

When mom talks, are infants with ASD listening?

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Motherese is a form of simplified, exaggerated melodic speech that parents use to communicate with newborns and young toddlers. A horse becomes horsie; a dog becomes doggie; parents become mama and dada.

The tendency to speak in such short sing-song phrases is universal across cultures.

Previous research has shown that infants prefer to listen to motherese, more formally known as infant-directed [speech](#), over adult-like speech; that it more effectively holds their attention and is an important component of emotional bonding and fosters learning experiences between child and parents.

An early sign of autism spectrum disorder (ASD) in children is a reduced response to motherese speech and challenges in sustained attention to social information in general. In a new study, published January 3, 2022 in the journal *Nature Human Behavior*, researchers at University of California San Diego School of Medicine employed a number of techniques to pinpoint the regions of the brain responsible for a child's response to baby talk.

"This new study, which combined state-of-the-art brain imaging, eye-tracking and clinical testing, opens the door toward precision medicine in autism," said senior author Eric Courchesne, Ph.D., professor of neuroscience at UC San Diego School of Medicine.

Courchesne said the approach generates new insights into how the brain is developing in children with autism related to objective information about social preference and social attention.

"For the first time, we are seeing what the possible brain impact is for children with autism who fail to pay attention to social information," he said.

Typically developing infants prefer motherese to other forms of adult speech, and previous studies have suggested their brains may process motherese differently from non-speech sounds. But research is scant

regarding how and why infants with ASD do not consistently respond to motherese speech and what the long-term consequences might be when they "tune out."

Courchesne, with colleagues at the Autism Center of Excellence at UC San Diego, hypothesized that ASD infants and toddlers experience impaired development of innately driven neural mechanisms that respond to motherese. To investigate, they conducted a series of tests involving 200 datasets from 71 toddlers and 41 datasets from 14 adults:

- Using functional magnetic resonance imaging (fMRI) of sleeping toddlers, they measured brain activity to motherese and other forms of social affective speech.
- They conducted clinical assessments of social and language development.
- And they utilized eye-tracking technology to measure responses to females speaking motherese versus non-speech computer sounds and images. Earlier research at UC San Diego and elsewhere has shown that toddlers with ASD show less interest in social activities and stimuli that would normally attract a young child's attention, such as watching other children play, sing or dance.

The researchers found that individual differences in early-age social and language development correlated with a child's neural responses to speech, and that ASD infants and toddlers with the poorest neural responses to motherese also displayed the most severe social symptoms, poorest language outcomes and greatest impairment of behavioral preference and attention toward motherese.

Conversely, infants and toddlers with typical development showed the strongest neural responses and affinity to motherese.

Using a computational precision medicine method for integrating data called similarity network fusion, they correlated eye-gaze patterns to neural and behavioral responses, further confirming their findings.

The researchers noted that the superior temporal cortex, a region of the brain that processes sounds and language, responded more weakly to motherese and emotion speech in ASD children, who also had the poorest social abilities and lowest eye-tracking attention to motherese.

The opposite was true among typically developing children, who displayed strong superior temporal neural response to motherese and emotion speech. A small number of toddlers with ASD showed strong brain activation and interest in motherese speech, as determined by [eye-tracking](#).

"Our conclusion is that lack of behavioral attention to motherese speech in ASD involves impaired development of innate temporal cortical neural systems that normally would automatically respond to parental emotional speech," said study co-author Karen Pierce, Ph.D., professor of neurosciences at UC San Diego School of Medicine and co-director of Autism Center of Excellence with Courchesne.

"The fact that a few children with autism did show strong brain activation and good attention to motherese speech is encouraging for two reasons: First, because it suggests that these particular toddlers with autism are likely to have good outcomes, a newly discovered and important subgroup. And second, it suggests a novel avenue for treatment.

The authors said their findings, based upon data-driven, empirical evidence, may be useful in developing further diagnostic tools and biomarkers for early identification of ASD and in further clarifying how ASD affects toddlers in widely and dramatically different ways.

Co-authors include: Yaqiong Xiao, Teresa H. Wen, Lisa Eyler, Disha Goel and Nathan E. Lewis, all at UC San Diego; Lauren Kupis, University of Miami; Keith Vaux, UC San Diego Health Physician Network; and Michael V. Lombardo, Instituto Italiano di Tecnologia and University of Cambridge.

More information: Yaqiong Xiao et al, Neural responses to affective speech, including motherese, map onto clinical and social eye tracking profiles in toddlers with ASD, *Nature Human Behaviour* (2022). [DOI: 10.1038/s41562-021-01237-y](https://doi.org/10.1038/s41562-021-01237-y)

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