

# Measuring benefits from transformation of lost segregation cues in hearing devices with Acoustical Change Complex



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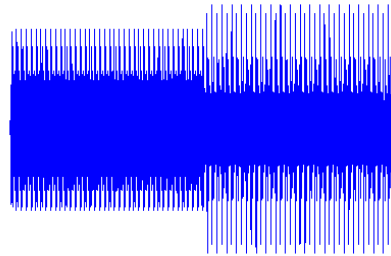
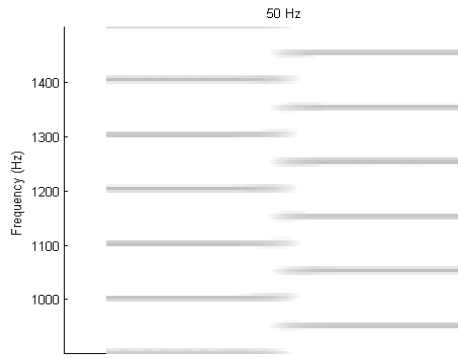
**Dan Gnansia**



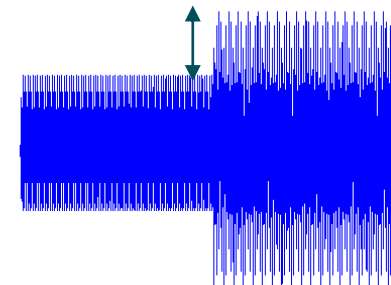
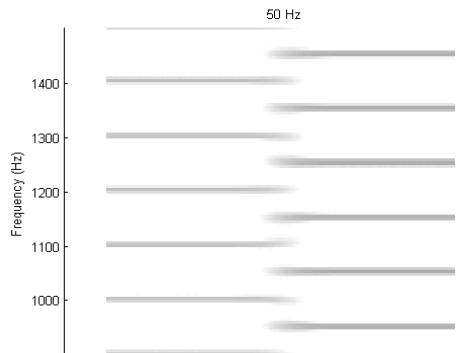
# Background

- People with sensorineural hearing loss (SNHL) have reduced sensitivity to complex acoustic cues compared to controls.
- Pilot study on people with SNHL suggests that transformation of temporal fine structure (TFS) cues to envelope cues (TFS2ENV) improves their performance in pitch discrimination tasks.
- Combined approach using behavioral and electrophysiological tests are useful to measure pitch processing in people with NH and SNHL.

