) and they also manage the daily hassles of life without becoming worn out, sick, or depressed. Many researchers believe that the seeds of our ability to manage stress as adults are sown in childhood through the interaction of our genes with our experiences. In our research we try to understand how the experiences of childhood affect children of different emotional temperaments and how the combination of temperament and experience shapes a child's ability to manage stress as she or he grows up. The many different studies you will read about in this newsletter all approach our "big picture" question in one way or another. Most of the studies are on-going. This means that we will provide you with progress reports rather than final results in this newsletter.

Children's Behavioral Styles Study

Some children are shy, others are bold. Some can't tolerate frustration, others can. Both shy children and those who have difficulty tolerating frustration may also have more trouble managing the everyday stresses and hassles of childhood. But, is this because they have more reactive stress systems? This is the question we are trying to answer in what we call our Behavioral Styles study.

In this study, we ask parents and children to come to the University to play a number of games. The games are meant to bring out differences among the children in shyness/boldness and frustration tolerance. If you have come in to help with this study, you know the types of games your child played. For example, as one way of seeing how bold or shy children are, we allow them to play in a "Risk Room" that has a number of exciting things to do. They can climb a set of stairs and jump onto a mattress, crawl through a tunnel, and explore a rubber gorilla mask. In another game, we ask children to put a fun toy in a plastic box, lock the box and then give the child a set of keys to use to open it. This game is frustrating because, at first, the child is given the wrong set of keys. Only after a few minutes does the researcher "realize" her mistake and give the child the set that does open the box.

Because every child will sometimes be shy and sometimes get really upset when frustrated, we can't be sure that every child's reaction to our games reflects how they typically act. For that reason, we also ask parents to fill out a questionnaire describing their child's typical reactions.

To examine children's physiological stress reactivity, during the session we pretend with the children that they are astronauts. As part of that game we measure the children's heart rate, eye-blink startle, and cortisol stress hormone reactions as they watch several

Early Social Communication Skills Study

Early social communication skills involve using nonverbal behaviors that children use to share their experiences with others. These behaviors include things like pointing (“Look!”) and making eye contact (“Wow, did you see that?”). These skills are the building blocks for subsequent language abilities and social skills. Internationally adopted children may have had little opportunity to practice these skills before adoption, especially if they received little individualized attention before they were adopted. The goal of our research is to understand the development of social communication skills once these children have come into a family where they now have many opportunities to “share” what they are thinking and feeling with parents and older siblings.

Currently, we are seeing 18- to 20-month-old infants who have been adopted from orphanages or foster care. We are also seeing a comparison group of 18- to 20-month-old infants who were born in Minnesota and are growing up in their biological families. Participating in the study involves one visit to our lab that takes about an hour and a half. In addition to early social communication skills, we also assess cognitive development, temperament, and patterns of brain activity (EEG). We are interested in how these other variables relate to early social communication. So far, 42 children have participated in this study. We plan to continue seeing children through next year.

If you have an infant who is younger than 20 months old (either a birth child or an adopted child), and you are interested in learning more about this study, please contact Amanda Tarullo at 612-624-6609 or taru0007@umn.edu. If you are on our registry of families that have adopted internationally, you will also receive the International Adoption Project’s newsletter this fall.



Family Child Care Research Project (FCP)

For the majority of young children in the United States, child care is where young children spend much of their waking day. Child care is also where many children first learn to interact with other children on a regular basis, establish relationships with adults other than their parents, and learn skills such as sharing, waiting and working together. Not surprisingly, many of these experiences can be challenging for some children. Family child care, also referred to as home-based child care, is the most prevalent type of child care in the U.S., yet minimal research has been conducted in this context. Therefore we felt that it was important that the experiences of children in these settings be explored. The Family Child Care Research Project (FCP) seeks to develop an understanding of how children with different temperaments and emotional needs adapt to the challenges of child care.

Preschoolers enrolled in the FCP are observed 2 times at their day care, separated by about 6 months. During the 45-minute observation we make notes regarding how the child interacts with his/her peers and day care provider and make ratings of the child’s mood. We also take saliva samples to measure the children’s stress hormone levels. To date, we have observed 100 preschool aged children in their family child care setting and 57 of these children have been observed twice. Not surprisingly, many children enrolled in the FCP leave their child care before we can observe them a second time. We are working very hard to enroll new children in the project.

