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READING YOUR BABY'S MIND

- **New research on infants finally begins to answer the question: what's going on in there?**
BY PAT WINGERT AND MARTHA BRANT

Ghislain and Marie David de Lossy / Getty Images

Reading Your Baby's Mind

New research on infants finally begins to answer the question: what's going on in there?



Timothy Archibald for Newsweek

The Thinking Cap: Using a net of electrodes, University of Minnesota researchers monitor changes in 7-month-old Theron Wangerin's brain activity as he views emotional facial expressions

By Pat Wingert and Martha Brant
Newsweek

Aug. 15, 2005 issue - Little Victoria Bateman is blond and blue-eyed and as cute a baby as there ever was. At 6 months, she is also trusting and unsuspecting, which is a good thing, because otherwise she'd never go along with what's about to happen. It's a blistering June afternoon in Lubbock, Texas, and inside the Human Sciences lab at Texas Tech University, Victoria's mother is settling her daughter into a high chair, where she is the latest subject in an ongoing experiment aimed at understanding the way babies think. Sybil Hart, an associate professor of human development and leader of the study, trains video cameras on mother and daughter. Everything is set. Hart hands Cheryl Bateman a children's book, "Elmo Pops In," and instructs her to engross herself in its pages. "Just have a conversation with me about the book," Hart tells her. "The most important thing is, do not look at [Victoria.]" As the two women chat, Victoria looks around the room, impassive and a little bored.

After a few minutes, Hart leaves the room and returns cradling a lifelike baby doll. Dramatically, Hart places it in Cheryl Bateman's arms, and tells her to cuddle the doll while continuing to ignore Victoria. "That's OK, little baby," Bateman coos, hugging and rocking the doll. Victoria is not bored anymore. At first, she cracks her best smile, showcasing a lone stubby tooth. When that doesn't work, she begins kicking. But her mom pays her no mind. That's when Victoria loses it. Soon she's beet red and crying so hard it looks like she might spit up. Hart rushes in. "OK, we're done," she says, and takes back the doll. Cheryl Bateman goes to comfort her daughter. "I've never seen her react like that to anything," she says. Over the last 10 months, Hart has repeated the scenario hundreds of times. It's the same in nearly every case: tiny babies, overwhelmed with jealousy. Even Hart was stunned to find that infants could experience an emotion, which, until recently, was thought to be way beyond their grasp.

And that's just for starters. The helpless, seemingly clueless infant staring up at you from his crib, limbs flailing, drool oozing, has a lot more going on inside his head than you ever imagined. A wealth of new research is leading pediatricians and child psychologists to rethink their long-held beliefs about the emotional and intellectual abilities of even very young babies. In 1890, psychologist William James famously described an infant's view of the world as "one great blooming, buzzing confusion." It was a notion that held for nearly a century: infants were simple-minded creatures who merely mimicked those around them and grasped only the most basic emotions—happy, sad, angry. Science is now giving us a much different picture of what goes on inside their hearts and heads. Long before they form their first words or attempt the feat of sitting up, they are already mastering complex emotions—jealousy, empathy, frustration—that were once thought to be learned much later in toddlerhood.

They are also far more sophisticated intellectually than we once believed. Babies as young as 4 months have advanced powers of deduction and an ability to decipher intricate patterns. They have a strikingly nuanced visual palette, which enables them to notice small differences, especially in faces, that adults and older children lose the ability to see. Until a baby is 3 months old, he can recognize a scrambled photograph of his mother just as quickly as a photo in which everything is in the right place. And big brothers and sisters beware: your sib has a long memory—and she can hold a grudge.

The new research is sure to enthrall new parents—See, Junior *is* a genius!—but it's more than just an academic exercise. Armed with the new information, pediatricians are starting to change the way they evaluate their youngest patients. In addition to tracking physical development, they are now focusing much more deeply on emotional advancement. The research shows how powerful emotional well-being is to a child's future health. A baby who fails to meet certain key "emotional milestones" may have trouble learning to speak, read and, later, do well in school. By reading emotional responses, doctors have begun to discover ways to tell if a baby as young as 3 months is showing early signs of possible psychological disorders, including depression, anxiety, learning disabilities and perhaps autism. "Instead of just asking if they're crawling or sitting, we're asking more questions about how they share their world with their caregivers," says Dr. Chet Johnson, chairman of the American Academy of Pediatrics' early-childhood committee. "Do they point to things? When they see a new person, how do they react? How children do on social and emotional and language skills are better predictors of success in adulthood than motor skills are." The goal: in the not-too-distant future, researchers hope doctors will routinely identify at-risk kids years earlier than they do now—giving parents crucial extra time to turn things around.

