

Reverberation increases perceptual calibration to reliable spectral peaks in speech

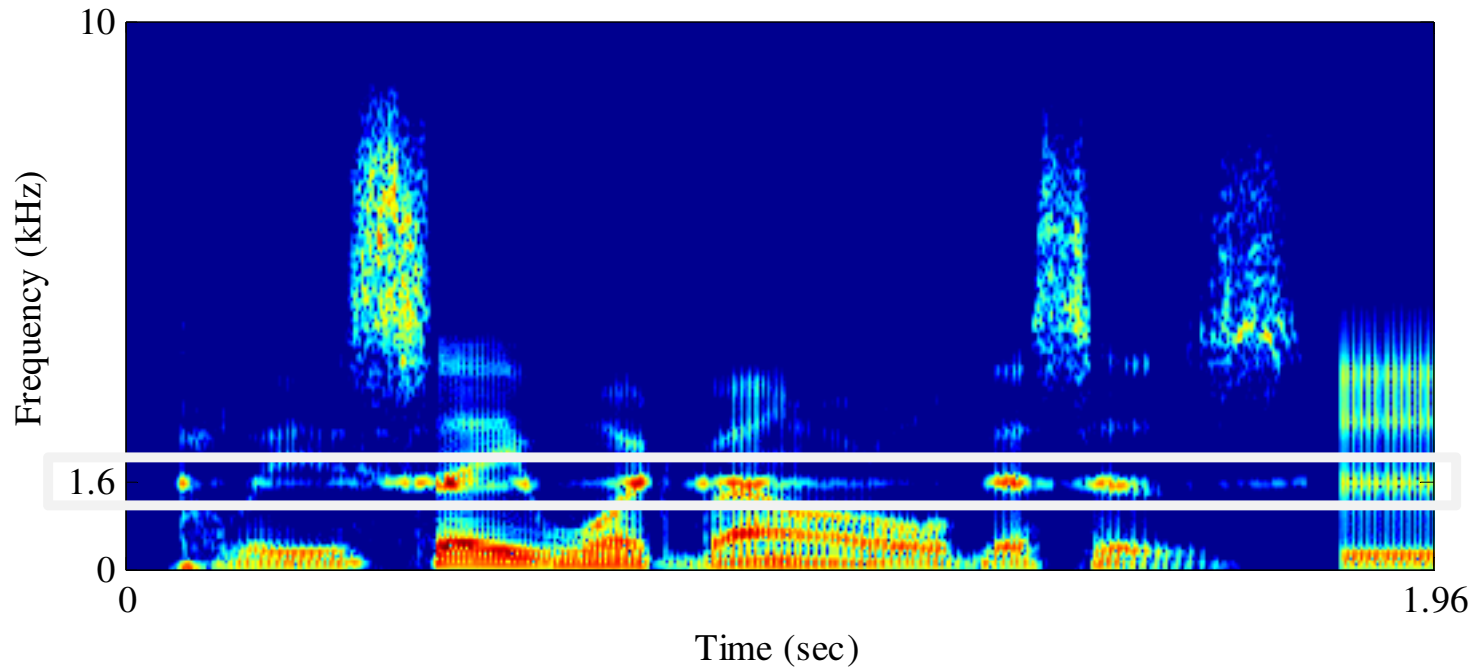
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- Sensory systems are highly sensitive to stable aspects of the environment.
- Signal properties are less informative when they are reliable (stable or recurring across time)
 - Adaptation, habituation, attenuation, calibration, ...
- Signal properties are more informative when they change
 - More useful for perception

