Resolving Lexical Ambiguity: Multiple Priming Effects on Word Association

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Overview

• Research on lexical ambiguity has traditionally focused on the effect of a single occurrence of an ambiguous word on a single subsequent encounter with that word.

• Since the pioneering work of Onifer and Swinney (1981), theories have similarly focused on the role of local context and the impact of a single processing decision.
Theories Include

- Gernsbacher and St. John’s (2001) model of the role of suppression in lexical access.
- The post-selection inhibition of the non-selected meaning of ambiguous words (Simpson & Kang, 1994).
Non-suppression Theories

- Effects of global and local context, the constraint-satisfaction model of Duffy, Kambe, and Rayner (2001).
- The activation-selection model of Gorfein, quantified by Brown (Gorfein, Brown, & DeBiasi, 2007).
Two Experiments

• One I will focus on and describe next.
• Two, I will describe briefly and you will be able to view it in the poster session.
Two Priming Tasks

- Sentence-sensibility judgment: respond as quickly as you can consistent with being correct as to whether this sentence makes sense or not.

- Picture location memory: a verbal label will be presented for each of a series of pictures presented 4 to a page. Your task is to remember the location of the picture.
Details of Sentence Task

- Sixty-Four unbalanced homographs were selected from a variety of norms. The 64 were divided into four subsets of 16 items each.
- Three sentences related to the secondary meaning of each homograph were written taking care not to use any obvious associate of the homograph.
- Each list was conceived as having 3 parts: Part 1 contained one-quarter of the homographs and an equal number of nonsense sentences.
Continued

• Part 2 contained a second occurrence of the part 1 homograph in a different sentence, 16 first occurrences of a different subset, and 32 new nonsense sentences.
• Part 3 contained the third occurrence of the part 1 homographs, the second occurrence of the part 2 homographs, and 16 first occurrence homographs as well as 48 nonsense sentences.
• Within each part items were presented in a random order.
• Across participants the subsets for each part were counterbalanced as were the particular sentences.
The Picture Location Task
You will see pages of pictures. Each page will contain 4 pictures. Your task will be to remember where on the page the picture appeared.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
• The slide containing the pictures will be shown for 4 seconds and then you will hear labels for each picture from left to right, top to bottom.
Later you would be tested for the location by hearing the labels. You will make a check mark on the answer sheet to indicate where the picture occurred.
The Slide Sets

• Half of the homographs were presented in the picture location task.

• The test set began with a 4 item buffer slide to minimize primacy effects.

• The test words were presented by a voice from the computer and the participant made a check mark in 1 of 4 columns to indicate where they saw the picture.
Design

- Half of the participants had the sentence task prior to the picture task, and half had the tasks in the order picture task then sentence test.
- Note: In the picture task while the participant was verbally exposed to 32 homographs no visual exposure occurred.
Dependent Measure: Word Association

For each of the words below print the first word it brings to mind on the line next to. For example, the word dog might make you think of cat and you would then print cat alongside the word dog as in the example below.

99 dog _CAT______________________________

Be sure you print your answers. Do not skip any word and don’t go on to the next word until you have printed your response. All responses must be single English words.

1 stand ______________________________
Word Association

- Items were randomized into two different random orders. Half the participants used each order.
- Scoring was done by a rater blind to which lists the participant had seen in each task.
- A person’s score was the number of homographs to which the association indicated the homograph had been perceived in the secondary direction, e.g. the response *river* to the homograph *bank*.
Effect of Prior Picture Test: RT

First Second Third
Sentence Occurrence
RT in msec Not Seen Seen
Effect of Sentence Occurrence: RT

