Where Autism Begins: Tapping the Infant Mind

The infants in Helen Tager-Flusberg's lab stare at alternating pictures of mommy and a stranger on a computer monitor. Later, a string of word sounds—ta, ta, ta, ta—is emitted from nearby speakers. The babies are wearing what look like white plastic hairnets, but are actually a set of electrodes on the scalp that record small voltage changes—called event-related potentials, or ERPs—due to brain activity. The hairnet-wearing babies are part of autism research funded by NIH and the Autism Speaks Foundation, aiming to identify children at high risk for autism well before the onset of the behavioral symptoms—trouble with language, lack of eye contact, social isolation, and repetitive motions such as arm flapping—that have traditionally led to the disorder's diagnosis.

In recent years, the clinical definition of autism has broadened into a range of neurological impairments known as "autism spectrum disorders," affecting one out of every 150 children born in the United States, according to the Centers for Disease Control and Prevention. And while the causes of autism remain mysterious, Tager-Flusberg, a neurobiologist and director of the NIH Autism Research Center of Excellence at BU, says that early behavioral interventions focused on language and social skills can significantly lessen the disorder's effects.

So, for about two years, Tager-Flusberg and Charles Nelson, a professor of pediatrics at Harvard University and research director of the Developmental Medicine Center at Children's Hospital Boston, have been using ERP studies to look for telltale differences in infant brain development. Every new picture or word sound creates an ERP wave "signature." The researchers then analyze and compare the ERP patterns produced by the brains of at-risk infants who have siblings diagnosed with autism and the brains of control infants with siblings who have not been diagnosed with autism.

The babies are first tested at three months, and then again every three to six months until two years of age. While findings are still preliminary, some clear differences in brain development are already apparent. For instance, the younger infants, whether at-risk or controls, "find mom's face to be so much more interesting than a stranger's face," says Tager-Flusberg, leading to a significant difference in the ERP wave signature gathered when her picture appears. But by nine months, babies with typical brain development have a greater interest in and sensitivity to strangers' faces than do at-risk infants.

Likewise, the brains of all six-month-old infants are primed to learn any language, and thus process an English "ta" as a different sound from the subtly distinct Hindi "ta." But after several months, the typically developing brain is a more efficient processor of speech, concentrating language tasks in the Broca's area of the left hemisphere and leveling many phonetic distinctions in favor of the infant's native language. According to preliminary ERP results, the language processing of at-risk infants involves more areas of the brain, evidence consistent with brain scans of older children diagnosed with autism. "It appears that they need both hemispheres of the brain to process language, so it's a lot more effortful," says Tager-Flusberg.

If the ERP research can identify autism risk signs in infants, the next step will be developing intensive, "parent-based interventions appropriate for such a young age group," says Tager-Flusberg. "This is a new area of very cool baby neuroscience."

Electrodes measure small voltage changes caused by brain activity as a 15-month-old control subject in Helen Tager-Flusberg's study is exposed to word sounds and images.

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