INTRODUCTION

- Learning to perceive and produce sound contrasts in a second language (L2) is especially challenging for adults. Relationship between first language (L1) and L2 matters. [1,2,3]
- Mechanism for how adults learn non-native contrasts may inform clinical strategies for training perception. Perception gains may also transfer to production [4].
- Insight from first language acquisition: infants are sensitive to distributions in L1. [5]
- Some evidence for distributional learning effect (bimodal > unimodal) in adults, but most studies suggest the need for additional supports to train adult perception using distributions.

CURRENT STUDY

- Test whether supports will enhance learning in the unimodal condition.
- Test with vowel contrast: previous studies included consonantal contrast.
- 1. Lexical support: Assign image to category; emphasize presence of 2 categories [6,7].
- 2. Active participation: Identify stimulus; immediate knowledge of results (KR) feedback [8].
- 3. Overnight consolidation: Allow two days to learn new speech categories [6,9,10].

Do these supports eliminate a distributional learning effect, such that a unimodal distribution leads to as much learning in perception and production as a bimodal distribution?

METHODS

Perceptual Training Stimuli

- Native French speaker produced /a/ or /i/ & filler vowels in idVt within carrier phrase, as in [11].
- Synthesized 8-step continuum.

Perceptual Training Task

- Identify stimulus as /a/ (1-4) or /i/ (5-8).
- Immediate KR feedback.

Outcome Measures:

- Measures of perceptual learning:
  - Proportion correct responses in discrimination task (AXB): within & across-category contrasts.
  - Proportion of /a/ responses in identification task: like training but no feedback.

Participants: 34 adult native English speakers; no experience with language from front-back contrast for rounded vowels; assigned to unimodal (n = 17) or bimodal (n = 17) condition.

Perception-production results

- Individual patterns:
  - Upon visual inspection, many of those who improved in perception also improved in production.
  - Supports perception-production link.
  - Many individual differences, and no clear group differences.

PERCEPTION RESULTS

Discrimination: Significant learning in both groups.
- Across-category contrasts (steps 3-6): Interaction between condition and time not significant.

Identification: Similar performance at middle of continuum.
- Different performance between groups near endpoints (steps 1,7,8) at pre-training test only.

Repetition: Euclidean distance (/a/−/i/) increased for both groups.
- Natural: condition and time interaction; unimodal learned more than bimodal.
- Synthetic: no condition differences; effect of time.

PRODUCTION RESULTS

- Measure of production learning:
  - Euclidean distance (/a/−/i/) in repetition task: repeat natural and synthetic idVt syllables containing /a/ and /i/ 4x each.

Individual patterns:

- Upon visual inspection, many of those who improved in perception also improved in production.
- Supports perception-production link.
- Many individual differences, and no clear group differences.

SCHEDULE

DAY 1

- Repetition 1

DAY 2

- Repetition 2

DAY 3

- Identification

DAY 4

- Discrimination

Replication study: New York University

MAIN FINDINGS

- Listeners in both conditions improved perception.
  - Small bimodal advantage observed after first training was no longer present after final training.
- Listeners in both conditions improved production.
  - Possible that unimodal group showed greater increase in production, though only observed in natural tokens. (Artifact of stimuli?)

- Supports perception-production link:
  - Individual patterns suggest that perceptual learning transfers to production.
- Instead of a bimodal advantage for learning to improve perception and production, as in previous studies, the current study demonstrates that:
  - A unimodal condition can lead to as much perceptual learning as a bimodal condition.
  - A unimodal condition can lead to more production gains than a bimodal condition.

- Relative improvement for unimodal condition likely explained by three supports: 1) lexical support, 2) active participation, 3) overnight consolidation.

CLINICAL RELEVANCE

- Instead of passive distributional learning approaches for adults, use procedures that allow active engagement with target stimuli & KR feedback.
  - Direct applications to accent modification therapy for acquiring non-native speech sounds.
  - Possibly also applicable to improving perception and production in children with perceptual deficits associated with speech sound disorder.

REFERENCES

- McGregor KK. What a difference a day makes: Change in memory for newly learned word forms over 24 hours. J Mem Cognit. 2005;33(5):599-607.