

Understanding early and late transient responses to speech: experiments using synthetic speech

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Background:

Recording auditory responses evoked with natural speech is challenging:

- Variability and typical parameters of normal speech:
 - Fundamental frequency [90 – 260] Hz (glottal pulses interval [3.8 – 11] ms)
 - Articulation rate 10-12 phonemes/s (phoneme duration [40 – 150] ms)

Due to this difficulty, conventional methods limited for evoked responses to speech:

- Transient responses using short and isolated vowels or syllables
- Frequency following response to fundamental frequency in stationary phonemes
- Speech-evoked envelope following responses

Methods:

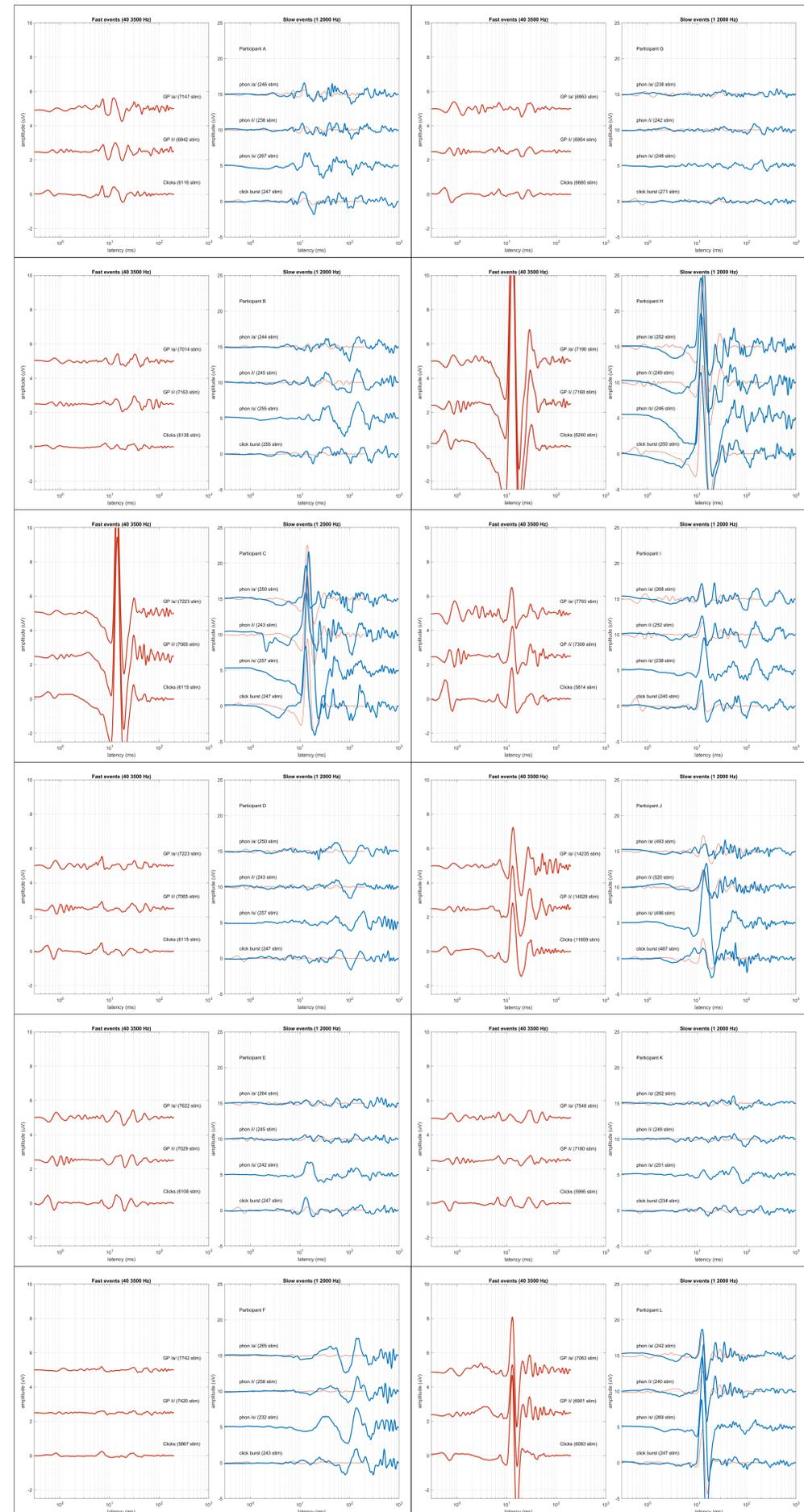
Simultaneous deconvolution of “fast events” (glottal pulses) and “slow events” (phonemes)

- Synthetic phonemes (/a/ /i/ /s/ [click burst]): controlled scenario
- Modular and flexible AEP recording system
- Multi response deconvolution + LDF (complete auditory pathway) [De la Torre et al. JASA: 155, 3639–3653 (2024); 151, 3745–3757 (2022); 148, 599–613 (2020)]

