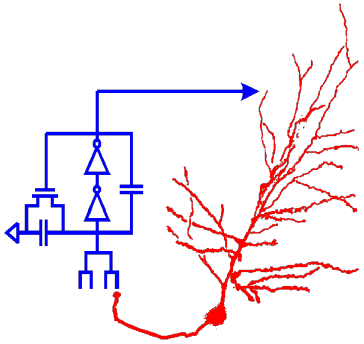


Neural Coding of Single and Simultaneous Talkers in Auditory Cortex

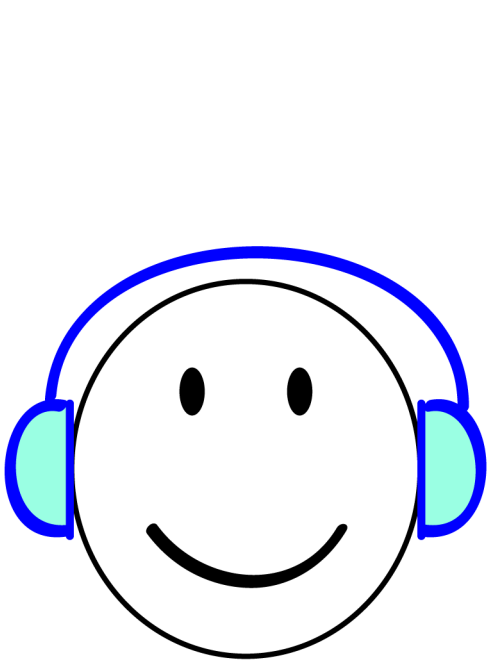
Nai Ding, Jonathan Z. Simon

Univ. of Maryland

Cocktail Party Problem

(Alex Katz)

Cocktail Party Problem



(Alex Katz)

Cocktail Party Problem

Magnetoencephalography

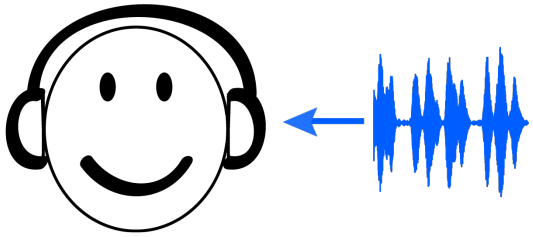
(MEG)

(Alex Katz)

