Autism has unique vocal signature, new technology reveals

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A new automated vocal analysis technology could fundamentally change the study of language development as well as the screening for autism spectrum disorders and language delay, reports a study in the July 19 online *Proceedings of the National Academy of Sciences.*

The LENA™ (Language Environment Analysis) system automatically labeled infant and child vocalizations from recordings and thereafter an automatic acoustic analysis designed by the researchers showed that pre-verbal vocalizations of very young children with autism are distinctly different from those of typically developing children with 86 percent accuracy.

The system also differentiated typically developing children and children with autism from children with language delay based on the automated vocal analysis.

The researchers analyzed 1,486 all-day recordings from 232 children (or more than 3.1 million automatically identified child utterances) through an algorithm based on the 12 acoustic parameters associated with vocal development. The most important of these parameters proved to be the ones targeting syllabification, the ability of children to produce well-formed syllables with rapid movements of the jaw and tongue during vocalization. Infants show voluntary control of syllabification and voice in the first months of life and refine this skill as they acquire language.

The autistic sample showed little evidence of development on the

parameters as indicated by low correlations between the parameter values and the children's ages (from 1 to 4 years). On the other hand, all 12 parameters showed statistically significant development for both typically developing children and those with language delays.

The research team, led by D. Kimbrough Oller, professor and chair of excellence in audiology and speech language pathology at the University of Memphis, called the findings a proof of concept that automated analysis of massive samples of vocalizations can now be included in the scientific repertoire for research on vocal development.

Although aberrations in the speech (or lack of it) of children with autism spectrum disorders has been examined by researchers and clinicians for more than 20 years, vocal characteristics are not included in standard criteria for diagnosis of autism spectrum disorders, said Steven F. Warren, professor of applied behavioral science and vice provost for research at the University of Kansas, who contributed to the study and was among the first to see the potential of the technology for autism spectrum disorders screening.

"A small number of studies had previously suggested that children with autism have a markedly different vocal signature, but until now, we have been held back from using this knowledge in clinical applications by the lack of measurement technology," said Warren.

Warren predicts that LENA, which allow the inexpensive collection and analysis of magnitudes of data unimagined in language research before now, could significantly impact the screening, assessment and treatment of autism and the behavioral sciences in general.

Since the analysis is not based on words, but rather on sound patterns, the technology theoretically could potentially be used to screen speakers of any language for autism spectrum disorders, Warren said. "The

physics of human speech are the same in all people as far as we know."

Warren says that children with autism spectrum disorders can be diagnosed at 18 months but that the median age of diagnosis is 5.7 years in the United States.

"This technology could help pediatricians screen children for ASD to determine if a referral to a specialist for a full diagnosis is required and get those children into earlier and more effective treatments."

LENA is digital language processor and language analysis software. The processor fits into the pocket of specially designed children's clothing and records everything the child vocalizes but can reliably distinguish child vocalizations from its cries and vegetative sounds, other voices and extraneous environmental sounds.

Recordings with the device have been collected since 2006. Parents responded to advertisements and indicated if their children had been diagnosed with autism or language delay. A speech-language clinician employed by the project also evaluated many of the children with a reported diagnosis of language delay. Many of the parents of children with language delay and all of the children with autism supplied documentation from the diagnosing clinicians, who were independent of the research.

The recordings were made by the parents at home and in the other natural environments of the children, by simply turning the recorder on and placing in the special children's clothing, and then worn all day.

The discovery that it was possible to differentiate recordings of the autistic children from those of the typically developing children by the totally objective method of automated vocal analysis inspired the researchers to consider both the possibility of earlier screening and

diagnosis and earlier intervention for children with autism.

"Autism interventions remain expensive and arduous. This tool may help us to develop cost-effective treatments and better understand how they work and how to keep them working," said Warren.

LENA could allow parents to continue and supplement language enrichment therapy at home and assess their own effectiveness for themselves, Warren said. "In this way, LENA could function similarly to the way a pedometer measures how much exercise one gets from walking."

Provided by University of Kansas

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