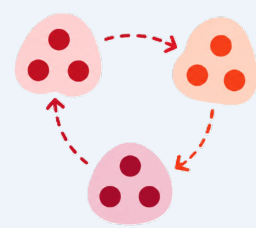
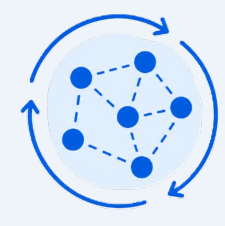


Introduction

Semantic word retrieval relies on two search strategies [1]:

- **Clustering** – local exploitation within a semantic subcategory
- **Switching** – exploratory transitions between subcategories
- Depend on partially dissociable functions & vary with age, sex and neuropsychiatric conditions [2–5]
- Neural implementation during overt speech remains poorly characterized

Aim: leverage an overt semantic verbal fluency paradigm to identify the neural correlates of clustering vs. switching



Performance Outcome

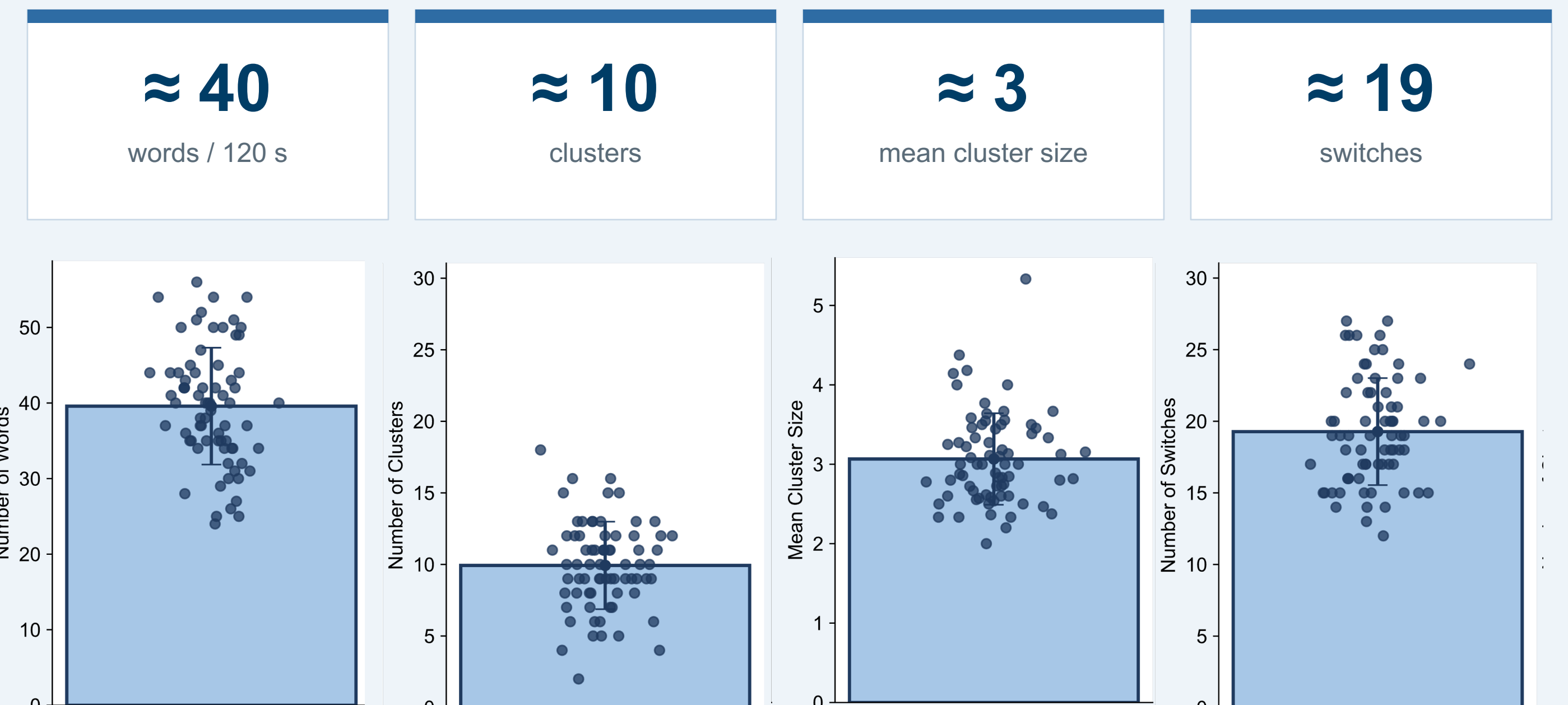
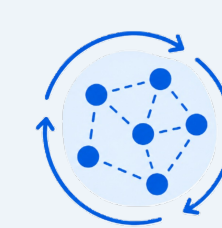
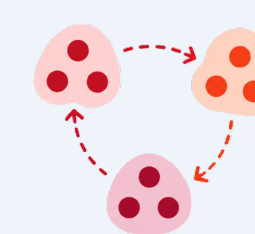


Fig 1. Semantic verbal fluency task outcomes across participants.



