

# Neural markers of auditory selective attention

Shiri Makov & Elana Zion-Golumbic

## BACKGROUND

Selective attention mechanisms are largely unknown.

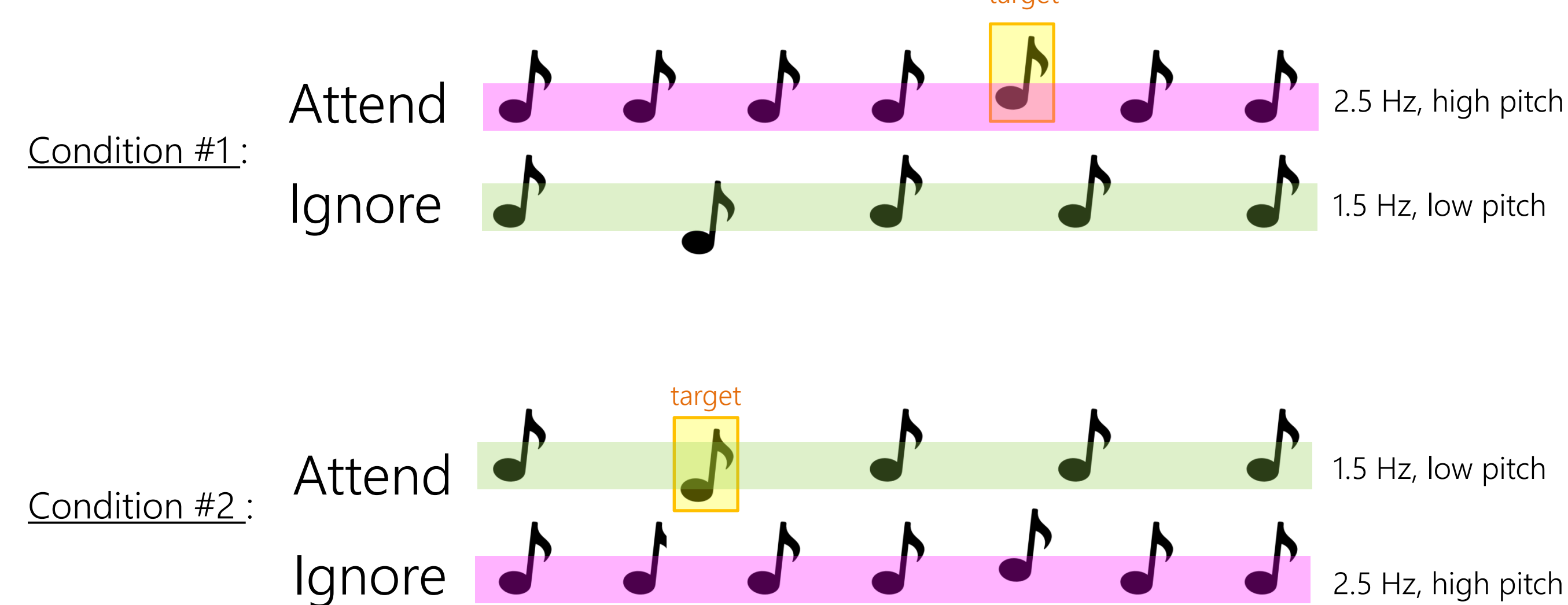
Here we tracked the activity in single intracranial electrodes, comparing their responses to rhythmic events as a function of attention.

We expected to find a diverse manifestation of attention effects in response to both task-relevant and distracting tones.

