



# Does the left posterior fusiform gyrus play a critical role in fruit and vegetables categorization? Evidence from 19 semantic dementia patients

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# Does the left posterior fusiform gyrus play a critical role in fruit and vegetables categorization? Evidence from 19 semantic dementia patients

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## Introduction

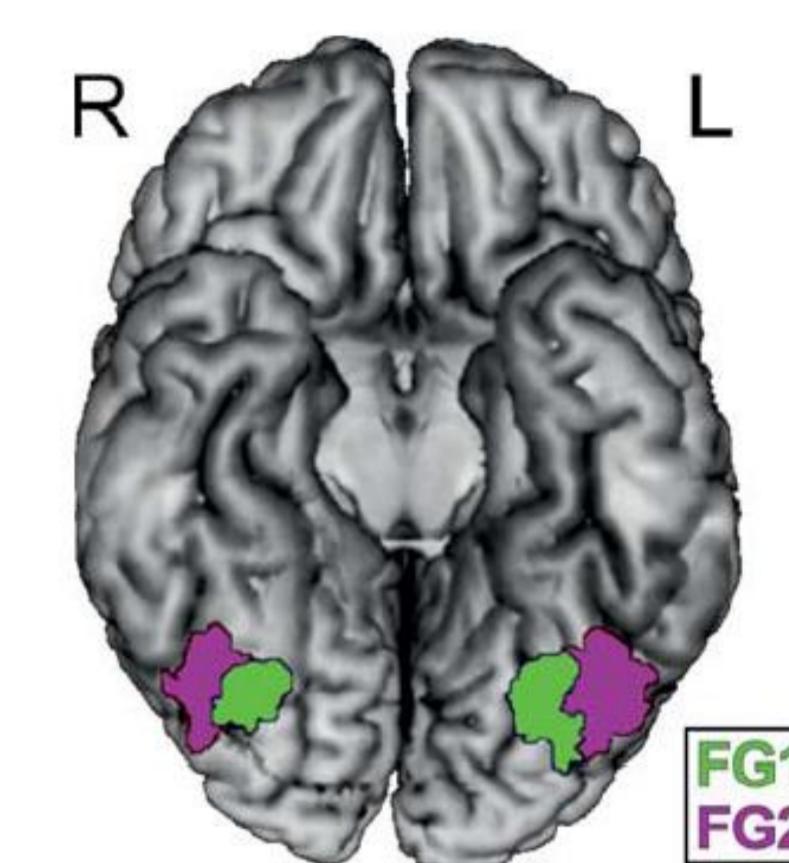
In our previous study [1], we reported a relative preservation of fruit and vegetables knowledge in a large cohort of 35 semantic dementia (SD) patients. This category effect was observed on a semantic sorting task, compared with three others categories: animals, tools and kitchenware.

⇒ Why fruit and vegetables seem to better resist to the massive semantic disruption that occurs in SD?

- ① This relative preservation of fruit and vegetables might be considered with regard to the importance of color knowledge in their discrimination [2] [3].
- ② Color knowledge retrieval is known to depend on the left posterior fusiform gyrus [4] [5], that is relatively spared in SD [6] [7].

## Aim of the study

To test this neuroanatomical hypothesis, we studied the link between sorting performance for fruit and vegetables and the volumes of two recently described areas within the posterior fusiform gyrus in the left side: FG1 and FG2 [8] [9].



Two cytoarchitectonic visual areas on the human posterior fusiform gyrus:

**FG1 & FG2** (Caspers et al 2013 [8])

(see also [9] for the SPM Anatomy Toolbox)