We have done some preliminary tests with our data, the results of which we can now share. Some of these analyses were done for undergraduate research papers, so they don’t deal with the central questions of the study. However, you may find the results interesting. We had one undergraduate student who wondered whether children had different experiences in family child care depending on the gender ratio of the setting. That is, did children have different experiences in settings that had more boys than girls? She found that the gender ratio did matter. Surprisingly, the sex of the child we were watching didn’t really matter that much. When there were more girls than boys in the day care, the child we were observing was more fully integrated into the play activities and the play was less aggressive. When there were more boys than girls, girls were more likely to spend more time playing alone. We don’t know whether the gender ratio of the setting will have long term effects on children’s development, but it certainly seems to affect their day to day experiences at child care.

Social-Emotional Development of Children

In this study, we focused on the social-emotional development of 6- and 7-year old children. For example, we wanted to better understand children's reactions to an unfamiliar adult. As every parent knows, children greatly vary in their response to unfamiliar people. Some children immediately feel comfortable talking and playing with others, while some children need time to feel comfortable around new people. In addition, we were interested in children's ability to understand emotions (e.g., identify another person's feelings in different situations) and regulate their behavior (e.g., wait patiently for a prize). The study included 80 children who were internationally adopted and 40 children who were born and raised with their birth families in Minnesota. Some internationally adopted children lived under challenging conditions before they were adopted, whereas others lived under less challenging conditions or were adopted at a very young age. Therefore, we were able to look at the impact that early experience has on later social-emotional development. We studied social behavior by interviewing parents and by observing children's behavior with an unfamiliar adult. We also played some games with the children that revealed their understanding of what others are feeling and thinking.

We have just started examining some of the information from this study. As described above, one of the main interests of this study was children's behavior with people with whom they were not familiar. Based on parent report and observation of the children, the adopted children were more likely to approach and talk with an unfamiliar adult than children who had lived with their parents from birth. Although not true for all adopted children, this type of behavior was seen in children who lived in institutions (i.e., hospitals, baby homes, or orphanages) and in children who lived in foster care before adoption. People have speculated that this willingness to interact with unfamiliar people, sometimes called indiscriminate friendliness, is specific to post-institutionalized children. However, our preliminary results suggest that this isn't true, which raises questions about the cause of this type of behavior.

In a different task, the children were required to take another's perspective and recognize that the person's thoughts may be different from their own. For example, in a story that was acted out using a doll, the doll placed an object in a certain location and then left the room. While the doll was gone, the object was moved to another location. The children were then asked where the doll would look for the object. The correct response (the original location) required the understanding that the doll would think it was still in the original location since the doll did not see it moved, even though the children saw it moved and knew the correct location. We found that nearly all of the children who had lived with their parents since birth could solve this problem correctly. Many of the adopted children could too, but some could not. In general, post-institutionalized children had more trouble with this task than did children who had lived with their parents all their lives.

We have planned additional analyses, but clearly more research is needed to better understand the social-emotional development of internationally adopted children. For more information, please contact Jackie Bruce at bruce009@umn.edu or Amanda Tarullo at taru0007@umn.edu. If you are on our registry of families that have adopted internationally, you will also receive the International Adoption Project's newsletter this fall.

Film & Startle Method Study

Long displays of still pictures and brief "air blasts" are typically used to manipulate emotion in studies of adults. However, these paradigms seem inappropriate for preschoolers. For the Styles Study we developed a video version for use with young children. This involves showing 3-minute videos independently rated to be neutral, negative, and positive. During each video, 9 probes of white noise were presented via headphones while eyeblinks were recorded. Emotion modulates or changes the size of the eyeblink, so that you see bigger responses to negative images.

We were concerned that videos with sound might interfere with the emotion-modulated startle response. To test this, a group of adults were tested using both the picture and video paradigms. There was a slight but significant reduction in the size of the startle response for the video as compared to picture mode. Both stimulus types yielded clear evidence of emotion-modulated startle. We also tested a group of children aged 3-5 using the video paradigm and compared them to the adults. We found that young children show smaller amplitude eyeblink startles, but they show the same percentage increases to the negative video as do the adults. There was a marked difference in startle size for young children versus adults. But both children and adults showed bigger eyeblinks to the negative than positive videos. This study has shown us that we can use our video procedures to measure emotion modulated startle responses in young children.