# What is transformation of TFS cues?

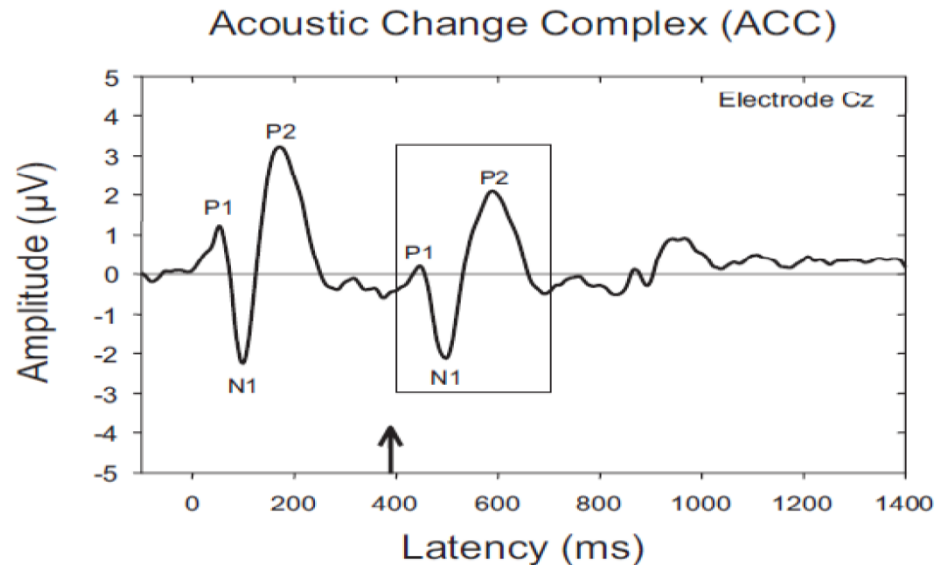


- TFS stimuli: only frequency shift



- TFS2ENV stimuli: both frequency shift and amplitude increase

# Electrophysiological measures



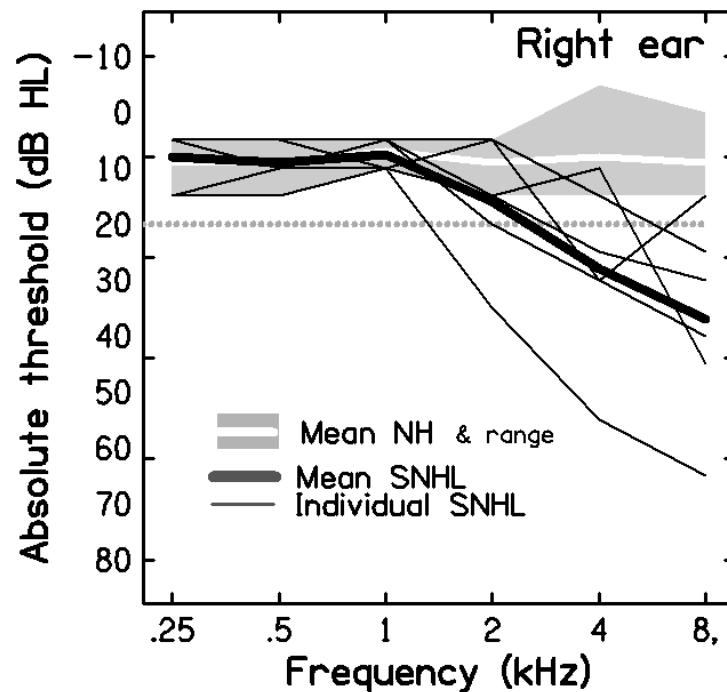
- The ACC is evoked by the contrast in the stimuli, e.g. the frequency change.
- Hypothesis: magnitude/ robustness of neural response during ACC increases with increasing pitch salience, which would indicate that the frequency shift was discriminated at a cortical level

# Research questions

- What does the ACC reveal about the efficiency of the transformation of TFS cues?
- How are TFS and Envelope cue contrasts represented in cortical responses?

# Participants

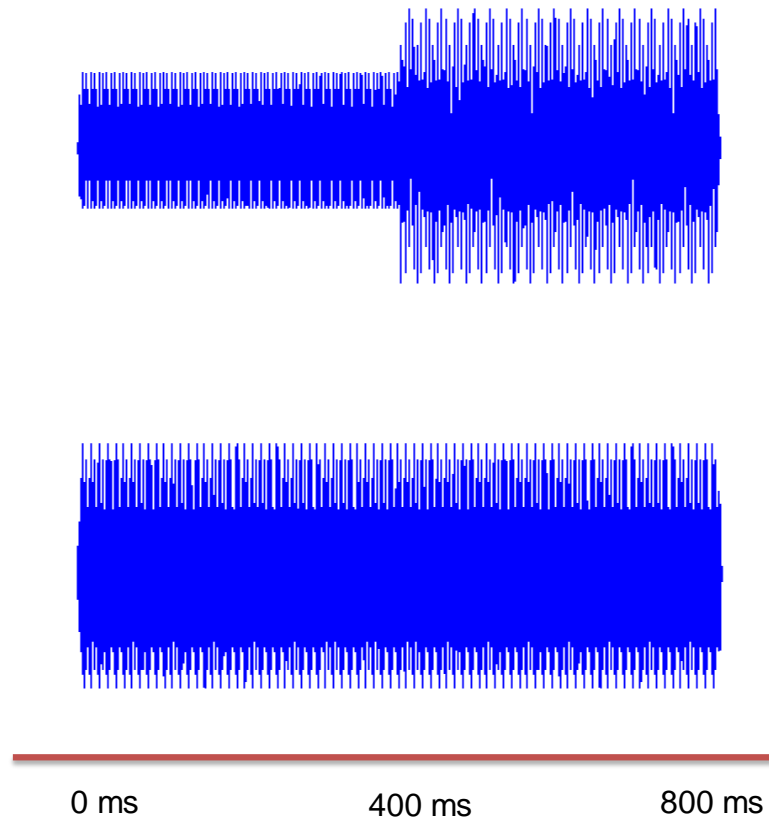
- Six participants with normal hearing (3 M, 3 F, mean age = 36.5 years, SD = 16.8 years)
- Six high-frequency SNHL (4 M, 2 F, mean age = 46.6 years, SD = 18.3 years)