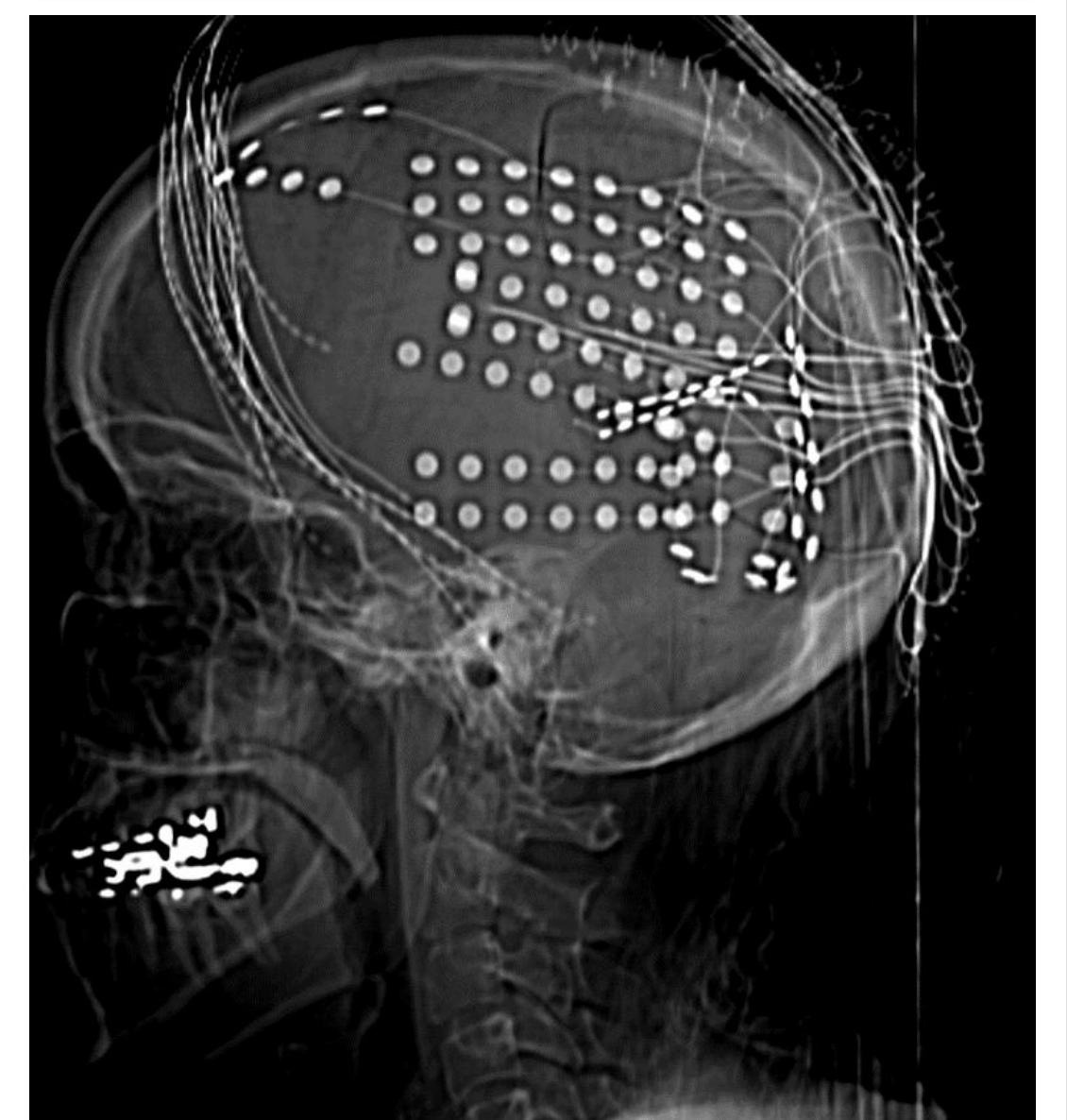
## EXPERIMENTAL DESIGN

Seven participants were presented with auditory stimulation consisting of 2 concurrent rhythmic streams. They were asked to attend to one stream and detect tone deviants, while ignoring the other stream. The experiment included  $624 \pm 244$  fast-pace and  $378 \pm 144$  slow-pace rhythmic tones (at 2.5 and 1.5 Hz, respectively). All tones were task-relevant half of the time and served as a distractor in the remaining half.

