

# Priming Effects on Speech Comprehension

**Introduction:** This study aims to investigate whether using a noun or a verb in a previous sentence can speed up or slow down a person's comprehension of a following locally ambiguous sentence. We will focus on the effects of lexical syntactic priming on speech comprehension by conducting a grammaticality judgement task.

## 1. Aims/Objectives

- Our aim with this study is to investigate influences on speech comprehension.
- While we know several factors have an effect, we do not know if this is the case for lexical syntax.
- Our objective is to shed light on the role of lexical syntax in speech comprehension, an area of research which has not been covered before.

## 2. Previous Research

- We know multiple sources of information interact to constrain speech comprehension, such as:
  - Collocations:** Sequences of words that co-occur more often than chance would predict; these can influence what syntactic structure you expect to hear.
  - Frequency of a word:** The more frequent a word, the easier it is to recognise it (Whaley 1978).
  - Ambiguous words:** Words that can be interpreted in more than one way; these tend to slow down comprehension (Rodd et al. 2012). E.g. 'bank' = a river bank or a bank for money?



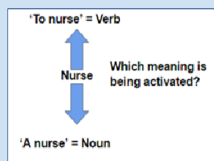
- Priming** has previously been used in order to test whether or not different factors influence the comprehension of words. Overall, the research shows that "if two things are similar to each other and are involved in similar processing, they will either assist or interfere with comprehension" (Harley 2008: 13)
- Semantic priming** has been found to assist speech comprehension. Meyer & Schvaneveldt (1971) showed that the "identification of a word is made easier if it is immediately preceded by a word related in meaning" (Harley 2008: 177).
- Repetition priming** can also help facilitate speech comprehension. According to Harley (2008: 176), "once you have identified a word, it is easier to identify it the next time you see it."
- Syntactic priming (structural)** has been found to help facilitate speech comprehension (Bock 1986).

## Motivations for our study:



- We know that these types of priming have an effect on speech comprehension, but we don't know if **lexical syntactic priming** (which word class the words belong to) has the same effect.
- Words such as 'nurse' belong to more than one word class, in this case noun and verb.

- Our study therefore explores whether the lexical syntax of words hinders or facilitates a person's ability to judge the grammaticality of a garden path sentence.



- We will look at whether being presented with a word in a particular syntactic class (our primes) can make a difference to the comprehension of the same word in a following sentence.

## 3. Research question

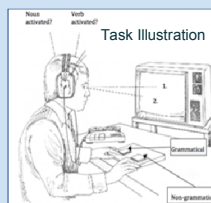
Does lexical syntactic priming affect the comprehension of syntactically ambiguous garden path sentences?

## 4. Hypotheses

- We predict that it will take **longer** to comprehend a garden path sentence if our target word has just been used as a **different** part of speech in the prime sentence, than if the prime sentence does not contain this word at all.
- We also predict that if the target word has just been used as the **same** part of speech in the prime sentence, it will take **less time** to comprehend a garden path sentence compared to if this word has not just been used at all.
- Null Hypothesis:** It will not matter if the target word has just been used as the same part of speech or the opposite; there will be no statistically significant difference in the time taken to process the target garden path sentence.

## 5. Methodology: Grammaticality Judgement Task

- Prime sentence shown for five seconds, followed by target sentence.
- Participant decides whether the target sentence is grammatical or not, and presses the relevant button.
- After 15 seconds the next prime appears.
- Each participant will see ten garden path sentences and ten fillers.
- Participants' error rate and reaction time measured.
- Participants: 30 students, all monolingual native speakers of English, who will have given informed consent to participate and have no known language or visual disorders.
- Participants will complete practice questions before the real test to make sure that they understand the task.



## 6. Example Stimuli

- In the example stimuli, the **verb** primes are in **red** and the **noun** primes are in **blue**.
- In the **prime-match** pair, in the first sentence (the prime) the ambiguous word appears as the **same** part of speech as in the second sentence (the target).
- In the **prime-opposite** pair, the ambiguous word is a **different** part of speech in the prime and the target.
- The **neutral** prime does not contain the ambiguous word. It functions as a **control** so that we can see what the reaction time and error rate is if there is no influence from the target word.

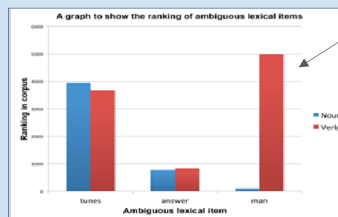
<ul style="list-style-type: none"> <li>Prime match: Fred <b>tunes</b> his radio</li> <li>Target: The woman who sings <b>tunes</b> instruments</li> </ul>	<ul style="list-style-type: none"> <li>Prime match: They <b>answer</b> the teacher</li> <li>Target: The daft <b>answer</b> the question</li> </ul>
<ul style="list-style-type: none"> <li>Prime opposite: Fred recognises the <b>tunes</b></li> <li>Target: The woman who sings <b>tunes</b> instruments</li> </ul>	<ul style="list-style-type: none"> <li>Prime opposite: The <b>answer</b> needs thought</li> <li>Target: The daft <b>answer</b> the question</li> </ul>
<ul style="list-style-type: none"> <li>Neutral prime: Fred adjusts the radio</li> <li>Target: The woman who sings <b>tunes</b> instruments</li> </ul>	<ul style="list-style-type: none"> <li>Neutral prime: The professor assigns work</li> <li>Target: The daft <b>answer</b> the question</li> </ul>

