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SPOKEN LANGUAGE PROCESSING LAB

Intelligibility of Multiple Talkers' Speech in Complex Noise

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Background

- Literature examining talker intelligibility in noisy environments has limited ecological validity.

- Studies typically use a small number of talkers to present stimuli (e.g., Wilson & Spaulding, 2010) and synthetic noise (e.g., Clopper & Bradlow, 2008).

- In order to better understand the perceptual degradation of speech in real-life, we need research that explores speech intelligibility across multiple talkers in ecologically valid background noise.

Aim

Assess a range of talkers for mean intelligibility in the presence of 8-talker babble and restaurant noise.

Design

study design: within-subjects 2 X 2 design

independent variables: background noise (*8-talker babble, restaurant noise*) and signal-to-noise ratio (SNR; -5 dB, -7 dB)

dependent variable: keyword accuracy (percentage correct)

Methods

participants: 30 adult, native speakers of American English

talkers: 20 young-adult females recorded the target stimuli. All talkers reported American English as their native language.
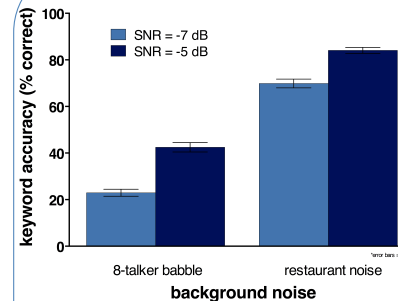
target sentences*:* Each talker recorded 8 sentences, randomly selected from the *Harvard Sentences* (IEEE, 1969), yielding a total of 160 stimulus sentences.

background noise. *8-talker babble and restaurant noise.* 8-talker babble consisted of 4 females and 4 males. Restaurant noise was a real life recording from a restaurant at peek hours. Noise was presented at a SNR of -5 dB and -7 dB.

Procedure

1. We screened listener's hearing.
2. We tested listeners individually at a personal computer set-up in a double-walled sound booth and equipped them with circumaural headphones.
3. The researcher instructed the listener that they would hear sentences from different talkers while noise played simultaneously in the background.
4. The listener's job was to type the target sentences.

Results

Bar chart: keyword accuracy (% correct) vs background noise. Legend: SNR = -7 dB (light blue), SNR = -5 dB (dark blue). 8-talker babble: ~22% and ~42%. restaurant noise: ~70% and ~84%. error bars = SEM

- main effect of background noise; large effect (partial $\eta^2 = 0.98$)

- main effect of SNR; large effect (partial $\eta^2 = 0.85$)

- no significant interaction

Discussion

- The data show that talker intelligibility was significantly decreased in the presence of 8-talker babble and an unfavorable SNR.

- However, the main effect of background noise is particularly notable with a group M accuracy of 84% for SNR = -5 dB and 70% for SNR = -7 dB.

- This relatively high performance across listeners suggests a ceiling effect resulting from weak auditory masking during lulls in the noise.

Future Directions

- We are in the process of replicating the current study with binary masking to minimize ceiling effect in the restaurant noise condition (Wang, et al., 2009).

- We are also conducting acoustic analyses on all the talkers' vocal recordings. These analyses will provide insight into the global and fine-grained, talker-specific characteristics that may be affecting intelligibility (AAS poster #172). We argue that such information is crucial if we are to gain insight into new clinical strategies that could improve listening and communication for people with hearing loss.

References

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