

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.

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 every day stresses and hassles of childhood. 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.



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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 short film clips, one neutral (about the planets), one happy (Winnie the Pooh), and one slightly scary (Land Before Time).

So far, 243 3-5-year-old children have participated in the Styles Study, and we have some of our data ready to present here. Early results show that children did respond to the films; heart rates increased an average of 5 beats per minute to the scary film, and returned to baseline levels during the happy film. Further, children who were the most shy and wary during the session had patterns of nervous system activity that showed the signature of their temperament. Specifically, they showed nervous system activity that was not helpful in responding to challenge; when we measured their heart beat patterns, they showed more parasympathetic (calming) activity and less sympathetic (arousing) activity in response to the scary film as compared to the neutral film. Children who could either use their parasympathetic or sympathetic system to raise their heart rate to the scary film were also better able to cope with the challenge of the stranger and the "risk room" episodes. These results 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" sometimes (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).

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 a "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 a "meow." This requires 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.

If you have any further questions about this study please contact Bonny Donzella (donze001@umn.edu, 612-624-4351) or visit our website at <http://education.umn.edu/icd/Styles/>.

Stress and the Transition to Adolescence

The period of time between 8 years and 15 years is one of remarkable change for children and families. It is during this period that children make a transition from childhood to adolescence. During this time their bodies undergo tremendous change. Not only do they sprout like weeds (the adolescent growth spurt), but their bodies also change from children's bodies to the bodies of young men and women. Every parent who lives through this change also knows that something is happening in their children's brains as well. And they know that whatever that is, it is having a big effect not only on how their children think, but on how they feel. Most children go through a bit of an emotional roller coaster as they make this adolescent transition, although for some the roller coaster is a bit wilder than for others.

In an on-going study we are attempting to understand how the stress systems of the body change from late childhood (age 8) to early adolescence (age 15). To examine this change, we are having children go through a stress test that involves giving a short speech (5 minutes) and doing difficult mental arithmetic.



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 US, 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. The FCP is entering the fourth and final year of data collection. We are no longer enrolling children in the study. To date, we have observed 171 preschool-aged children, in 120 family child care homes. Ninety-six of these children have been observed twice, while 40 left the study, mostly because they were no longer in child care. We will complete the second observations on the remaining 35 children in the upcoming months.

This summer we are also working on completing the toddler portion of the FCP (Our main FCP study is focused on preschoolers). We have observed 90 toddlers, one time, in their home-based child care setting. 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, and whether the experiences of toddlers and preschoolers in family child care are distinct.

We have done some preliminary analyses looking at differences between preschoolers' and toddlers' behavior in child care. While caregiver behavior directed towards the child in our study did not differ between toddlers and preschoolers there were some behavioral differences. Mainly, toddlers spent more time unoccupied and/or playing by themselves while preschoolers spent more time in social activities with other children. Some of these differences reflect typical developmental differences between the two age groups, but the activities in the child care also contributed to this age difference. For example, in settings where group activities (i.e. circle time) were taking place, toddlers were more likely to be socially engaged with their peers. How much support children received from their care provider also made a difference. Toddlers who received more support from their care providers were more socially engaged at child care. For preschool-aged children, their engagement in positive interactions with other children depended, in part, on how much effort the care provider put into helping the children understand one another's needs and in feeling like they were part of a group who cared for one another. Interestingly, it also seemed to depend on the ratio of boys to girls. Among the preschoolers, child care settings with more girls than boys were ones where both the girls and boys were able to be more positively engaged in social play. We are not sure whether these last two findings are related to one another. Other child development studies have found that adults spend more time talking with girls than boys about their own and others' feelings. It seems possible that when there are more girls in the group, care providers may (without thinking about it) talk more about feelings and "being nice" to one another and this may help create a "group atmosphere" that allows both boys and girls to spend more time in social interactions. In the upcoming year, we will begin to look at how these differences are related to stress hormone levels in both toddlers and preschoolers.

If you have any further questions about this study please contact Erin Kryzer (ahern004@umn.edu, 612-624-0321) or visit our website at <http://education.umn.edu/icd/FCP>.

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The children perform this arithmetic test in front of a panel of two judges while being videotaped. Public speaking is both a normative stressor (we all have to do it in school) and one that is very challenging for many of us. At all the ages we have tested, children say that the experience is stressful and how stressed they report feeling doesn't differ between the 8 and 15-year-olds. What does change is how their bodies manage the stress. We find that 8-year-olds use the parasympathetic system to manage the challenge. This is the "calming" side of the autonomic nervous system, and what they do is simply "lift" or "reduce" how much calming input this system applies to their heart. This is a low wear and tear way of increasing your heart rate. By 11 years of age, children begin to recruit their sympathetic system to manage this challenge. That is, they kick in the "fight/flight" system of the body. But, even at 11 years they don't engage the big guns provided by the stress hormone system. This system provides "bigger" guns because it affects the body for a longer time than does the sympathetic system. It is not until 13 years that we see the big guns of the stress hormone system being recruited, and then only for those children who are more advanced in their pubertal development. That is, by 13 years children whose bodies have become more like young men and women are showing stress reactions that are more adult-like.

All of the work in our laboratory over the years has suggested that young children manage stress within the framework of their relationships with adults. In close and supportive relationships, the stress system seems to have evolved to allow the adults who are caring for the child to "kick in" the big biological stress reactions that, while necessary for survival, also have physiological costs for the body. Children in such caring relationships typically exhibit behavioral signs of stress (which clue their parent that they need help) but don't kick in the "big stress guns" of the body. It's a nice arrangement that protects children from life's problems, without requiring the same physiological costs.