Experiment

- **Monaural speech**

  2 minute audio book excerpt



- **Dichotic speech mixture**

  a different audio excerpt in each ear

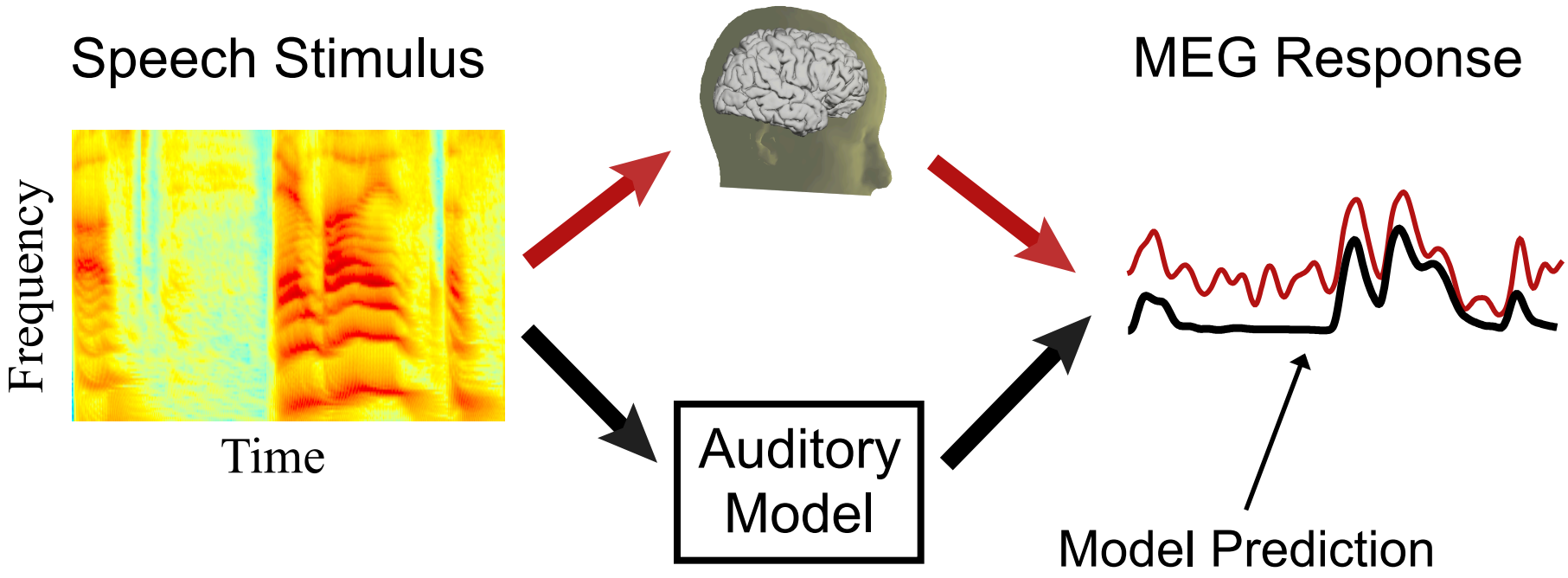
  attention on one ear

MEG Recording

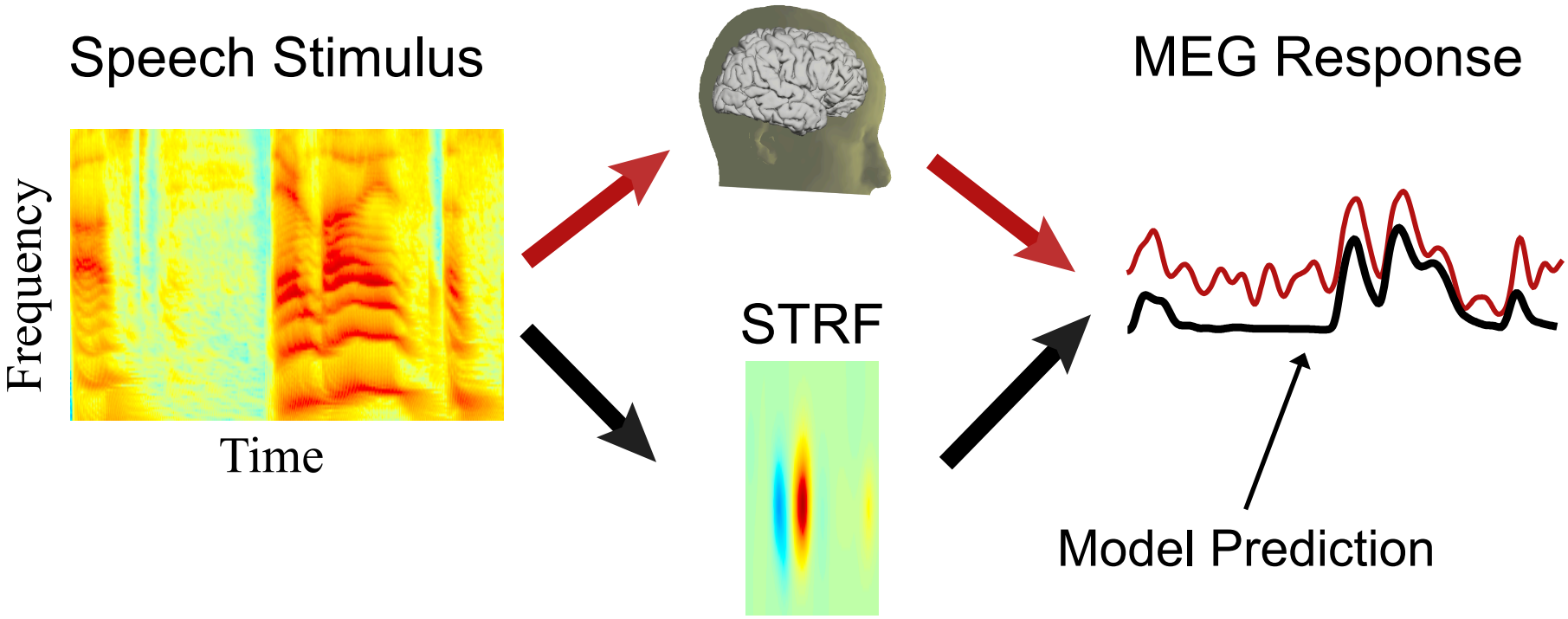
Whole head MEG system

Response localized to bilateral auditory cortex in STG.

Neural Code of Temporal Modulations

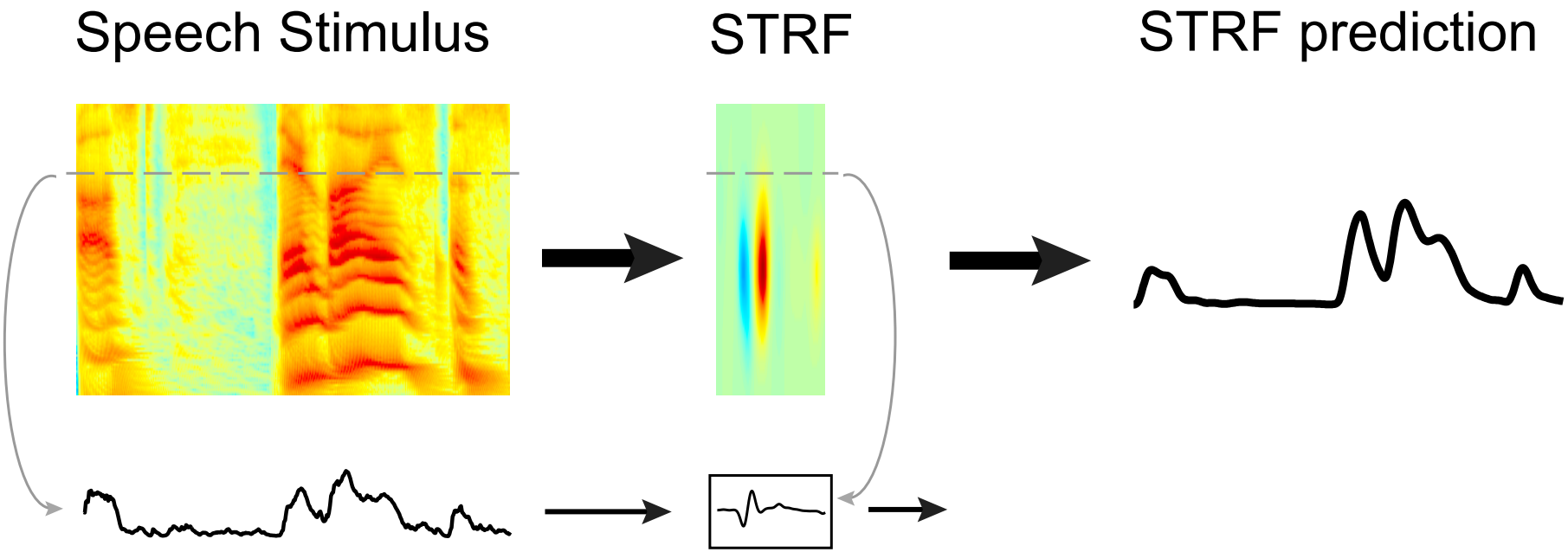


Spectro-Temporal Response Function (STRF)

