Human Cortical Representations of Simultaneous Fast FM and Slow AM

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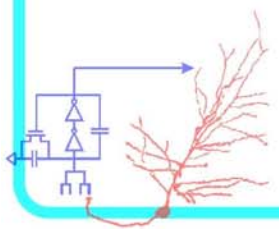
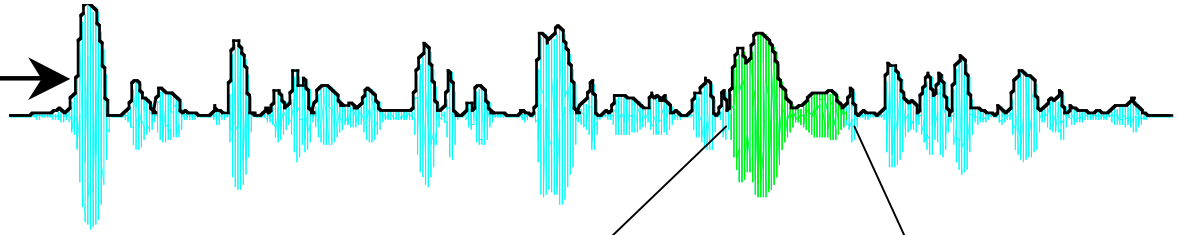
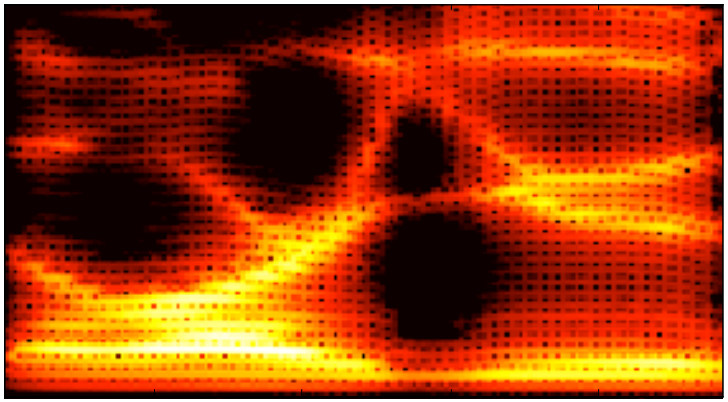
University of Maryland, College Park



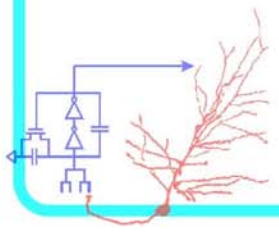
Complex Modulations in Speech

Envelope





Fine structure



Complex Modulations in Speech

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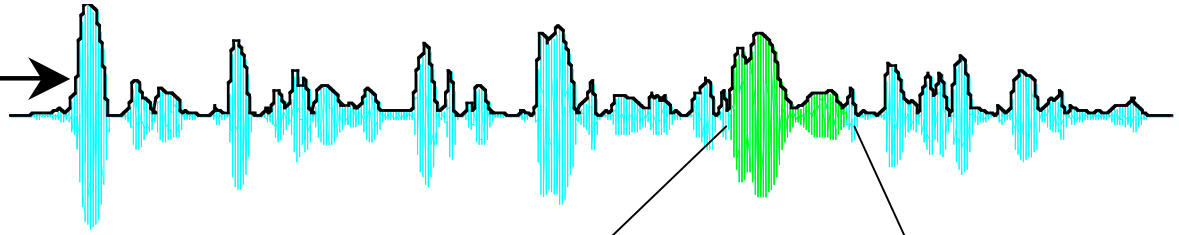