Perceptual Calibration

“Please say what vowel this is” before /i/-/u/ target

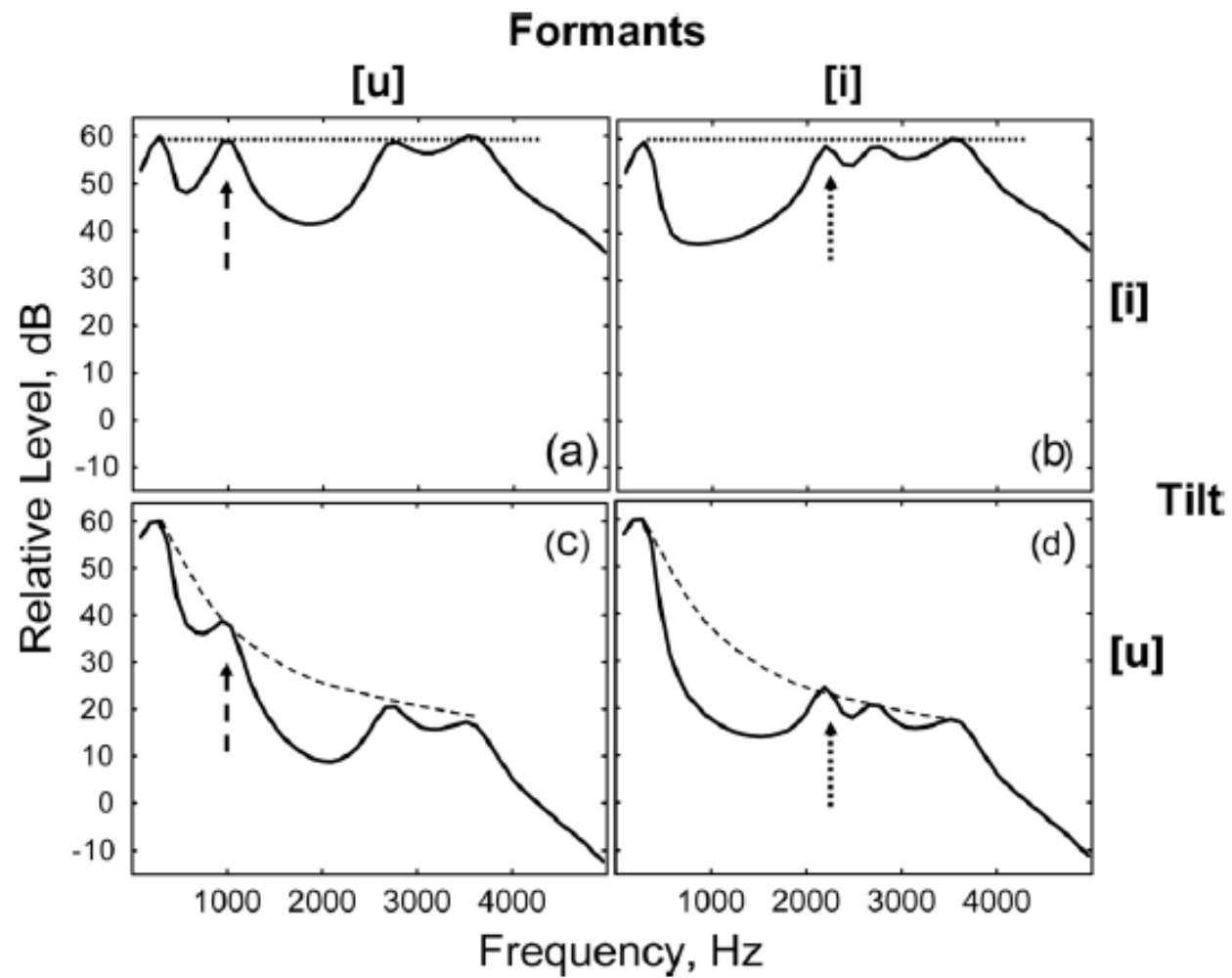


Common F_2 peak = decrease reliance on F_2 , increase reliance on tilt

Kiefte & Kluender (2008), Alexander & Kluender (2010), Stip & Anderson (2014)

