Phonetic instruction as a tool to overcome L1 biases in L2 articulation

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Introduction

How do adult learners acquire production targets in a new second language?

Acquisition of L2 production targets varies based on many factors, including L1, training type, and individual variation (e.g. Bradlow et al. 1997, Baese-Berk 2010). Classroom L2 learning rarely includes instruction on articulatory targets (Lord 2005), and it has not been investigated widely in the lab, although it may be beneficial for perceptual learning (Cutler and colleagues 1970).

Major study questions

1. Does production training focused on articulatory features aid in non-native phoneme production?
2. Can that learning be maintained when visual cues are no longer present?
3. Do phonetic features improve consistently across L2 targets that share them?

Production training

- Explicit training in target articulatory postures
- Repetition task with visual cues for reinforcement

Study design and analysis

Study design: 8 sessions of training and testing with both perception training and production training (1 session)

Pretest → Perception Training → Posttest → Production training → Re-Test Training

Test task: Repetition of CV syllables produced by native Hindi speaker during tests and production training (visual cues present in training only)

Stimuli: VCV and CV Hindi syllables with one of 8 coronal stops

Participants: 21 native English speakers, no prior exposure to Hindi

Patterns of interest after training:
- Does positive VOT lengthen for breathy and voiced stops?
- Do dental and retroflex tokens dissociate across sessions?

Results: Voicing contrast

Analysis of positive VOT (aspiration)

\[ \log_{10}(\text{VOT}) = \text{session} \times \text{voicing} + (1 + \text{session}) \times \text{sub} + (1 + \text{token}) \]

- [A] Breathy: more aspiration than voiced and voiceless across all sessions (p adj < 0.001; post-hoc tests with Tukey adjustment)
- [B] Both voiced and voiceless marginally or significantly shorter (p adj. > 0.10) after each session compared to baseline/pre-test

Analysis of negative VOT (prevoicing)

\[ \log_{10}(\text{VOT}) = \text{session} \times \text{voicing} + (1 + \text{sub}) + (1 + \text{token}) \]

- [A] Positive VOT durations in breathy tokens dissociated from both voiced and voiceless tokens across the experiment.
- [C] Breathy: marginally longer during production training than pre-test (p adj. = 0.069; pre-test difference maintained at re-test (p adj. = 0.020)
- [D] Voiced: no change across any sessions (p adj. > 0.10); overall greater than breathy (p adj. = 0.005)

Results: Place of articulation contrast

Production of place contrast tested with 2 classification analyses
- Acoustic predictors (selected from preliminary GLM) entered into linear discriminant analysis (classify: dental/retroflex)
- Classification above chance assessed with permutation tests

(E) Analysis 1: burst stop spectra

Predictors: burst centroid, burst standard deviation, burst kurtosis (following Forrest et al. 1988)
(Overall accuracy for stimuli with this analysis: 75.1%)

(F) Analysis 2: vowel formants

Predictors: F2 and F3 at vowel onset (voiced/voiceless tokens only, following Sussman et al. 1993)
(Overall accuracy for stimuli with this analysis: 83.3%)

Discussion

1. Does articulatory training aid non-native phoneme production?
- In some cases [C, E, F] improvement was detected across sessions
- In others, targets showed trait across all sessions [A, D]
- Training may also emphasize contrast with native categories [B]

2. Is learning maintained after visual cues are no longer present?
- In some VOT results [C] improvement maintained after training
- But place of articulation [E, F], improvement not maintained to re-test
- Past work (Cibelli 2015) perceived learning maintained through re-test, so cannot be attributable to weak perceptual skills

3. Are phonetic features consistently shared across L2 targets?
- Not always [C vs. D]
- Different starting proficiencies may affect how much improvement is detectable during testing

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References


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