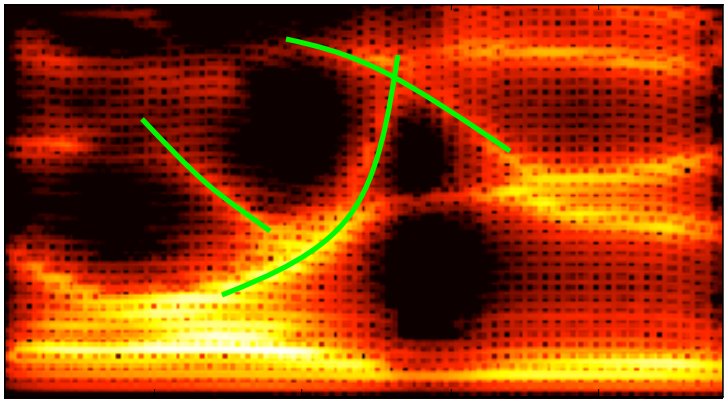

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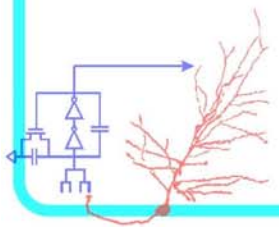
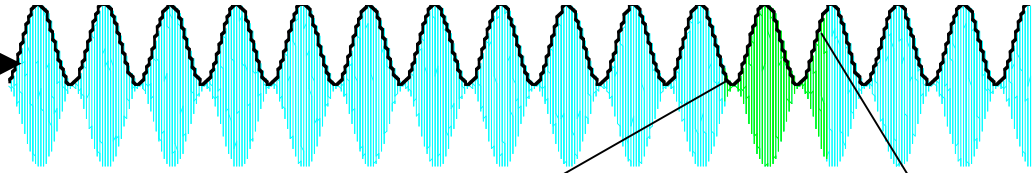
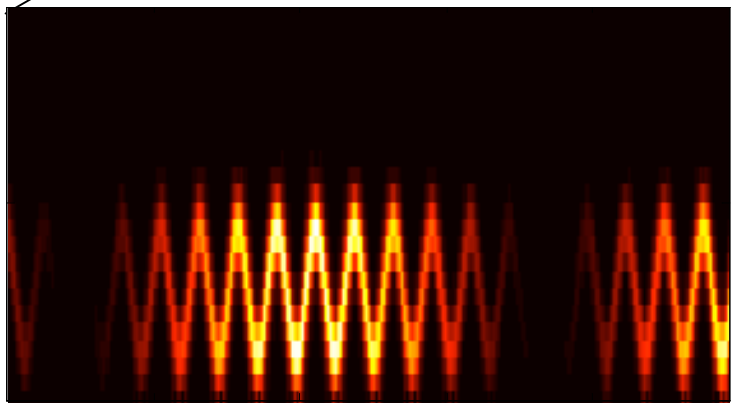


Our Stimuli

Envelope

f_{AM} = 3.1 Hz





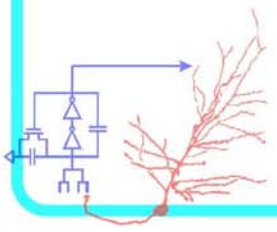
Fine structure

f_{FM} = 37.7 Hz

Carrier: 550 Hz pure tone

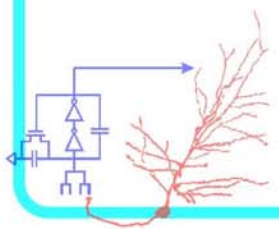
f_{AM} = 0.3, 0.7, 1.7, 3.1,4.9, 9.9, 13.8 Hz

f_{FM} = 37.7 Hz



Neural response to our stimuli

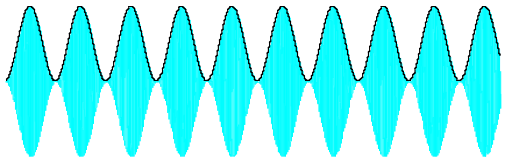
- 1. Neural representation of fast FM (at f_{FM})?
- 2. Neural representation of slow AM (at f_{AM})?
- 3. Interactions between neural representations of fast FM and slow AM?



