

# Exploring Listening Effort in Adults: A Study Using an Overlapping Dual-Task Paradigm in Multi-Talker Babble Noise

Julia Seitz<sup>1</sup>, Jana Berger<sup>1</sup>, and Janina Fels<sup>1</sup>  
<sup>1</sup>Institute for Hearing Technology and Acoustics, RWTH Aachen University, Germany

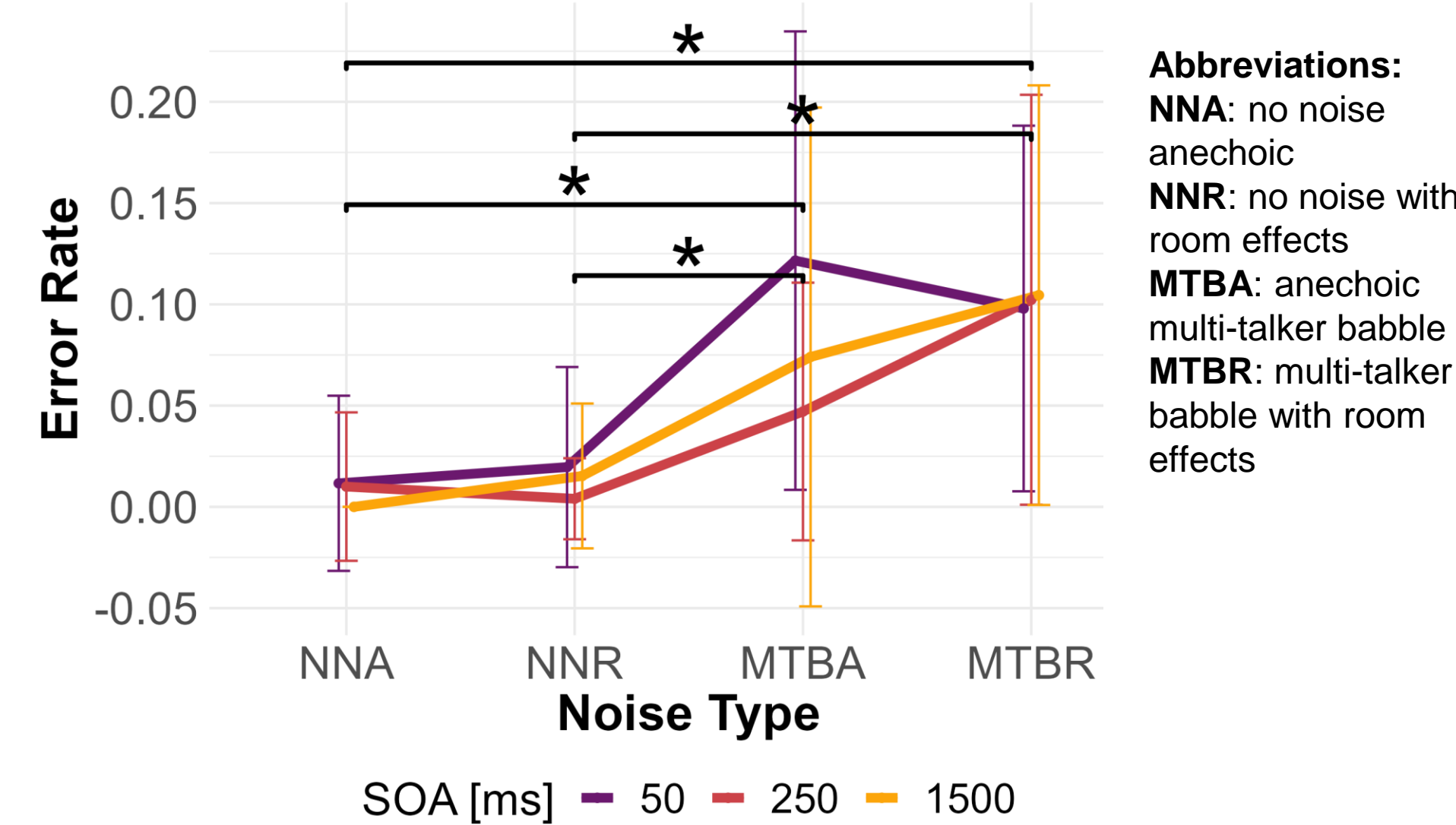


## Study Aims & Design

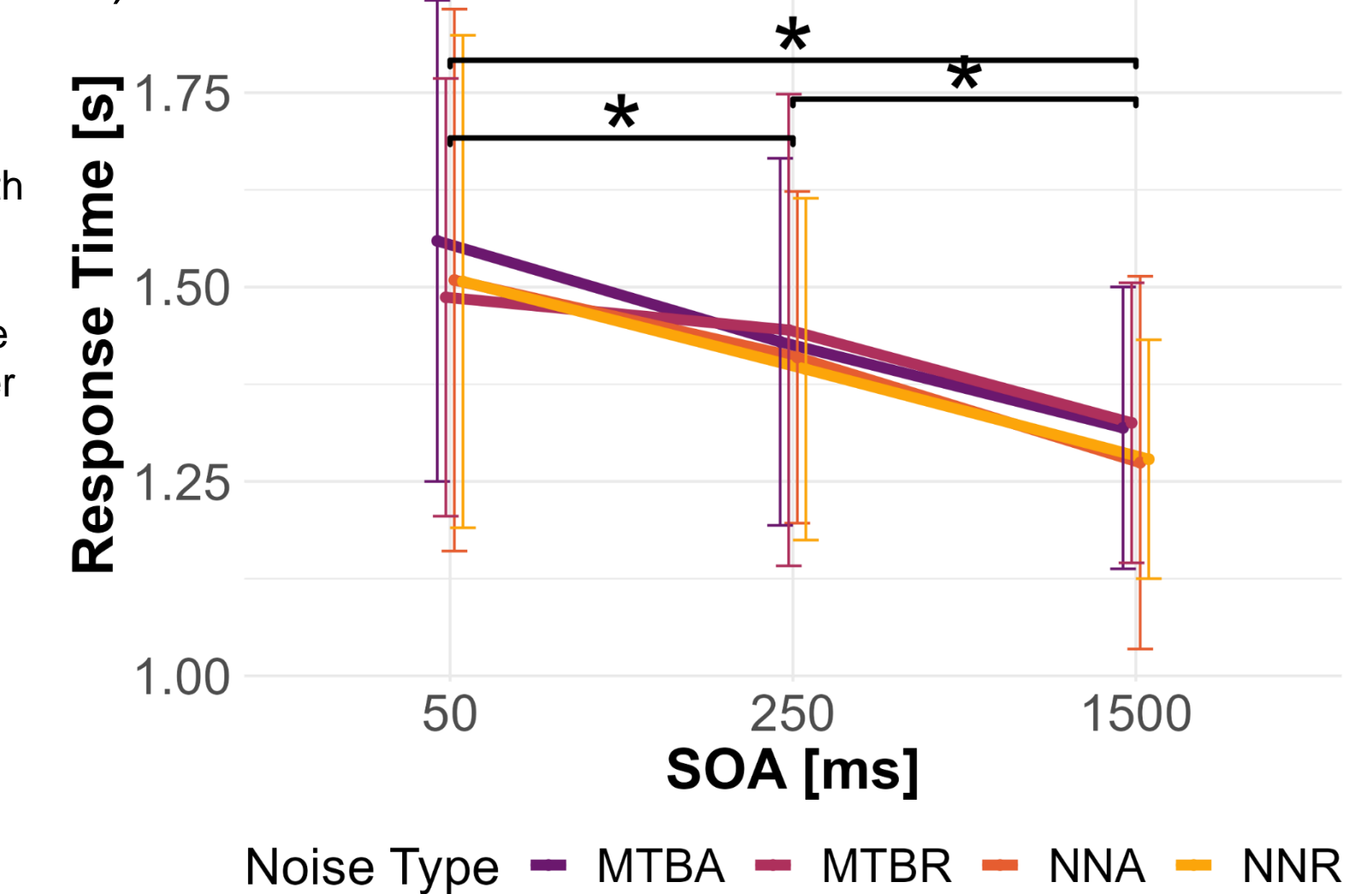
- Concurrent dual-task paradigms objectively measure listening effort in adults but are ambiguous in children [1].
- Psychological refractory period effect: a reaction-time effect, leading to increased reaction times with shorter stimulus onset asynchronies (SOAs), initiated by simultaneous processing of two stimulus-response streams [3]  
→ prolonged “bottleneck” in stimulus-response processing and higher cognitive cost for multitasking [3]
- This study introduces a child-appropriate sequential dual-task paradigm: tasks were performed consecutively with varying SOA [2].
- Two tasks: decision task and word recognition task - conducted in quiet and with multi-talker babble noise in two binaural acoustic scenarios: anechoic and with simulated classroom effects (comprising a reverberation time of  $T_{30} = 0.63s$ )
- Stimuli were auralized binaurally in a virtual classroom [5] using RAVEN [6].
- Preliminary data analysis examined effects from SOAs and the impact of noise and acoustic scenario on word recognition error rate and response time.

## Results for Word Recognition Task

2x2x3 rm ANOVA (noise x room effects x SOA) on error rates: Significant main effect of noise  $F(1, 24) = 69.72$ ,  $p < .001$ ,  $\eta_p^2 = .74$ , and acoustic scenario  $F(1, 24) = 5.49$ ,  $p < .028$ ,  $\eta_p^2 = .19$

