Perceptual scaffolding of non-native speech categories through videogame-based training

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Background

Acquiring non-native speech sound categories is notoriously difficult.

Incidental category learning paradigms may be effective and efficient towards this goal.

- Task with overt goals that are unrelated to sound category learning
- May draw on different neural substrates than overt learning paradigms (Tricomi et al., 2006; Lim et al., 2013)

Participants can incidentally acquire spectro-temporally complex sound categories by playing a videogame. (Wade & Holt, 2005; Leech et al., 2009; Liu & Holt, 2011)

Existing research on incidental learning of speech sounds has shown limited generalization to novel productions. (Lim & Holt, 2011; Vlahou et al., 2012)

Objectives

Can learners incidentally acquire robust representations that generalize to novel, naturally-spoken speech?

What training stimulus features lead to effective learning and generalization?

Methods

Stimuli

Mandarin Chinese Lexical Tones

Training Conditions

SPEECH (N=12) Natural speech tokens produced by multiple speakers, multiple phonetic contexts

NONSPEECH (N=12) Nonspeech analogs of all exemplars in the speech condition – “hums” with identical pitch (F0) contours

Videogame Paradigm

Vocab Learning Pre-Test → Videogame Training 4 sessions (.5 hr 45 min) across 4 consecutive days → Explicit Categorization & Generalization Test → Vocab Learning Post-Test

Results

Explicit Categorization

Learners trained on nonspeech generalize to novel speech stimuli robustly above chance and do so just as well as listeners trained on speech.

Within-Videogame Learning

Vocabulary Learning

Conclusions

In the context of a videogame learning environment, listeners can incidentally acquire robust perceptual, non-linguistic sound category representations. These representations (1) readily generalize to novel, naturally-produced speech, and (2) scaffold performance on vocabulary learning among learners who have not yet reached ceiling performance.

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