

The Theory of Auditory Relativity

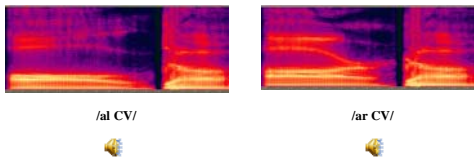
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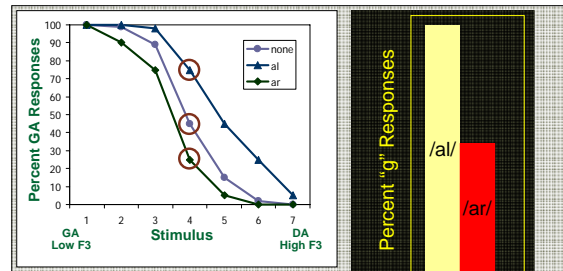
$$\text{Experienced Percept} = \text{Context} \text{ Main Target } \text{Context}$$

$$E = MC^2$$

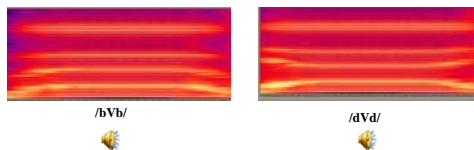
Speech Context Effects



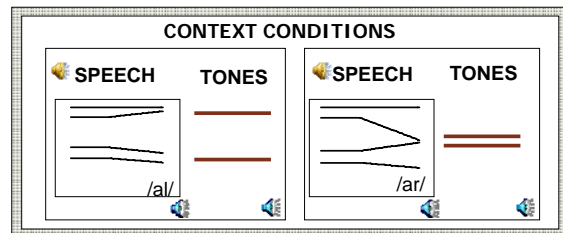
Phonetic Context Effect



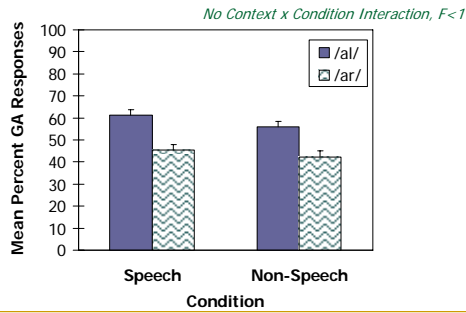
Speech Context Effect #2



Non-Speech – Speech Context Effect

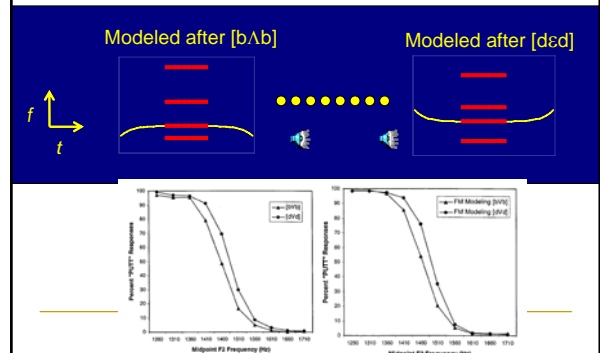


Results



Lotto, Sullivan, & Holt (2003). Journal of the Acoustical Society of America

Non-Speech-Speech Context Effect 2

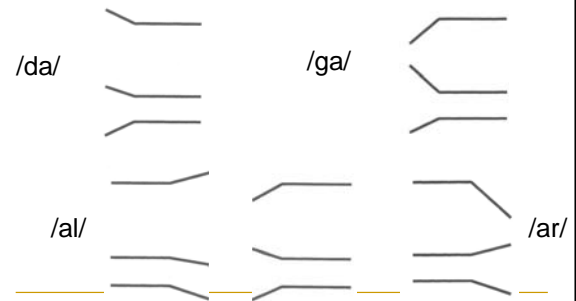


More Context Effects

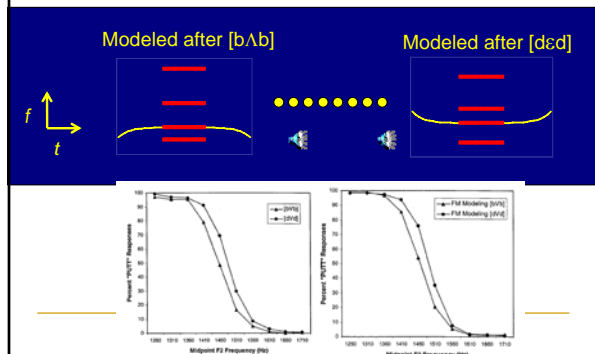
- Effects can occur backwards in time – following context effects preceding target (speech and non-speech)
- Speech context can affect non-speech perception
- Infants (4 month olds) demonstrate speech context effects
- Birds demonstrate speech context effects



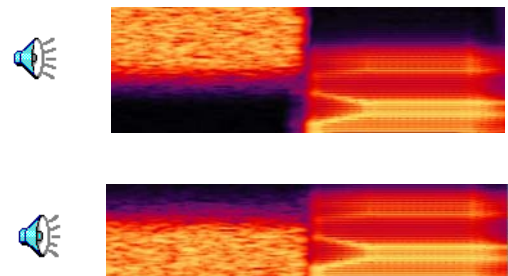
Spectral Contrast – Relative Perception



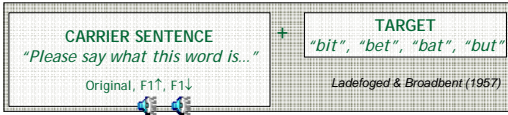
Non-Speech-Speech Context Effect 2



Spectral Contrast