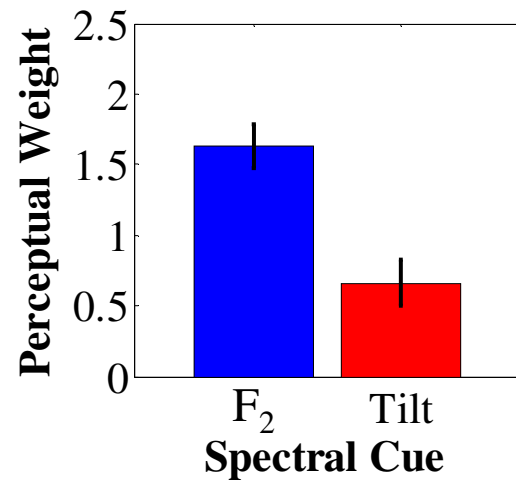
Methods

- 20 native English speakers with normal hearing
- Precursor: “Please say what vowel this is”
 - 100-Hz bandpass filter centered at vowel F_2 , gain = +20 dB
- Vowels: synthesized 5-by-5 matrix varying from /i/ to /u/
 - Varied in F_2 and tilt, all other stimulus parameters matched



Alexander & Kluender (2010)

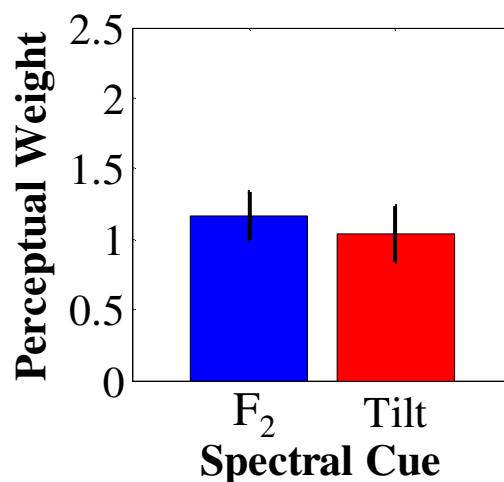
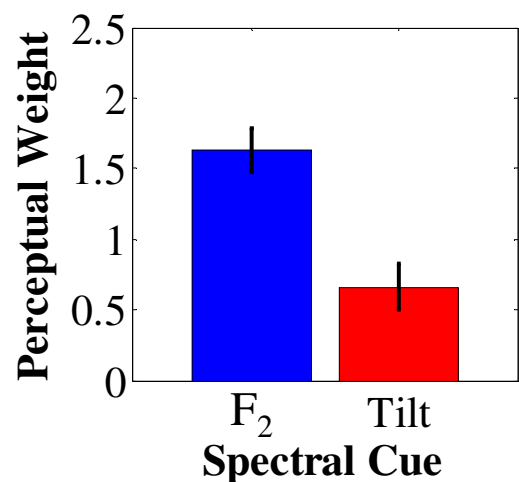
Results: Experiment 1



