Background

- Non-native accented speech is considered an adverse listening condition for native speakers.¹
- Accented speech may distort particular phonemic and suprasegmental characteristics, while energetic masking may distort the speech signal at the auditory periphery.²
- Linguistic information can be extracted even when tasks focus on extralinguistic information in the signal.³
- Previously, accurate categorization of non-native accents was found to relate to accented speech in noise recognition.⁴

Aims & Predictions

The aims of the study were to examine:
1) The extent to which native English speakers can be trained to categorize the accents of non-native speakers using feedback
2) The extent to which accent categorization training improves non-native accented word recognition in noise

We predicted that:
1) By providing trial-by-trial feedback, participants would be able to successfully categorize accented speech
2) Relative to control tasks involving sentence transcription and speaker sex categorization, accent categorization training would result in greater improvement on non-native accented word recognition in noise

Methods

Participants
- 30 participants (19 females) ages 18-35
- All reported <6 years of music training
- Hearing thresholds ≤20 dB for both ears at 250, 500, 1000, 2000, 4000, & 8000 Hz
- All reported no significant exposure to any of the languages used in the study (formal/informal courses, immersion experience >2 weeks, relatives or close friends who spoke the language, etc.).
- Random assignment to one of 3 conditions:
  - Accent categorization task with trial-by-trial feedback (n=10)
  - Speaker sex categorization with trial by trial feedback (n=10)
  - Transcription task in quiet with no feedback (n=10)

Stimuli
- All participants were exposed to the same stimuli.

Categorization Training & Control Tasks
- Speech from 2 speakers (1 female) was used for each of the following accents: French, German, Korean, & Mandarin
- Intelligibility >90% for all speakers

Speech in Noise Transcription (SINT) Task
- Speech from 2 speakers (1 female) was used for each of the following accents: French, Korean, Japanese, Spanish, & American English
- 80 sentences were selected for each session from BKB Sentence Lists
- Speech-shaped noise (SSN) at -5 dB SNR was used.

Results: Categorization Training

- Categorization accuracy improved for all accents.
- By the final training block, participants significantly improved on all accents except Korean.
- Our results demonstrate that a single-session feedback-based sound to category training procedure can improve accent categorization.

Results: Speech in Noise Transcription

- Accent Categorization Training
- Speaker Sex Categorization Training
- Transcription Training

Discussion

1) Native English speakers were able to categorize the accents of non-native speakers given feedback.
- Categorization performance suggests that not all accents were learned equally. Participants may use rules (such as Eastern or Western) that do not result in higher accuracy for all accents.
- Distance from their native language may also make learning to categorize some accents more challenging.
2) Word recognition performance in noise did not significantly differ following accent categorization training compared to training with speaker sex categorization or transcription.
- Accuracy gains in SINT performance may relate to procedural task learning, but similar improvements across training conditions suggest non-specific categorization training led to similar gains.
- Our results suggest that training native English speakers can result in improved intelligibility of accented speech; however, it is unclear whether non-specific exposure or flexible adaptation may account for part or all of the improvements seen.

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Categorization Training for Non-native Accented Word Recognition

Rachel Tessmer¹, Eriko Atagi², Tessa Bent³, & Bharath Chandrasekaran¹

¹ Department of Communication Sciences and Disorders, The University of Texas at Austin ² Volen National Center for Complex Systems, Brandeis University ³ Department of Speech and Hearing Sciences, Indiana University

Figure 1. Schematic showing stimulus presentation, instructions, and feedback for accent categorization and control tasks.

Participants were instructed to transcribe target sentences presented with noise. They did not receive feedback.
Each participant completed one session of the SINT task immediately prior to and immediately following the training task.

Figure 2 (left). Categorization training accuracy for accented speech across 6 blocks of training.

Error bars show standard error.

Figure 3. Confusion matrices showing categorization responses to accented speech for French, German, Korean, Mandarin.

Figure 4. Word recognition accuracy in pre-training and post-training SINT tasks.

Error bars denote standard error.

- Accent categorization, speaker sex categorization, and transcription training all yielded more accurate word recognition (post-training>pre-training) in the SINT task.
- There was no significant difference between training tasks on improving non-native accented word recognition in noise.

Discussion

1) Native English speakers were able to categorize the accents of non-native talkers given feedback.
- Categorization performance suggests that not all accents were learned equally. Participants may use rules (such as Eastern or Western) that do not result in higher accuracy for all accents.
- Distance from their native language may also make learning to categorize some accents more challenging.
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