MEG Response to Temporal Modulations

***Acoustic* Stimulus**

AM at 3 Hz

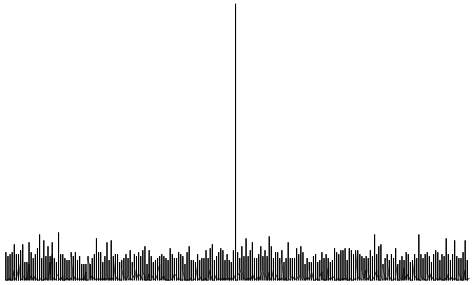


Cartoon *Neural* Response Measured by MEG

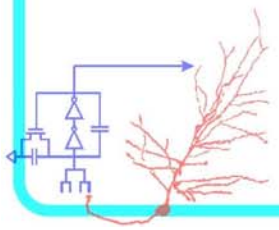
3 Hz oscillation phase locked to the stimulus

Fourier Transform

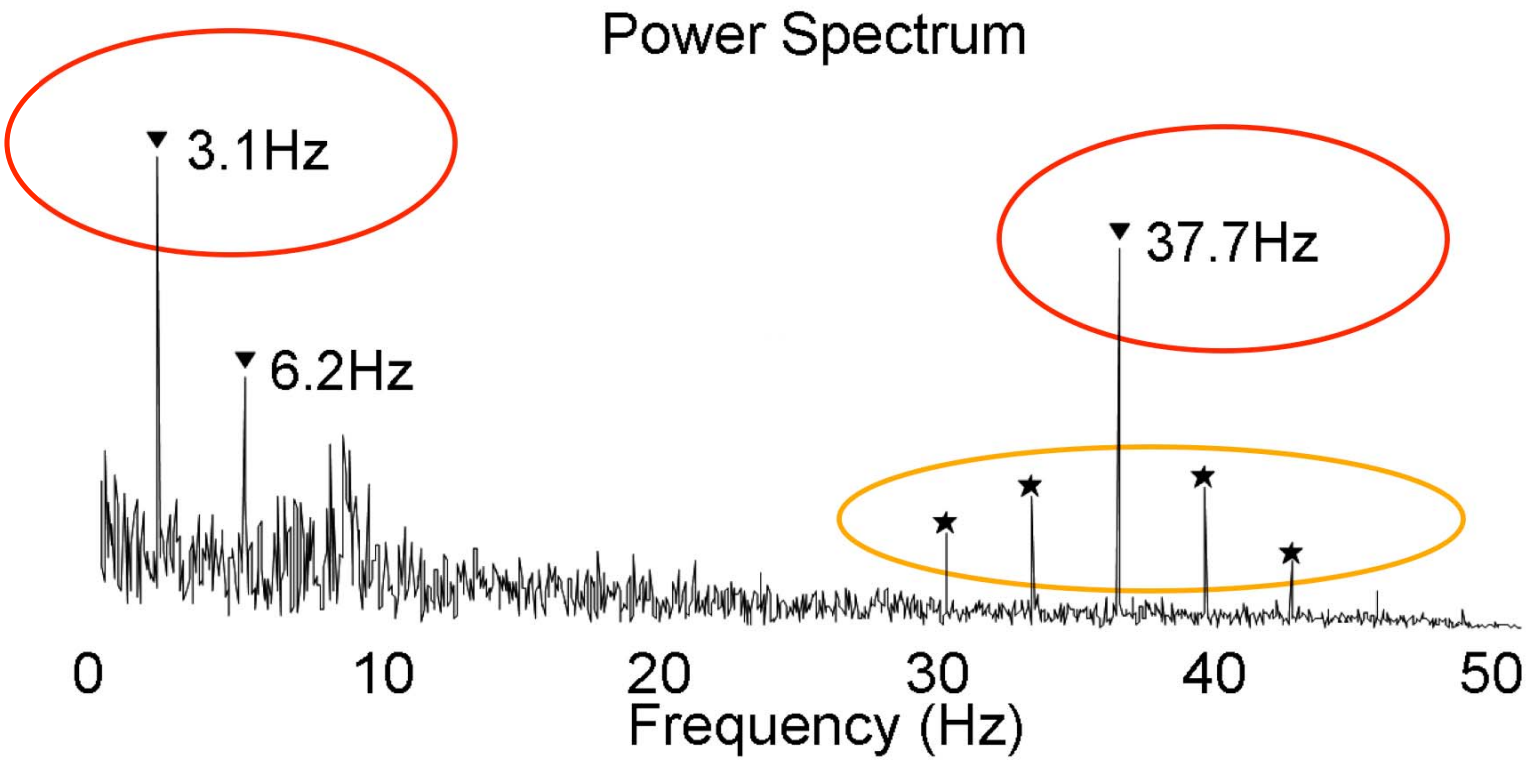
Power spectrum of the response



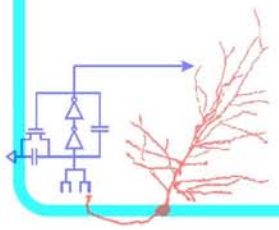
1 Hz 3 Hz 5 Hz



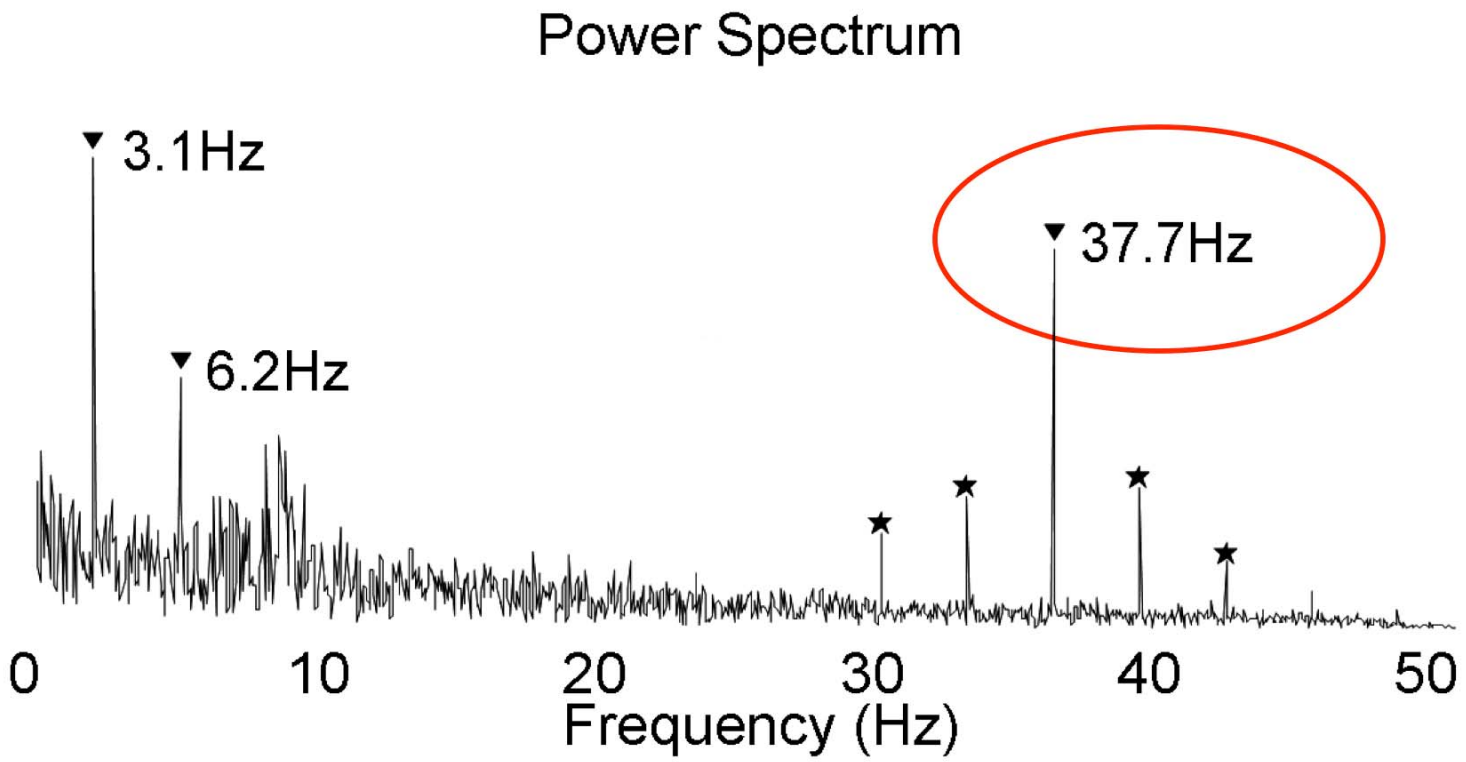
