

Sex difference on spatial skill test linked to brain structure

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Men consistently outperform women on spatial tasks, including mental rotation, which is the ability to identify how a 3-D object would appear if rotated in space. Now, a University of Iowa study shows a connection between this sex-linked ability and the structure of the parietal lobe, the brain region that controls this type of skill.

The parietal lobe was already known to differ between men and women, with women's parietal lobes having proportionally thicker cortexes or "grey matter." But this difference was never linked back to actual performance differences on the mental rotation test.

UI researchers found that a thicker cortex in the parietal lobe in women is associated with poorer mental rotation ability, and in a new structural discovery, that the surface area of the parietal lobe is increased in men, compared to women. Moreover, in men, the greater parietal lobe surface area is directly related to better performance on mental rotation tasks. The study results were published online Nov. 5 by the journal *Brain and Cognition*.

"Differences in parietal lobe activation have been seen in other studies. This study represents the first time we have related specific structural differences in the parietal lobe to sex-linked performances on a mental rotation test," said Tim Kosciak, the study's lead author and a graduate student in the University of Iowa Neuroscience Graduate Program. "It's important to note that it isn't that women cannot do the mental rotation tasks, but they appear to do them slower, and neither men nor women

perform the tasks perfectly."

The study was based on tests of 76 healthy Caucasian volunteers -- 38 women and 38 men, all right-handed except for two men. The groups were matched for age, education, IQ and socioeconomic upbringing. When tested on mental rotation tasks, men averaged 66 percent correct compared to 53 percent correct for women. Magnetic resonance imaging (MRI) revealed an approximately 10 percent difference between men and women in the overall amount of parietal lobe surface area: 43 square centimeters for men and 40 square centimeters for women.

"It's likely that the larger surface area in men's parietal lobes leads to an increase in functional columns, which are the processing unit in the cortex," said Kosciuk. "This may represent a specialization for certain spatial abilities in men."

The findings underscore the fact that not only is the brain structure different between men and women but also the way the brain performs a task is different, said Peg Nopoulos, M.D., a study co-author and professor of psychiatry and pediatrics at the University of Iowa Carver College of Medicine.

"One possible explanation is that the different brain structures allow for different strategies used by men and women. While men appear able to globally rotate an object in space, women seem to do it piecemeal. The strategy is inefficient but it may be the approach they need to take," said Nopoulos, who also is a psychiatrist with University of Iowa Hospitals and Clinics.

"The big question remains whether this is nature or nurture. On the one hand, boys, compared to girls, may have opportunities to cultivate this skill, but if we eventually see both a strong performance and parietal lobe structural difference in children, it would support a biological, not

just environmental, effect," Nopoulos added.

Source: University of Iowa

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