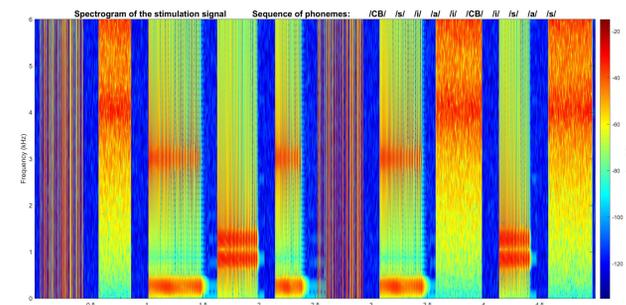
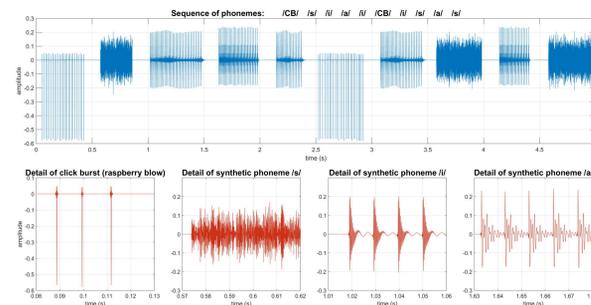
Results:

- Responses recorded from 12 subjects
- 12 minutes of recording with each participant
- Consistent early responses (with clear ABR/MLR components) to the short-term events
- Consistent late responses (with clear MLR/ALR components) to the long-term events

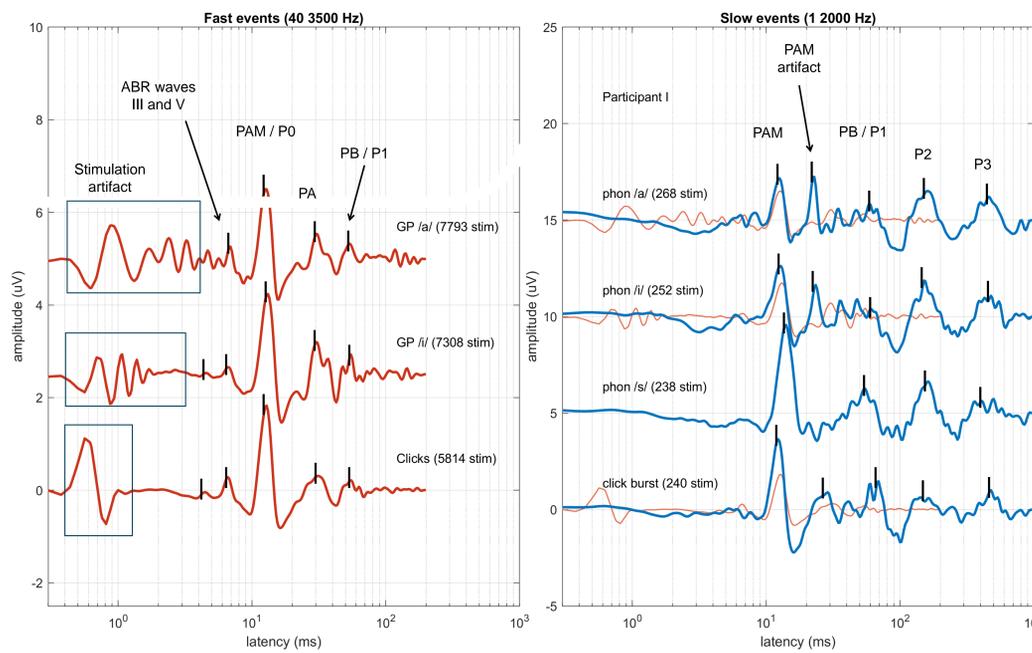
INDIVIDUAL RESULTS FOR EACH PARTICIPANT



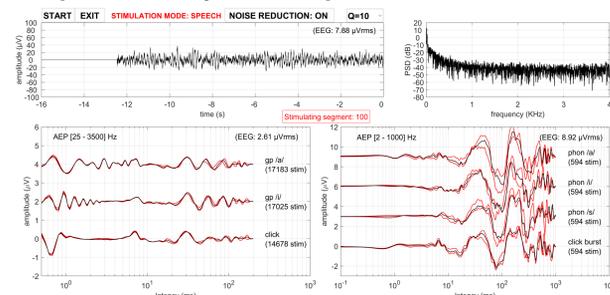
STIMULATION SIGNAL



ANALYSIS OF RESPONSES TO SHORT-TERM AND LONG-TERM EVENTS



Responses to synthetic speech included in DEMO



Conclusions: This preliminary study with synthetic speech provides valuable information for a better understanding of the perception of the speech, and for the development of protocols based on speech signals to assess the auditory function.

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