Brain Signatures of Food Semantic Knowledge

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Keywords: category-specificity, semantic memory, Alzheimer's disease, Frontotemporal dementia, voxel based morphometry, food

Semantic memory is a store of conceptual knowledge about different types of objects such as vehicles, places, plants, conspecifics among the others. Several theories have been put forward to explain how semantic memory is organized. The sensory-functional theory [1] suggests that semantic memory is organized in two putative modality-specific subsystems, one storing sensory information about an object, and the other its functional information. Damage to the sensory subsystem, should primarily impair recognition of living things since it relies more on sensory properties, while damage to the functional subsystem is expected to reduce recognition of non-living things that relies more on functional information. One question that requires further exploration is whether the recognition of food items can follow this sensory/functional distinction: natural food may be better recognized according to its sensory features (e.g., a tomato is red), while transformed food, that underwent to an organoleptic transformation, may be better recognized according to its functional attributes (e.g., pasta is eaten at lunchtime).

In this study, we investigated whether recognition of natural food relies on shared featured with living things, and recognition of manufactured food on shared features with non-living things. To reach this aim we recruited patients with frontotemporal dementia (FTD), Alzheimer's disease (AD) and healthy controls (HC) and asked them to perform a Naming, a Categorization and a Word-to-picture matching task with food (natural and transformed) and non-food (living and nonliving things). Finally, we used voxel-based morphometry (VBM) to correlate accuracy on these tasks with gray matter volumes.

As to the behavioral performance, patients with a selective deficit for living things (or nonliving things) were not also impaired with natural (or transformed) foods. However, the VBM showed that i) performance on natural foods and living things was associated with the anterior temporal lobes and the right occipital cortex, e.g. [2,3], and that ii), performance on transformed food and non-living things was associated with the superior parietal lobule, the posterior middle-temporal gyrus and the inferior frontal gyrus, consistently with the literature on anatomical localization of tools [4].

In conclusion, the anatomical findings support the hypothesis of a shared neural subsystem for natural food and living things, and transformed food and non-living things. In turn, these results provide evidence that food concepts may be organized according to sensory/functional properties.

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