

The Role of Frontal Areas in Naming of Objects Pictured from Unusual Viewpoints

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Background

Semantic memory is the basis on which we organize and understand our interaction with the world. This memory is known to be affected in normal aging, which manifests primarily in naming problems, probably because naming places a critical and heavy load on semantic processing. We designed a naming test to study the semantic memory decline in normal aging and to detect brain areas and activation patterns associated with object naming performance (Gigi, Babai, Katzav, Atkins, & Hendler, 2005).

Methodology

Naming Performance was studied behaviorally on 117 participants aged 20 to 75 years old. Cerebral activation patterns were studied using functional-MRI (fMRI) on 18 healthy participants. Nine young participants (aged 20-30) and nine old participants (aged 60-78).

The test included two types of pictured stimuli. One, common objects that were pictured from a conventional viewpoint (usual condition), and the other condition included common objects that were pictured from a non-conventional viewpoint (unusual condition). The stimuli were presented in a block-design fashion and the participants were asked to name the objects as fast and as accurate as they could. Correct responses and Reaction Time (RT) were measured in the behavioral study.

Results

In the usual condition the percent of correct responses was high and remained stable (93%-94%) across the ages 20 to 70. Decline in performance was only evident above 70 years of age. In the unusual condition the naming performance was significantly lower in all age groups (66% of correct responses in average). Moreover, age-related naming decline for this condition was evident already from 40 years of age. Reaction times, on the contrary, showed a consistent increase with age in the usual as well as in the unusual conditions.

With regards to brain imaging, young participants had additional activated brain regions during the unusual condition compared with the usual one. This included the Ba 9 and Ba 47 in both right and left prefrontal cortex (PFC) and the right anterior cingulate (Ba 32), all of which are associated with semantic searching and decision-making. Comparison between young and old participants showed that the latter had a significantly higher activation in the hippocampal formation, which was more predominant in the left hemisphere.

Discussion

The brain patterns detected in the young population, suggests an important role of the PFC in naming of objects seen from unusual viewpoints. Since there is a loss of frontal grey matter with age, this might explain (at least in part) the observed age-decline in naming performance. Over activation of the hippocampal formation in the old population, during naming performance, might represent a compensatory attempt. This is in accordance with a recent study showing the contribution of the hippocampus to semantic processing of visual objects (Vannucci et al., 2003).

Acknowledgments

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References

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