# Can Energetic Masking of Competing Talkers Increase Informational Masking?

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## BACKGROUND

- In many everyday environments, speech understanding may be hindered both by the presence of loud sounds that obscure parts of the message ("energetic masking", EM) and by the presence of competing talkers which may also cause "informational masking" (IM).
- The possible interactions between these two kinds of interference are not well understood.
- Anecdotally, it seems that even low-level background noise (e.g., in a pub or restaurant) can make the task of ignoring competing voices even harder than it is in a quiet setting.
- Here we explored the idea that in addition to obscuring the target speech (i.e. causing EM), background noise also reduces the available information about competing talkers and thereby impedes segregation (i.e. increases IM).

## APPROACH

- The basic stimulus was a mixture of two equal-level talkers (one **target** and one **masker**) presented either in quiet or in increasing levels of speech-shaped **noise** (SNRs of +6, +3, 0, -3, -6 dB).
- A glimpsing model (e.g. Cooke 2006) was used to capture the energetic effects of the noise on the target alone, as well as on the target+masker pair.
- Glimpsing was implemented according to previous studies (e.g. Brungart et al 2006) using 128 frequency bands (80-8000 Hz) and 20-ms time windows.
- Acoustic analyses showed that as the SNR decreased, the amount of target and masker energy declined (i.e., the speech **sparseness** increased) and more tiles with low SNRs were retained (i.e., the glimpse **quality** decreased).

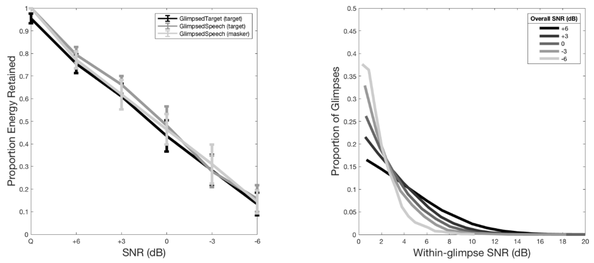


**Figure 1. Left: Proportion of target and masker energy retained after glimpsing for the different SNRs. Right: Histograms of within-glimpse SNRs for the different overall SNRs.**

## CONDITIONS

- Experiment 1 (n=6) tested the hypothesis that noise increases IM by increasing the **sparseness** of the target and masker talkers.
- Experiment 2 (n=6) tested the hypothesis that noise increases IM by degrading the **quality** of the glimpses.

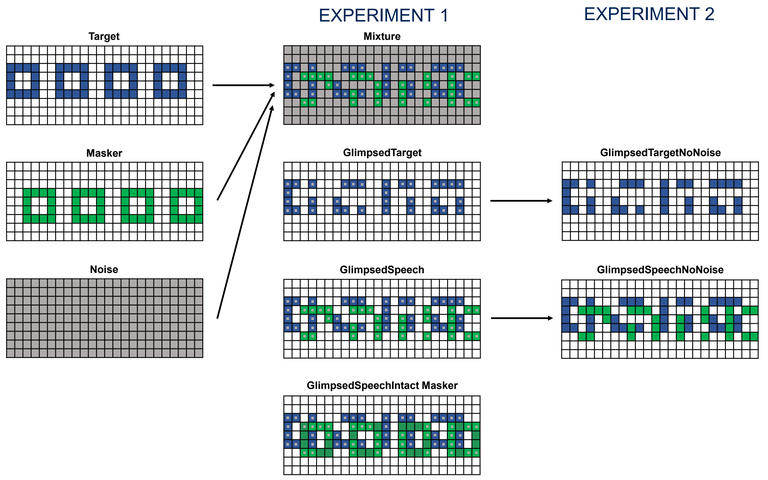


**Figure 2. Schematic of stimulus conditions. Left column: Target, masker, and noise, which combine to give the Mixture condition. Middle column: Conditions tested in Experiment 1. Right column: Conditions tested in Experiment 2.**

## SUMMARY

- In addition to its energetic effects on the target, we found evidence that the background noise disrupted the segregation of the competing talkers and increased IM.
- The increased IM was related primarily to the increased **sparseness** of the competing talker signals but also to the reduced **quality** of the available talker information.

## REFERENCES

Cooke M (2006). A glimpsing model of speech perception in noise. JASA 119: 1562–1573.

Brungart DS, Chang PS, Simpson BD & Wang D (2006). Isolating the energetic component of speech-on-speech masking with ideal time-frequency segregation. JASA 120: 4007–4018.

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## RESULTS

- EXPERIMENT 1: The addition of background noise increased the estimated IM in the mixture, resulting in an IM "sweet spot". The increase in IM was associated with an increase in masker confusion errors. It was eliminated by making the masker intact.

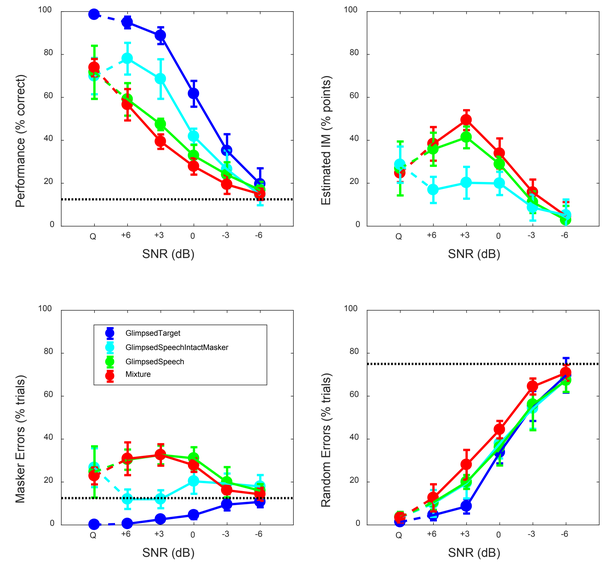


**Figure 3. Results from Experiment 1, showing performance, estimated IM, and error rates as a function of SNR.**

- EXPERIMENT 2: Removing the noise from the speech-dominated tiles improved performance overall but did not eliminate the IM "sweet spot".

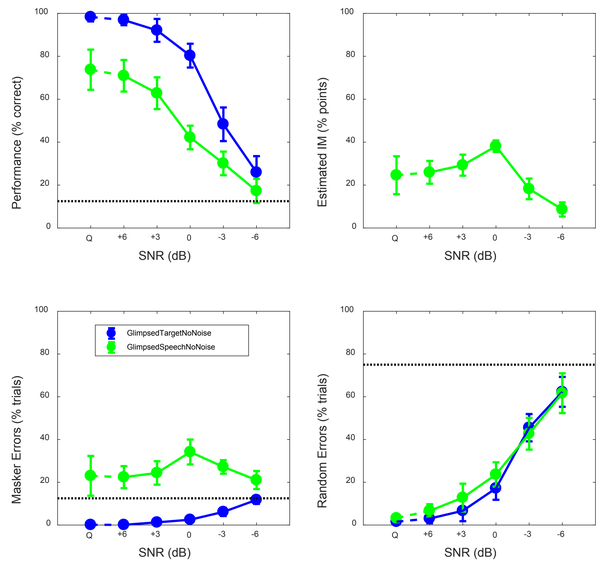


**Figure 4. Results from Experiment 2, showing performance, estimated IM, and error rates as a function of SNR.**