

Sentence comprehension with a competing talker: informational interference or semantic facilitation?

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1. Introduction

In everyday environments (for example in a cocktail party situation), we often have to attend to one person's speech (target speech) while ignoring another (competing speech). A competing talker can impair speech processing through both energetic masking (acoustic degradation at the periphery) and informational, cognitively-demanding aspects of the mask. We refer to the latter as informational interference. We hypothesized that informational interference depletes processing resources that could otherwise be allocated to recognizing and understanding target speech. Consequently, informational interference should be more pronounced for target sentences with high processing demands (complex syntactic structure) than for sentences with low processing demands (simpler syntactic structure). Furthermore, informational interference should be particularly marked when participants' own processing demands are elevated, as with non-native listeners. Finally, modulating the semantic content of the competing talker utterances should influence the degree of informational interference.

2. Method

Using a speeded picture-selection task, we assessed native and non-native listeners' understanding of subject-relative (simple) and object-relative (complex) spoken sentences played with a competing talker or a matched energetic mask. An example stimulus can be found in Figure 1.



Figure 1: Example of a picture for a subject-relative sentence ("Show the girl who is holding the boy") and the corresponding object-relative sentence ("Show the girl who the boy is holding").

In a first series of studies we compared a competing talker with speech-modulated noise and time-reversed speech to control for energetic masking of the competing speech. In a follow-up study, we varied the semantic content of the competing talker utterance to be congruent, incongruent or unrelated to the target sentence. Participants' performance was measured with accuracy and reaction times from button presses, as well as eye-tracking for certain versions of the experiment. Stimuli were presented at signal-to-noise ratios (SNR) of -5dB, -22dB and -25dB SNR across different experiments.

3. Results

Although participants responded more slowly to the object-relative sentences than the subject-relative sentences, the competing talker did not affect performance more than the energetic mask controls, contrary to our hypothesis. This pattern was comparable for native and non-native listeners, and across SNRs. The eye-tracking versions of this experiment yielded similar results. To determine under which conditions informational interference might arise, in the follow-up study we investigated whether informational interference could be observed if the semantic content of the competing talker's utterances was modulated. We found no difference between semantically incongruent and neutral competing sentences, but faster reaction times with semantically congruent sentences indicated facilitation.

4. Conclusions

Contrary to prior research ([1], [2], [3]), but in accordance with some studies ([4], [5], [6], [7]), we found no evidence that a competing talker requires greater processing resources than energetic masking alone. These results provide little support for the existence of a uniquely informational source of speech masking. However, the facilitation (priming) effect found in the follow-up study indicates that the content of a competing talker is not indiscriminately inhibited. The notion of a strategic informational filter as a regulatory mechanism of informational interference is discussed.

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6. References

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