1. Vowels in isolation

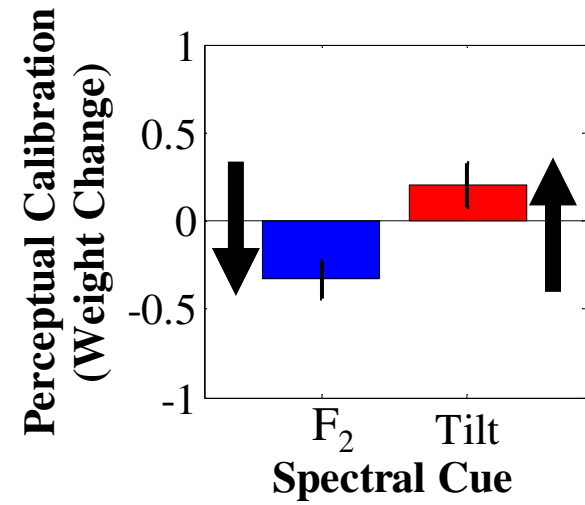
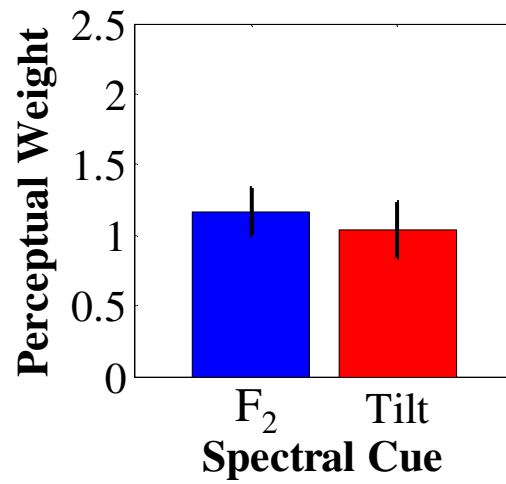
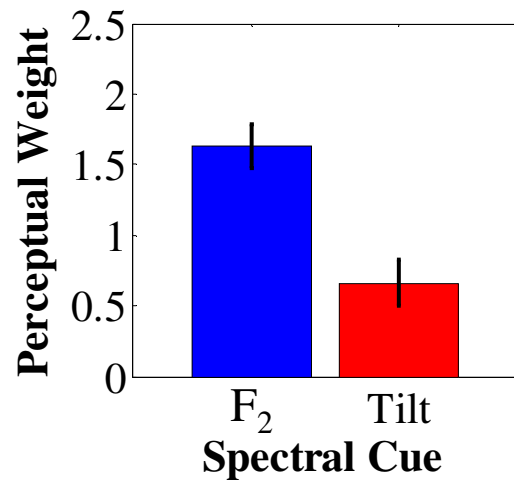
- Calculate logistic regression on responses
- Standardized regression coefficients = perceptual weights

Results: Experiment 1



2. Vowels following precursors that share F₂ peak
 - Calculate logistic regression on these responses

Results: Experiment 1

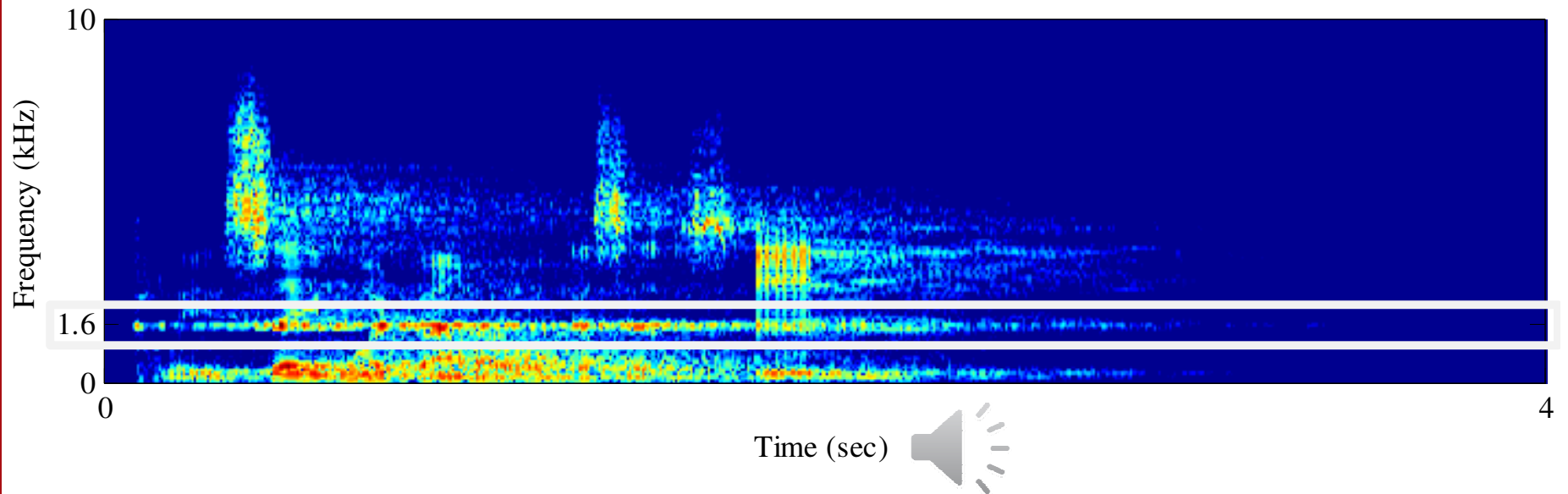
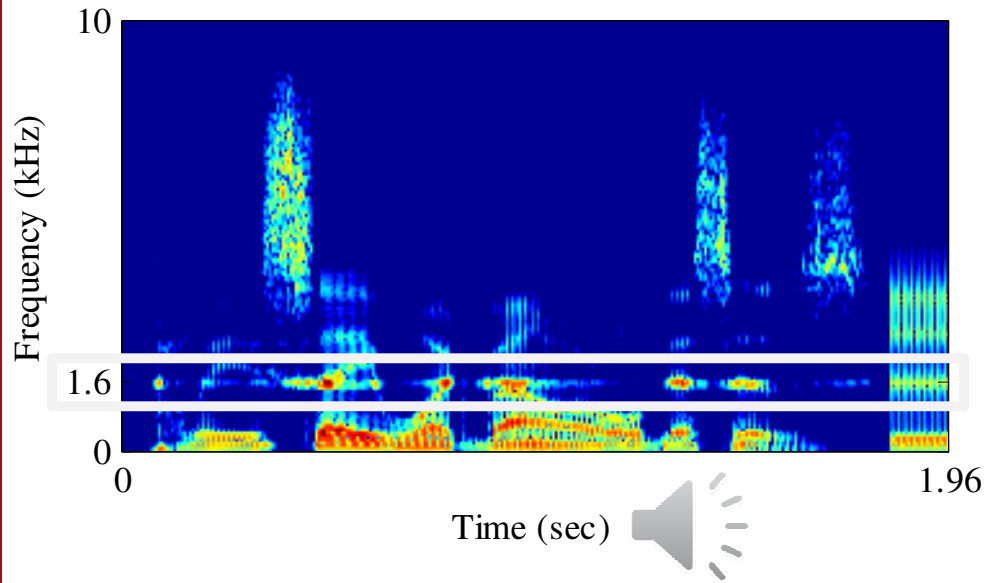


