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Wise Beyond Their Years: What Babies Really Know

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A baby has a MEG brain-imaging test while listening to spoken words.

Infants as young as 6 months are capable of making predictions based on probability, a higher level of reasoning than is commonly believed possible, researchers have found.

When shown a range of facial expressions, children as young as 7 months cast the longest gaze on the fearful face, similar to adult behavior, which scientists say signals an early sign of emotional processing.

And every parent knows that mimicking a baby's behavior, such as clapping hands, brings the child pleasure. Imaging technology has confirmed that this kind of play activates the pleasure

center in the baby's brain, whereas engaging in a mismatched activity doesn't.

New laboratory technology is enabling scientists to see more clearly what is going on inside a baby's brain and monitor how it interacts with its environment. The findings are helping to shed light on the earliest stages of learning.

"The baby brain is a mystery, waiting to be unpeeled. It's full of secrets waiting to be uncovered," says Patricia Kuhl, co-director of the Institute for Learning & Brain Sciences, at the University of Washington in Seattle. Scientists at the institute are conducting some of the first experiments using magnetoencephalography, or MEG, brain-imaging machines on children. The technology allows researchers to measure magnetic-field changes around the brain while a baby sits under what looks like a beauty-salon hair dryer. Dr. Kuhl says the technology is noninvasive and silent, making it ideal for working with babies.

How infants learn and process language and emotions is important in helping to develop best parenting practices and early education programs, experts say. It also can help in the early diagnosis of learning disabilities.

"We've said a million times, 'Read with your baby, talk with your baby, read your baby's cues.' But it takes on a much greater level of importance when you can actually connect it to brain function," says Claire Lerner, a child developmental specialist and director of parenting resources for Zero to Three, a Washington, D.C.-based nonprofit that promotes healthy early-childhood development.

An infant brain is just 25% the volume of an adult's. But that grows quickly to 70% by age 1 and 85% by 3 years of age. Early experiences can have a profound and lifelong impact on brain development. Babies have more synapses, or connections between neurons, than adults, researchers say. Over time, such connections are lost if we don't use them. The development of healthy vision, for example, is dependent on being able to see normally in order to develop the visual cortex. If this isn't used, because of a vision problem for instance, such connections will be reduced.

Still, developmental setbacks in early childhood don't have to be permanent, says P. Murali Doraiswamy, a professor of psychiatry at Duke University Medical Center in Durham, N.C. Many cognitive abilities don't fully develop until the early teenage years, he says. And a baby's brain is plastic, able to reprogram one area to substitute for another. "So definitely babies' brains try to level the playing field as much as possible to compensate for environmental adversity," he says.

Research into how babies acquire language skills could someday further understanding of how development goes awry, allowing for earlier treatments of disorders such as autism, says Dr. Kuhl.

In one study, published in the journal Brain & Language in January, Dr. Kuhl and colleagues found that the language ability of a 1 year old could be predicted months earlier. This is done by examining the combined concentration of gray and white matter, or nerve cells and fiber tracts, in parts of the brain not normally used for verbal processing—the hippocampus and cerebellum, normally associated with memory and motor learning.

The finding could suggest that babies with better memory and motor skills may advance faster in their verbal abilities, but it isn't clear if that is based on genetic or environmental factors, Dr. Kuhl says. The study, which involved 19 infants, tested the infants' verbal skills at age 1 by assessing their babbling and their ability to recognize familiar names and words and to produce

different sounds.

Scientists also are studying infants' capacity to reason. Stephanie Denison, a psychology professor at the University of Waterloo in Ontario, and Fei Xu, a psychology professor at University of California, Berkeley, recently completed a study under review for publication which showed that infants have some knowledge of probabilities.

The researchers conducted experiments involving a total of 72 infants, ranging in age from 10 months to 12 months. Infants were first tested to see if they showed preference for a shiny pink lollipop or a black one. They were then shown two jars of lollipops: one with a higher proportion of the color they like and the other with more of the lollipops they don't favor. Researchers then covered the jars, took a lollipop out of each jar and covered the individual lollipop with a cup.

The infants, encouraged to find the lollipop of their choice, chose the cup most likely to contain their desired lollipop about 80% of the time. "This shows us that infants can make a prediction about probability," Dr. Denison says. "They can also guide their own behaviors and navigate their own world."

Most people might think of babies as self-centered. A growing number of behavioral studies suggest this might not be the case.

Research presented in the current issue of the journal Infancy found that parents can influence a child's ability to help and share with others and to show a sense of empathy by discussing emotions with their toddlers.

The two studies presented in the report, which involved more than 90 children ranging in age from 18 to 30 months, examined parent-child discourse about emotions during picture-book reading. "Children who helped and shared more quickly and more often, especially in tasks that required more complex emotion understanding, had parents who more often asked them to label and explain the emotions depicted in the books," the researchers wrote.

"What studies show is that even extremely young babies can already understand something about what's going on in the minds of other people and can even to some extent take the perspective of other people," says Alison Gopnik, a psychology professor at the University of California, Berkeley, who has conducted other research on empathy.

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