

# Neurofunctional substrates of learning and retrieval of verbal facts - Planning



Chiara Banfi<sup>1\*</sup>, Karl Koschutnig<sup>1</sup>, Andreas Fink<sup>1</sup>, Karin Landerl<sup>1,2</sup>

<sup>1</sup>Institute of Psychology, University of Graz, Graz, Austria; <sup>2</sup>BioTechMed-Graz, Graz, Austria

## Introduction

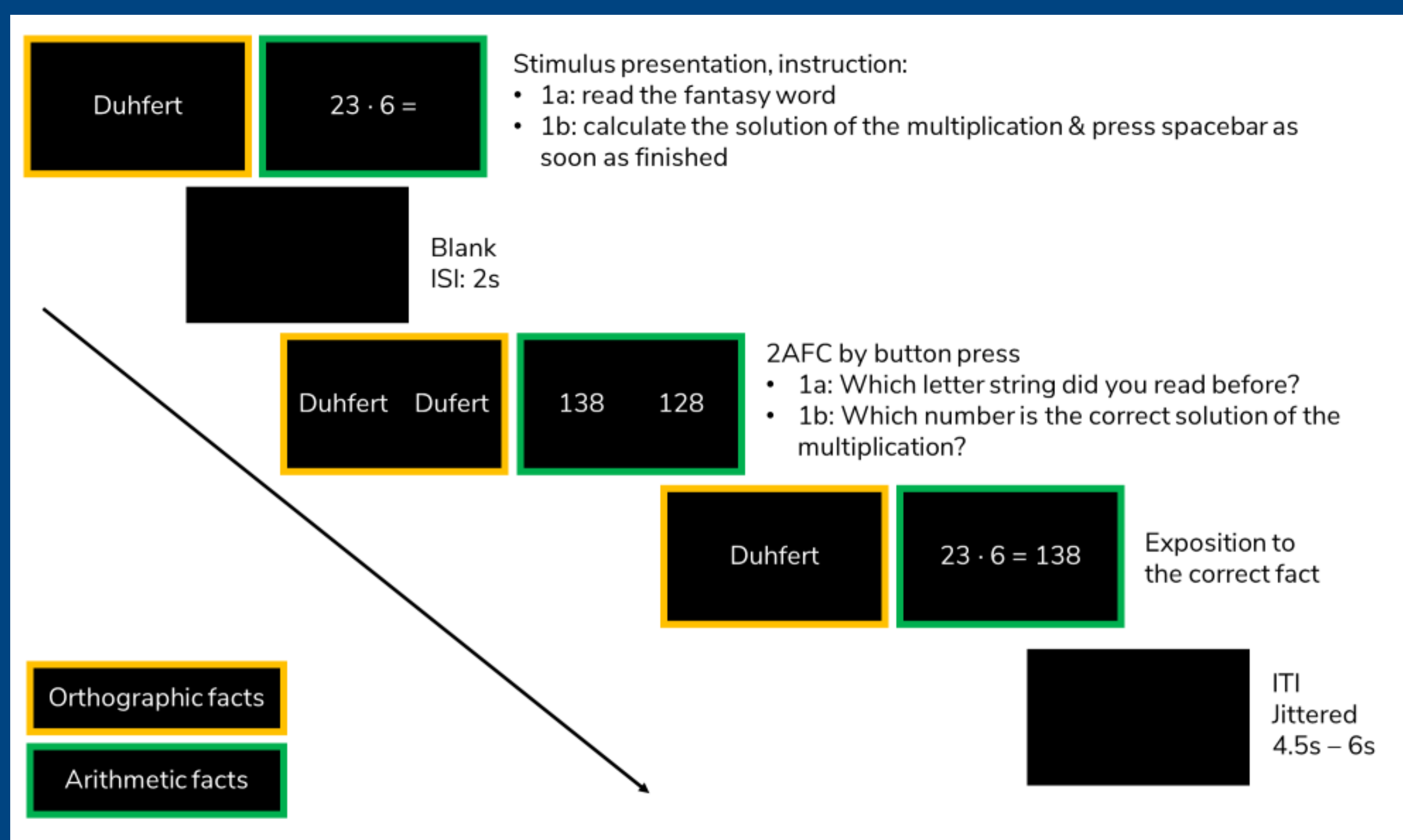
Reading, spelling and arithmetic show associations at the behavioral (Landerl & Moll, 2010; Peterson et al., 2017; Willcutt et al., 2019; Vanbist et al., 2020; Zoccolotti et al., 2021), cognitive (Fuchs, Geary, Fuchs, Compton, & Hamlett, 2016; Geary, 2011; Koponen et al., 2007, 2013, 2019; Vanbist et al., 2020; Zoccolotti et al., 2020) and neurofunctional levels (Evans et al., 2016; Pollack & Ashby, 2018; Prado et al., 2011).

This evidence supports our understanding of the overlap among acquired skills in a static perspective. In the current MRI project, we aim to unravel the neural basis of the dynamics of learning processes in the orthographic and arithmetic domains.