Perceptual calibration = changes in weights across sessions

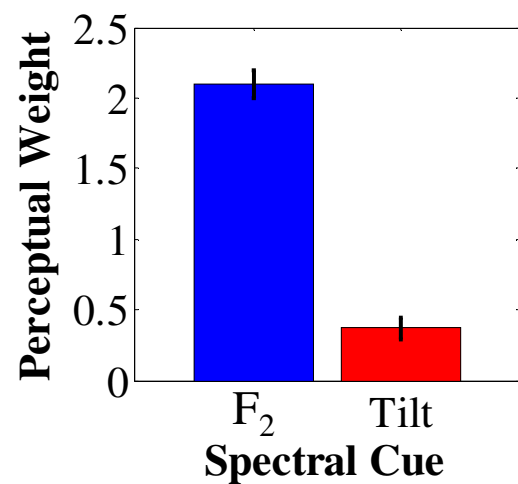
- Reliable cue (F₂) → decrease weight
- Changing cue (tilt) → increase weight

Reverberation

- In speech, energy in a spectral peak waxes and wanes across time; here this peak is made reliable.
- Reverberation smears spectral peaks across time, which would increase their presence throughout the precursor.
- Perceptual calibration is predicted to increase in highly reverberant listening conditions ($T_{60} = 2.97$ seconds).