= sequences of at least two consecutive correct words belonging to the same semantic subcategory (e.g., *eagle, duck*... = birds)



= transitions between semantic subcategories, including shifts between clusters and single unclustered words (e.g., *eagle, duck, tuna, salmon, cod*... = birds → fish)

Methods

Sample & task

- 72 neurologically healthy, German-speaking adults (41 f / 31 m; mean age 31.25 ± 8.84 y)
- Overt semantic verbal fluency in fMRI: name as many animals as possible across 120 s of continuous speech

fMRI acquisition

- 3 T Siemens Prisma, 64-ch head coil; 64 slices, 2.2 × 2.2 × 2.0 mm³, TR 980 ms, TE 30 ms, FA 70°, multiband 4
- BIDS + fMRIPrep: motion & susceptibility-distortion correction, spatial normalisation, nuisance regression

Speech processing

- Audio via FOMRI-III+ MR-compatible microphone, denoised with deep-learning source separation (Ultimate Vocal Remover)
- Transcription with faster-whisper large-v3, manually quality controlled, each word time-stamped and classified as cluster or switch [1]

Analysis

- Voxel-wise event-related GLMs (FSL FEAT), double-gamma HRF, motion as nuisance regressors
- Group-level mixed-effects analysis with FLAME 1

Data Resource Statement

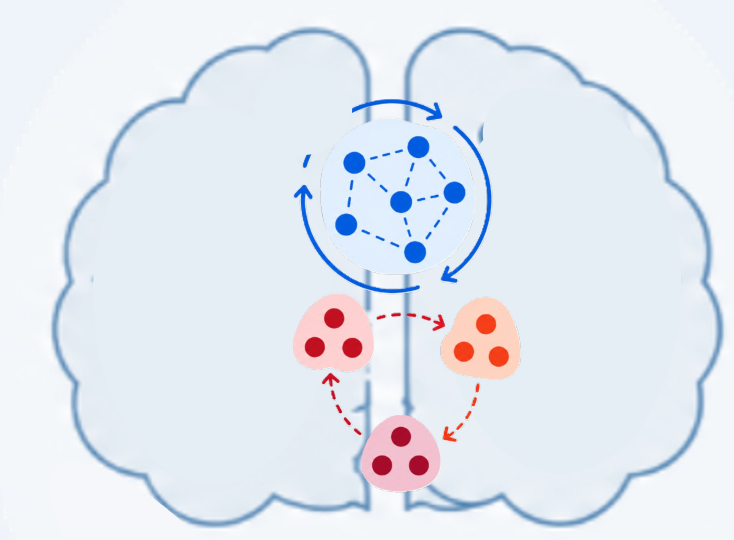
SpExNeuro will soon be released as an open multimodal dataset integrating speech, executive functions, brain imaging, and neuroendocrine measures to study individual differences in speech – cognition – brain relationships.

Interested in **collaborating** or using the dataset? Visit us at the **INM-7 booth (#46)** to learn more! ☺

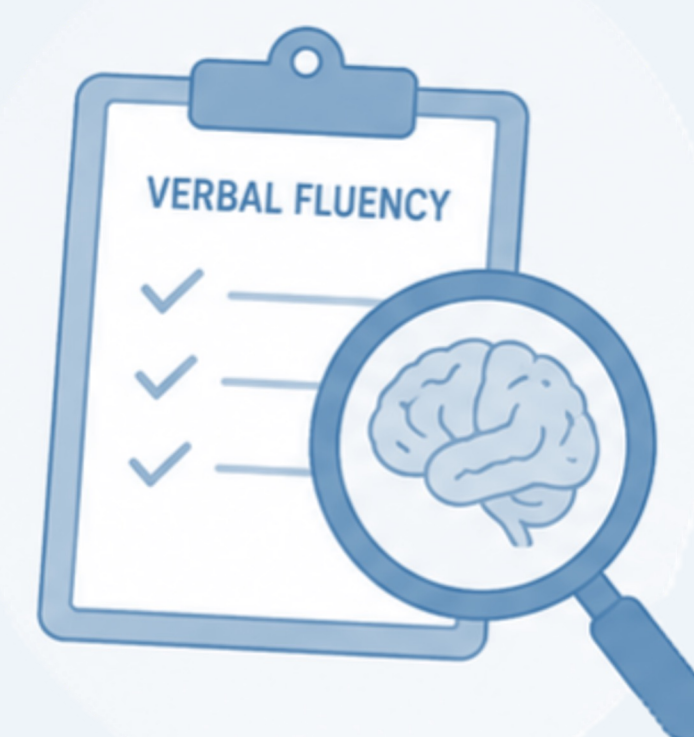
Discussion



Overt verbal fluency can be analysed at the level of individual strategy events with fMRI, given **high-quality** audio acquisition & proper motion correction



Clustering → frontal regions, central & cingulate gyri
Switching → more extended frontal network, (frontal pole, insular cortex, & opercular regions)



Strategy-specific impairments may trace to distinct neural mechanisms, improving **neurofunctional specificity** for early executive decline.



