Title: **Spatial Release from Speech-on-Speech Masking in Reverberation Evaluated Using the Portable Automated Rapid Test**

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Abstract:

Objective: This study used the Portable Automated Rapid Testing (PART) system to examine the effect of reverberation on spatial release from masking (SRM) for speech stimuli in a multi-talker environment. To examine the informational masking aspects of SRM, the experiment used a closed-set corpus (Coordinate Response Measure, CRM) and symmetrically placed maskers, reducing the energetic benefits of target-masker separation.

Methods: Ten young adults with normal hearing (ages 20-32) completed a speech-on-speech recognition task in a sound-attenuating booth, using calibrated headphones and a tablet running the PART system. On each trial three different sentences with the structure "Ready [callsign] go to [color] [number] now" were presented simultaneously and the listener's task was to identify the color and number in the sentence containing the callsign "Charlie". The three sentences were spoken by three different male voices and differed in the callsigns, colors, and numbers. The target's position was always simulated directly ahead of the listener, and the maskers could be either co-located with or spatially separated from the target (simulated at +/- 45° azimuth). The simulated environment was either anechoic or reverberant, generated using a modified image source model simulating a 10 × 10 m room with a reverberation time of 0.4 s, with the subject placed slightly off center to enhance

realism of the simulation. Testing employed an adaptive scan procedure consisting of five scans (two non-adaptive, three adaptive), each with nine steps and a three-error termination rule. Trial-level data were analyzed with a general linear model to estimate the slope and 50% threshold of the psychometric function in each condition. Errors were categorized as intrusions if the response matched the color and/or numbers from the masker(s).

Results: SRM was 8.5 dB in the anechoic environment, reduced to only 1.1 dB in reverberation. This was driven mainly by an increase in separated reverberant thresholds (8 dB higher on average than separated anechoic thresholds), whereas co-located thresholds only increased by 0.5 dB in reverberation. The slopes of the psychometric curves were comparable in the co-located conditions (anechoic: 13.4 %/dB, reverberant: 13.3 %/dB). In the separated conditions, slope was shallower overall, particularly in the anechoic condition (anechoic: 8 %/dB, reverberant: 12 %/dB). Most errors were categorized as intrusions, accounting for approximately 85-90% of errors in most conditions, while only accounting for approximately 75% of errors in the separated anechoic condition.

Conclusions: The study showed that PART can be used to obtain measures of SRM consistent with published approaches. Results suggest that, in scenarios with high informational masking, the benefit of spatial separation can be dramatically reduced in reverberant vs anechoic environments, possibly due to increased difficulty segregating the target from maskers in reverberation.

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