Neural response to our stimuli



f_{AM} = 3.1 Hz, f_{FM} = 37.7 Hz



Neural response to our stimuli



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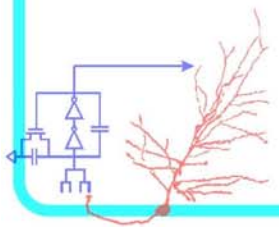
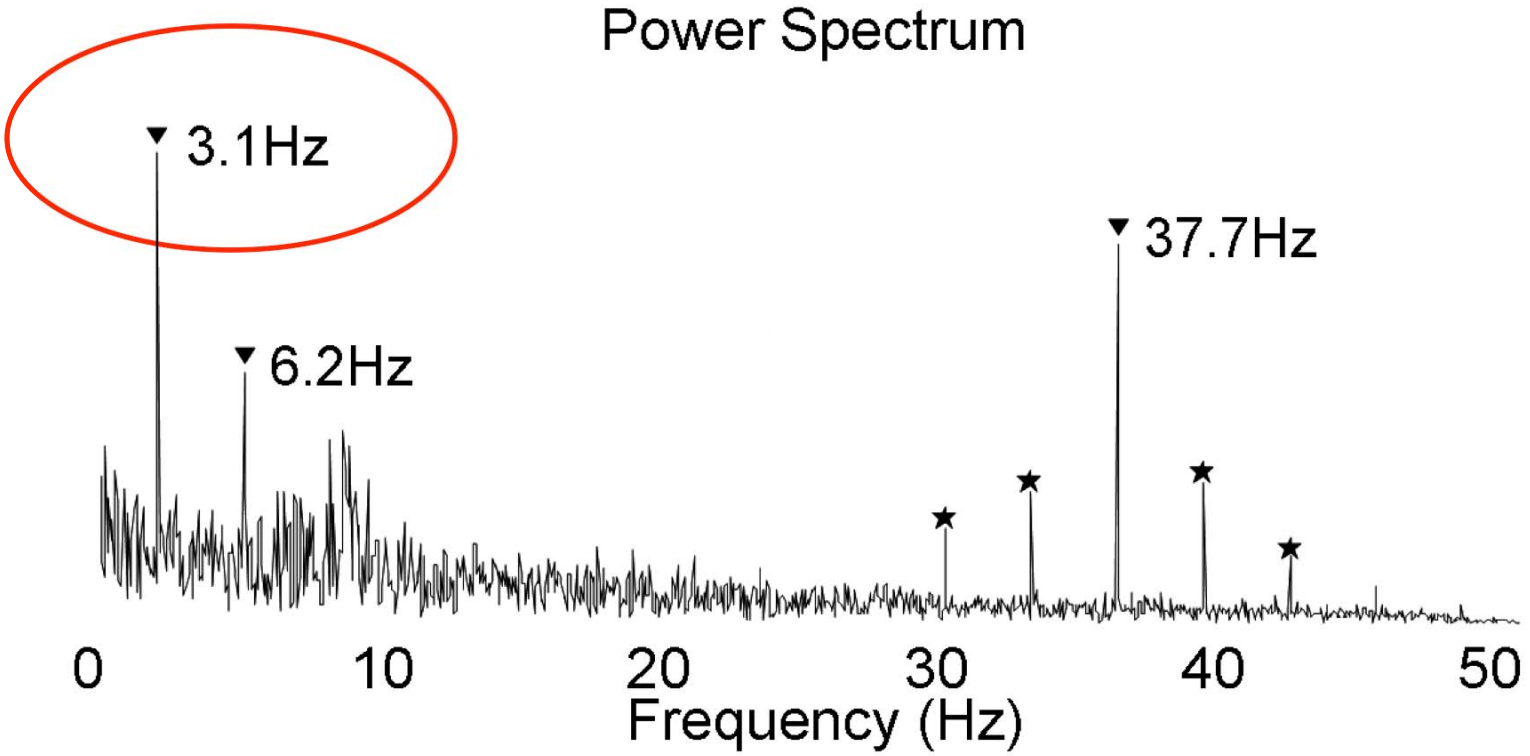