Ongoing data collection, to be **validated** in larger samples and **extended** to further semantic categories (jobs, emotions) and phonemic fluency

Activation patterns underlying semantic verbal fluency strategies

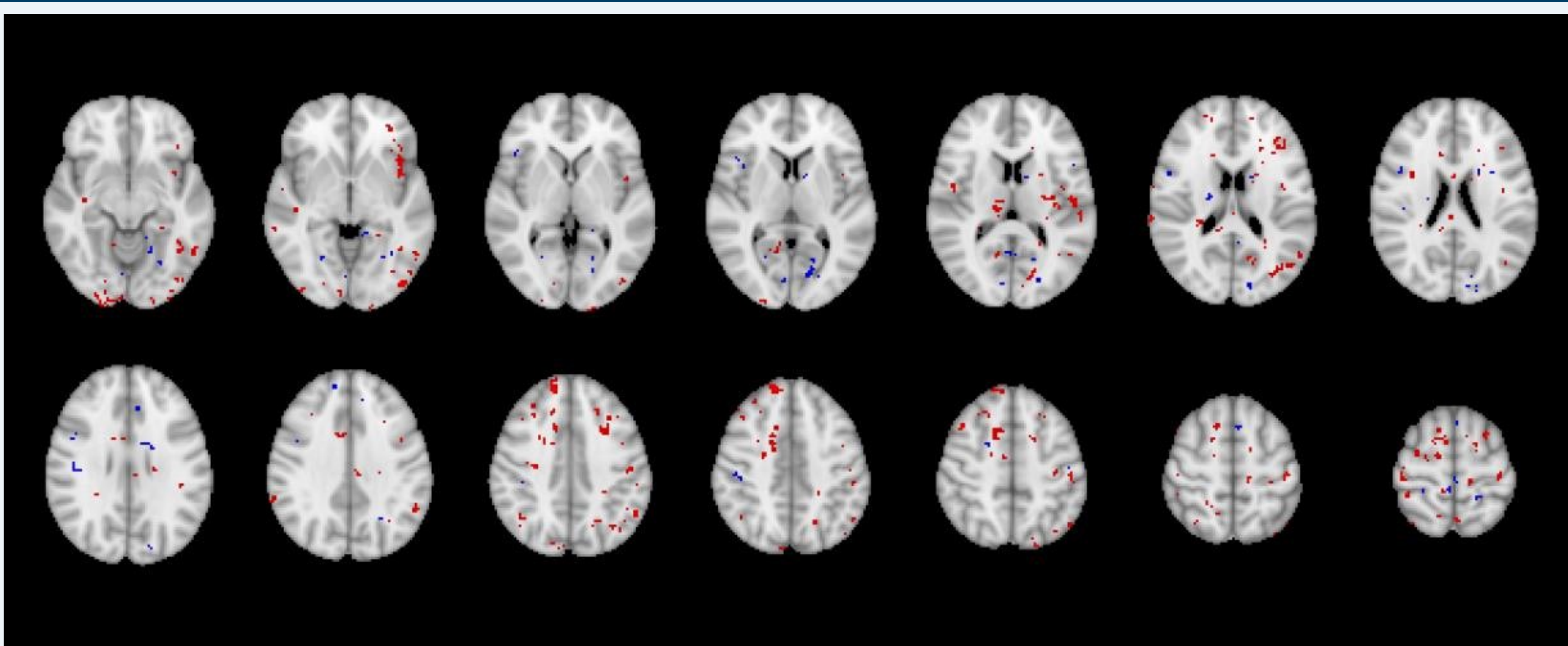


Fig 2. Group-level voxel-wise activation maps illustrate brain regions associated with clustering (blue) and switching (red) events during overt semantic verbal fluency.

Clustering

Switching

Whole-brain, voxel-wise FWE-corrected ($p < .05$):

Clustering > Switching:

increased activation in frontal, central, and cingulate regions, consistent with semantic retrieval within activated subcategories.

Switching > Clustering:

increased activation in the frontal pole, insular, and opercular cortices, reflecting cognitive control and set-shifting processes.

→ **Partially dissociable neural substrates underlying clustering and switching.**

References

- [1] Troyer & Moscovitch, 2006. Cognitive processes of verbal fluency tasks.
- [2] Haugrud et al., 2011. J Int Neuropsychol Soc, 17, 1153–1157.
- [3] Lanting et al., 2009. J Int Neuropsychol Soc, 15, 196–204.
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- [5] Fossati et al., 2003. Psychiatry Res, 117, 17–24.

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