Introducing words (e.g., "smile") from pseudowords (e.g., "smiel") is a crucial skill of visual word recognition. How the brain allows us to make this distinction is yet unknown, with neural responses that differentiate words and pseudowords often found elusive in standard fMRI, MEG, and EEG paradigms using standard tasks like lexical decision.

Lochy et al. (2015) reported a neural contrast between French words and pseudowords in a study that combined two methods:

- **Fast Periodic Visual Stimulation (FPVS):** Presentation of a rapid stream of stimuli with intermittent oddball stimuli. Subjects are not required to make a response to the stimuli.
- **Electroencephalography (EEG):** Provides a continuous measure of electrical potentials generated by brain cells

Our Study

Can we **replicate** Lochy et al.'s finding and find a neural marker for visual word recognition in English?

**Stimuli**

- 3 lexical conditions (named as <Oddball> in <Base>):
  - **Words in Pseudowords** (e.g., smile in sliem)
  - **Words in Nonwords** (e.g., smile in rdoba)
  - **Words in False fonts** (e.g., smile in ñ<äó>
- Control condition (named as <Oddball> in <Base>):
  - **Natural faces in Phase-scrambled faces**
- 30 stimuli for each type (4 times per trial)
- Lexical characteristics calculated by MC-Word

**Procedure**

- 20 right-handed undergraduate MQ students
- EEG: 32-channel Neuroscan set-up
- FPVS:
  - Trial starts with a fixation cross
  - 60 second rapid presentation of stimuli (100ms/stimulus)
  - Every 5th item in the stream is the “oddball” stimulus
  - Task: Press a key when the fixation cross changes colour
  - Four trials per condition (total test time of 16 minutes)

**Results – Z-scores for frequencies of interest in electrode O1.**

**Words in Pseudowords**

<table>
<thead>
<tr>
<th>Word</th>
<th>Frequency (Hz)</th>
<th>2Hz (oddball)</th>
<th>10Hz (base)</th>
<th>Replicated?</th>
</tr>
</thead>
<tbody>
<tr>
<td>sliem</td>
<td>0.51 (3.15*)</td>
<td>12.10* (32.89*)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>rdoba</td>
<td>0.37 (3.54*)</td>
<td>14.13* (34.94*)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>fäöó</td>
<td>2.70* (14.67*)</td>
<td>10.15* (35.20*)</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

**Faces in Scrambled faces**

- Individuals: Orthogonal (i.e., smile)

**Conclusions**

- Key findings:
  - Significant base response in all conditions
  - Significant oddball response only in the false fonts condition and the control (faces) condition
  - Unsuccessful in replicating Lochy et al.’s finding of a neural marker for visual word recognition

**Future directions**

- Follow-up study in which presentation parameters are more closely matched to Lochy et al.’s study
- Validate the FPVS paradigm with the Emotiv EPOC+ to potentially shorten testing time even more
- What does all of this mean?
  - Could word meaning not be activated automatically and perhaps be task-dependent?
  - Could the oddball effect reflect a process other than activation?

Research funded by the ARC CCD Neural Markers Training Scheme (2017) "Investigating word recognition with Fast Periodic Visual Stimulation using Emotiv and Neuroscan EEG." de Wit, B., Woolgar, A., Schubert, T., Wang, H.-C., Badcock, N., He, W., & Kinoshita, S.