Neural response to our stimuli



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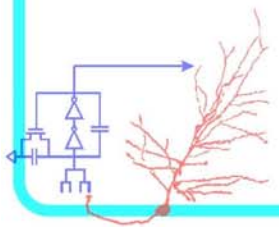
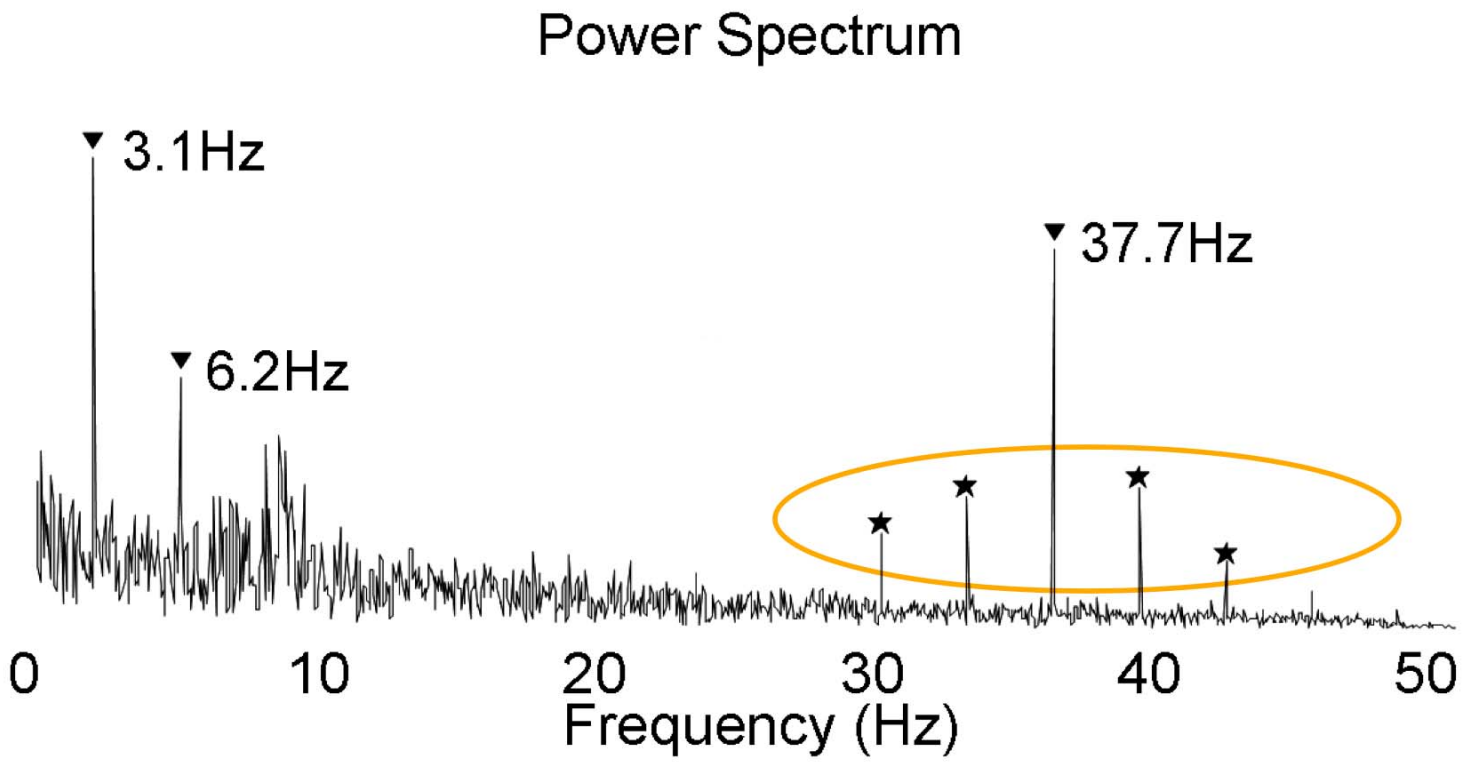
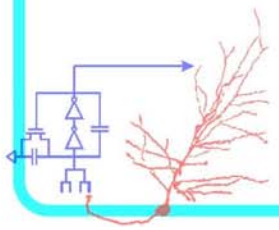


