



Nonnative phonemes are open to native interpretation: A perceptual learning study



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Introduction

- Phonetic categories in one's native language are flexible: They can be altered by exposure to an ambiguous sound, presented in only 20 words (lexically-guided perceptual learning).
- Acquiring second-language (L2) phonetic categories is difficult, even after extensive exposure.

Can a (difficult) L2 phoneme be learnt to represent an L1 phoneme, when presented in L1 context?

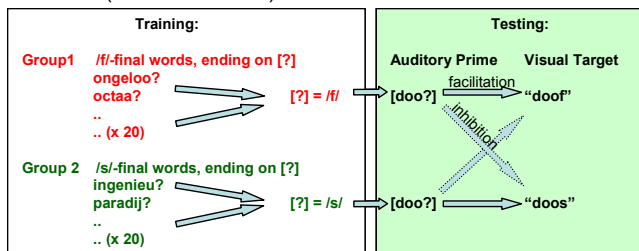
- Four experiments investigated the possibilities and bounds of lexically-guided perceptual learning in speech perception, using (1) a digital /fs/-mixture, (2) English [θ] (as in "bath"), (3) a nonspeech sound, and (4) natural instances of /f/ and /s/.

General methodology:

Cross-modal identity priming

Training: Two groups of Dutch listeners were trained to interpret an ambiguous sound [?] as either /f/ or /s/, using /f/- or /s/-biasing words (e.g. "ongeloo?" (disbelief) or "ingenieu?" (ingenious)), which ended in [?] ("ongeloo?" or "ingenieu?").

Testing: We used Dutch minimal pairs like "doof"/"doos" (deaf/box). Listeners made visual lexical decisions to those words, after auditory primes. The primes were ambiguous versions of the minimal pairs (e.g. "doo?"), or unrelated words (control condition).



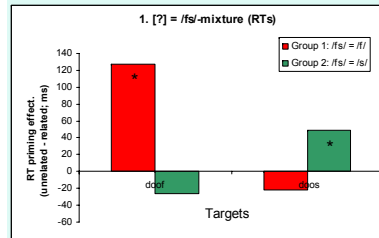
References:

McQueen, J. M., Cutler, A., & Norris, D. (2006). Phonological abstraction in the mental lexicon. *Cognitive Science*, 30, 1113-1126.

Results

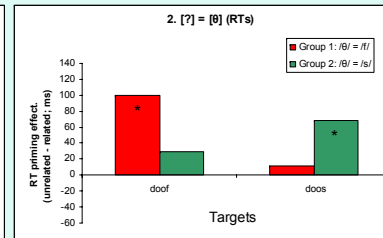
1. [?] = /fs/-mixture

- Dutch listeners successfully learnt to interpret a digitally mixed /fs/-sound as representing either /f/ or /s/.
- Replication of McQueen et al. (2006).



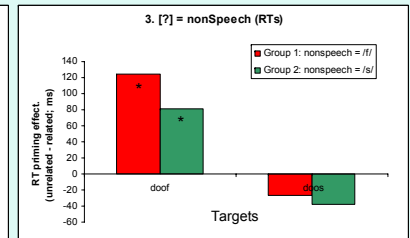
2. [?] = [θ]

- Dutch listeners with English as L2 successfully learnt to interpret [θ] as representing /f/, or /s/, despite years of learning that /f/, /s/ and [θ] are distinct.
- Same amount of priming with [θ] as with /fs/.



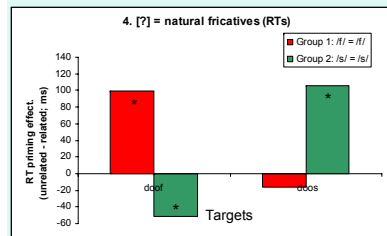
3. [?] = signal-correlated noise

- Listeners successfully learnt to interpret the nonspeech sound as representing /f/, but not /s/.
- Spectral similarity is important for perceptual learning.



4. [?] = natural fricatives

- Natural instances of [f] and [s] were used during "training"; one group at test heard [f]-final primes (e.g. "doof"), the other group heard [s]-final primes (e.g. "doos").
- This allowed for a comparison between the processing of "old" and "new" instances; and thus is a test of thoroughness of learning.
- The priming effects obtained with [θ] and /fs/ were very similar to the effects obtained with natural fricatives.



Conclusions

- English [θ] can be learnt to represent either /f/ or /s/ by L1 speakers of Dutch, when presented in L1 context.
- Perceptual learning of ambiguous items transfers to words that were not in the training set. This argues against a word-level episodic model of speech perception.
- The priming effects obtained with both /fs/ and [θ] were very similar to the effects obtained with natural fricatives. This finding reflects the fact that lexically-guided perceptual learning is fast and very thorough.

Perceptual learning in a native language is thorough, depends on spectral characteristics, and can override years of second-language phonetic learning.