Semantic memory

Our knowledge of objects, people, words, and facts. However, there is substantial disagreement over the precise role of the anterior temporal lobe (ATL) in semantic memory, and there is considerable variability in the anatomic findings that link the ATL with semantic processing. The inconsistent findings across studies may be related to the diverse anatomic structures within the ATL and their differential contribution to distinct modalities of semantic information (e.g., visual, auditory, affective).

Most contemporary theories of semantic memory assume that concepts are formed from the distillation of information arising in distinct sensory and verbal modalities.

Both MTG and the anterior temporal region-especially its ventral surface (vATL) are activated in common for word and picture semantic processing. Additional planned, ROI analyses show that this result follows from two principal axes of convergence in the temporal lobe: both lateral (toward MTG) and longitudinal (toward the anterior temporal lobe) [1)].

The middle temporal gyrus (MTG) participates in a variety of functions, suggesting the existence of distinct functional subregions. In order to further delineate the functions of this brain area, Xu et al., parcellated the MTG based on its distinct anatomical connectivity profiles and identified four distinct subregions, including the anterior (aMTG), middle (mMTG), posterior (pMTG), and sulcus (sMTG). Both the anatomical connectivity patterns and the resting-state functional connectivity patterns revealed distinct connectivity profiles for each subregion. The aMTG was primarily involved in the default mode network, sound recognition, and semantic retrieval. The mMTG was predominantly involved in the semantic memory and semantic control networks. The pMTG seems to be a part of the traditional sensory language area. The sMTG appears to be associated with decoding gaze direction and intelligible speech. Interestingly, the functional connectivity with Brodmann's Area (BA) 40, BA 44, and BA 45 gradually increased from the anterior to the posterior MTG, a finding which indicated functional topographical organization as well as implying that language processing is functionally segregated in the MTG. These proposed subdivisions of the MTG and its functions contribute to understanding the complex functions of the MTG at the subregional level [2)].

1)
Visser M, Jefferies E, Embleton KV, Lambon Ralph MA. Both the middle temporal gyrus and the ventral anterior temporal area are crucial for multimodal semantic processing: distortion-corrected fMRI evidence for a double gradient of information convergence in the temporal lobes. J Cogn Neurosci. 2012 Aug;24(8):1766-78. doi: 10.1162/jocn_a_00244. Epub 2012 May 23. PubMed PMID: 22621260.
2)
Xu J, Wang J, Fan L, Li H, Zhang W, Hu Q, Jiang T. Tractography-based Parcellation of the Human Middle Temporal Gyrus. Sci Rep. 2015 Dec 22;5:18883. doi: 10.1038/srep18883. PubMed PMID: 26689815; PubMed Central PMCID: PMC4686935.