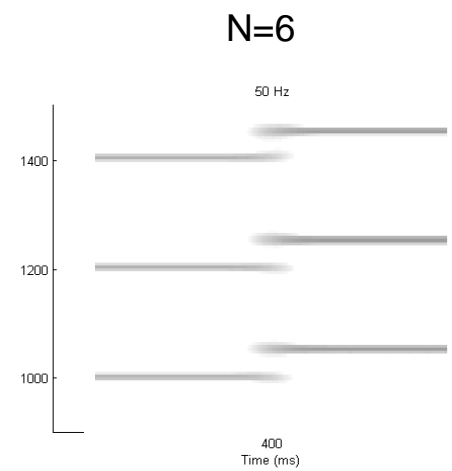
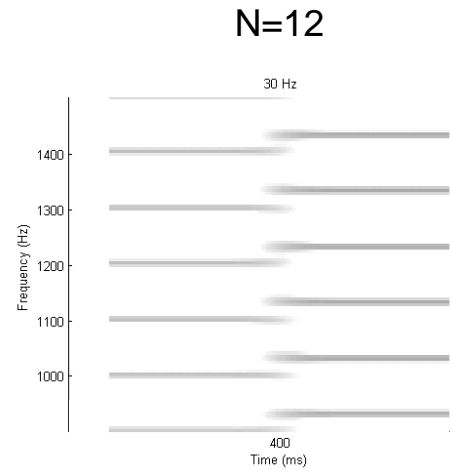
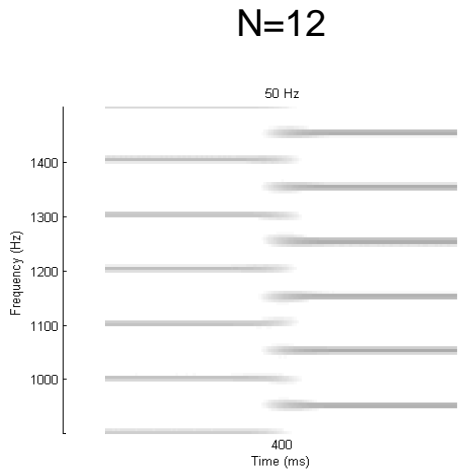
# Stimuli

- 800 ms long stimuli with change occurring 400 ms after stimulus onset
- No of beeps = 2 (AB), control = 1 (A)

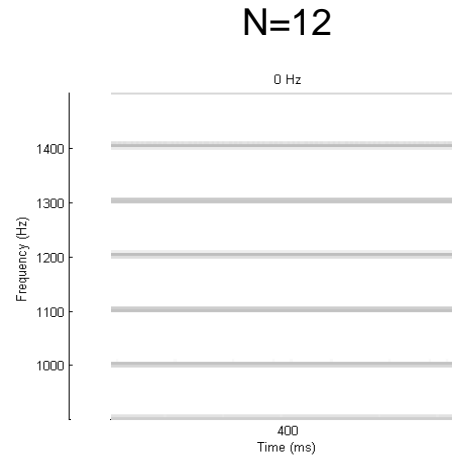
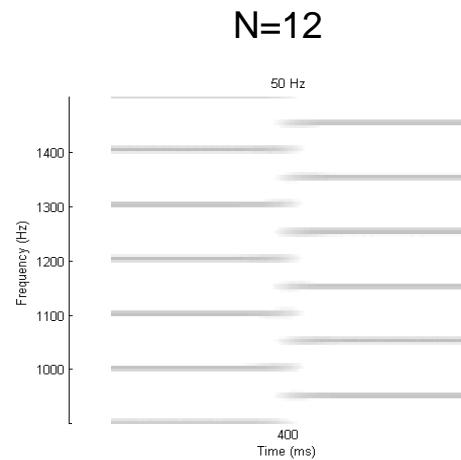