### Pitch discrimination (oddball) task



## ECOG



Recorded at Columbia Presbyterian Hospital, New York

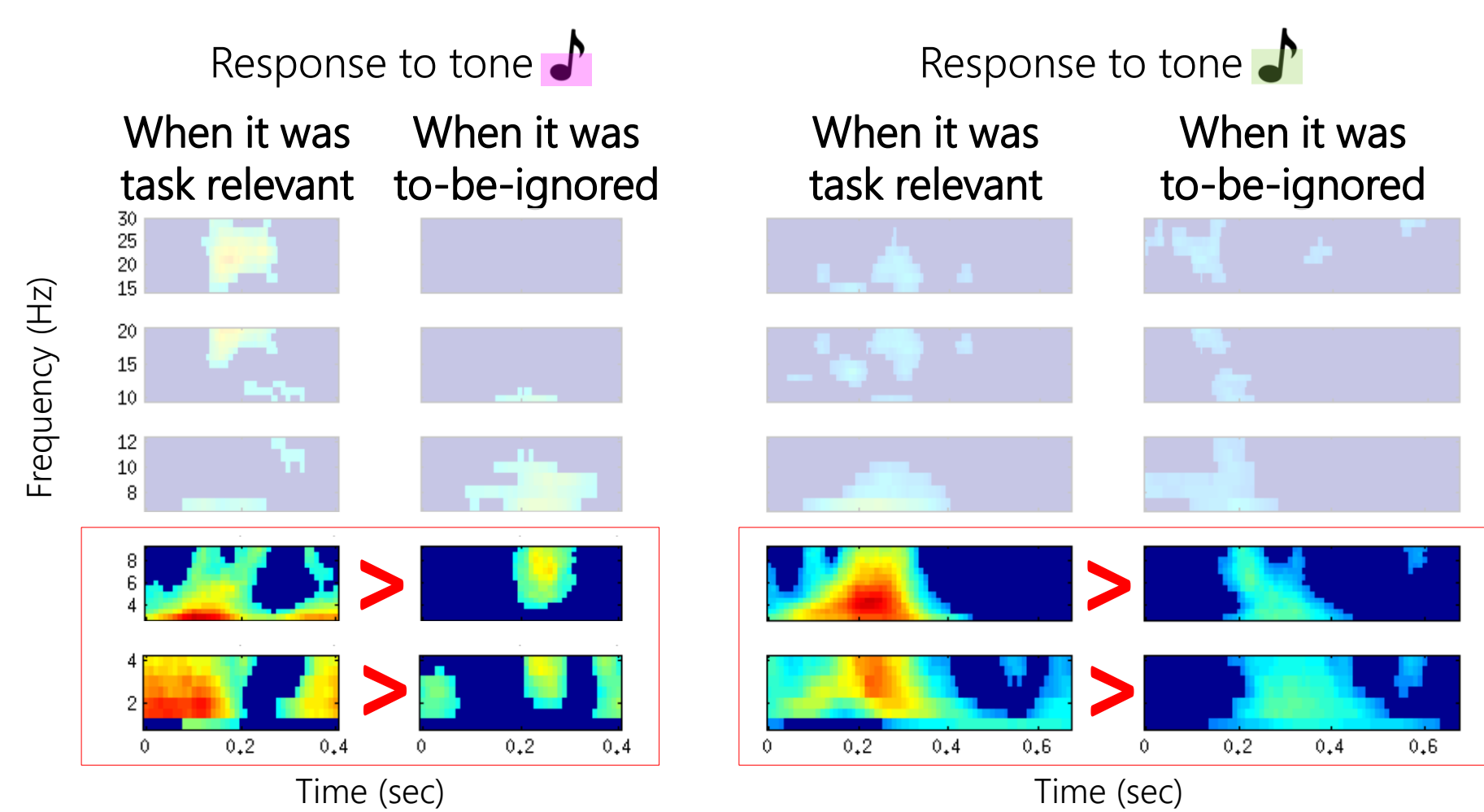
## PRELIMINARY RESULTS (N=1)

Analysis pipeline:

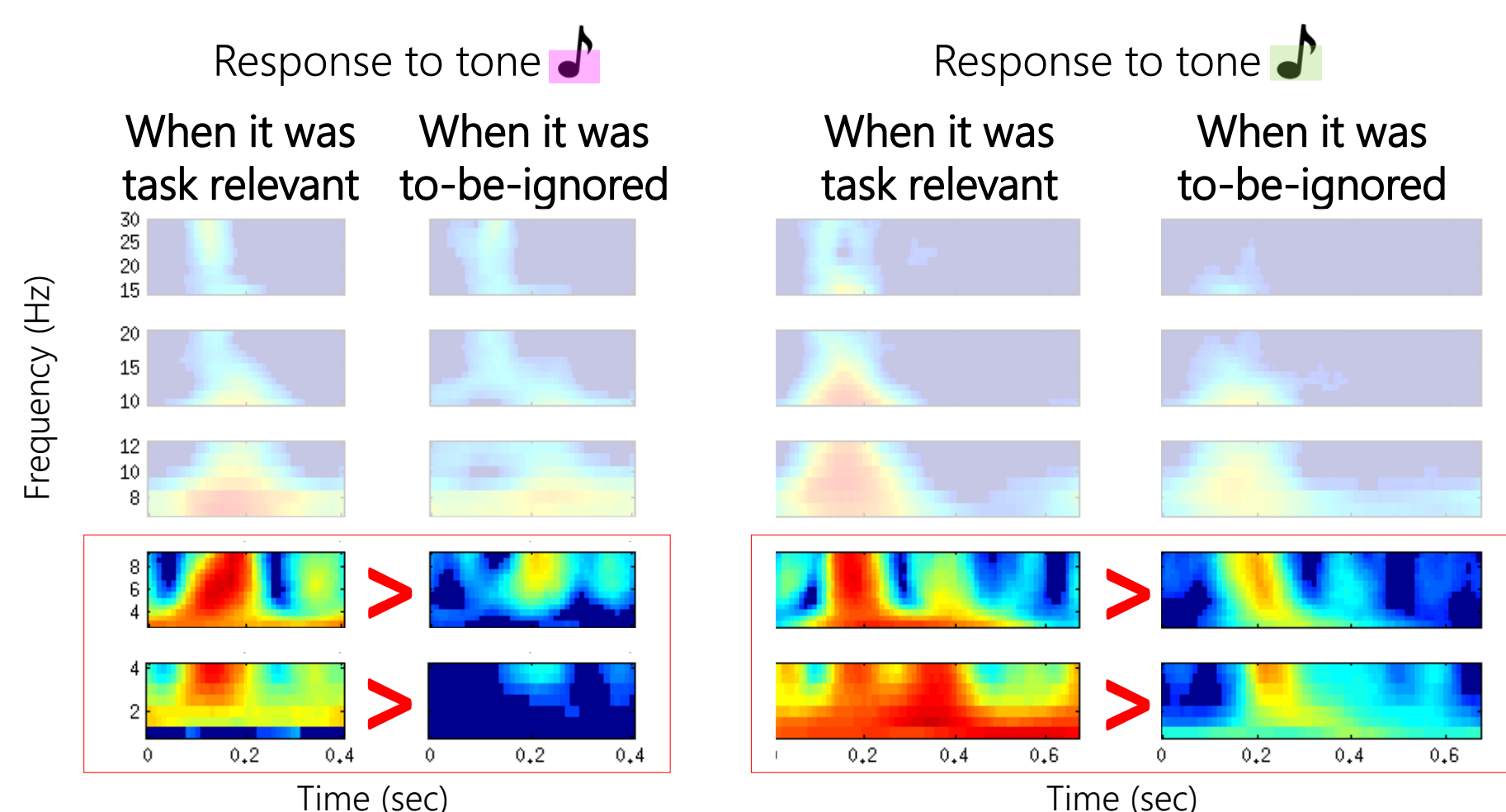
- First, we found which electrodes respond to sounds, via permutation tests against time-shifted data (200 perm.,  $\alpha=0.05$ , fdr corrected for multiple comparisons in all the implanted electrodes).
- Among the channels that showed a response to both high and low pitch tones, we further tested to see if this response was modulated by attention, via permutation tests against label-scrambled data (200 perm.,  $\alpha=0.05$ ).