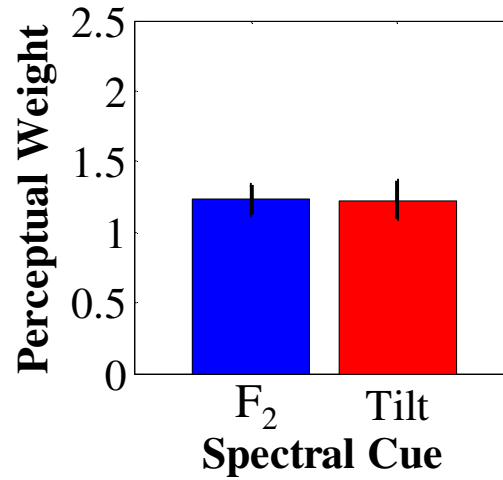
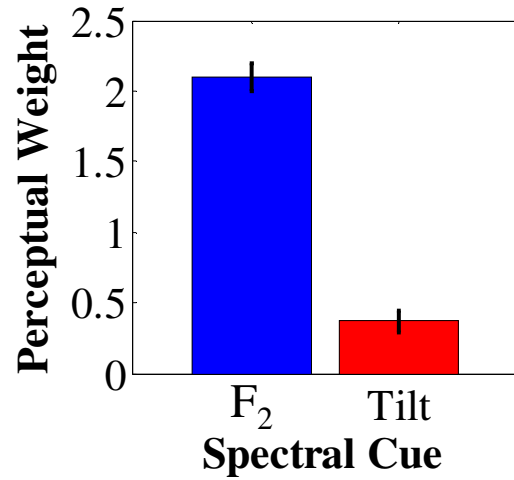


Results: Experiment 2



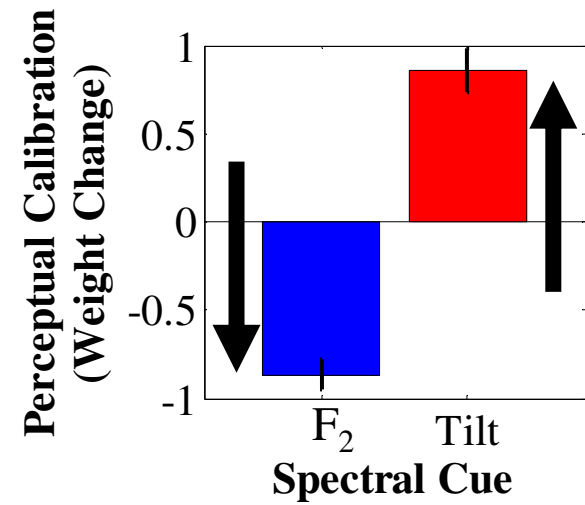
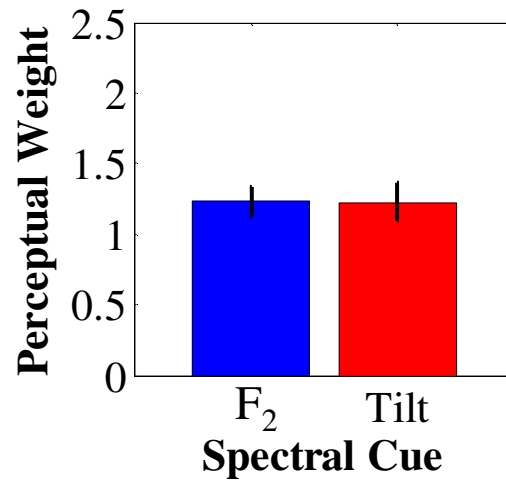
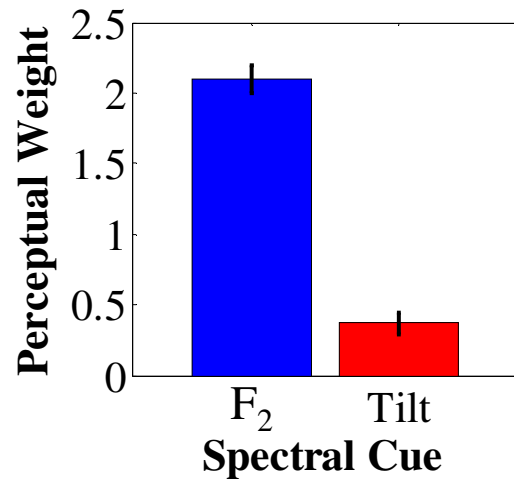
1. Vowels in isolation, reverberation

