# Context sensitivity of the N1 and P2 components in an unattended tone sequence

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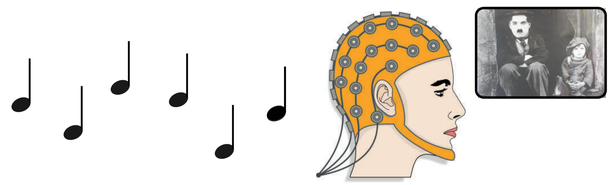
## Introduction

- We studied the dependence of the N1 and P2 event-related potentials (ERPs) on sensory context.
- Context was manipulated by presentation of pure tone sequences that had different total frequency spread.
- Using the N1 and P2 ERPs allowed us to probe two successive stages of auditory processing.

## Methods

Stimuli:
5 equi-probable pure tones (20% each).
Duration - 100 ms. SOA - 500 ± 50 ms.

Particiants were asked to ignore tone sequences while concentrating on a silent film.

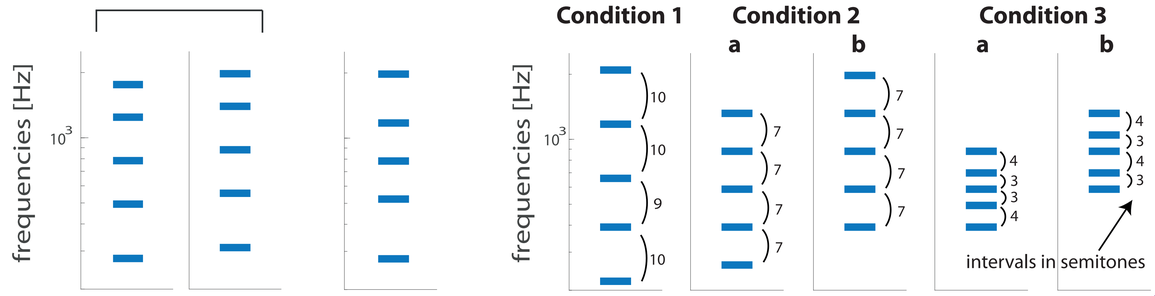


3 EEG experiments:

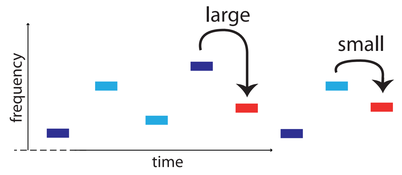
Experiment 1: 21 musicians

Experiment 2: 27 musicians

Experiment 3: 31 non-musicians varying frequency spread:

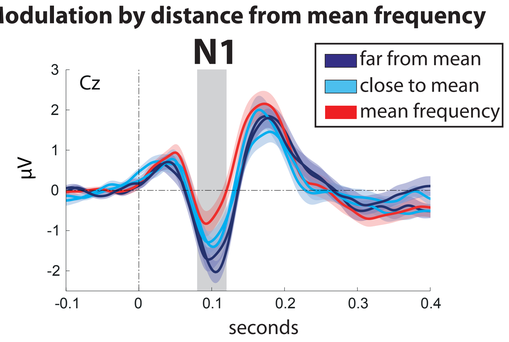



## Results

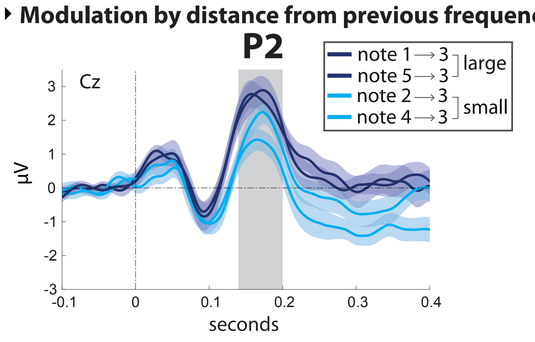



Experiments 1 and 2 :

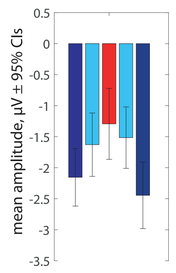
- **Modulation by distance from mean frequency**



