The role of speech-specific signal characteristics in vowel normalization

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Introduction

- Listeners interpret vowels relative to the vowel space of a speaker
- Sounds from a [ɪ] to [ɛ] continuum (a first formant (F1) vowel contrast) are interpreted relative to a speakers' F1 range
- Vowel normalization might be due to a general-purpose acoustic mechanism, which compensates for long-term spectra

If vowel normalization is the result of an acoustic mechanism, it should also apply to nonspeech sounds

Experiment 1: speech

- Listeners categorized [pɪt] to [pɛt] targets presented after F1 manipulated precursor sentences

Experiment 2: nonspeech

- Experiment 1 materials manipulated to become uninterpretable, but to retain their acoustic complexity
- A training procedure familiarized participants with the nonspeech sounds

Experiment 3: fewer manipulations

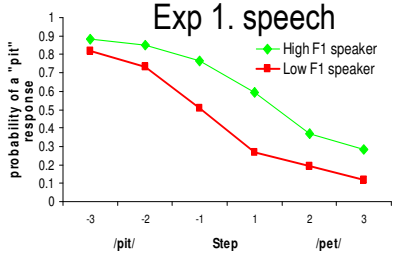
- A) Materials only spectrally rotated
- B) Materials manipulated in all ways *except* spectral rotation

Experiment 4: speechyness ratings

- Precursors rated on how much they "resembled speech"

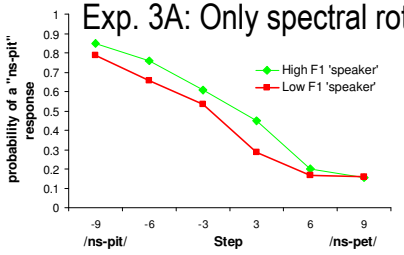
Results

Exp 1. speech



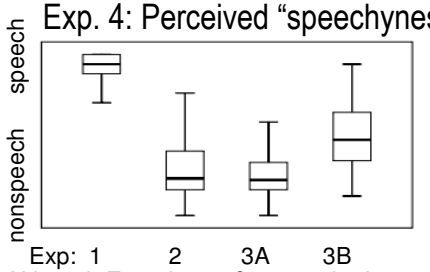
⇒ More /ɪ/ responses to targets presented after a precursor with a high F1

Exp. 3A: Only spectral rotation



⇒ Normalization re-occurred.

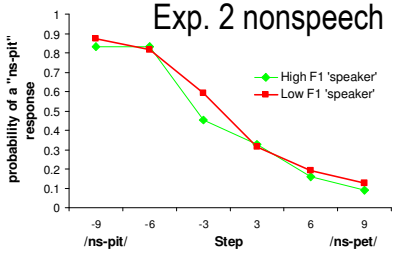
Exp. 4: Perceived "speechyness"



- Although Experiment 3a gave the largest effect (of the nonspeech materials), its precursor was rated as least speech-like.

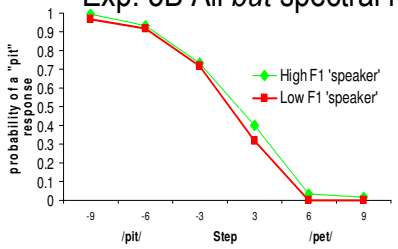
⇒ Amount of normalization is not predicted by *perceived* "speechyness"

Exp. 2 nonspeech



⇒ No normalization despite a similar long-term average relation between precursor and target.

Exp. 3B All *but* spectral rotation

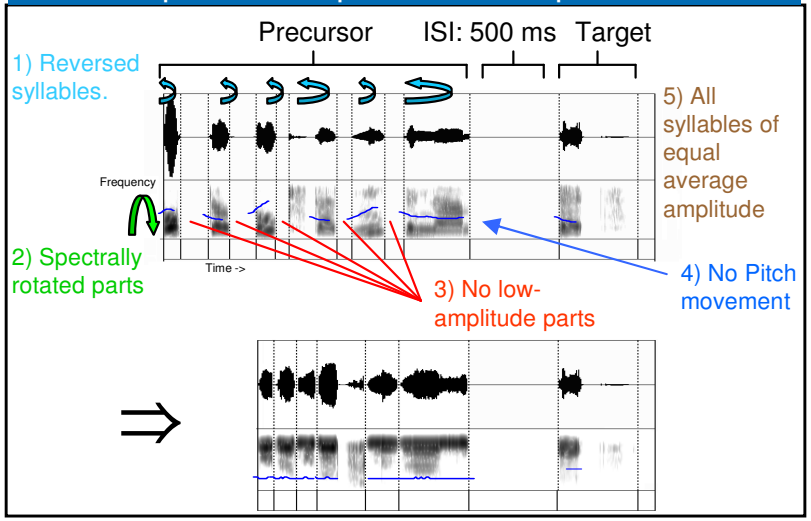


⇒ Weak normalization, which was not replicated on a second occasion.

Additional experiments:

<u>Nonspeech carriers:</u>
A) With pitch movement: No normalization
B) Reintroducing breaks: No normalization
<u>Nonspeech targets:</u>
A) Imposing pitch movement: No normalization
B) Reversing the targets: No normalization
<u>Replicating 3a&b with attention to carriers:</u>
Introducing an attentional task did not increase the effect (in fact, the small normalization of Exp. 3B vanished, while that of 3A remained)

Nonspeech manipulations in Experiment 2:



Conclusions

- *Perceived* resemblance to speech does not explain the results
- Only nonspeech with enough *acoustic* resemblance to speech results in normalization
- It appears that vowel normalization is not due to a general acoustic process
- Vowel normalization might be a result of learning about covariations in natural speech