Neural response to our stimuli



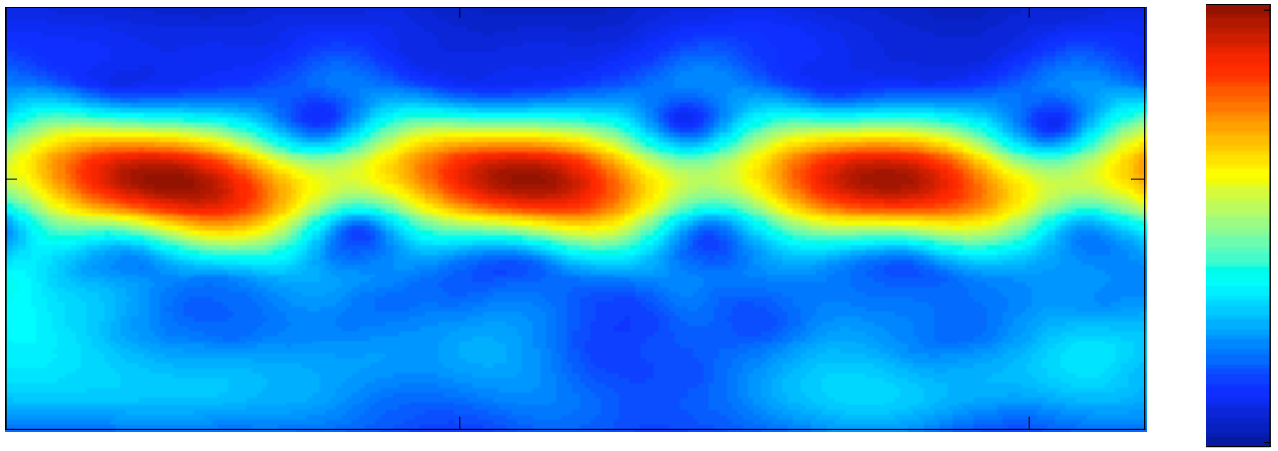
f_{AM} = 3.1 Hz, f_{FM} = 37.7 Hz



Interactions between Neural Responses

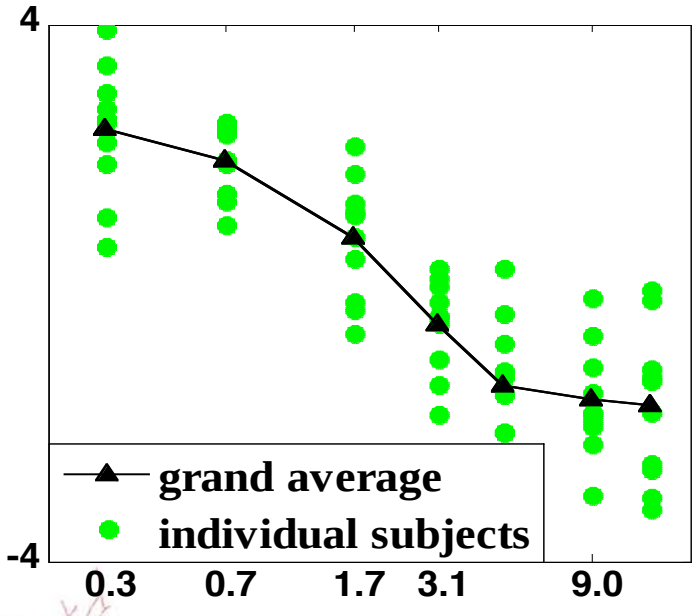
- Neural responses at $f_{FM} \pm f_{AM}$, $f_{FM} \pm 2f_{AM}$ indicate the power or phase of the neural response at f_{FM} is fluctuating with fundamental frequency f_{AM}.

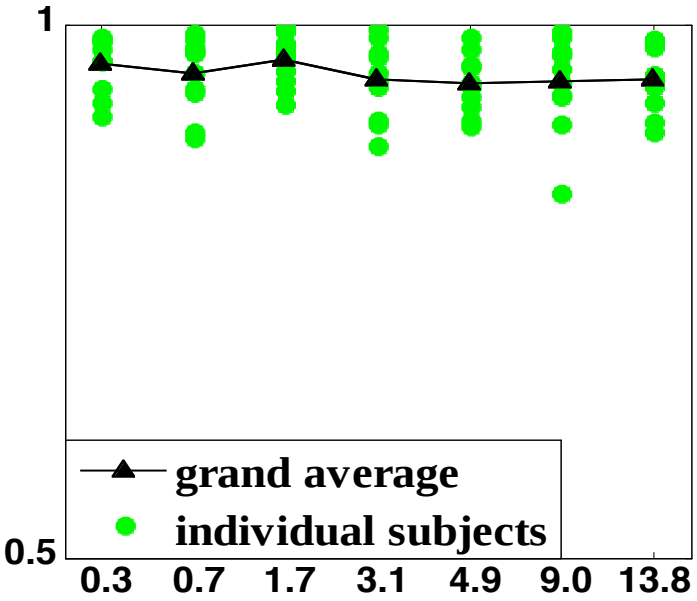
f_{AM} = 3.1 Hz, f_{FM} = 37.7 Hz

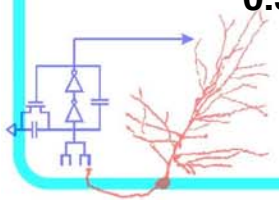


Neural Response at f_{FM}

- The power rather than phase locking of the neural response at f_{FM} decreases with increasing f_{AM}.



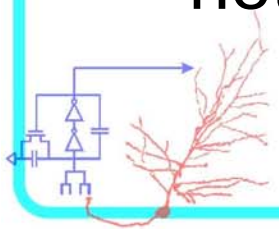




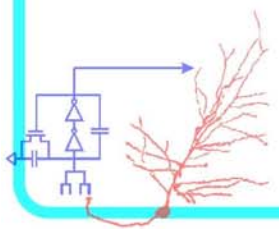
Neural representations of Complex Modulations

- 1. The properties of slow Amplitude Modulations are represented by not only the neural response at f_{AM} but also the temporal dynamics of the neural response at $f_{FM.}$

- 2. The properties of slow Amplitude Modulations affect the neural representation of fast Frequency Modulation, but only in magnitude, not in reliability (phase-locking).



Thank you!



Neural Response at f_{AM}

- The power rather than phase coherence of the neural response at f_{AM} decrease with increasing f_{AM}, consistent with previous studies on modulation transfer function.