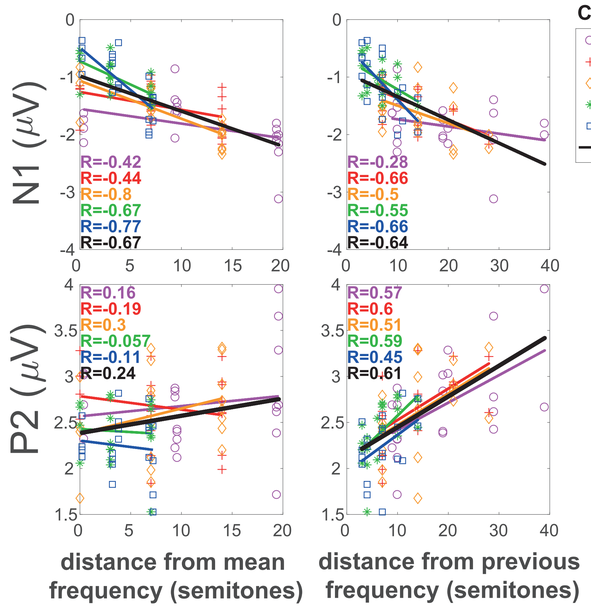

- **Modulation by distance from previous frequency**




N1 peaks - Cz



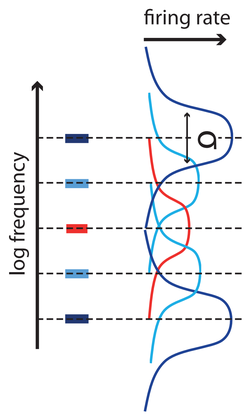

Experiment 3 :




Condition:
1
2a
2b
3a
3b
all together

## Model

- Co-adaptation: Neurons are adapted by a range of requecies weighted by the their tuning profiles.
- Two main parameters:
  - σ - width of tuning curve
  - τ - temporal constant of recovery from adaptation



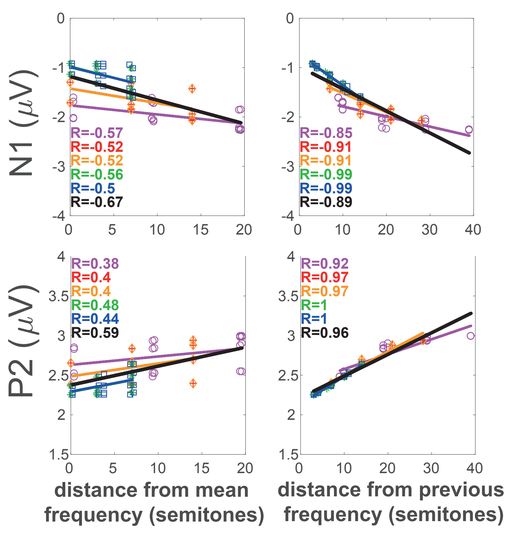

$$RA_{i,j+1} = RA_{i,j} + (1 - RA_{i,j})e^{-\frac{1}{2}\left(\frac{\log(f_i)-\log(f_{S_j})}{\sigma}\right)^2} e^{\frac{-\Delta t_{S_j \to S_{j+1}}}{\tau}}$$

$RA_{i,j}$ - response adaptation of neuronal population i at time step j of the sequence

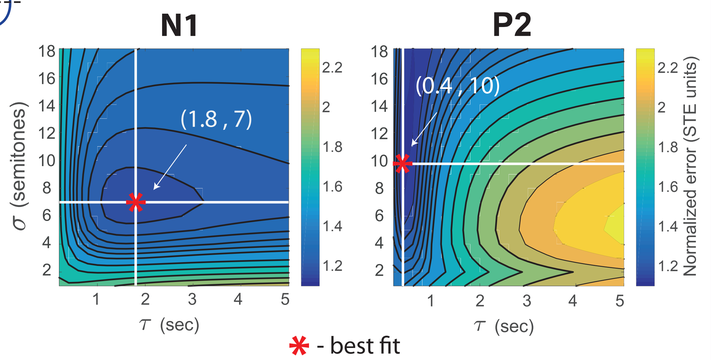
$S_j$ - stimulus at time step j

$f_i$ - best frequency of a neuronal population i

Best fit predictions :

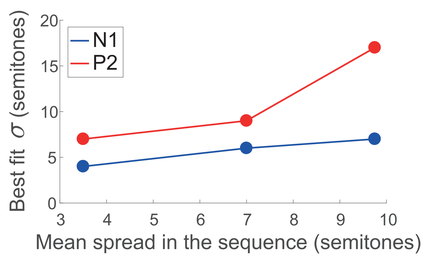



**Modelling all conditions together**




✱ - best fit

**Modelling each condition separately**




## Conclusions

- N1 and P2 depend on context with different time scales and frequency bandwidths.
- Accounting for N1 adaptation requires longer recovery time constant and narrower frequency tuning than P2.
- The modelled bandwidth of the tuning curves was sensitive to the context - increasing with a wider spread of frequencies in the sequence. This suggests context-based plasticity of neuronal tuning, especially at the P2 latency.

| | N1 P2 |
|---|---|
| τ | > |
| σ | < |
| adaptable σ | < |