- Ten fillers** will be included so that the participants do not become aware of what we are testing. The **ungrammatical fillers** will make sure the participants have to decide whether each target sentence is grammatical or not and because in each of our targets the ambiguous word is a verb, we will also include some **noun fillers**.
- The fillers will be as similar as possible to the test stimuli, e.g. by having the same syntactic structure where possible.

<ul style="list-style-type: none"> <li><b>Ungrammatical filler example:</b></li> <li>Prime: The men <b>yawn</b> loudly</li> <li>Target: The girls <b>yawn</b> the tired</li> </ul>	<ul style="list-style-type: none"> <li><b>Noun filler example:</b></li> <li>Prime: He <b>deals</b> the cards</li> <li>Target: The magazine contained <b>deals</b></li> </ul>
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## 7. Controls

How will we ensure that <b>other factors</b> won't also prime the subjects?	Our controls will ensure that these factors <b>do not</b> play a part in response times.
<b>Frequency</b> of word as a noun vs. verb?	All words will be chosen on the basis of <b>equal frequency</b> (as shown in the graph below) using the Corpus of Contemporary American English
<b>Semantic priming?</b>	All primes and targets will be <b>semantically related</b>
<b>Structure preferences?</b>	All sentence <b>structures will be SVO</b>
<b>Real world knowledge?</b>	All sentences will be <b>plausible</b>
<b>Collocations?</b>	Google search results will provide <b>figures</b> of the collocation frequency for the stimuli



'Man' is an example of a word we would not use because the frequency of its use as a noun and as a verb is too different to adhere to our controls.

Source of frequency data: Corpus of Contemporary American English (2012)

## 8. Expected Results

- We predict that our results will provide an interactive account of speech comprehension.
- If our predictions were based on discrete model assumptions, we would expect consistently large error rates and long reaction times **no matter what the target was primed with**, because a discrete model **always specifies late closure**.
- A participant would consistently get garden-pathed because of the tendency to keep the phrase open as long as possible. Therefore no matter what the prime was, you would be incorrect or take a long time to judge the grammaticality (as shown in the orange graph).
- However, with an interactive model we predict that constraints (**lexical syntax and collocations**) will affect the comprehension times between the conditions (as shown in the green graph below).
- Based on this model, our primes will facilitate or hinder tree construction, (as shown in the green graph) and there will be a statistically significant difference between the categories.

**Matched prime** = shortest latency times and lowest error rate

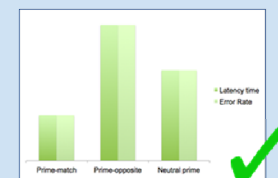
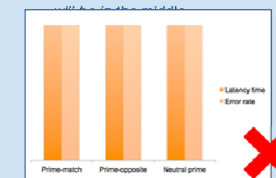
- The participant will have just heard the word used as the same part of speech, so this repetition will mean they correctly expect the word to be used the same way again.

**Opposite prime** = longest latency times and highest error rate

- The participant will expect the word to be used as the same part of speech, and as this is not the case it will take them longer or result in them incorrectly judging the sentence to be ungrammatical.

**Neutral prime** = in between match and opposite.

- This is our control and there will be no facilitation or hindrance from the prime so its results will be in the middle.



## 9. Implications

- Assuming we find our expected results, this would mean that upon hearing a sentence, we are affected by how specific words have just been used i.e., they remain active in our memory.
- Therefore, the effects of lexical syntactic priming would need to be taken into account within theories of speech comprehension; if we see a word appearing as a verb in a prior context, we expect to see it used in the same way in the next.

## 10. Limitations

- Furthermore, this would support an interactive account of speech comprehension because multiple primes can affect the interpretation of a locally ambiguous sentence.
- "Gernsbacher (1984) pointed out that corpora of printed word frequencies are only an approximation to experiential familiarity." (Harley 2008: 173). For example, if you work in a hospital, you may be more familiar with the word "nurse", this varies from person to person.
- Our study uses a student sample, so it lacks representativeness of the population.
- Our experimental stimuli may not provide an accurate account of naturally occurring speech, and subjects might therefore interpret the ambiguities in a different way.
- By instructing participants to give accurate responses, this may not be representative of participants' natural reactions.
- This study focuses on reading stimuli, not listening; this limits the implications of our research within the field of speech comprehension.

## 11. Extensions of our Study

- We have focused solely on the prime-match of verbs; future lines of research could investigate the prime-match of solely nouns, though this would require sentence structure to be reconsidered.
- New research could look at lexical syntax more broadly, for example, by using words that function as a noun/adjective or adjective/verb.