# Experimental conditions

TFS2ENV  
stimuli



Stimuli  
without  
amplitude  
increase



Control

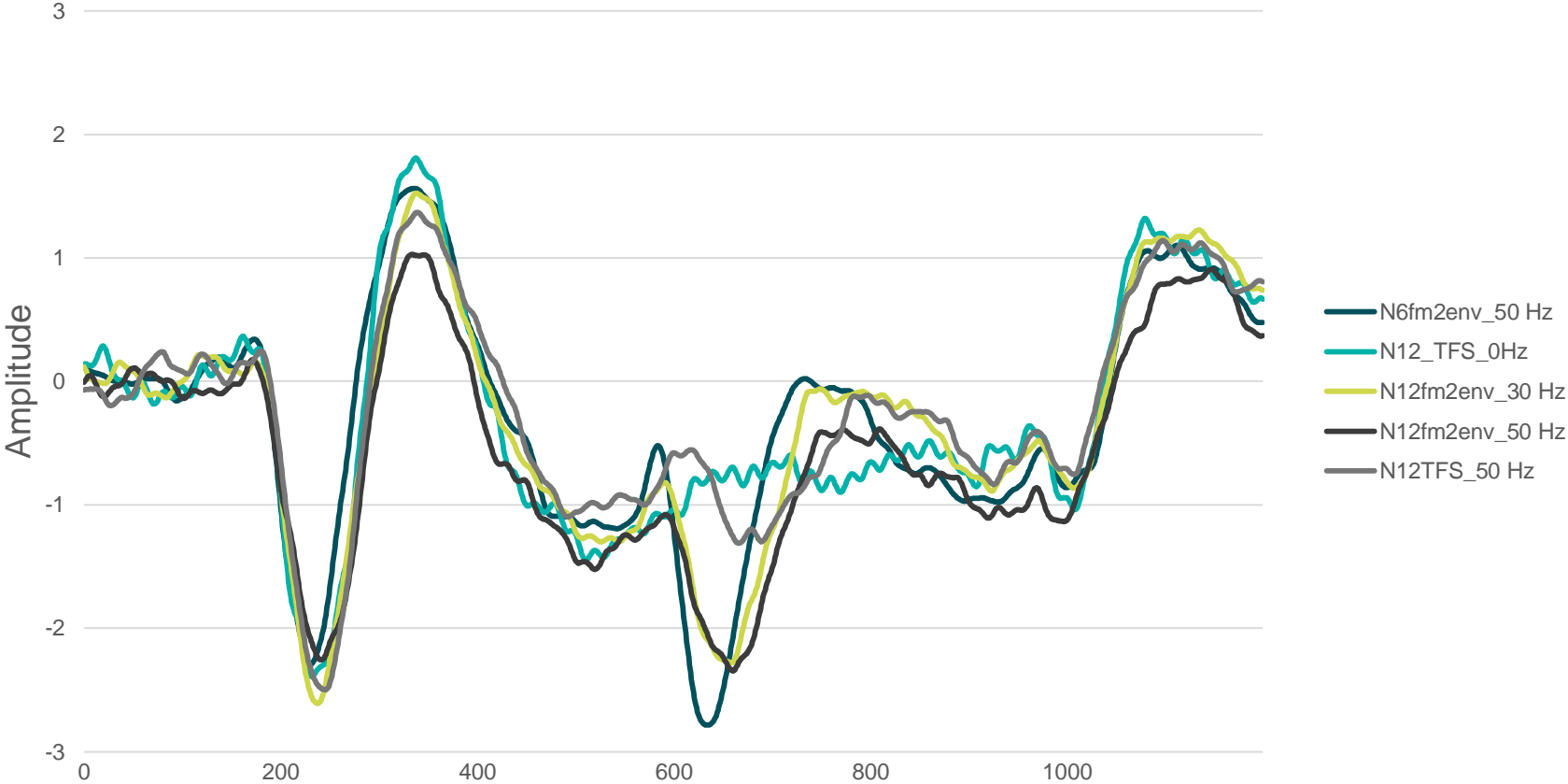


# Electrophysiology recording and analysis

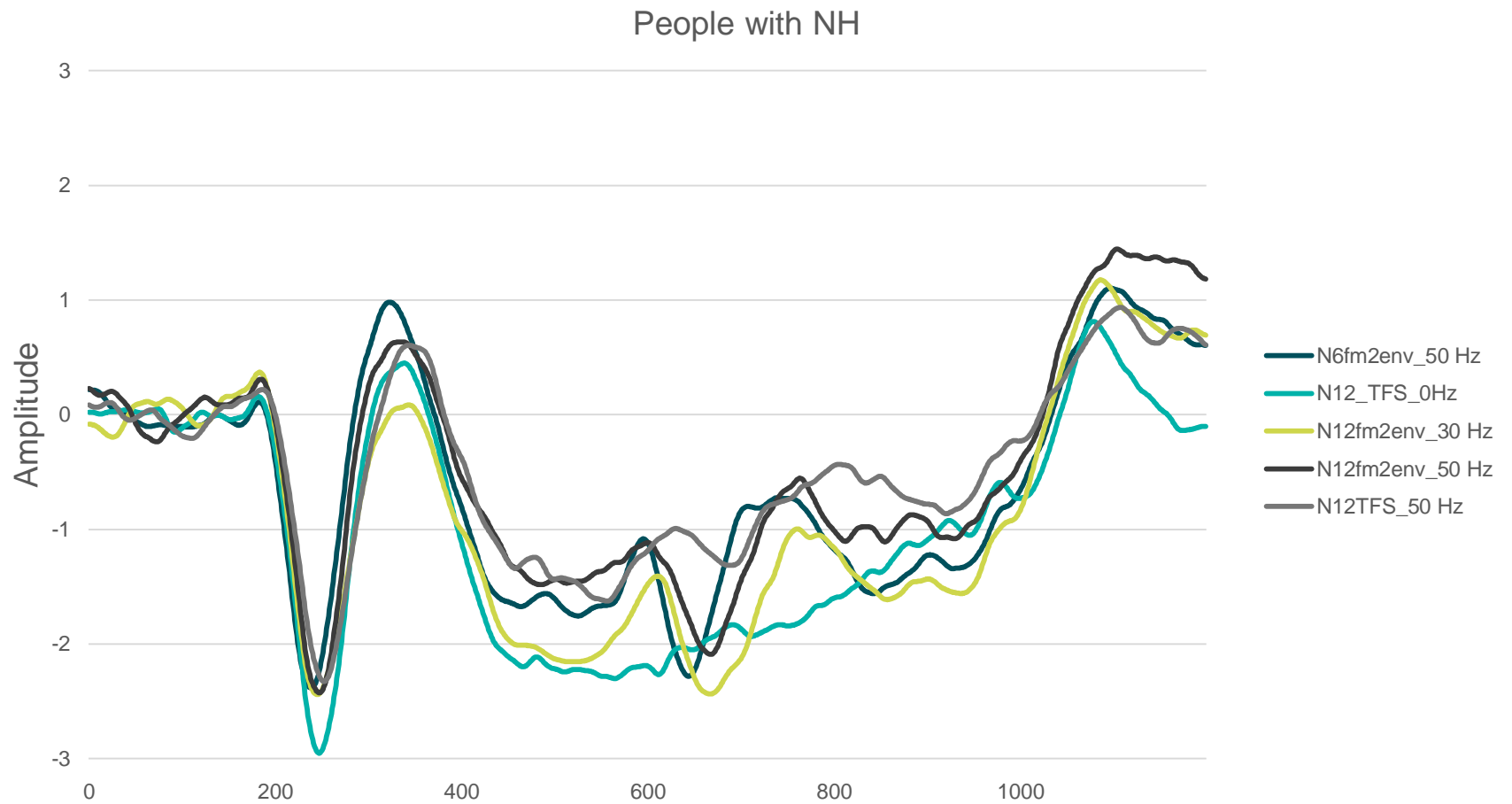
- Monaural presentation on the right ear
- 75 dBA peak level
- Each stimulus was presented 200 times, in blocks of 100 sweeps
- Transducer: Insert Earphones ER 3A
- Subject state: Awake watching a movie
- 64-channel Neuroscan SCAN™ (version 4.5) and Synamps 2 system. The online- reference channel was located at vertex (Cz) while the ground electrode was located on the midline 50% of the distance to nasion.
- The ACCs were analyzed by pooling the frontal- central regions (FC1,FCz, FC2).
- ACC amplitudes were defined as the absolute voltage difference between N1 and P2 peaks of the response after the change in the stimulus.

# Results

People with SNHL



# Results



# Conclusions

- The present study explored how pitch and level contrasts are represented in cortical responses.
- We found that FM2ENV stimuli have a better morphology than TFS stimuli for both people with NH and SNHL. Correlations with behavioral data are needed to confirm that the cortical responses also reflect perception apart from the physical properties of the stimuli.
- From a clinical point of view ACC recordings are relevant since behavioral tests are demanding for the listeners. Also, ACC recordings may potentially reveal differences in cortical responses invoked by pitch and level contrasts.
- FM2ENV transformation may have relevance for future auditory implants as an alternative to encoding of TFS cues.

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