Results: Experiment 2



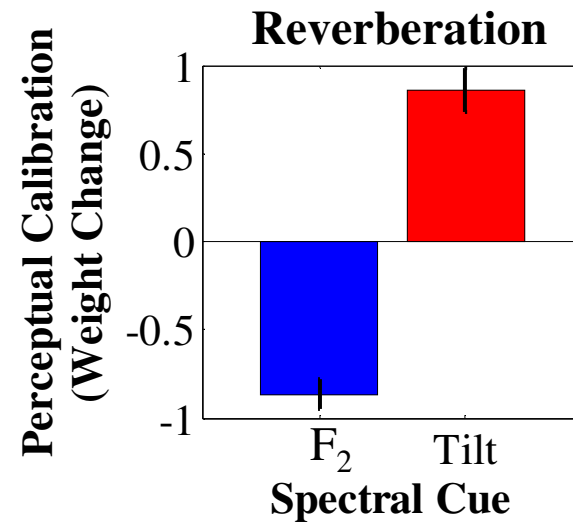
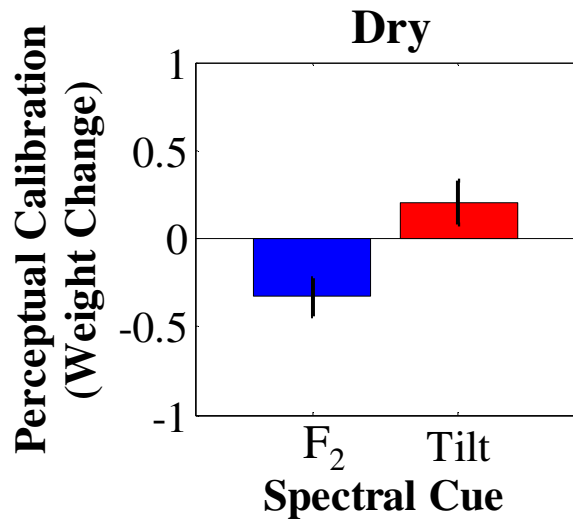
2. Vowels following precursors that share F₂ peak, reverberation

Results: Experiment 2

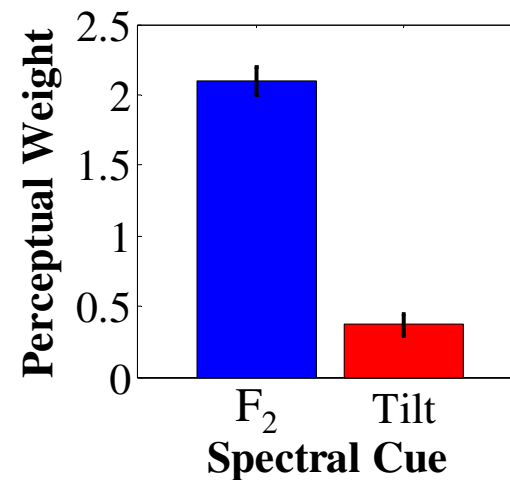
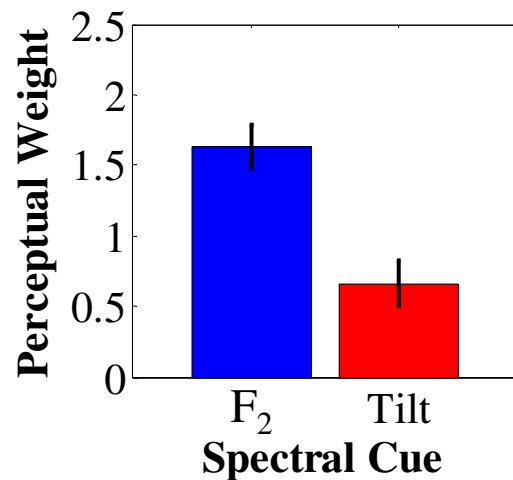


