Acoustic features associated with similarity judgments of voices

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Summary

- Native speakers of English and Mandarin heard 820 pairs of speech recordings from English and Mandarin talkers and rated the perceived dissimilarity of the pairs of voices.
- The *language-familiarity effect*[6] (greater dissimilarity for different-voice pairs, greater similarity for same-voice pairs in one's native language)[2] was not reliably observed.
- Dissimilarity ratings of pairs of voices were highly consistent across listener language background and between forward and time-reversed speech.
- Across talker language, listener language, and time-reversal, dissimilarity ratings of voice pairs were most closely related to trial-by-trial differences in mean F0.

Methods

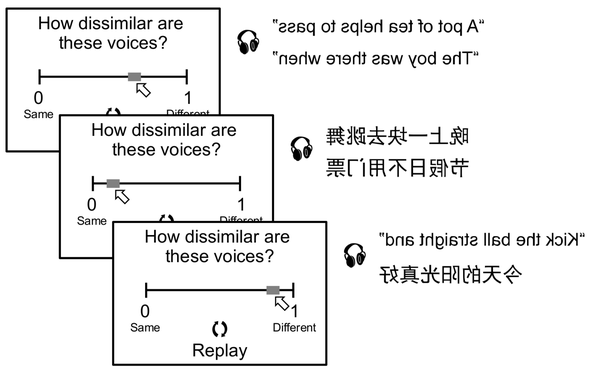
Stimuli: Recordings of female native speakers of Mandarin (n=20) and English (n=20) reading 10 phonetically balanced sentences in their native language [3,4].

Acoustic measurements: For each recording: fundamental frequency mean and variation ($s/\bar{x}$), jitter, harmonics-to-noise ratio (HNR), speech rate, and formant dispersion [1].

Participants: Native speakers of English (n=40) and Mandarin (n=40). Half of each group was assigned to rate voices from either time-reversed [2] or time-forward speech.

Procedure: Participants heard pairs of recordings and indicated subjective dissimilarity from 0 (certain these are the same talker) to 1 (certain these are different talkers) [2].

Perceptual dissimilarity rating paradigm



Perceptual Dissimilarity Judgments

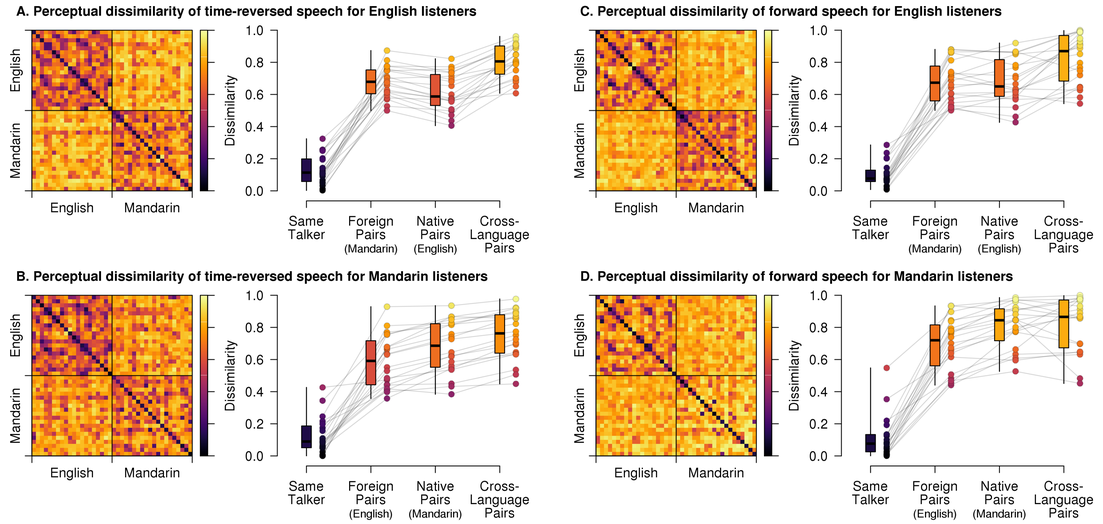


Fig. 1: Mean perceptual dissimilarity judgments for all pairs of voices by listener group, talker language, and time-reversal (matrices); mean ratings by listener and type of voice pairs (boxplots).