One of the earliest emotions that even tiny babies display is, admirably enough, empathy. In fact, concern for others may be hard-wired into babies' brains. Plop a newborn down next to another crying infant, and chances are, both babies will soon be wailing away. "People have always known that babies cry when they hear other babies cry," says Martin Hoffman, a psychology professor at New York University who did the first studies on infant empathy in the 1970s. "The question was, why are they crying?" Does it mean that the baby is truly concerned for his fellow human, or just annoyed by the racket? A recent study conducted in Italy, which built on Hoffman's own work, has largely settled the question. Researchers played for infants tapes of other babies crying. As predicted, that was enough to start the tears flowing. But when researchers played babies recordings of their own cries, they rarely began crying themselves. The verdict: "There is some rudimentary empathy in place, right from birth," Hoffman says. The intensity of the emotion tends to fade over time. Babies older than 6 months no longer cry but grimace at the discomfort of others. By 13 to 15 months, babies tend to take matters into their own hands. They'll try to comfort a crying playmate. "What I find most charming is when, even if the two mothers are present, they'll bring their own mother over to help," Hoffman says.

Part of that empathy may come from another early-baby skill that's now better understood, the ability to discern emotions from the facial expressions of the people around them. "Most textbooks still say that babies younger than 6 months don't recognize emotions," says Diane Montague, assistant professor of psychology at LaSalle University in Philadelphia. To put that belief to the test, Montague came up with a twist on every infant's favorite game, peekaboo, and recruited dozens of 4-month-olds to play along. She began by peeking around a cloth with a big smile on her face. Predictably, the babies were delighted, and stared at her intently—the time-tested way to tell if a baby is interested. On the fourth peek, though, Montague emerged with a sad look on her face. This time, the response was much different. "They not only looked away," she says, but wouldn't look back even when she began smiling again. Refusing to make eye contact is a classic baby sign of distress. An angry face got their attention once again, but their faces showed no pleasure. "They seemed primed to be alert, even vigilant," Montague says. "I realize that's speculative in regard to infants... I think it shows that babies younger than 6 months find meaning in expressions."

This might be a good place to pause for a word about the challenges and perils of baby research. Since the subjects can't speak for themselves, figuring out what's going on inside their heads is often a matter of reading their faces and body language. If this seems speculative, it's not. Over decades of trial and error, researchers have fine-tuned their observation skills and zeroed in on numerous consistent baby responses to various stimuli: how long they stare at an object, what they reach out for and what makes them recoil in fear or disgust can often tell experienced researchers everything they need to know. More recently, scientists have added EEGs and laser eye tracking, which allow more precise readings. Coming soon: advanced MRI scans that will allow a deeper view inside the brain.

When infants near their first birthdays, they become increasingly sophisticated social learners. They begin to infer what others are thinking by following the gaze of those around them. "By understanding others' gaze, babies come to understand others' minds," says Andrew Meltzoff, a professor of psychology at the University of Washington who has studied the "gaze following" of thousands of babies. "You can tell a lot about people, what they're interested in and what they intend to do next, by watching their eyes. It appears that even babies know that... This is how they learn to become expert members of our culture."



Toby Burditt for Newsweek

Alive and Kicking: Three-month-old Caroline Larsen-Rife's sense of achievement at moving a mobile with her foot helps her build self-esteem, say California State University researchers

Meltzoff and colleague Rechele Brooks have found that this skill first appears at 10 to 11 months, and is not only an important marker of a baby's emotional and social growth, but can predict later language development. In their study, babies who weren't proficient at gaze-following by their first birthday had much less advanced-language skills at 2. Meltzoff says this helps explain why language occurs more slowly in blind children, as well as children of depressed mothers, who tend not to interact as much with their babies.