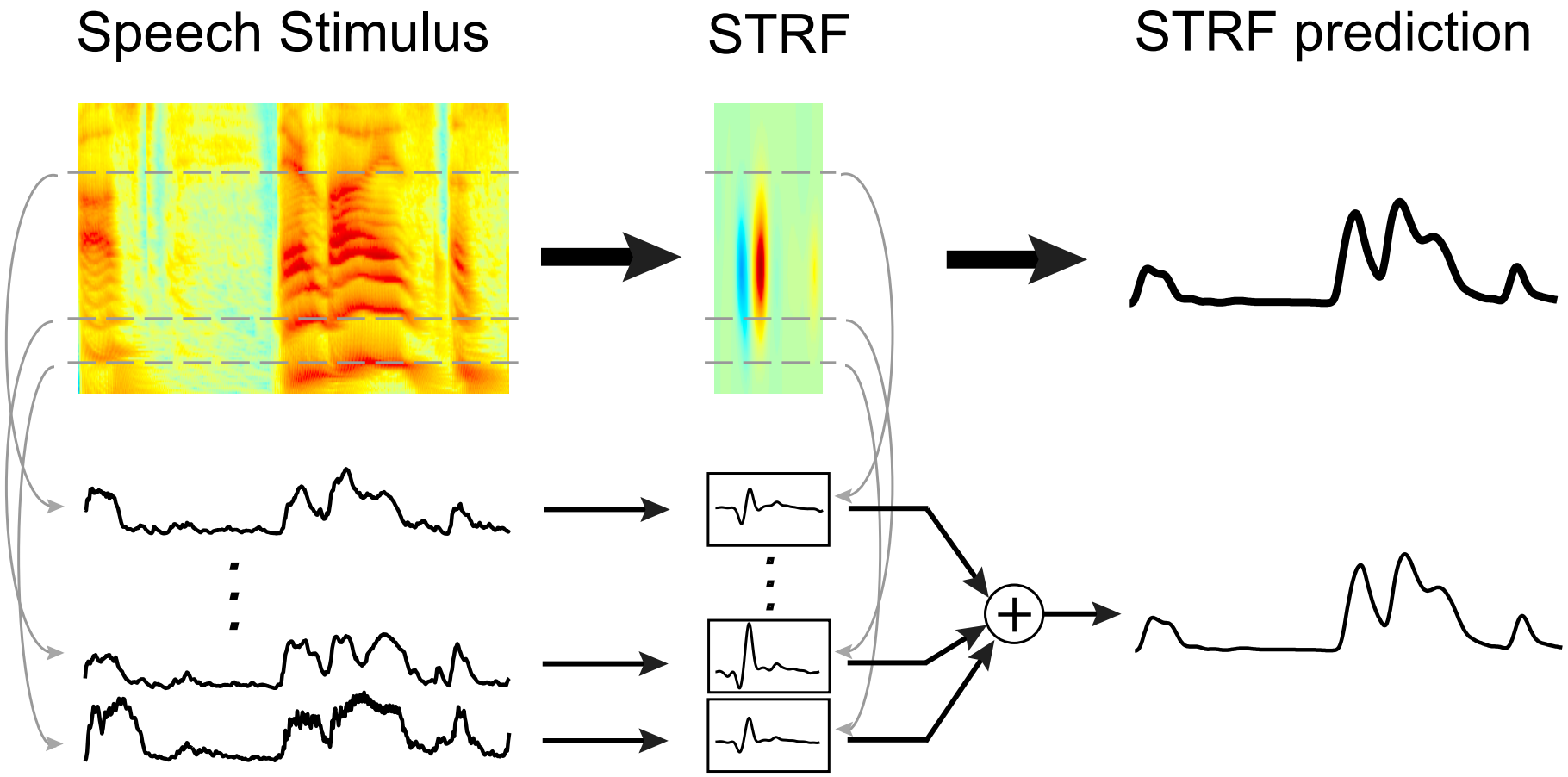


STRF models how spectro-temporal features of speech are encoded into cortical neural activity.

Auditory Model: STRF

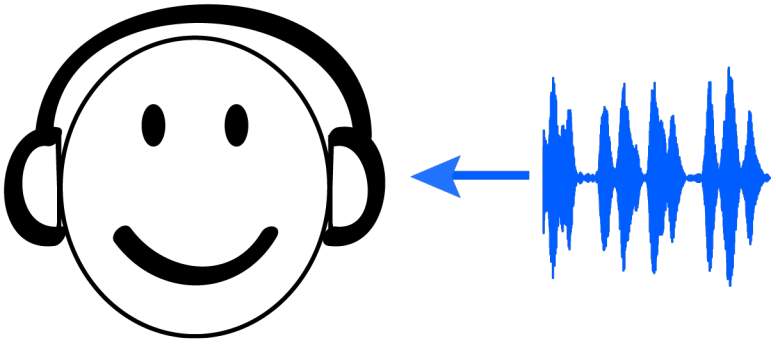


Auditory Model: STRF

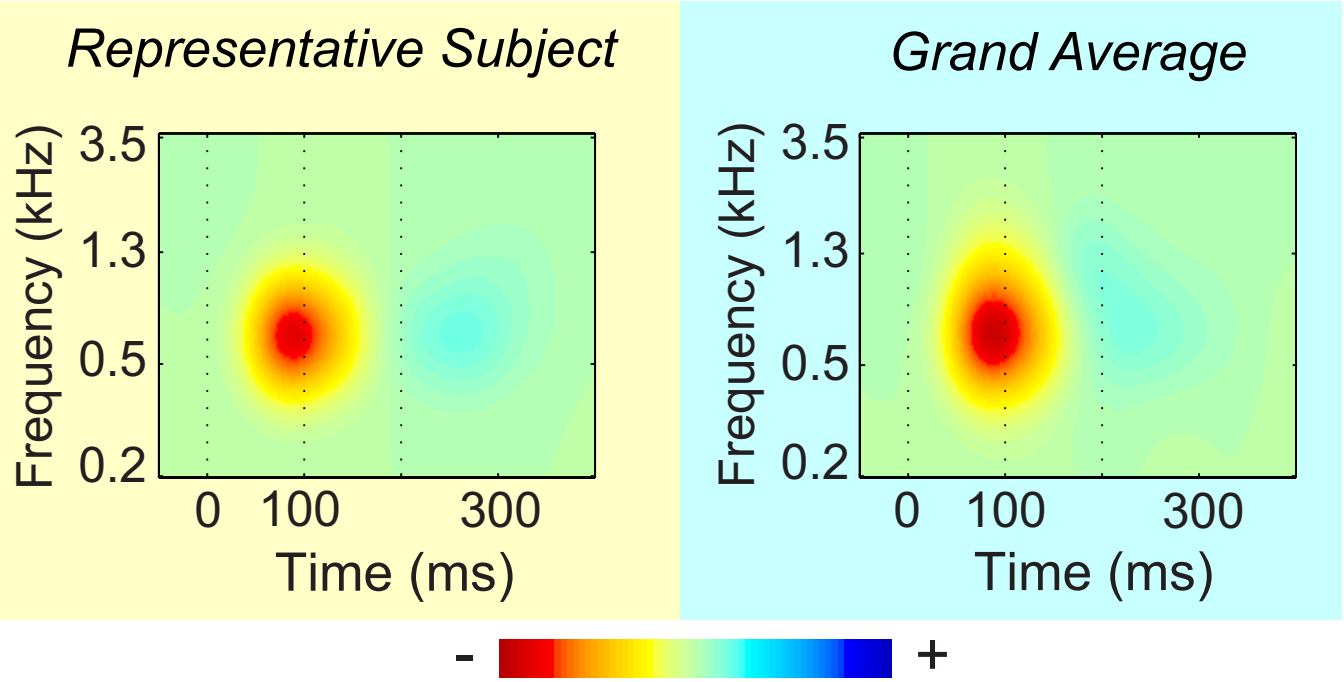


STRF estimated by boosting with cross validation (David et al. 2007)

