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Mechanisms of speech masking release: role of temporal and spectral cues

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Speech “masking release” (MR) corresponds to the improvement in speech intelligibility in fluctuating compared to steady-state background maskers. This effect is substantial in normal-hearing listeners, reduced in hearing-impaired listeners, and completely abolished in cochlear implantees. The current research program attempts to clarify the different mechanisms involved in the MR effect.

MR was assessed systematically as a function of masker modulation depth and rate in 8 normal-hearing listeners. Vowel-consonant-vowel logatomes were embedded in a steady-state or fluctuating speech-shaped noise masker and presented at a fixed signal-to-noise ratio yielding 50% correct identification in steady noise. Fluctuations were obtained by applying sinusoidal modulation to the amplitude of the noise. For each modulation rate (8 and 32 Hz), masker modulation depth was varied systematically from 0.1 to 1.0.

The results show that for both masker modulation rates, MR (performance in fluctuating minus steady noise) increases monotonically as a function of masker modulation depth, and reaches 35 points of percentage when modulation depth is 1.0. In a second experiment, the temporal fine structure of the stimuli was degraded using a 32-band tone vocoder, in order to force listeners to identify the speech items on the basis of temporal-envelope and spectral cues. The results show that MR increases more slowly as a function of masker modulation depth and reaches about 20 points of percentage when modulation depth is 1.0.

Taken together, these results indicate that at least two separate mechanisms are involved in MR: a first one using spectral and/or envelope cues contributing to roughly 2/3 of the effect, and a second one based on fine structure cues contributing to roughly 1/3 of the effect.

These data provide therefore additional evidence that current implant processors should be modified to deliver place and fine structure cues in order to restore MR.

