

# Time Constant of Auditory Adaptation to Noise: Psychoacoustic and Neurophysiological Evidence with Clicks



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## Motivation

- This study aimed to investigate (1) whether adaptation to noise occurs at longer noise–word onset delays than previously measured, and (2) whether the response to target stimuli is enhanced at the subcortical auditory system when the stimuli are delayed in noise.

## Methods

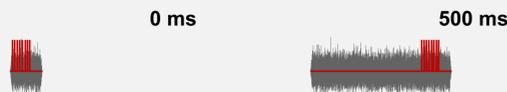
### Word-in-noise intelligibility

- Participants: 15 normal-hearing adults (19–46 years old, 7 female).
- Stimuli: Vocoded words.<sup>1</sup> Noise: Speech-shaped noise at 60 dBA.
- Conditions: Words at 50 ms, 800 ms, or 1600 ms after noise onset.
- Method: SRT-50 measured with an adaptive procedure. 3 reps/condition.



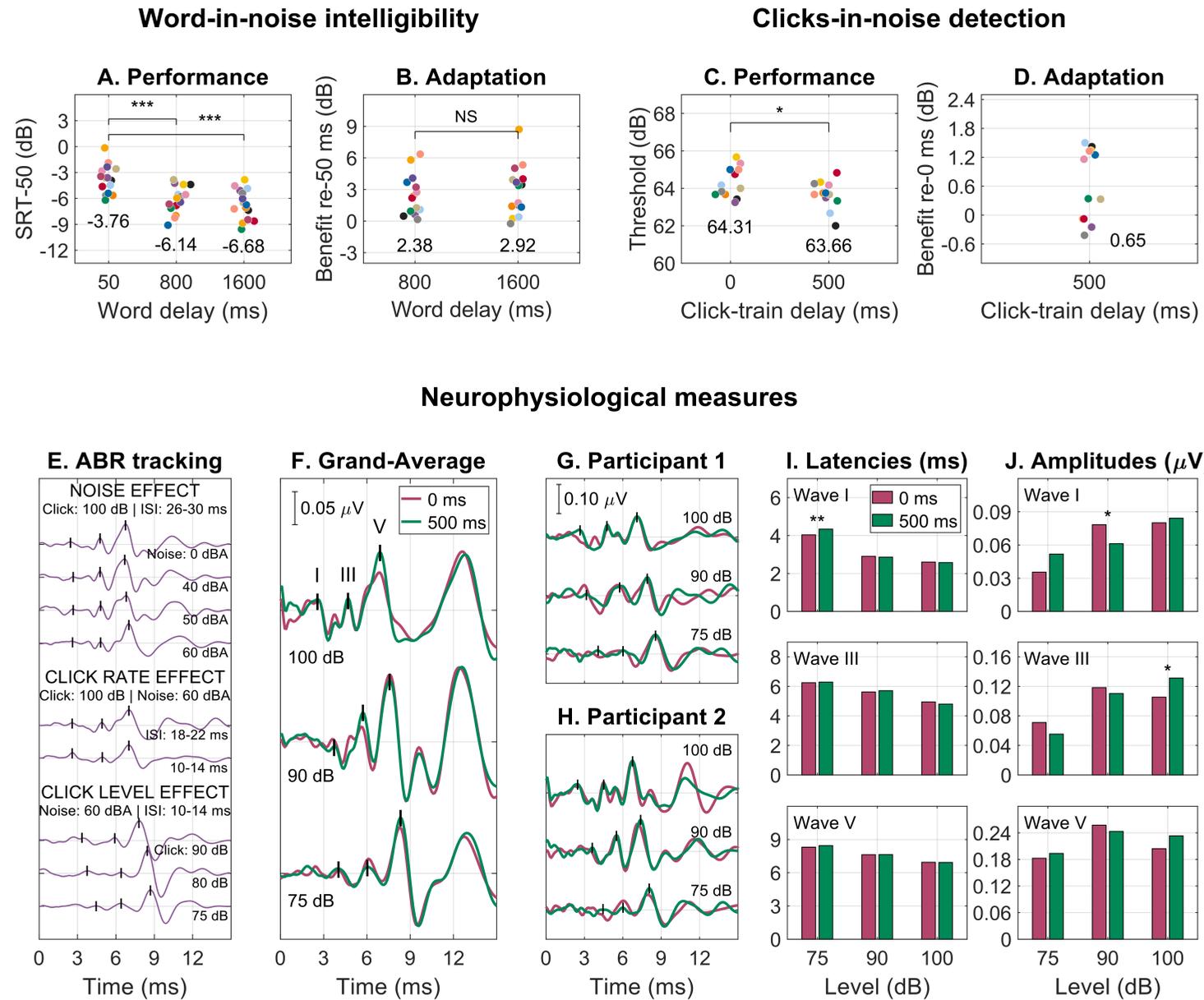
### Clicks-in-noise detection

- Participants: 12 normal-hearing adults (22–40 y/o, 5 female).
- Stimuli: Bursts of 8 clicks, ISI = 10–14 ms. Noise: White noise at 60 dBA.
- Conditions: Click bursts presented at 0 ms or 500 ms after noise onset.
- Method: Threshold detection via 3AFC task. 4 reps/condition (1<sup>st</sup> excluded).



### Neurophysiological measures

- Participants: Same participants as in the Clicks-in-noise detection task.
- EEG recording system: Duet (Intelligent Hearing Systems, Miami, FL, USA).
- Transducer: ER-2 (Etymotic Research, Elk Grove Village, IL, USA).
- Stimuli: 1000 bursts of 8 clicks (100 / 90 / 75 dB ppeSPL, ISI = 10–14 ms).
- Noise: White noise at 60 dBA.
- Conditions: Bursts at 0 ms and 500 ms after noise onset.
- Calibration: GRAS RA0402 ear simulator → Nor145 sound-level meter.
- Auditory brainstem responses (ABR) estimated via deconvolution.<sup>2</sup>



