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**Study confirms males/females use different parts of brain in language & visuospatial tasks**

***Findings pave the way for Kennedy Krieger Institute Researchers to understand which sex differences are Developmental vs. Sociological vs. Hormonal***

(Baltimore, MD) -- Differences in the way men and women perform verbal and visuospatial tasks have been well documented in scientific literature, but findings have been inconsistent as to whether men and women actually use different parts of their brains. This inconsistency has been attributed to many factors, including variability in the tasks used in studies and failure to match study participants on performance equivalency. But a new study published in the journal *Brain and Language*, which accounted for and corrected these methodological factors, confirmed that men and women do indeed use different parts of their brains when processing both language and visuospatial information.

At a time when 37% of boys score below basic levels on standardized academic tests, compared to 15% of girls (National Center for Education Statistics) and the rate of ADHD in boys is twice that of girls (Centers for Disease Control), this study provides a solid benchmark to use in comparing whether underlying sex differences also exist in all children. Such an inquiry can pave the way towards understanding the extent to which sex differences are developmental, sociological and/or hormonal and which differences may become more, or possibly less, distinct with age.

The study, led by Dr. Laurie Cutting and research scientist Amy Clements, both of the Kennedy Krieger Institute in Baltimore, used functional magnetic resonance imaging to study thirty adult participants while performing language and visuospatial tasks. Distinct differences were evident between male and female participants. Specifically, females showed more bilateral activation in the inferior frontal gyrus for the language task than males, who were more left lateralized. The opposite pattern of lateralization

was found for the visuospatial task, with males showing more bilateral activation in the parietal lobe while processing visuospatial information than females, whose activations were more right lateralized.

"What we found most compelling was that male and female participants performed equally on tasks, both in terms of accuracy and timing; they just used different parts of their brains to get the tasks done," said Amy Clements, lead author of the study. "This study forms the basis for understanding early developmental preferences that may differ between boys and girls. Future studies based on these findings may help illuminate more about improved special and mainstream education techniques for males and females."

The study's language task consisted of participants viewing two 4-letter pronounceable nonsense word strings, one above the other. Participants were instructed to push a button with their right index finger if the words rhymed, and their left index finger if they did not rhyme. The visuospatial task involved displaying a fan of eleven lines, with nine lines in blue and two in yellow. Above the fan was a pair of yellow lines oriented in either the same or different positions as the two yellow lines highlighted in the fan. Participants pushed a button with their right index finger if all the yellow lines were aligned or pushed a button with their left hand finger if the lines were not aligned. In order to ensure performance equivalency, all participants were right handed, had English as their first language, finished at least some college coursework and completed tasks with an average of 90% accuracy.

"Only by understanding what constitutes normal brain development can we increase our capabilities for treating pediatric learning disorders," said Dr. Goldstein, M.D., President and CEO of the Kennedy Krieger Institute. "Through our many research projects at Kennedy Krieger, our experts are unlocking the mysteries of the brain and translating those findings into better outcomes for children and their families."

"We know that there are frequent and significant gender differences in intellectual developmental disabilities," said Ljubisa Vitkovic, Ph.D., of the Mental Retardation and Developmental Disabilities Branch of the National Institute of Child Health and Human Development, NIH. "Knowledge of gender differences in normally functioning brains is essential for understanding what may go wrong during development."

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### About the Kennedy Krieger Institute

Internationally recognized for improving the lives of children and adolescents with disorders and injuries of the brain and spinal cord, the Kennedy Krieger Institute in Baltimore, MD serves more than 12,000 children each year through inpatient and day treatment programs, outpatient clinics, home and community services and school-based programs. Kennedy Krieger provides a wide range of services for children with developmental concerns mild to severe, and is home to a team of investigators who are contributing to the understanding of how disorders develop and pioneering new interventions and earlier diagnosis. For more information on Kennedy Krieger Institute, visit <http://www.kennedykrieger.org/>.

### About the National Institute of Child Health and Human Development

The NICHD sponsors research on development, before and after birth; maternal, child, and family health; reproductive biology and population issues; and medical rehabilitation. For more information, visit the Web site at <http://www.nichd.nih.gov/>.

The National Institutes of Health (NIH) -- The Nation's Medical Research Agency -- includes 27 Institutes and Centers and is a component of the U. S. Department of Health and Human Services. It is the primary federal agency for conducting and supporting basic, clinical, and translational medical research, and it investigates the causes, treatments, and cures for both common and rare diseases. For more information about NIH and its programs, visit <http://www.nih.gov/>.

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