Sentence Occurrence

RT in msec

First Second Third

Sentence Occurrence

RT in msec

First Second Third
Effect of Prior Picture Test: Accuracy

<table>
<thead>
<tr>
<th>Sentence Occurrence</th>
<th>Proportion Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Seen</td>
<td>0.75</td>
</tr>
<tr>
<td>Seen</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>0.84</td>
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<tr>
<td></td>
<td>0.87</td>
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<tr>
<td></td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>0.93</td>
</tr>
</tbody>
</table>
Effect of Sentence Occurrence: Accuracy

<table>
<thead>
<tr>
<th>Sentence Occurrence</th>
<th>Proportion Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>0.72</td>
</tr>
<tr>
<td>Second</td>
<td>0.75</td>
</tr>
<tr>
<td>Third</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td>0.9</td>
</tr>
</tbody>
</table>

Graph showing the increase in proportion correct with the occurrence of sentences.
Effects

• Picture adds to sentence effect, primarily in accuracy.
• Performance improves across primes, but not linearly.
Word Association
Word Association: Effect of Sentences

Number of Sentence Primes

Prop. Secondary Assoc.
Experiment to be Presented

- Phase 1: Sentence Sensibility employing 32 Balanced and 32 Unbalanced Homographs. Zero to 3 occurrences, primed in the secondary direction.
- Phase 2: Word Association to either Balanced or Unbalanced homographs.
- Phase 3: Sentence Sensibility using dominant meaning sentences for those not tested in phase 2.
Secondary Word Associations

![Bar chart showing the proportion of secondary words for different primed sentences seen.

- **None**: Low proportion for both balanced and unbalanced conditions.
- **One**: Higher proportion for balanced conditions.
- **Two**: Higher proportion for balanced conditions.
- **Three**: Highest proportion for balanced conditions.

**Legend**:
- Blue: Balanced
- Red: Unbalanced

**Axes**:
- Y-axis: Proportion (0 to 0.6)
- X-axis: Primed Sentences Seen
Activation-Selection Model
Gorfein & Bubka (1989); Gorfein (2001); Gorfein, Brown, & DeBiasi (2007)

Words are represented by a weighted set of attributes.

For modeling purposes “attributes” are just abstract features, but presumably they constitute the visual, phonological, and semantic aspects of a word’s representation.

Dominant Attributes
seal (animal)

Secondary Attributes
seal (shut)
Activation-Selection Model
Gorfein & Bubka (1989); Gorfein (2001); Gorfein, Brown, & DeBiasi (2007)

Processing a word “activates” a subset of attributes.

Attributes are activated in proportion to their current weight (baseline weights for dominant-meaning attributes are higher than baseline weights for secondary-meaning attributes).

The number of attributes activated is determined by task constraints, such as the type of response required and the processing time available.
The meaning of a word is assigned based on the majority of its active attributes.
Activation-Selection Model
Gorfein & Bubka (1989); Gorfein (2001); Gorfein, Brown, & DeBiasi (2007)

The meaning of a word is assigned based on the majority of its active attributes.

Activation of an attribute decays fairly quickly to a resting level. That is, “activation” is a short-term property of an attribute.
Activation-Selection Model
Gorfein & Bubka (1989); Gorfein (2001); Gorfein, Brown, & DeBiasi (2007)

Each time a meaning is selected, the weights of active attributes associated with that meaning are increased.

Incrementing the weight of an attribute has the effect of increasing the likelihood the attribute will be activated on subsequent encounters with the word.

Thus, the weights are a long-term (but not permanent) property of an attribute.
Ambiguous words are represented by attributes associated with both dominant and secondary meanings.

In a neutral context, attributes are activated in proportion to their baseline weights.

The weights of attributes that contribute to meaning selection in the current context are increased.

Reweighted Dominant Attributes Secondary Attributes Not Reweighted
Conclusions

• Multiple priming events alter meaning access despite the relatively miniscule number of exposures compared to a lifetime of language processing.
• Transfer is obtained across temporally separated events and across tasks as well.
• The data appear to be consistent with the Activation-Selection model, although we have not yet tried to fit the data.
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  - William Schweinle
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Questions?