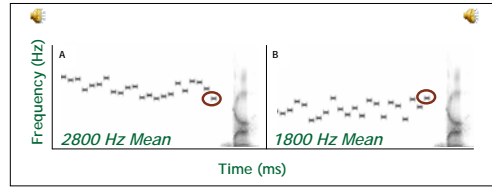
Speaker Normalization



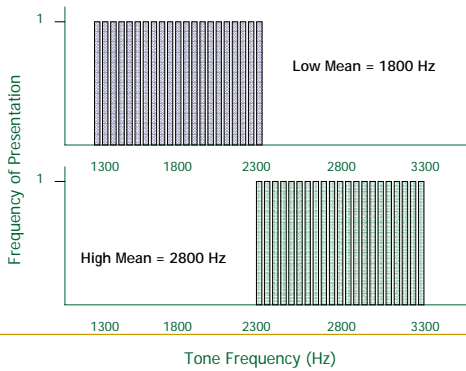
- TARGET acoustics were constant
- TARGET perception shifted with changes in "speaker"
- Spectral characteristics of the preceding sentence predicted perception

'Talker/Speaker Normalization'
Sensitivity to Accent, Etc.

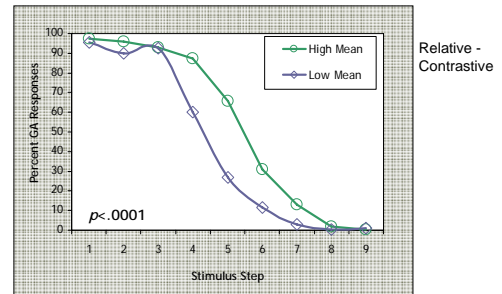
Example Stimuli



Acoustic History Distributions



Results



Summary

- Auditory system tracks average spectrum
- Perception enhanced for deviations from that spectrum
- Story's neutral vocal tract = average spectrum
- Vowel space re-centered on average spectrum – vowels plotted as deviations from this average

NORMALIZATION!!!

Further Extension

- In the cases discussed here, the auditory system represents new energy patterns with respect to the distribution of previous energy patterns.
- Similar to categorizing a vowel by comparing to distributions of past exemplars
- The distinction between perception and learning is artificial

Time Course of Effects of Context

Long Term	Extended	Immediate	Target
Phonetic Categories	Carrier Sentence	/al/-/ar/	
Linguistic Experience	Acoustic History	Tones	
Many Talkers	Single Talker	noise	

Thank You