## Research questions

1. Which brain areas are jointly engaged in the **acquisition** of verbal facts? (Experiments 1a, 1b)
2. Which brain areas are jointly engaged in the **retrieval** of verbal facts? (Experiment 2)

### Task 1: Orthographic (1a) / Arithmetic (1b) learning.



### Procedure and planned analysis

Two tasks, each task has 3 runs, 40 trials per run, two conditions:

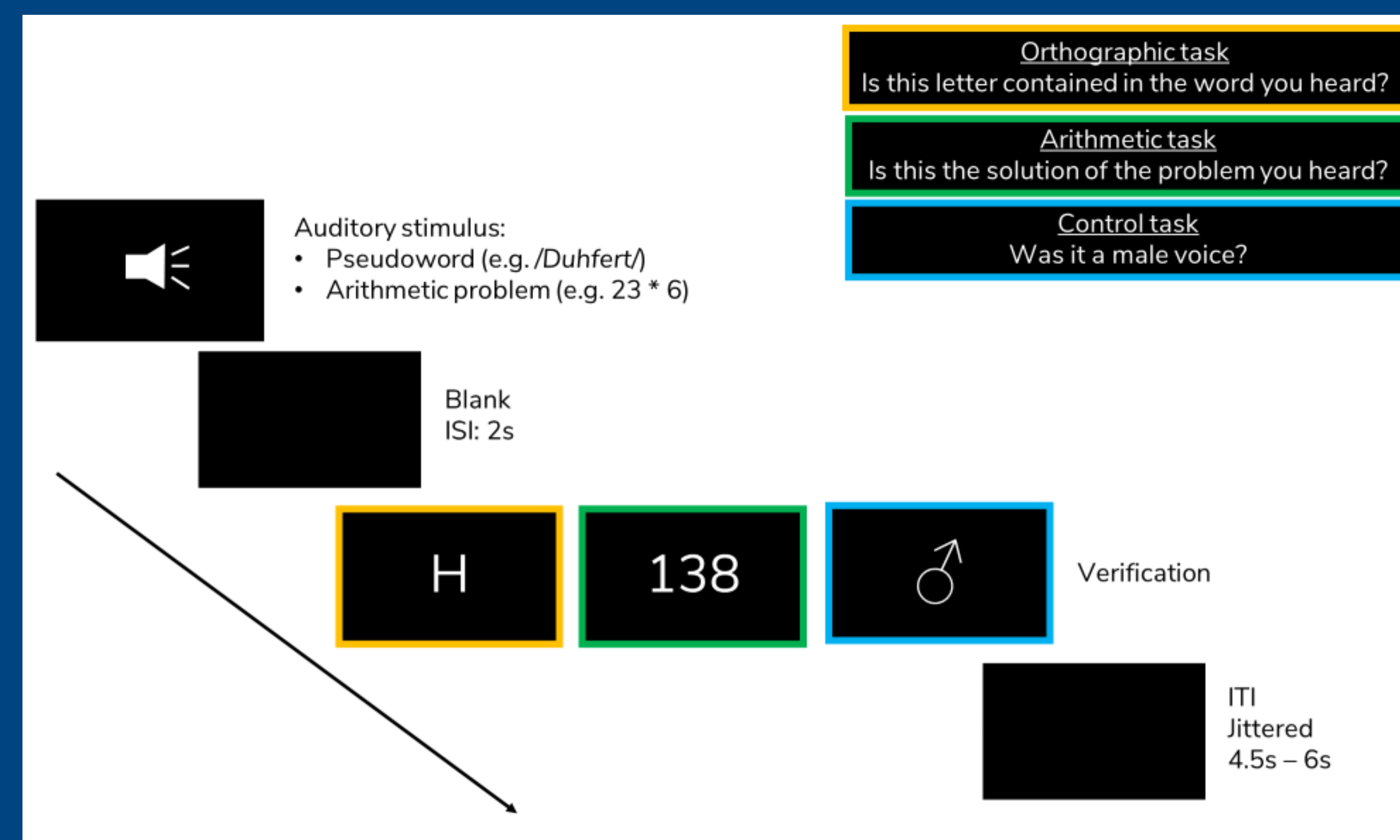
- unrepeatd stimuli (20 trials)
- repeated stimuli (20 trials, 5 stimuli x 4 times).

#### **Within-subject contrasts of interest:**

1. Repeated vs. non-repeated and vice versa
2. Run3 - Run1 and vice versa

Conjunction analysis: [arithmetic]  $\cap$  [orthographic]

### Task 2: Orthographic & Arithmetic retrieval.



### Procedure and planned analysis

One task, three subtasks, two conditions per subtask

- untrained stimuli (30 trials)
- trained stimuli (30 trials, 5 stimuli x 6 times)

#### **Within-subject contrasts of interest:**

1. Orthographic stimulus - control
2. Arithmetic stimulus - control
3. Trained vs. untrained

Conjunction analysis: [arithmetic]  $\cap$  [orthographic]

## Expected results

- **Acquisition** of verbal representations, overlap in
  - Frontal areas (particularly Inferior Frontal Gyrus)
  - Middle temporal cortex (hippocampal and parahippocampal areas)
- **Retrieval** of verbal representations, overlap in
  - Temporo-parietal regions (including Angular Gyrus)
- **Domain-specific activity**
  - Visual word form area for orthographic stimuli
  - Intraparietal Sulcus for arithmetic stimuli

