

ABSTRACT

While it is well documented that prefrontal cortices play an essential role in memory, previous studies yield inconsistent findings on the specific involvement of the left and right prefrontal cortex in subsets of memory processing including encoding and retrieval. One purpose of the present study was to investigate the prefrontal involvement in encoding and retrieval. To study the functional role of the prefrontal involvement in memory processing, this study was further to compare the memory performances of subjects with different patterns of brain activation associated with encoding and retrieval.

Thirteen healthy subjects (8 M & 5 F; mean age= 24.77 years; mean education level=16 years) were recruited on a voluntary basis. The fMRI experiments were performed on a 1.5 T MRI system (Philips ACS-NT) with parameters of TR/TE/ θ 2000/40/90°. A block-designed paradigm was used in the encoding and the retrieval task. During encoding, subjects silently memorized 18 novel words in the task blocks and fixated on a cross in the rest blocks. In retrieval, a similar design was conducted, except that the subjects were asked to perform a mixed new (9 words)/ old (9 words) forced recognition task.

Analysis at a group level suggested that encoding activated the left inferior prefrontal cortex and retrieval activated bilateral middle and inferior

prefrontal cortices. Analysis at an individual level showed that not all individual subjects demonstrated an activation pattern that was observed in the group analysis; such an activation pattern was only observed in around 50% of the subjects but not in another of the subjects. Subjects with an activation pattern that left prefrontal activated in encoding and bilateral prefrontal activated in retrieval performed significantly better than those without such an activation pattern.

Results from the present study suggest that the left prefrontal is responsible for memory encoding and both the left and right prefrontal cortices are responsible for memory retrieval. However, there are individual differences in utilizing various neurocognitive processing to mediate memory. Some may utilize left prefrontal cortex to mediate encoding and bilateral prefrontal cortex to mediate retrieval; others may not utilize such a processing pattern. The findings that better memory performances are associated with the participation of the left prefrontal cortex in encoding and bilateral prefrontal cortices in retrieval may suggest that left prefrontal activation in encoding and bilateral prefrontal activation in retrieval are associated with memory efforts and memory success.