Spatial Unmasking of Chirp Trains in a Simulated Anechoic Environment: Behavioral Results and Model Predictions

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Gilkey and Good (Human Factors 37:835-843) hypothesized that improvements in detection with spatial separation of a target (T) and masker (M) come about due to low-frequency binaural effects and/or high-frequency changes in the target-to-masker ratio. The current study examines the relative importance of low and high frequency (binaural and energetic) cues for broadband stimuli.

Detection thresholds were measured for a broadband periodic 40-Hz chirp train (T) in the presence of a broadband noise M for various T and M spatial configurations (using procedures and stimuli similar to Lane, Delgutte, and Colburn, 2003 ARO abstract). Results are compared to model predictions to test whether thresholds are determined by the "best" single frequency channel or if information is integrated across channels. Various T and M spatial configurations were simulated using non-individualized head-related transfer functions. Measurements were made for both broadband and low-pass-filtered stimuli; monaural, high-pass, and narrowband conditions were measured for a subset of conditions.

Results suggest that broadband thresholds depend primarily on high-frequency monaural cues. Low-frequency information and binaural processing do not contribute significantly to broadband performance. For low-pass stimuli, both energetic and binaural factors are important. While low-pass performance is worse than broadband, the improvement in detection with spatial separation of T and M (compared to when T and M are in the same direction) is similar for low-pass and broadband stimuli for angular separations of up to 45°. At larger angular separations, spatial unmasking is greater for broadband stimuli than for low-pass stimuli, presumably due to additional increases in high-frequency head-shadow effects. For both broadband and low-pass conditions, "best channel" predictions underestimate performance, suggesting that listeners integrate information across frequency channels.

[Supported by AFOSR and NIH]