Perceptual calibration = changes in weights across sessions

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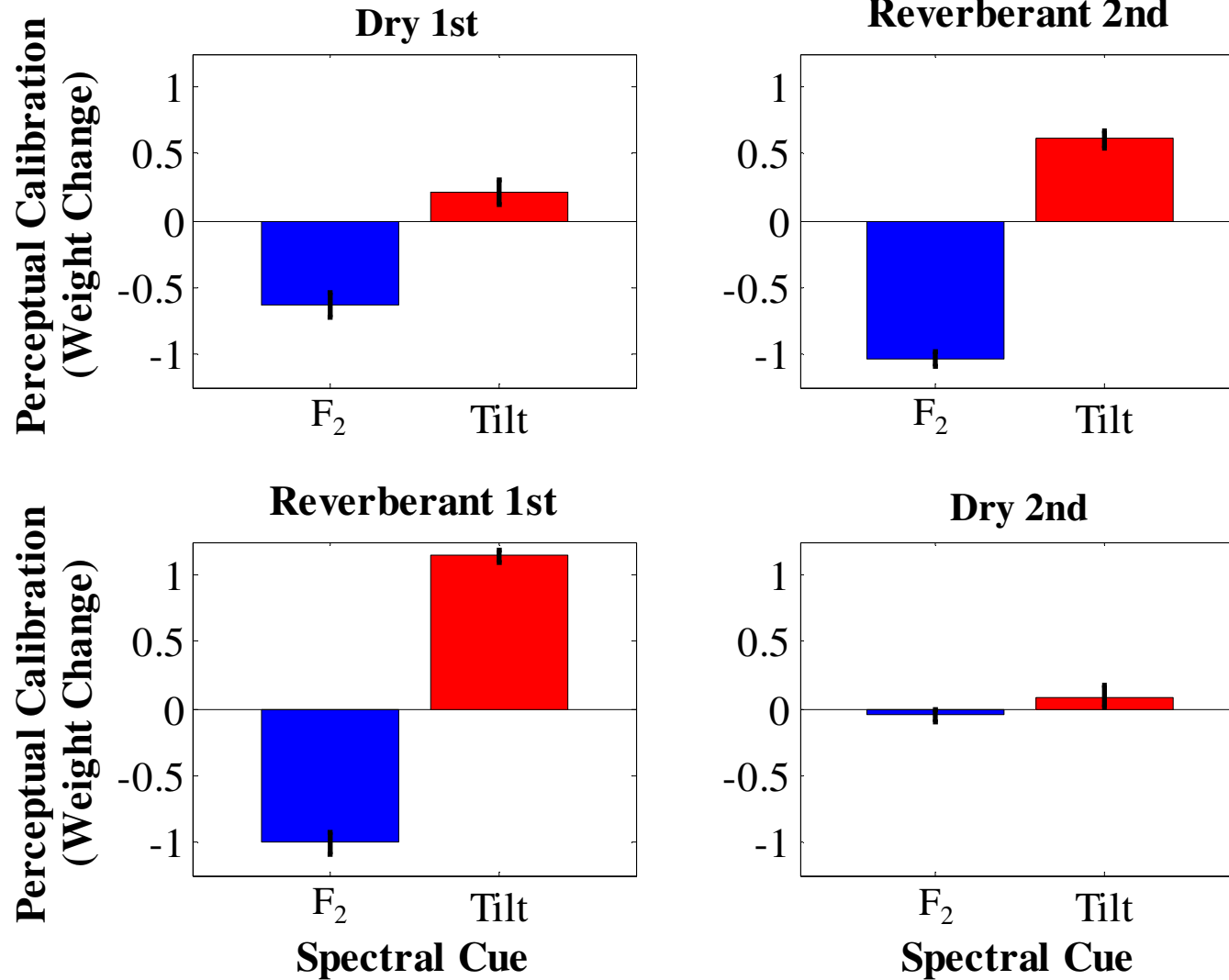
- Greater perceptual calibration for reverberant speech (p 's < .001)
- But, different starting points for listener groups (F₂: p < .02)



Methods

- 22 new listeners
 - n=11: Dry 1st, Reverberant 2nd
 - n=11: Reverberant 1st, Dry 2nd
- Same stimuli as previous experiments

Results: Experiment 3



Conclusions

- Perceptual calibration increases in highly reverberant listening conditions.
- Experience with reverberation extinguished calibration in non-reverberant listening conditions.