In fact, at just a few months, infants begin to develop superpowers between human faces. But at the University of Minnesota, neuroscientist Charles Nelson (now of Harvard) wanted to test how discerning infants really are. He showed a group of 6-month-old babies a photo of a chimpanzee, and gave them time to stare at it until they lost interest. They were then shown another chimp. The babies perked up and stared at the new photo. The infants easily recognized each chimp as an individual—they were fascinated by each new face. Now unless you spend a good chunk of your day hanging around the local zoo, chances are you couldn't tell the

difference between a roomful of chimps at a glance. As it turned out neither could babies just a few months older. By 9 months, those kids had lost the ability to tell chimps apart; but at the same time, they had increased their powers of observation when it came to human faces.

Nelson has now taken his experiment a step further, to see how early babies can detect subtle differences in facial expressions, a key building block of social development. He designed a new study that is attempting to get deep inside babies' heads by measuring brain-wave activity. Nelson sent out letters to the parents of nearly every newborn in the area, inviting them to participate. Earlier this summer it was Dagny Winberg's turn. The 7-month-old was all smiles as her mother, Armaiti, carried her into the lab, where she was fitted with a snug cap wired with 64 sponge sensors. Nelson's assistant, grad student Meg Moulson, began flashing photographs on a screen of a woman. In each photo, the woman had a slightly different expression—many different shades of happiness and fear. Dagny was given time to look at each photo until she became bored and looked away. The whole time, a computer was closely tracking her brain activity, measuring her mind's minutest responses to the different photos. Eventually, after she'd run through 60 photos, Dagny had had enough of the game and began whimpering and fidgeting. That ended the session. The point of the experiment is to see if baby brain scans look like those of adults. "We want to see if babies categorize emotions in the ways that adults do," Moulson says. "An adult can see a slight smile and categorize it as happy. We want to know if babies can do the same." They don't have the answer yet, but Nelson believes that infants—who display early signs of emotional disorders, such as autism, may be helped if they can develop these critical powers of observation and emotional engagement.

Halfway across the country, researchers are working to dispel another baby cliché: out of sight, out of mind. It was long believed that babies under 9 months didn't grasp the idea of "object permanence"—the ability to know, for instance, that when Mom leaves the room, she isn't gone forever. New research by psychologist Su-hua Wang at the University of California, Santa Cruz, is showing that babies understand the concept as early as 10 weeks. Working with 2- and 3-month-olds, she performs a little puppet show. Each baby sees a duck on a stage. Wang covers the duck, moves it across the stage and lifts the cover. Sometimes the duck is there. Other times, the duck disappears beneath a trapdoor. When they see the duck has gone missing, the babies stare intently at the empty stage, searching for it. "At 2 1/2 months," she says, "they already have the idea that the object continues to exist."

A strong, well-developed ability to connect with the world—and with parents in particular—is especially important when babies begin making their first efforts at learning to speak.

Baby talk is much more than mimickry. Michael Goldstein, a psychologist at Cornell University, gathered two groups of 8-month-olds and decked them out in overalls rigged up with wireless microphones and transmitters. One group of mothers was told to react immediately when their babies cooed or babbled, giving them big smiles and loving pats. The other group of parents was also told to smile at their kids, but randomly, unconnected to the babies' sounds. It came as no surprise that the babies who received immediate feedback babbled more and advanced quicker than those who didn't. But what interested Goldstein was the way in which the parents, without realizing it, raised the "babble bar" with their kids. "The kinds of simple



Peter Yang for Newsweek

Reaching Out: By watching as 7-month-old Malaika Joy Jackson road-tests her social skills, Dr. Stanley Greenspan hopes to learn how children develop healthy emotional ties

sounds that get parents' attention at 4 months don't get the same reaction at 8 months," he says. "That motivates babies to experiment with different sound combinations until they find new ones that get noticed."