Neural Coding of Monaural Speech



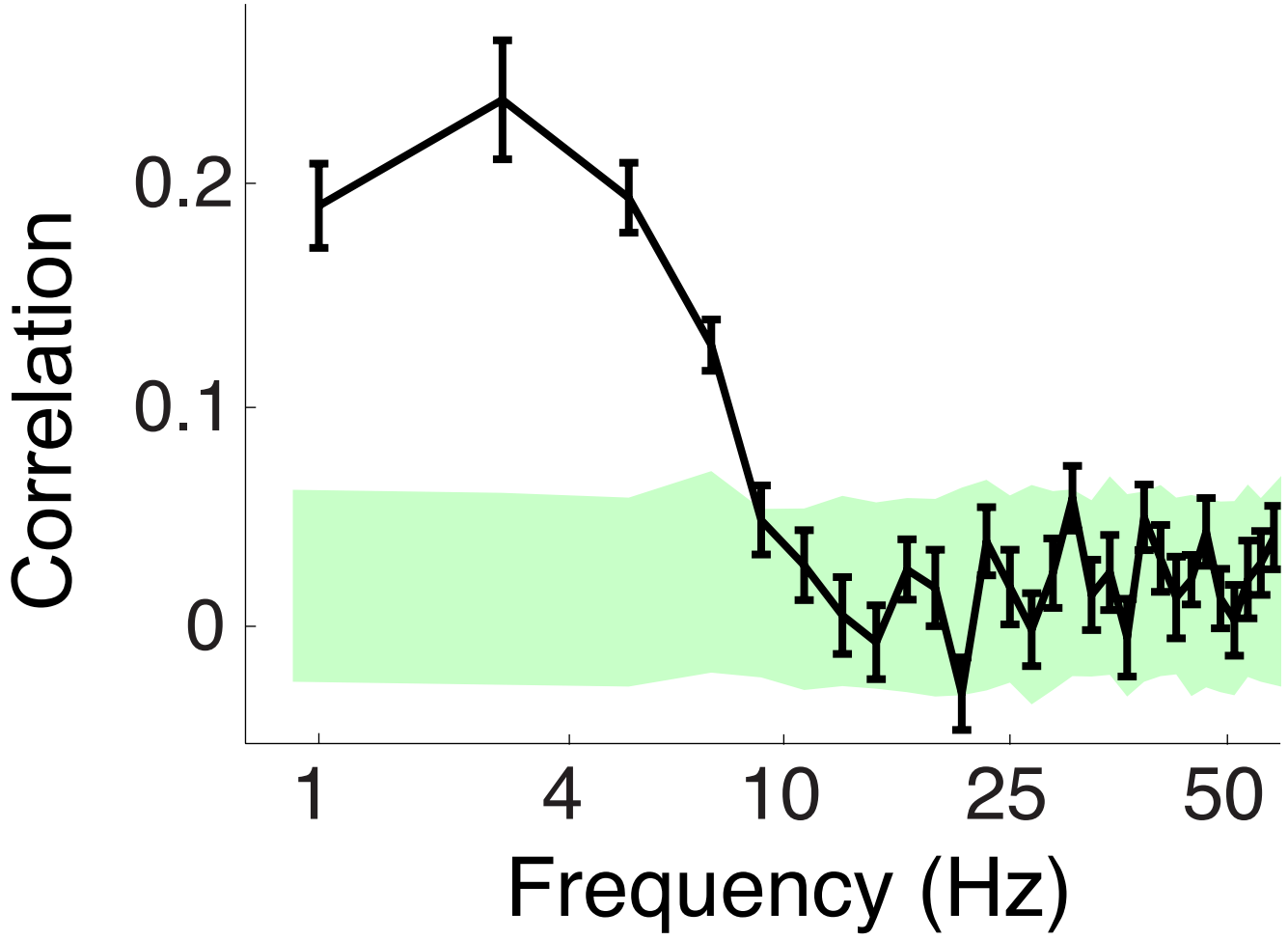
Monaural STRF



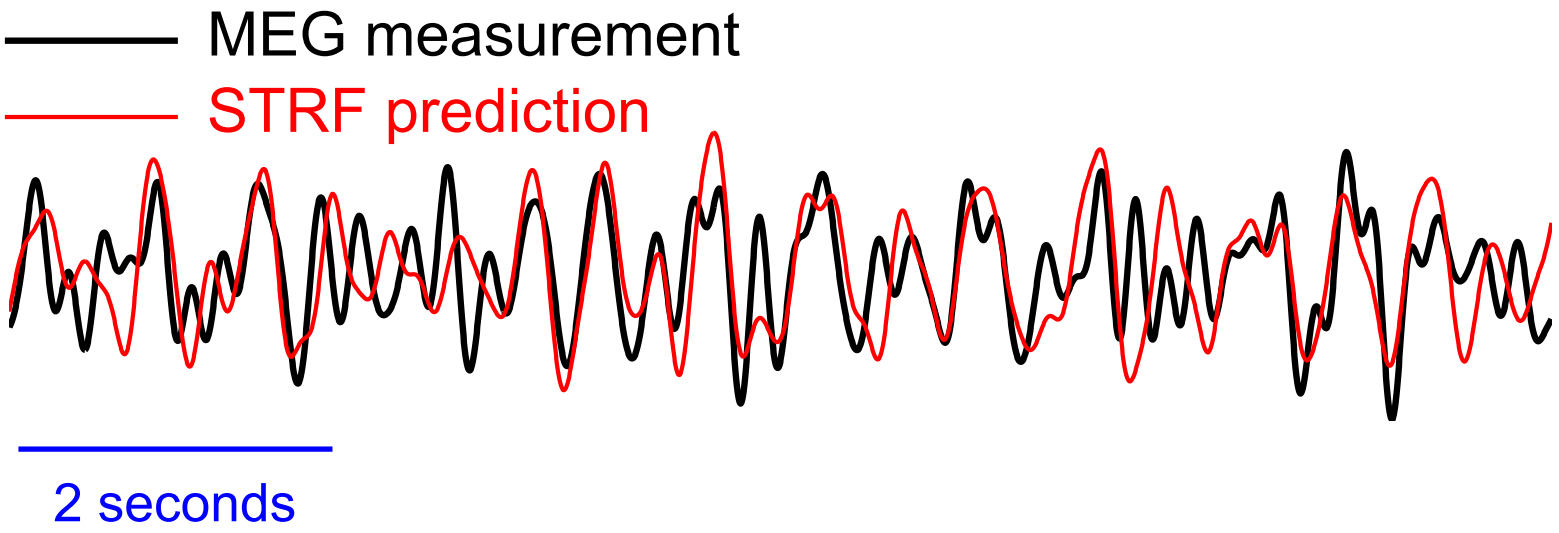
The neural response tracks the slow temporal modulations of speech in a broad spectral region.