### Phase coherence in lower frequencies is enhanced for Attended tones

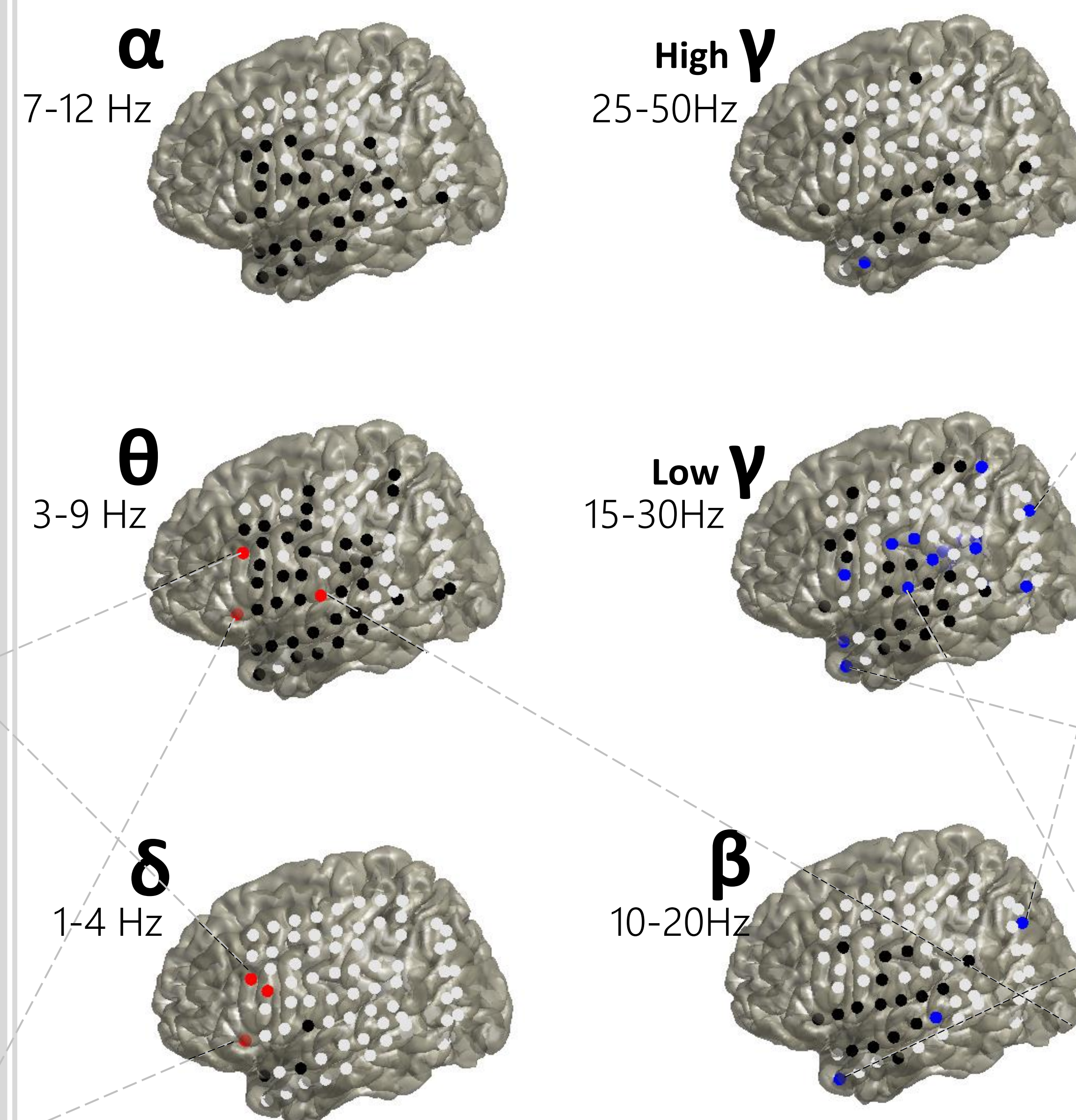
Channel G17