Language-Familiarity Effect

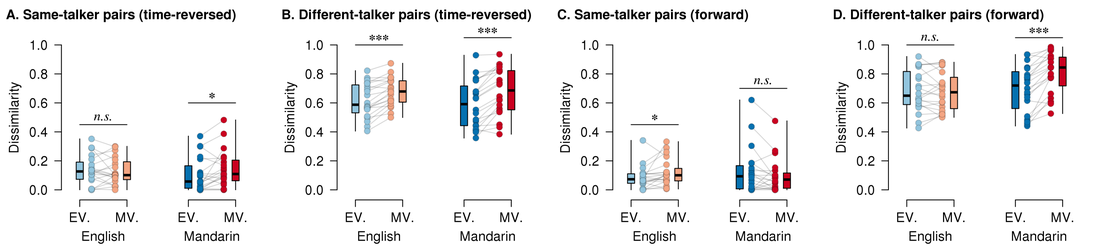


Fig. 2: Comparison of perceptual dissimilarity judgments by listener and talker language frequently revealed listener judgments that were inconsistent with the language-familiarity effect [2,6].

Acoustic Representational Similarity

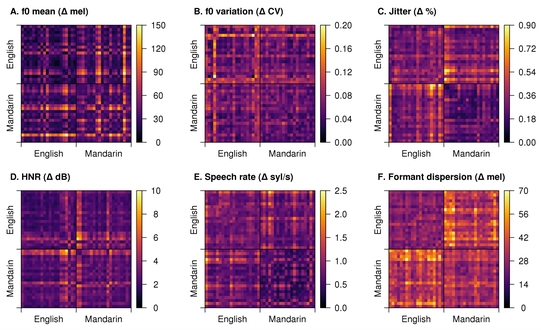


Fig. 3: Mean acoustic differences between pairs of talkers. Comparison of trial-by-trial acoustic differences[5] between talkers and perceptual dissimilarity judgments by listeners revealed perceived dissimilarity to be most closely related to the difference in mean F0 for both forward and time-reversed English and Mandarin speech. Differences in jitter were also related to dissimilarity judgments of Mandarin voices by both listener groups. Formant dispersion played a larger role in judgments of forward speech.

Consistent Ratings

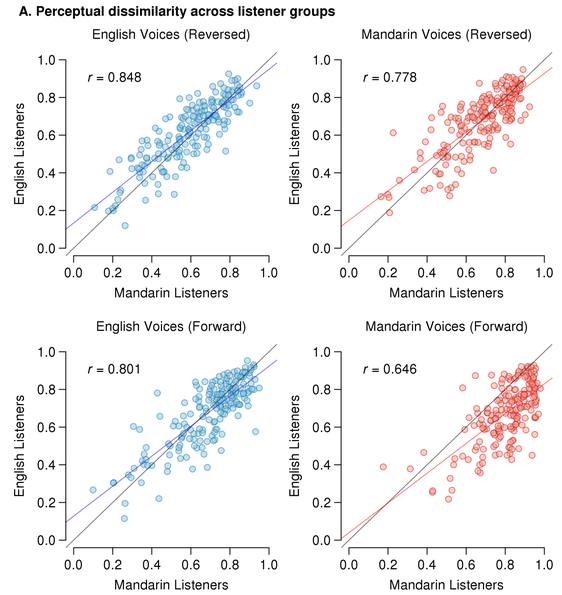
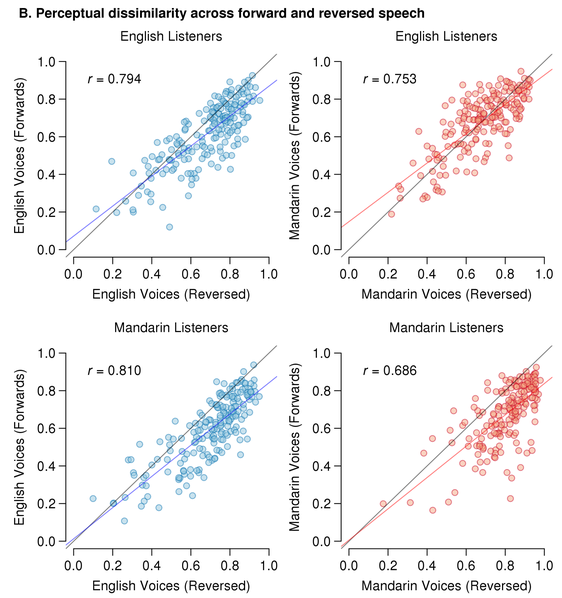


Fig. 4: Relationship between mean perceived dissimilarity of voice pairs across listener group and time-reversal. (A) Voice pairs rated as more dissimilar by English listeners also tended to be rated as more dissimilar by Mandarin listeners. **(B)** Voice pairs rated as more dissimilar from time-reversed speech also tended to be rated as more dissimilar from forward speech.



Acknowledgments

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