## Methods

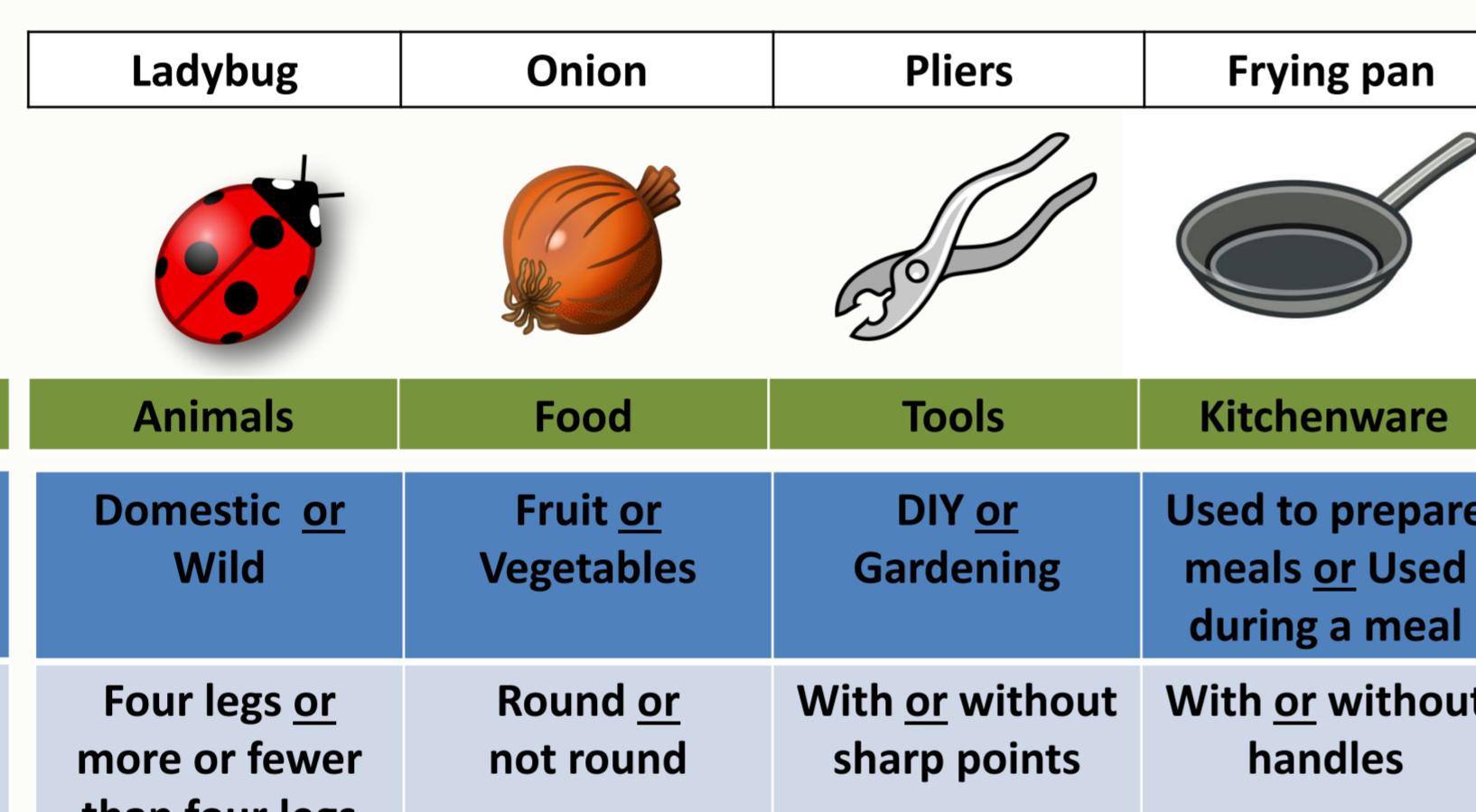
### Population

- **19 SD patients**:
- performing the semantic sorting task
- undergoing an MRI scan (anatomical 3D-T1w 1x1x1 mm<sup>3</sup>) within a period of 3 months
- **12 controls**:
- performing the semantic sorting task

### Semantic sorting task: stimuli and procedure

#### ⇒ 64 stimuli

- Selected from the "Imagier du Père Castor" playing cards
- Divided into 4 categories
- Presented first as words, then as pictures
- Sorted at both superordinate and subordinate levels (see labels in Table)



### Anatomical data (MRI): processing

1/ Pre-processing using Matlab/SPM8 Segmentation into grey matter (c1), white matter (c2) and cerebro-spinal fluid (c3)

2/ Spatial normalisation into the MNI space, with modulation

4/ Correction of the ROIs volumes by the intra cerebral volume {c1+c2+c3}

3/ ROIs analysis : computation of c1 volumes in the two sides of temporal lobes, for:

- **FG1 and FG2**
- 5 others areas from the AAL template [10]: Superior, middle and inferior temporal gyri, temporal pole, fusiform gyri minus {FG1 + FG2}

