# CONDITIONED ALLOPHONY IN SPEECH PERCEPTION:

## AN ERP STUDY

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# Overview

- **Mismatch Negativity (MMN)** study comparing MMN responses to phonemic and allophonic vowel pairs evaluating pre-attentive perception
- **Same-different** task performed to evaluate attentive perception
- Difference in **latency**, but not amplitude implies that **phonemic contrasts are parsed & encoded more easily**
- **More studies needed**, factors of methodology and consonants vs vowels may influence outcomes

# Background

- Among existing behavioural & MMN studies, few explicitly address perception of conditioned allophones
- Behavioural studies:
  - Peperkamp et al (2003) on perception of allophonic pair [ʁ-χ] vs phonemic pair [m-n] in French speakers
  - Boomershine et al (2008) study on attentive discrimination of [d-ð] and [d-ɾ] in English and Spanish speakers
- MMN studies:
  - Phillips et al. (1995) on perception of [r] and [l] in English and Japanese speakers
  - Hungarian speakers in Winkler et al. (1999) show no MMN for [e-æ] contrast present in Finnish
- Results of previous studies indicate MMN for phonemic pairs, but not allophonic ones
- Speakers cannot rely on phonemic representations alone; knowledge of allophonic representations required

# Methods

- Subjects were 12 right-handed students from the University of Salento with no history of neurological illness
- Native speakers of Tricase dialect
- **Same-different task** testing attentive discrimination in behavioural study followed by **EEG measurements** to prevent attentive processing before ERP measurement

# About Tricase

- Southern Italian dialect with five-vowel system (/i, ɛ, a, ɔ, u/)
- Stressed low-mid front vowels become high-mid front vowels in front of a high front vowel
- Vowel assimilation occurs in open and closed syllables
- **[’mɛte] → [’meti]** *I/he reap(s)*
- **[’dɛnte] → [’denti]** *tooth/teeth*

# Stimuli

- Male Tricase speaker producing total of 30 pseudowords in context b[V]b[V]
- Carrier sentence: *leu tico* ____ *moi* (I say ___ now)
- Audio normalized for duration and peak amplitude
- Portions containing only steady-state vowel signal eliminated

# Behavioural Test

- Same-different discrimination task assessing attentive discrimination of allophonic variation [ɛ - e]
- Three pair types tested: [ɛ - ɛ] [ɛ - e] and [e - e] with 800ms between stimuli and 500ms initial silence
- Allophonic pair perceived as different at a high rate (94%)

# ERP Test

- Testing MMN responses to phonemic contrast [e – i] and allophonic pair [ɛ - e] with oddball paradigm
- Subjects were presented stimuli while watching a silent movie, and asked to disregard sounds from loudspeakers
- No significant differences in amplitude, but latency of the phonemic condition was significantly earlier

# Discussion

- Both behavioural and electrophysiological responses showed detection of the allophonic pair [ɛ - e]
- Perception of vowels as "within category" may account for some difference with similar studies using allophonic consonant pairs
- Some difference between current study's results and previous results can be attributed to differences in methodology and stimuli (pseudowords vs words, synthetic vs natural speech etc.)
- Results suggest a single neural computation comprised of two perceptual modes: phonological (faster) and phonetic (slower)
- Phonetic mode must access contrastive **and** non-contrastive sounds, performs more computation than phonological mode
- Within-category variations are easier to distinguish **out of context**

# THANKS FOR WATCHING!