

Language performance and differences in brain activity possibly affected by sex

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In a new fMRI study conducted in the Epidemiology, Biostatistics and Clinical Research Laboratory (Montpellier I University, France) and published by Elsevier in the February 2009 issue of *Cortex*, researchers found differences among male and female groups on activation strength linked to verbal fluency (words generation).

Results from previous fMRI studies identifying the neural basis of sex differences in language production are still in debate. Particularly, the question of group differences in verbal abilities which might account for neurocognitive differences elicited between men and women, still remain unresolved. Although the cerebral regions involved are identical for both men and women, men show greater activation than women, irrespective of performance levels in classical language regions (frontal, temporal and occipital lobes, and cerebellum).

From a representative sample of 331 French speakers, students showing a sex difference for a verbal fluency task, with women scoring higher than men as reported in the literature, four groups of 11 healthy right handed subjects were selected a priori. Selection was based on sex and contrasted scores in a fluency task i.e. high versus low verbal fluency scores. The 44 subjects were submitted to a covert verbal fluency fMRI protocol.

In addition to a sex effect, this design also shows a performance effect irrespective of sex. Low fluency subjects elicit greater activation in the anterior cingulate than high fluency subjects, with these later activating

the cerebellum more than those with low performances.

The combined sex and performance effects play a role on activation strength. High fluency men differ both from low fluency men and high and low fluency women by showing more activation in the right precuneus and left dorsolateral prefrontal cortex and less activation in right inferior frontal gyrus. Furthermore, in low fluency women, the left anterior cingulate is activated more than in those with high fluency scores.

By dissociating sex and performance effects on brain regional activation strength, this study clearly shows either an effect exclusively related to sex in several regions, or another effect exclusively related to performance or indeed to the both in certain other regions.

Investigating the neural correlates of verbal fluency focusing on sex differences should take into account behavioral variations in order not to alter the conclusion and better grasp the complexity of the phenomenon being studied.

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