If you have any further questions about this study, please contact Bonny Donzella (donze001@umn.edu, 612-624-4351) or Karina Quevedo at quev0002@umn.edu.

Salivary Cortisol Method Study

In our laboratory we study cortisol, a hormone that the body produces in larger amounts when we are stressed. To get measures of cortisol, we take small samples of saliva. To make the experience pleasant to children, we have the children taste a small amount of sweet crystals. This also gets the children's saliva flowing and makes sampling easier on everyone. Unfortunately, the Kool-aid crystals we use can sometimes interfere with the tests we perform on the saliva to measure cortisol. For this reason, we have been testing other types of sweet crystals to see if they are less likely to mess up our measurements.

Some labs are now using crushed Sweet Tarts instead of Kool-aid crystals. Lately we have been running a number of tests on both Sweet Tarts and Kool-aid to see which is better to use. Our results are very consistent. They show us that both Sweet Tarts and Kool-aid have similar effects. Both interfere a bit with our measurement of cortisol. But we find that when we use very small amounts of either substance, it is enough to make the experience pleasant for children and produce very little problem in our assays. This work on how sweet-tasting crystals affect the measurement of cortisol explains why we ask parents to use only a *few grains* of the crystals when they take saliva samples for us at home. If your child is over age 5 and was in one of our studies, we didn't ask your child to use "crystals" at all. Instead, we provided a piece of Trident gum, which doesn't affect our measurement of cortisol. Of course, we can't use gum with infants and preschoolers, which is why we have them play the "Tasting Game."

If you have any further questions about this study please contact Bonny Donzella at donze001@umn.edu or Nicole Targe at talg0001@umn.edu.

Styles Study continued from Page 1...

short film clips, one neutral (about the planets), one happy (Winnie the Pooh), and one slightly scary (Land Before Time). *See the Film Method Study on page 3 for information about using films with children, whereas still pictures are usually used with adults.*

So far, 121 3-5 year old children have participated in the Styles Study. Early results showed that children who were more shy and wary had patterns of nervous system activity that showed the signature of their temperament. Specifically, they showed less parasympathetic (calming) activity when we measured their heart beat patterns during the neutral film and less change in parasympathetic activity as they watched mildly “scary” (a dinosaur chase scene) compared to happy (Winnie-the-Pooh) videos. We also see that bold and exuberant children show more sympathetic (arousing) activity when we measure their heart beat patterns. These results, if they hold as we test more children, suggest that children’s temperamental styles are more than skin deep. They reflect the wiring of their nervous systems. Children with different temperaments have different experiences as they move about their worlds. Both shy and exuberant children can be very successful in life, but to be successful they need to regulate the expression of their temperamental styles in ways that are appropriate to the situation. Exuberant children need to learn to “hold back” some times (like when they must wait to be called on by the teacher) and shy/wary children need to learn to “take risks” at times (like when they need to talk in class).

Parents are important teachers for children learning to express and regulate their emotions. For this reason, we also ask parents and children to play with a set of toys, make a snack, and complete a puzzle together. This “break” between some of the more stimulating games may help children emotionally recharge. We are looking to see how interactions between parents and children may help children regulate their emotions to games designed to bring out shyness/boldness and frustration.

Brain researchers believe that “going against our grain” requires the development of the frontal regions of our brain. This area in humans is much larger, relative to the rest of the brain, than in many other animals. This region of the brain also develops very slowly over the course of childhood. To measure this development in the Styles Study we used a game in which children first touch a dog when they hear a “bark” and a cat when they hear “meow” (the pattern our brains have learned by age 3). Then the game changes and the children must touch the cat when they hear a “bark” and the dog when they hear “meow.” This requires inhibiting (stopping) the learned response and shifting to the opposite of what we have learned. We are finding that 4-year-olds are better at this game than are 3-year-olds. This is just what is expected because these regions of the brain are developing rapidly over the preschool years. We are also finding that children who are better at this game are described by their parents as being better at focusing their attention and controlling their behavior. We find that they are also better at not peeking when their prize is wrapped and not touching to tell us what toy they want out of a bin of little toys. It will take testing many more children, however, before we can analyze whether being better at these tasks helps children of different temperament be more successful in their everyday lives.