A decade ago **Patricia Kuhl**, a professor of speech and hearing at the University of Washington and a leading authority on early language, proved that tiny babies have a unique ability to learn a foreign language. As a result of her well-publicized findings, parents ran out to buy foreign-language tapes, hoping their little Einsteins would pick up Russian or French before they left their cribs. It didn't work, and Kuhl's new research shows why. Kuhl put American 9-month-olds in a room with Mandarin-speaking adults, who showed them toys while talking to them. After 12 sessions, the babies had learned to detect subtle Mandarin phonetic sounds that couldn't be heard by a separate group of babies who were exposed only to English. Kuhl then repeated the experiment, but this time played the identical Mandarin —lessons to babies on video- and audiotape. That group of babies failed to learn any Mandarin. Kuhl says that without the emotional connection, the babies considered the tape recording just another background noise, like a vacuum cleaner. "We were genuinely surprised by the outcome," she says. "We all assumed that when infants stare at a television, and look engaged, that they are learning from it." Kuhl says there's plenty of work to be done to explain why that isn't true. "But at first blush one thinks that people—at least babies—need people to learn."

So there you have it. That kid over there with one sock missing and smashed peas all over his face is actually a formidable presence, in possession of keen powers of observation, acute emotional sensitivity and an impressive arsenal of deductive powers. "For the last 15 years, we've been focused on babies' abilities—what they know and when they knew it," says the University of Washington's Meltzoff. "But now we want to know what all this predicts about later development. What does all this mean for the child?"



Courtesy Dr. Sybil Hart / Texas Tech University

Baby envy: In a Texas Tech laboratory, 8-month-old Joseph McCarty becomes distressed when his mother directs attention to a life-size doll

Some of these questions are now finding answers. Take shyness, for instance. It's long been known that 15 to 20 percent of children are shy and anxious by nature. But doctors didn't know why some seemed simply to grow out of it, while for others it became a debilitating condition. Recent studies conducted by Nathan Fox of the University of Maryland show that shyness is initially driven by biology. He proved it by wiring dozens of 9-month-olds to EEG machines and conducting a simple experiment. When greeted by a stranger, "behaviorally inhibited" infants tensed up, and showed more activity in the parts of the brain associated with anxiety and fear. Babies with outgoing personalities reached out to the stranger. Their EEG scans showed heightened activity in the parts of the brain that govern positive emotions like pleasure.

But Fox, who has followed some of these children for 15 years, says that parenting style has a big impact on which kind of adult a child will turn out to be. Children of overprotective parents, or those whose parents didn't encourage them to overcome shyness and childhood anxiety, often remain shy and anxious as adults. But kids born to confident and sensitive parents who gently help them to take emotional risks and coax them out of their shells can often overcome early awkwardness. That's an important finding, since behaviorally inhibited kids are also at higher risk for other problems.

Stanley Greenspan, clinical professor of psychiatry and pediatrics at George Washington University Medical School, is one of the leaders in developing diagnostic tools to help doctors identify babies who may be at risk for language and learning problems, autism and a whole range of other problems. He recently completed a checklist of social and emotional "milestones" that babies should reach by specific ages (graphic). "I'd like to

see doctors screen babies for these milestones and tell parents exactly what to do if their babies are not mastering them. One of our biggest problems now is that parents may sense intuitively that something is not right," but by the time they are able to get their child evaluated, "that family has missed a critical time to, maybe, get that baby back on track."

So what should parents do with all this new information? First thing: relax. Just because your baby is more perceptive than you might have thought doesn't mean she's going to be damaged for life if she cries in her crib for a minute while you answer the phone. Or that he'll wind up quitting school and stealing cars if he witnesses an occasional argument between his parents. Children crave—and thrive on—interaction, one-on-one time and lots of eye contact. That doesn't mean filling the baby's room with "educational" toys and posters. A child's social, emotional and academic life begins with the earliest conversations between parent and child: the first time the baby locks eyes with you; the quiet smile you give your infant and the smile she gives you back. Your child is speaking to you all the time. It's just a matter of knowing how to listen.

With T. Trent Gegax, Margaret Nelson, Karen Breslau, Nadine Joseph and Ben Whitford

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Toby Burditt for Newsweek

Look Who's Talking: At a day-care center in Davis, Calif., a child uses sign language to ask for another song. Babies can learn to express needs and feelings with signs long before they can speak.