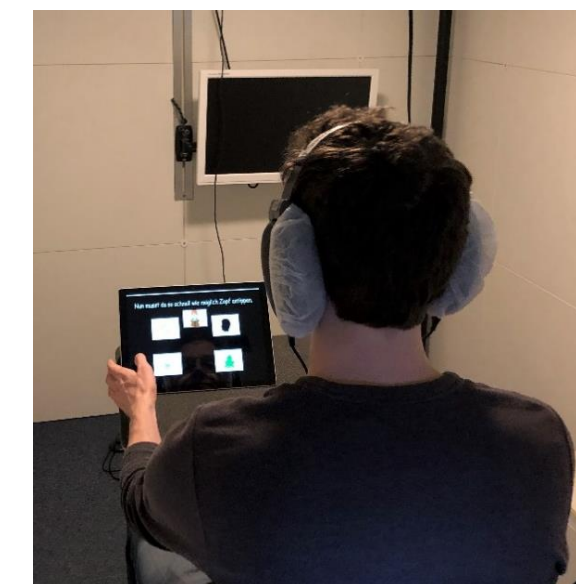


2x2x3 Greenhouse-Geisser corrected rm ANOVA (noise x room effects x SOA) on response times: Significant main effect of stimulus onset asynchrony ( $F(1.34, 32.09) = 38.04$ ,  $p < .001$ ,  $\eta_p^2 = .61$ )



## Population

- 26 participants, aged 20-30 (mean 23.6, 53.8% female)
- Normal hearing (within 20dB HL), no ADHD or epilepsy, normal/corrected-to-normal vision and fluent in German
- 1 dataset discarded due to task misunderstanding
- Informed consent obtained from all participants, 10€ voucher compensation



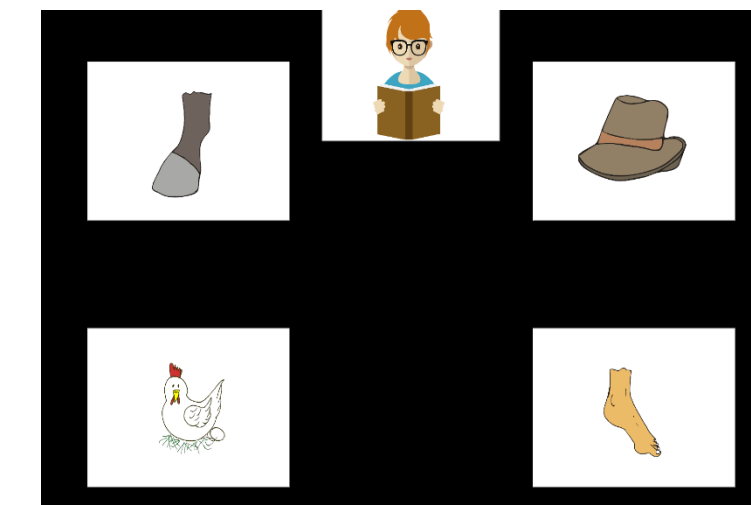
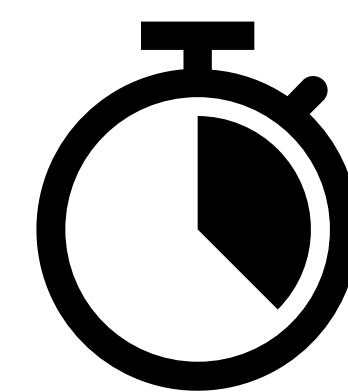
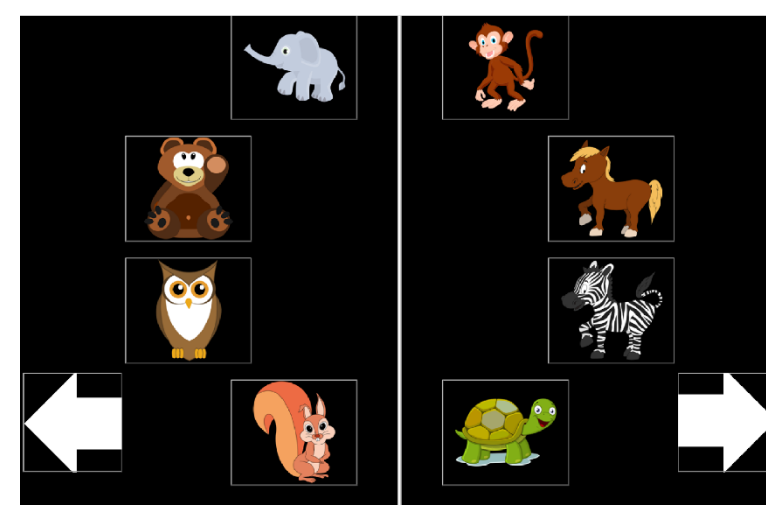
## Conclusion

- Multi-talker babble noise and room effects impact error rate but not processing time.
- SOA affects processing time but not error rate.
- Psychological refractory period effect confirms paradigm concept [2, 3].
- Unexpected: no interaction between SOA and noise

## Outlook

- Further data analysis will investigate:
  - Discern masking effects from listening effort
  - Explore the relationship between processing time and error rate for effects of SOA and noise conditions

## Experiment Procedure



**Decision task:**  
Is the bear on the right or left?

**SOA**  
50ms - 250ms - 1500ms

**Word recognition task:**  
Which word did you hear?

## References

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