Left ear speech, right/contralateral hemisphere

STRF predicts neural response in low frequencies.

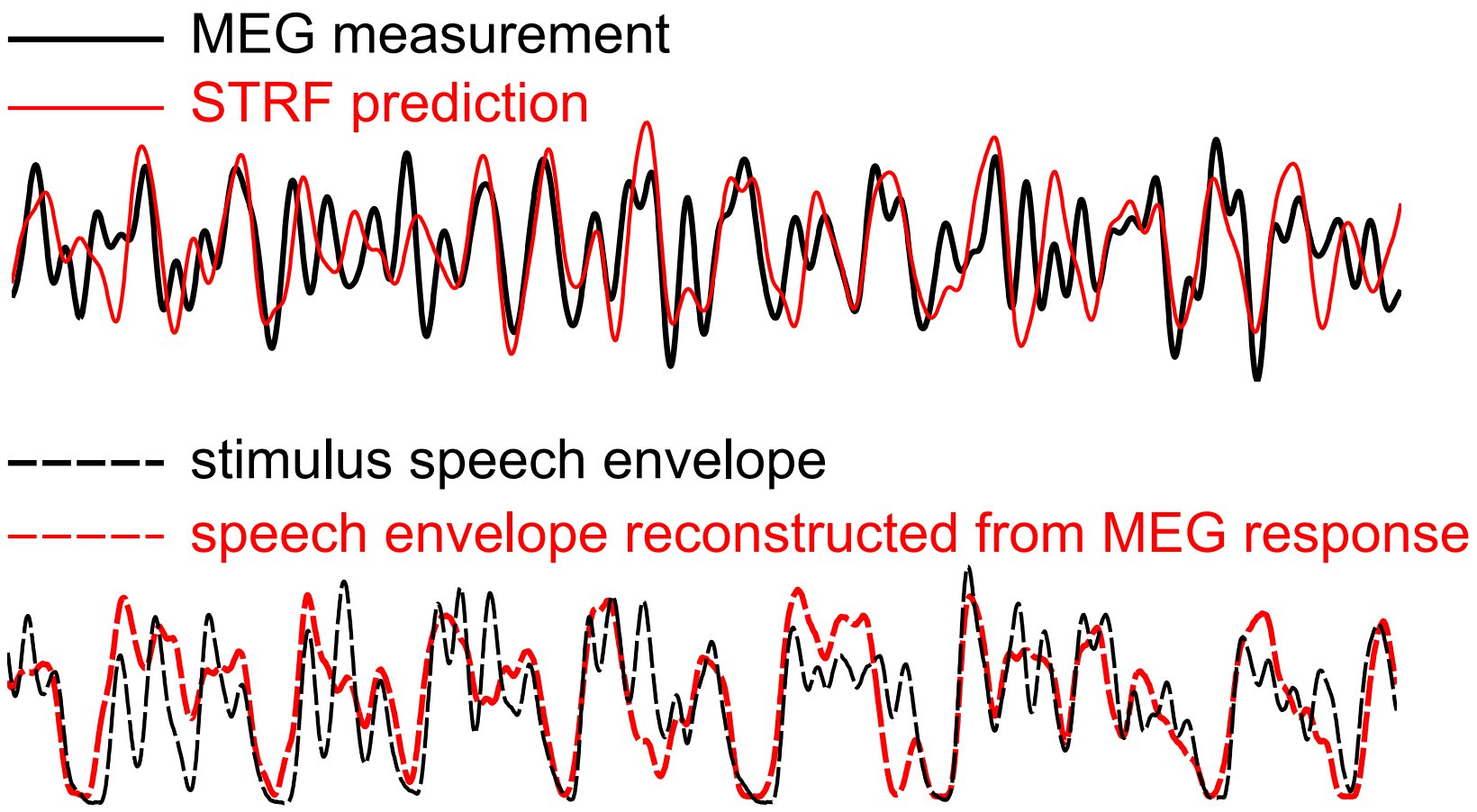


STRF prediction



Subject 1141

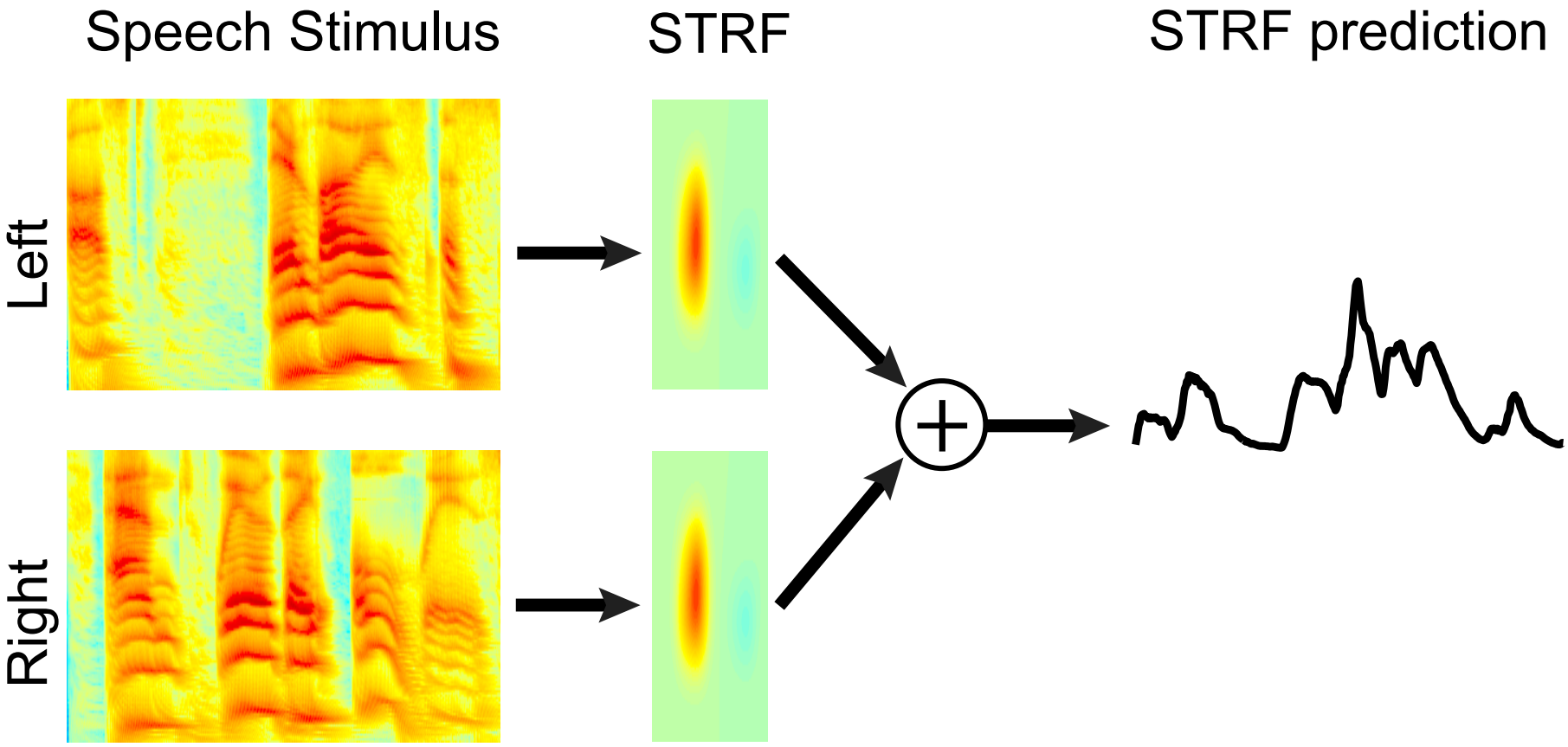
Stimulus envelope reconstruction



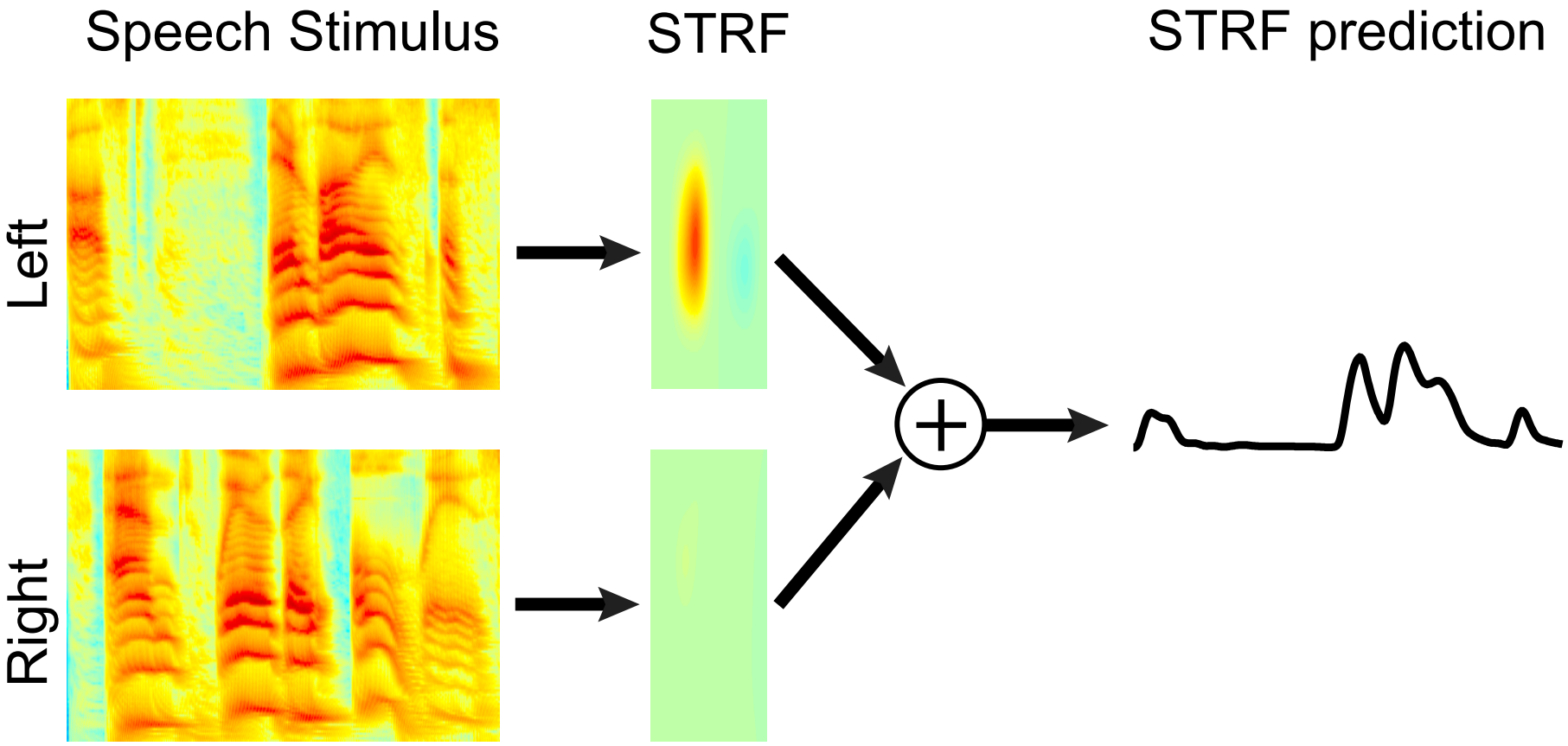