FCP continued from Page 2...

This past winter we also began observing toddlers in family child care settings, in addition to the preschoolers. In previous studies we have observed toddlers at large child care centers. In that work we have seen that many toddlers, especially those who are more temperamentally shy, produce higher levels of stress hormone as the day progresses. Families sometimes choose to keep their toddlers in small, family child care settings, only moving their children to larger centers around preschool age. We are very interested in whether toddlers in family child care are less stressed than they appear to be in larger centers. We are also interested in whether the toddlers’ experiences in family child care depend on the ages of the other children and gender ratios in those family child care homes. So far, we have observed 21 toddlers; we hope to have 60 toddlers participate.

We are continuing to recruit preschoolers, toddlers and their child care providers to participate in the Family Child Care Research Project. Both parents and child care providers are reimbursed up to \$100 for their participation. If you are interested in participating or would like more information, please contact Erin Kryzer at (612) 624-0321.

International Adoption Project



The International Adoption Project (IAP) has recently received funding for a 5-year grant to study brain development in children adopted from orphanages and foster care around the world. We know from our large survey of internationally adopted children that most children are doing well in their adoptive homes. Please see our website for more information at <http://education.umn.edu/icd/IAP/>. However, parents told us that many of the children have needed special education services and other help to reach their full potential. The research we are planning over the next 5 years will be done with children who will be 8 - 11 years of age. We have designed studies that will tell us about the specific brain regions that may be affected by the experiences the children had before they reached their adoptive homes. We are very hopeful that this type of information will lead to the development of interventions that will be more effective in helping internationally adopted children reach their full emotional and intellectual potentials. However, this is basic research that will only be meaningful once all the studies are completed.

If you are a family with an internationally adopted child who will be in our age range (8-11 years over the next 5 years) and are interested in taking part in this research, please contact Sandi Wewerka at wewerka@umn.edu. If you are on our registry of families that have adopted internationally, you will also receive the International Adoption Project’s newsletter this fall.

Peer Relations Project

The Peer Relations Project just completed its third year in the Shirley G. Moore Laboratory School. In this project, we are trying to understand how children's temperaments and sensitivity to stress influence the way they negotiate relationships with other children. During the preschool years, children develop friendships and being liked becomes important. The Peer Relations Project is designed to help us and preschool teachers understand how the social challenges of the classroom may translate into mild stress for children with sensitive temperaments so that we may know how best to support their healthy development.

Children in the preschool identify our project with our puppet mascot "Mo the Monkey." Mo helps us invite children to attend fun events including a carnival, a jungle party, and a scavenger hunt. To examine assertiveness, Mo has the children line up to get tickets for these events. Every child gets to go of course, but those who get the first tickets go first. The children seem to love Mo's events. As part of this project we also invite children to play the "Picture Game" and the "Tasting Game." In the "Picture Game," children look at photographs of their classmates and point out their circle of friends at school. Playing the "Tasting Game" gives us our measure of the hormone cortisol that increases when children attempt to handle mild stress and challenge. To play the tasting game the children taste a few grains of sweetened Kool-Aid crystals and then hold a cotton rope in their mouths to absorb saliva. When the whole project is done we will have these saliva samples analyzed for cortisol. We also observe children's social interactions in the classroom, gym, and outside. Lastly, the preschool teachers complete a set of questionnaires seeking information about temperament, friendship qualities, and the social skills of the children in their classrooms. This whole project won't be over until 2006, so here we can only describe some very preliminary findings.

Because we are interested in how children negotiate the peer landscape at preschool, one of the things we are focusing on is how much influence different children have on their peers and how children get to positions of influence in the classroom. It is common lore that boys often have more power over others than girls. We find that this is NOT the case in the preschool. Boys and girls are similar in how much influence they have. For both boys and girls, however, there seem to be two major pathways to gain influence or social power. One pathway seems to operate through being well-integrated into play, being an active member of play groups, and establishing friendships. As adults, we might call this "networking." Another pathway seems to be through using power assertion to get others to do what you want. As we continue to analyze our data, we will be examining whether positions of influence obtained through these different pathways serve children differently. Because networking requires being more socially skilled, we expect that this pathway will be more open to older than younger children who have had more time to practice social skills. Indeed, we are finding that older children are more likely than younger children to hold positions of greater influence, but when we have looked at the children who we have observed over two years, there also seems to be an individual component to influence. Children who are more influential for their age at 3 years tend to also be more influential for their age at 4 years.