Channel G41



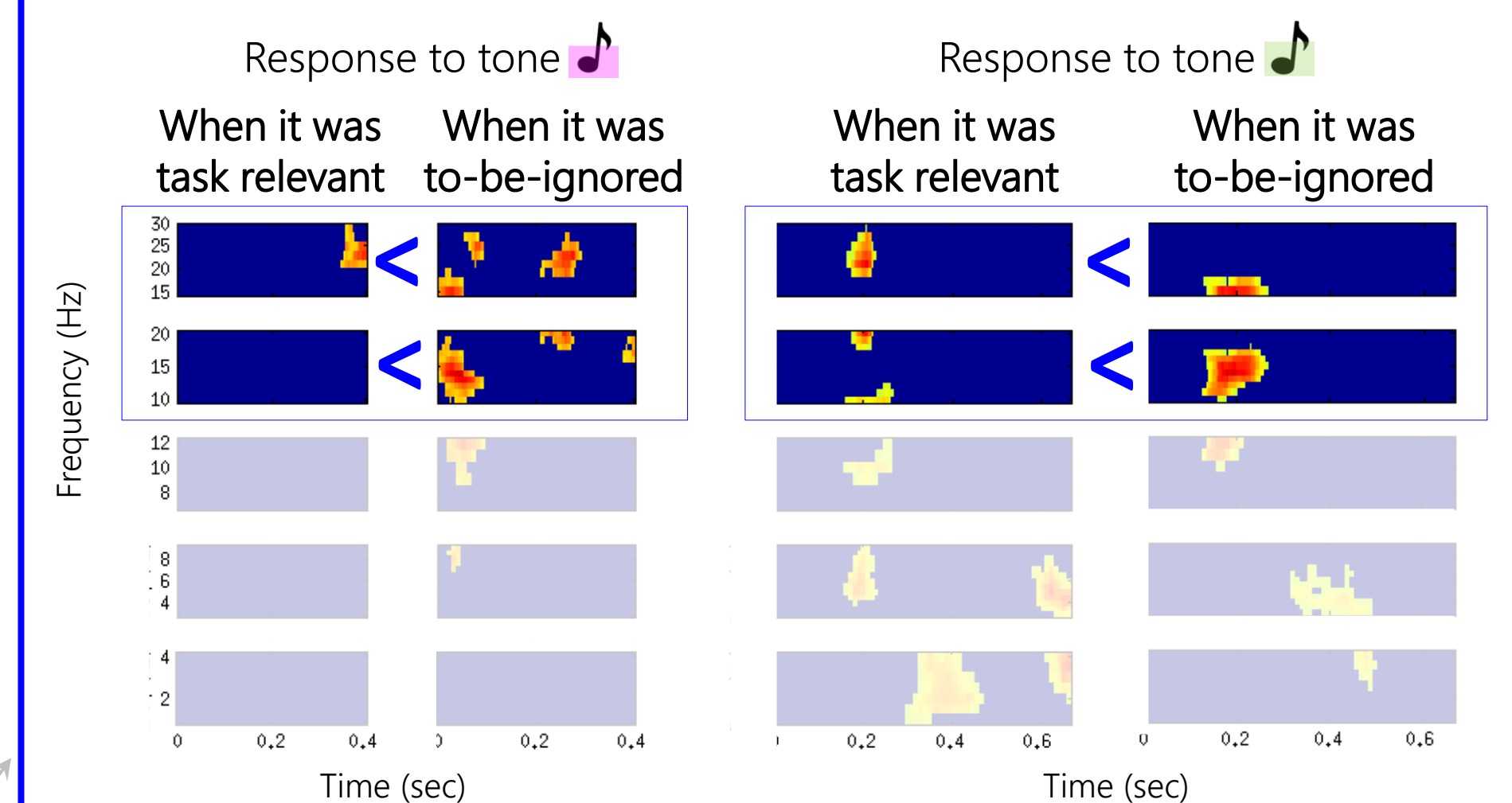
### A diverse repertoire of attention effects during early sound processing