Subject 1141

Dichotic Listening

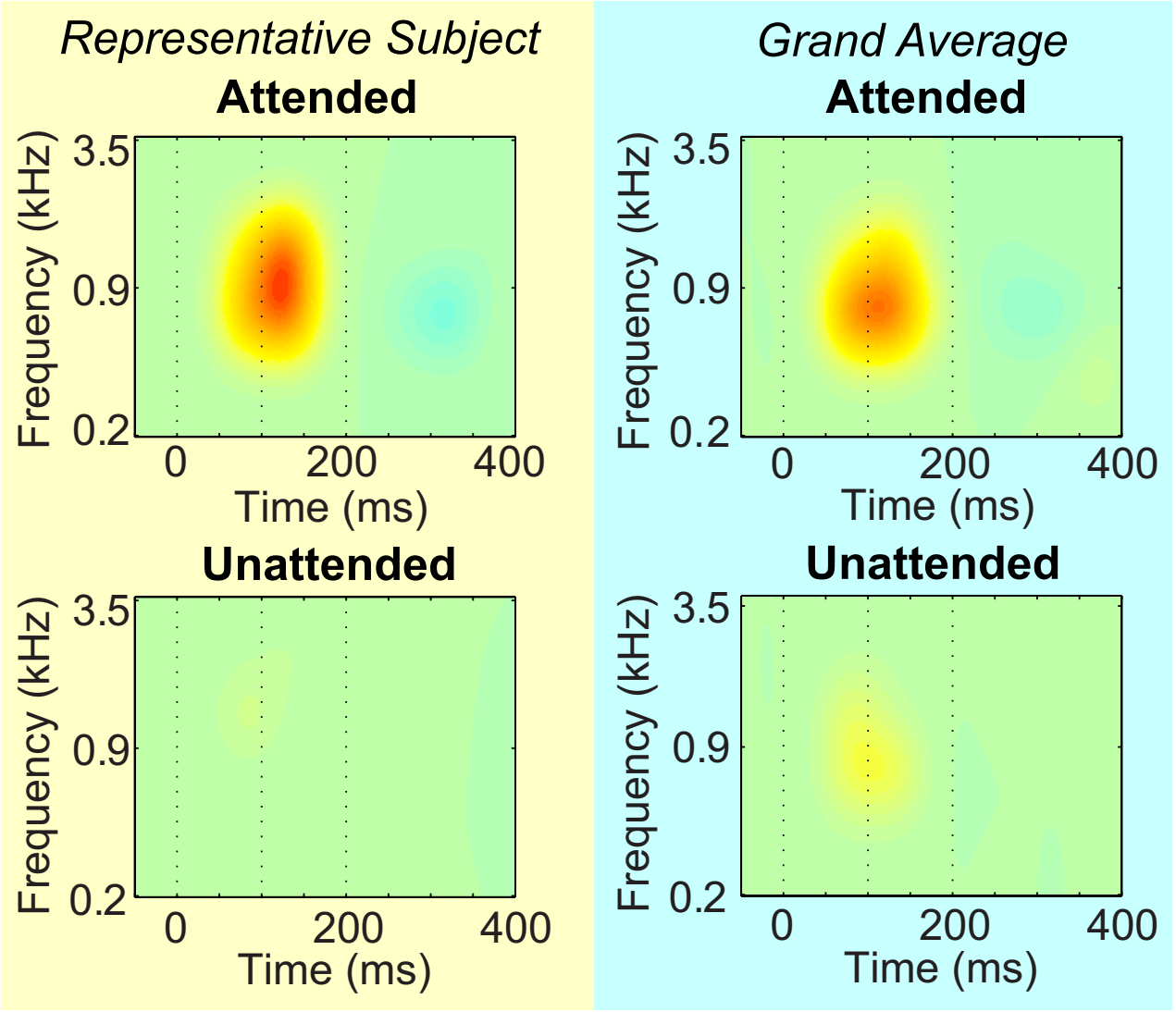
Binaural STRF Model



Binaural STRF Model

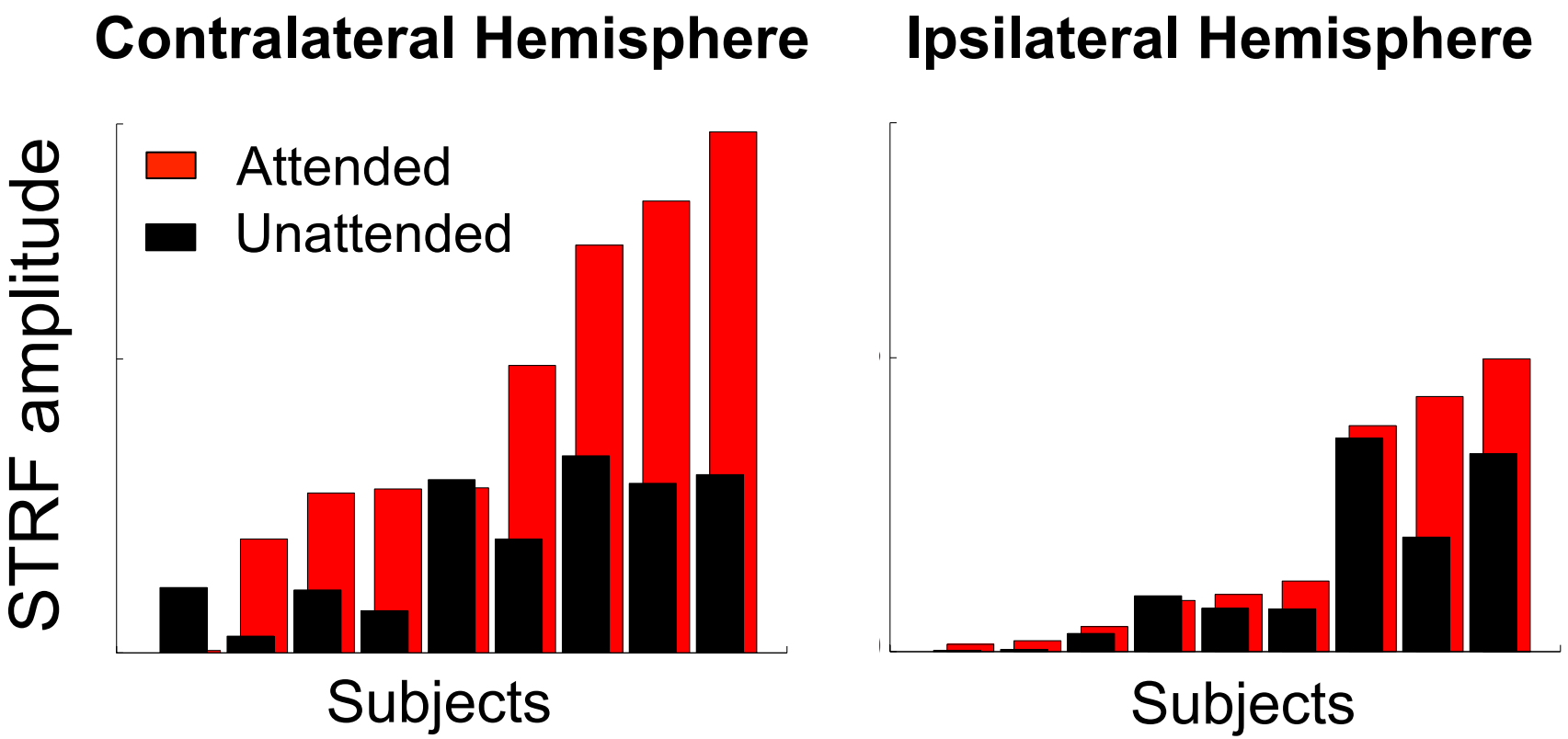


STRF



Left ear speech, right/contralateral hemisphere

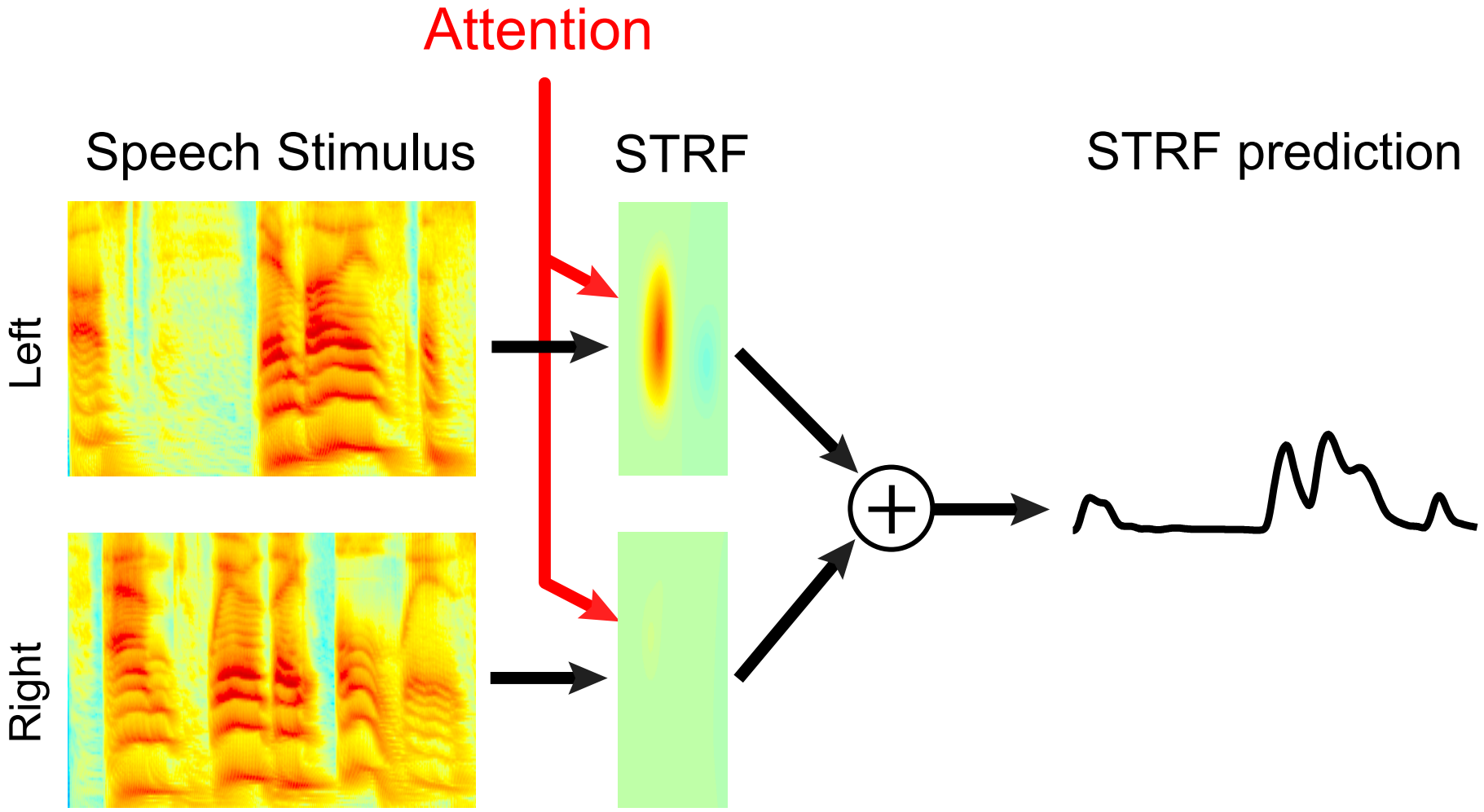
Attentional Modulation



7 dB attentional gain in contralateral hemisphere

3 dB attentional gain in ipsilateral hemisphere

Binaural STRF Model



Summary

- Low frequency neural activity in human auditory cortex quantitatively encodes the slow temporal modulations of speech.

- Simultaneous speech signals are separately represented in auditory cortex, and the attended speech signal is encoded with larger gain.

Acknowledgement

- We thank David Poeppel & Stephen David for many insightful discussions!

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