The effects of distracting information on language production: The neural correlates of semantic interference, phonological facilitation, and target picture frequency

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**Behavioral Results**

<table>
<thead>
<tr>
<th>Target Frequency Modulates Brain Activation</th>
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<tbody>
<tr>
<td>Higher frequency targets were associated with increased activation of the left angular gyrus and right middle temporal gyrus when distractors were categorically related, compared to when they were nonwords.</td>
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<td>Activation associated with decreasing frequency</td>
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<td>Lower frequency targets were associated with increased activation of the right middle temporal gyrus when distractors were nonwords, compared to when they were categorically related.</td>
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**Neuroimaging Results**

**Semantic Interference**

- Compared to unrelated distractors, the presence of categorical distractors elicited greater activation during production in the bilateral angular gyrus and right superior frontal gyrus.

**Phonological Facilitation**

- Compared to unrelated distractors, the presence of phonological distractors elicited greater activation in bilateral regions including the angular gyrus, supramarginal gyrus, and superior temporal gyrus.

**Differences between Facilitation and Interference**

Phonological distractors elicited greater activation than categorical distractors in the bilateral insula, right supramarginal gyrus, and left postcentral gyrus. Categorical distractors elicited no greater activation during target naming than phonological distractors.

**Rationale**

**PURPOSE**

The goal of the current study was to examine the neurological basis of language production during the presentation of distracting information, and to explore how target picture frequency may also affect production.

**BACKGROUND**

- Picture Word Interference (PWI) paradigm: presenting a distracting word in conjunction with a target picture influences the ease with which one can produce the name for the target.
- Categorically related distractors activate a network of related items, slowing target production.
- Middle temporal gyrus and superior frontal gyrus activation reflects increased demands on lexical selection and inhibitory control processes.
- Phonologically related distractors activate phonemes that are part of the target word, speeding production.
- Superior temporal gyrus and supramarginal gyrus support phonological processing and phonological working memory.

**SUBJECTS**

- 20 healthy younger adults between 20 and 31 years old (M= 23.7)

**MATERIALS AND PROCEDURE**

- 240 color images with a written distractor superimposed.
- Target pictures vary on frequency (log-

**TARGET FREQUENCY MODULATES BRAIN ACTIVATION**

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**Conclusions**

- We did not find priming-related reductions in activity associated with phonological facilitation.
- Activation of the precentral gyrus suggests that phonological distractors may aid in the articulation of the target word.
- The presence of categorically related distractors was associated with activation patterns that suggest these distractors induced greater semantic processing/ elaboration, while also requiring increased need for inhibition.
- The right middle temporal gyrus appears to track word frequency, but does so differently depending on the type of distractor associated with the target.

**References**


**Method**

- Participants were asked to name the target quickly and accurately.
- Scanning occurred in a 3T Prisma Fit MRI, with a jittered rapid event-related design and continuous data collection.
- Response accuracy and reaction times were collected with an MR-compatible microphone.

**Behavioral Results**

Response latency was negatively correlated with target frequency (r = -0.21, p < 0.005), as low frequency words were slowest to be named.

**Target Frequency Modulates Brain Activation**

Activation associated with increasing frequency

Activation associated with decreasing frequency

**Phonological Facilitation**

Compared to unrelated distractors, the presence of phonological distractors elicited greater activation in bilateral regions including the angular gyrus, supramarginal gyrus, and superior temporal gyrus.

**Semantic Interference**

Compared to unrelated distractors, the presence of categorical distractors elicited greater activation during production in the bilateral angular gyrus and right superior frontal gyrus.

**Differences between Facilitation and Interference**

Phonological distractors elicited greater activation than categorical distractors in the bilateral insula, right supramarginal gyrus, and left postcentral gyrus. Categorical distractors elicited no greater activation during target naming than phonological distractors.