However, we think that what we are seeing is that with the transition to adolescence, nature has organized a change in how the body manages stressful situations. Increasingly over this time, children's bodies take on more responsibility for responding to stress with the biological changes that will both allow them to be more independent from adult support, but also will mean that even in a loving home, their bodies will experience more costs when they deal with life's stressors. These changes probably prepare children for adulthood, but they also may explain why the transition to adulthood involves a roller coaster ride.

If you have any further questions about this study please contact Sandi Wewerka (wewerka@umn.edu, 612-624-4351).

International Adoption Project

One major focus of our research group is on the development of children who have been adopted internationally. Many of you probably have friends who have adopted a child from Asia, Eastern Europe, or South America. Last year about 23,000 children were adopted internationally into the U.S. While some of those children are adopted soon after birth and experience warm, loving care before adoption, many spend months in orphanages or other institutional settings before adoption. Our research group is involved in understanding how those early conditions of social and physical deprivation impact cognitive and emotional development and on how well children recover once they are adopted into loving homes.

We are very grateful to the many families who have brought their birth children in to take part in the studies we are conducting with internationally adopted children. The development of children born and raised in their birth families provides a comparison group in our studies of internationally adopted children. In the past few years, we have learned from our studies that children adopted from orphanages when they are toddlers (i.e. 14 months or more), often do not seek out eye contact with their adoptive parents in the way that birth children do. They are not as motivated to share what they are thinking and feeling with their adoptive parents. You may remember when your toddler spent hours getting you to "look" at what they found interesting and they were very curious about anything that you were looking at. This motivation to share our inner world with the people we are close to is a critical step in emotional development and socialization. It is believed to provide a building block to the understanding that emerges during the preschool years that other people do not always think the way we do or know what we know. That is, what is in our mind doesn't necessarily correspond to what is in other people's minds.

One way child developmentalists test this is by using the "false belief" tasks. If two people see an object hidden in a particular place, then one leaves the room and while they are gone the other person sees the object moved to a new hiding place, the one who stayed in the room knows that the one who left will think the object is still in the first place it was hidden. That is, they will hold a "false belief". Until about age 4, children reared in families think that everyone knows what they know (that the object was moved to a second location). After age 4 children understand that while they know where the object is, the other person still thinks it is hidden in the first location.

Peer Relations Project

Greetings from the Peer Relations Project! We just completed our fourth consecutive year of research in the Shirley G. Moore Laboratory Preschool. The Peer Relations Project is best known for its puppet mascot "Mo the Monkey." Mo invites the preschoolers in our project to line up to get tickets to attend a Carnival, a Monkey Hunt, and a Jungle Party as our method of studying assertiveness, as those who get the first tickets are able to attend the fun events first. Each year the children let us know they love Mo's events, and we've found some interesting initial results with this measure. 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 is in all our bodies and increases when attempting to handle mild stress and challenge. 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 levels. We also gather information about play styles, social interactions, temperament, and friendship qualities from questionnaires, interviews, and observation.

With all of these measures, we are trying to understand how children negotiate relationships with other children. During the preschool years, children develop friendships and being liked becomes important. Part of what children learn in preschool is how to get their needs met while still being a good friend to other children. 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.

Currently we have full data from approximately 110 preschool children from their first year in the Peer Relations Project. Some children enroll in the preschool for a second year before graduating to kindergarten and so we have full data from approximately 30 of these children on a second year in the project. A total of about 75 children from the preschool agreed to take part in the Children's Behavioral Styles Study. This separate study allows us to closely assess children's temperament and some of the physiological contributions to how they manage social interactions with peers in a laboratory setting. You can read more about this study in this newsletter on page 1.

We can discuss some initial findings here. Last year we told you that being a boy or girl did not influence whether children were able to get to the front of the line for "Mo's events". However, being older did result in getting to the front of the line. This year we examined the way that temperament was related to getting to the front of the line. Exuberant children were more often close to the front of the line, while shy children had difficulty getting near the front. We also found that children whose nervous systems were more readily aroused were more likely to get to the front of the line. These results suggest that getting to the front of the line takes emotional exuberance and physiological energy. Some children are more temperamentally disposed to take the "front" positions. What we don't know, of course, is whether this disposition will follow children as they grow up or will change with development.

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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That is, by age 4 or 5 children know that what they are thinking and what others are thinking can be different. While this sounds sort of obscure, you may have experienced your young child asking you to look at what they are dreaming, or show you a book that is right side up for them but upside down for you and expect it looks fine to both of you. We have found that children who are adopted from conditions of social and physical deprivation have trouble with this kind of social perspective taking. Even after living in their adoptive homes for 4 or more years and several years after birth children readily solve the false-belief task, they continue to think that others know what they know.

We think the reduced motivation to “share” their inner lives with others as infants and toddlers is related to this delay or deficit in developing an understanding that people don’t always know what they know. To test that hypothesis, we are currently following children adopted internationally from the time they are 18 months until they are preschoolers. In time, we should know whether our hypothesis is correct. Meanwhile, these studies strongly suggest that the love, attention, and nurturance we provide our children as babies plays an important role in preparing them to develop the kinds of social reasoning that will ultimately allow them to understand the thinking of others, even when that thinking differs from how they view the world.

As part of our attempts to understand the development of children who started their lives without the care and attention of loving parents, we are also conducting a series of studies with 8- to 11-year-old children. We have just begun this work, so do not yet have results to share with you. However, look in future newsletters for this information.

If you have any further questions about this study please contact Sandi Wewerka (wewerka@umn.edu, 612-624-4351).