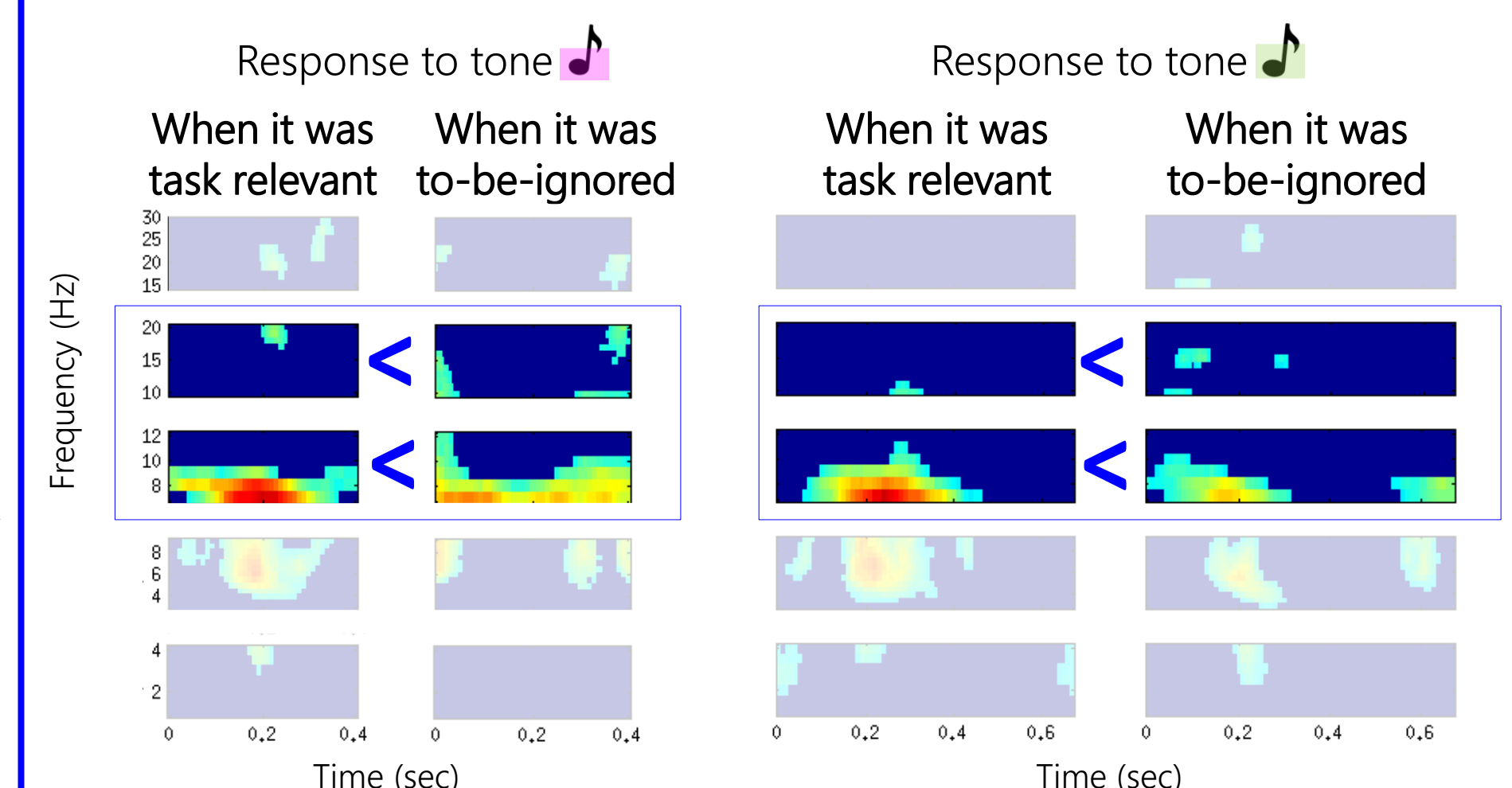
- Responsive to sounds, more when they are task-relevant
- Responsive to sounds, more when are to-be-ignored
- Responsive to sounds, no effect of attention
- Not responsive to sounds