Some children who have participated in the Peer Relations Project also agreed to participate in the Children's Behavioral Styles Study. This study allows us to closely assess children's temperament and some of the physiological contributions to how they manage social interactions with peers. Preschool families returning to the lab school who were unable to participate in the Styles Study this past year will have another opportunity during the upcoming school year. *You can read more about this study beginning on page 1.*

So far, 35 preschool children have complete data from the Styles Study in addition to the Peer Relations Project, with more children still being tested. Pre-Ejection Period (a measure of sympathetic input to the heart) and Vagal Tone (a measure of parasympathetic input to the heart) were assessed at base levels and during video clips that were slightly scary (Land Before Time dinosaur chase) and happy (Winnie the Pooh).

Early findings suggest that children who achieve positions of greater influence in the classroom are also bolder in their exploration of a novel room. They also have nervous systems that are "set" somewhat differently than children who achieve less influence in the classroom. Specifically, they are temperamentally more exuberant and less shy, and their sympathetic nervous system is set to a higher level, meaning that they tend to become more physiologically aroused in challenging situations. This might seem odd, as sympathetically reactive children are usually more anxious and shy. However, the children who hold higher positions of influence in the classroom also have parasympathetic nervous systems (the "calm-down" side of the nervous system) that let them control their arousal more effectively. We need a lot more children from the Peer Relations Project to take part in the Styles Study, however, before we can be certain of these findings. Understanding how children's temperament influences their preschool experience is something that can help preschool teachers deal more effectively and sensitively with the children in their classrooms.

The Peer Relations Project will continue through the spring of 2006. For more information about this project, please check out our website at <http://education.umn.edu/icd/PRP/> or contact Shanna Mliner at (612) 626-8949 or newma039@umn.edu.

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Stress in Full-Term and Premature Infants

Cortisol is a stress-sensitive hormone, but it also plays important roles in helping the body grow and become more mature. Right before birth babies produce high levels of cortisol. This isn't because they know that birth will be stressful. It's because nature needs to get the baby's lungs mature enough to breath air. Babies who were born prematurely used to be a high risk for developing lung disease. Now, however, if a mother comes into the hospital in premature labor she is given a shot full of cortisol (called betamethasone). The cortisol gets to the baby and quickly matures the lungs so that the baby won't develop lung disease if born early. This is one of the great success stories of modern medicine. However, while the cortisol given to the mother reduces the likelihood of lung disease in the premature baby, it may also affect the development of the child's brain. One effect may be to make the baby more emotionally reactive.

In a study we conducted several years ago, we found that healthy premature babies who were born around 33 (instead of 40) weeks gestation showed effects of being given betamethasone right before birth. Mothers in premature labor sometimes get the shot of betamethasone and sometimes don't. It depends on how far along they are and whether there is enough time before the delivery for the hormone to have any effect on the baby. Babies who are 33-34 weeks along often do okay without the hormone. Their lungs are mature enough to avoid the lung disease. We tested healthy 33-34 week premature newborns and found differences in the functioning of their stress system when their mothers had or had not received the betamethasone shot. What we don't know is whether the differences we saw when the babies were still in the hospital will continue as they get older.

We are just beginning a study to answer this question. Healthy babies born around 33-34 weeks are going to be seen in our laboratory twice (once shortly after the baby goes home from the hospital and once about 6-8 weeks later). At these visits there will be a gentle physical examination. Babies often cry when they are undressed, weighed, measured, and have their reflexes checked. We know that healthy full-term babies adapt to physical exams by increasing their heart rates and producing slightly more cortisol. What we want to know is whether babies who have and have not received betamethasone before birth show the same reactions as do healthy full-term babies. We expect that we might find that betamethasone treated premature infants will react a bit more strongly and have a bit more trouble calming. If we find this, it won't mean that the babies are not doing as well. But it will caution physicians to use the least amount of betamethasone possible to avoid lung disease.

We will be studying healthy full-term babies as well as healthy premature babies in this study. If you are expecting a new baby or if a friend of yours is and you would like more information about this study, please contact Nicole Talge at (612) 626-2296.