## Conclusions

- Adaptation-to-noise occurs in both word-in-noise intelligibility and clicks-in-noise threshold detection.
- The similar ABR traces at 0 ms and 500 ms delays suggest that subcortical contributions to noise adaptation are minimal or that clicks are suboptimal to characterise these mechanisms.

## Results

**Word-in-noise intelligibility.** Panels A and B show that word-in-noise intelligibility improves by 2.38 dB and 2.92 dB when words are delayed 800 and 1600 ms, respectively, relative to the 50 ms condition, with the improvement reaching a plateau after the 800 ms delay.

**Clicks-in-noise detection.** Panels C and D show that delaying the click burst by 500 ms relative to noise onset improves clicks-in-noise detection by 0.65 dB.

**Neurophysiological measures.** Panel E shows data from a single participant (male, 24 y/o) and illustrates how ABR waves I, III, and V are tracked from a standard condition to the experimental setup.

Panel F shows grand-average ABR waveforms for the 0 and 500 ms conditions across the three click levels, revealing similar responses. Panels G and H show individual traces from two participants.

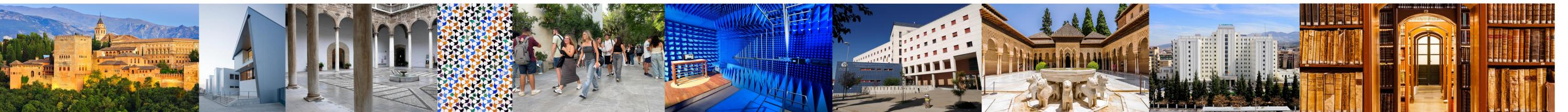
Panels I and J show the latencies and amplitudes of waves I, III, and V, respectively, across the three click levels. Although some differences reach statistical significance, overall ABR morphologies are comparable between the 0 ms and 500 ms delay conditions.

\*  $p$ -value < 0.05 | \*\*  $p$ -value < 0.01 | \*\*\*  $p$ -value < 0.001.

- Cárdenas and Marrero (1994). ISBN: [84-362-3009-4](#).
- de la Torre A et al. (2024). doi: [10.1121/10.0026228](#).

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Poster