### Phase coherence in higher frequencies is enhanced for to-be-ignored tones

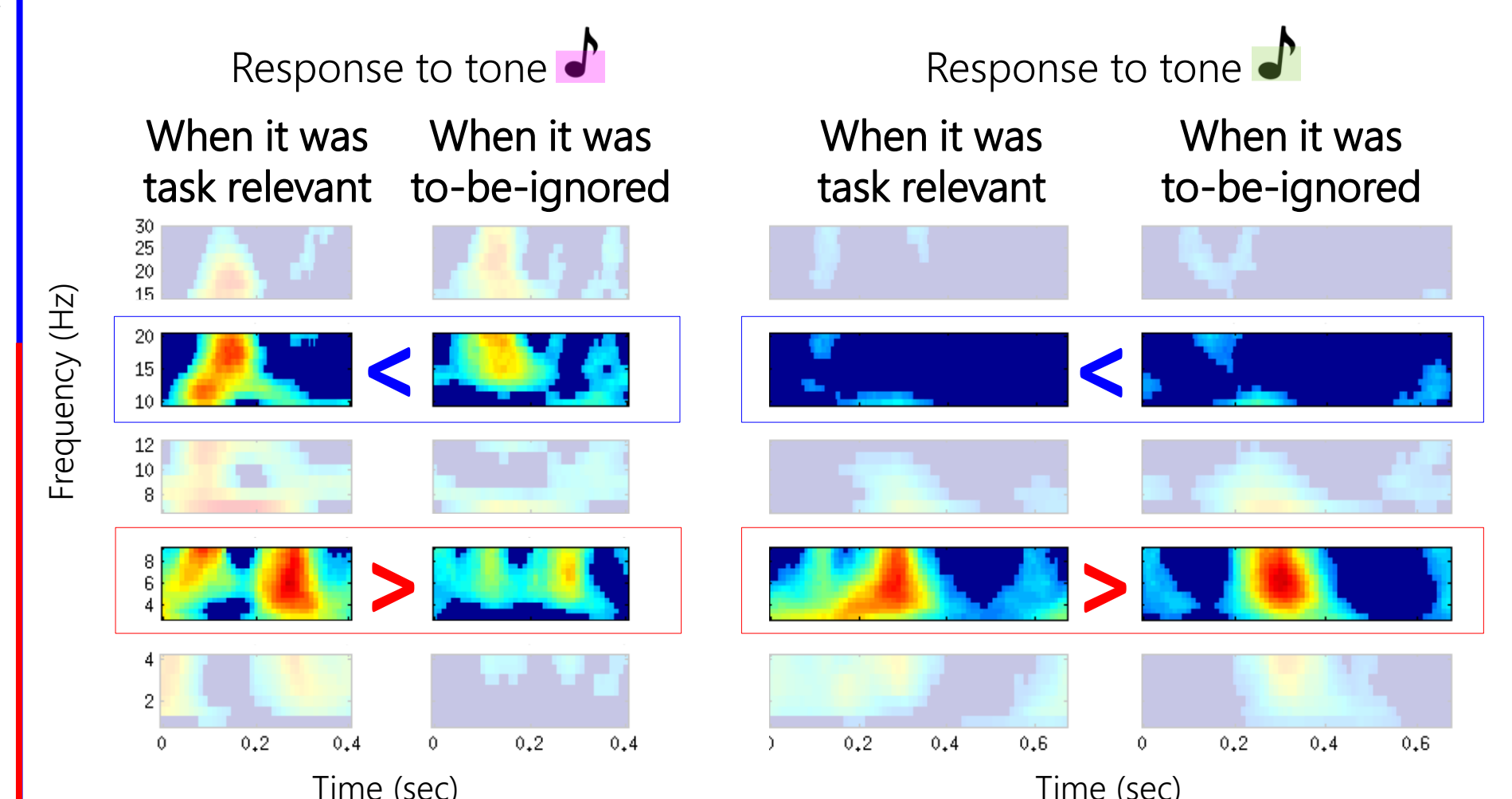
Channel PO5



Channel TG57



Channel G45



## DISCUSSION

Our preliminary results suggest that attention affects cortical activity in a complex manner: while some areas respond stronger to task-relevant sounds, others systematically respond to auditory distractors that are supposed to be ignored. While the 'attending-oriented' responses occupy lower frequencies, center around auditory areas and appear shortly after the stimulus, the 'ignoring-oriented' responses are characterized by higher frequencies, scattered across the lateral surface of the hemisphere and appear mainly before sounds onset. This may suggest that attention supports auditory selection in a dual manner, actively manipulating the representations of both desired information and distracting noises.