## Results

### Sorting task performances : a category-specific effect

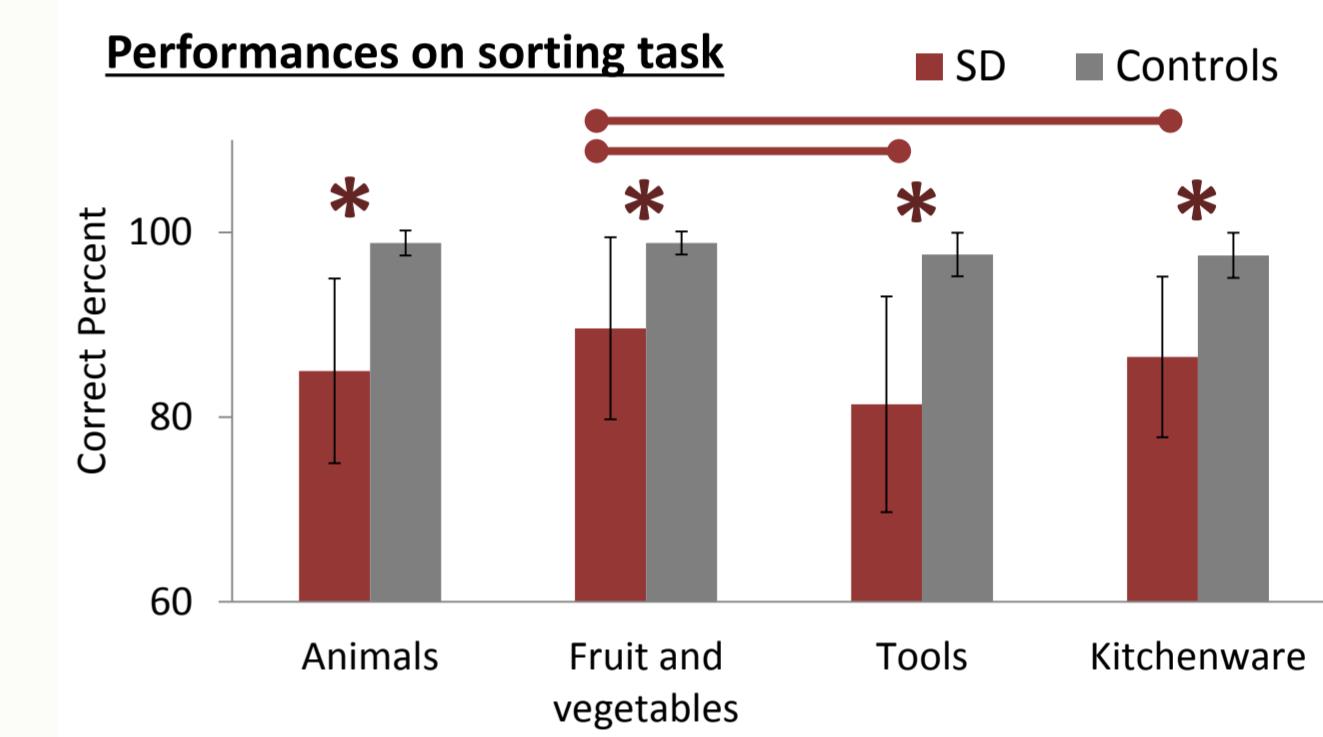
On all categories, SD patients < controls ( $p < 0.01$  \*)

Within the SD group:

- Repeated-measures ANOVA :  $F(3,54) = 7.712$ ;  $p < 0.001$

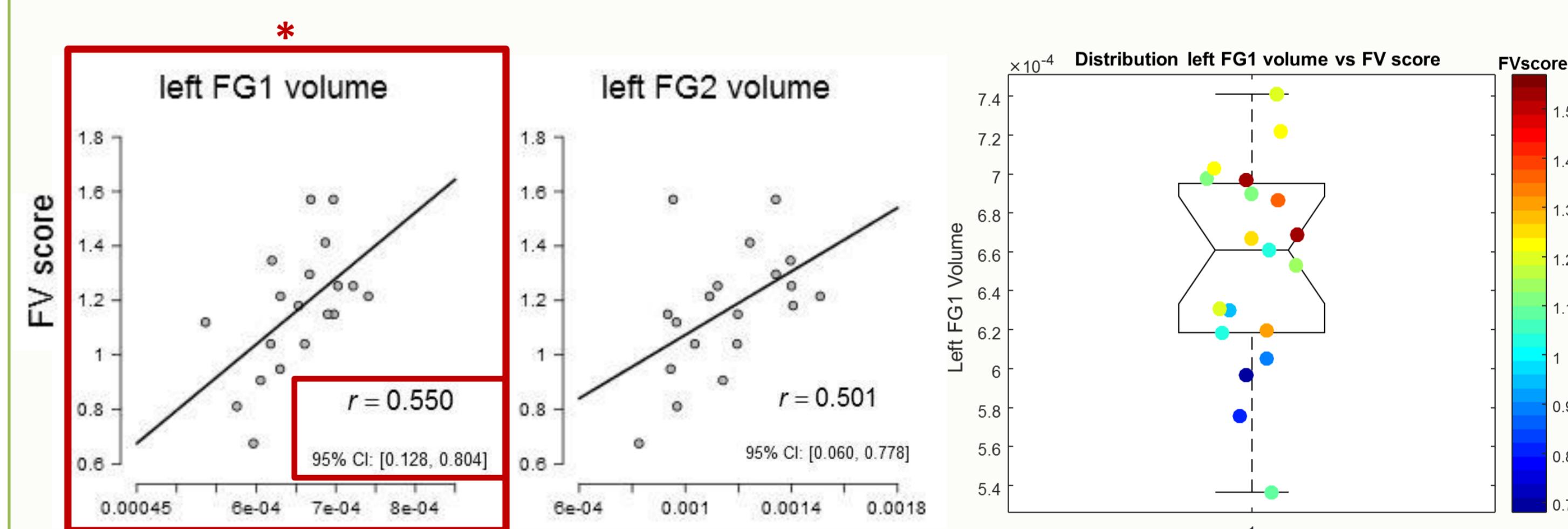
- Planned comparisons (*t*-tests):

- Fruit and vegetables vs. - animals;  $p = 0.012$  (NS)
- tools;  $p < 0.001$
- kitchenware;  $p = 0.009$



### Link between the fruit and vegetables score and the left FG1 volume

**Correlations** between Fruit & Vegetables (FV) scores and the volumes of two areas in the left posterior fusiform gyrus (left FG1 & left FG2)



### Linear regression analysis

For each ROI, the c1 volume was predicted using: (a) sociodemographic features (age, sex, years of education), (b) total c1 volume, (c) MRI models, and (d) sorting scores for : FV, Animals, Tools and Kitchenware categories

- Only FV score predicted the left FG1 volume:  $R^2 = 0.302$ ;  $t = 2.711$   $p=0.015$
- None of the other categories-scores was a predictor of the left FG1 volume
- FV score was not associated with any other ROIs volumes

## Discussion

① We reported a specific relationship between the volume of a subregion within the left posterior fusiform gyrus and sorting performance for fruit & vegetables in SD.

**This area was proved to be a core region underlying the ability to identify fruit and vegetables.**

③ Recent studies [7] [11] pointed out the major contribution of fusiform gyrus to semantic performances in SD. Our results revealed that the left FG1 is more involved in semantic processing when concepts depend upon color knowledge. We further bring evidence for a functional specialization along the longitudinal axis of the fusiform gyrus that depends on the nature of concepts.

② Since prior studies emphasized the major role of color knowledge in the identification of fruit and vegetables, the **left FG1 and its strategic position - in the far posterior part of the fusiform gyrus, near the lingual gyrus - could be a privileged candidate for the storage of the color knowledge of objects.**

## References

- [1] Merck et al. (2013). Relative category-specific preservation in semantic dementia? Evidence from 35 cases. *Brain and Language*, 124, 257-267.
- [2] Crutch & Warrington (2003). *Cognitive Neuropsychology*, 20(3), 355-372.
- [3] Warrington & McCarthy (1987). *Brain*, 110, 1273-1296.

- [4] Simmons et al. (2007). *Neuropsychologia*, 45(12), 2802-2810.
- [5] Chao & Martin (1999). *Journal of Cognitive Neuroscience*, 11(1), 25-35.
- [6] Desgranges et al. (2007). *Neurobiology of Aging*, 28(12), 1904-1913.
- [7] Mion et al. (2010). *Brain*, 133(11), 3256-3268.

- [8] Caspers et al. (2013). *Bain Struct Funct*, 218, 511-526.
- [9] Caspers et al. (2014). *Human Brain Mapping*, 35, 2754-2767.
- [10] Tzourio-Mazoyer et al. (2002). *Neuroimage*, 15, 273-289.
- [11] Ding et al. (2016). *Frontiers In Human Neuroscience*, 10, article 215.