

A Comparison of Behavioral Measures of Processing Load in Children

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HEaring Across the Lifespan
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Some Definitions

Effort is the deliberate allocation of resources to overcome obstacles when carrying out a task (Pichora-Fuller et al., in press).

Listening effort is a specific form of *mental* effort that occurs when a task involves listening (Pichora-Fuller et al., in press).

Can be quantified subjectively, behaviorally, or physiologically

Processing load is the magnitude of mental effort applied during a task.

May vary based on task-imposed demands as well as the motivation and available resources of the listener.

Measuring Processing Load

- ★ – Speech response-times
 - McCreery & Stelmachowicz, 2013
 - Gustafson et al., 2014
- ★ – Dual-task paradigms
 - Picou & Ricketts, 2014
 - Hicks & Tharpe, 2002
- Physiological measures
 - Mackersie & Cones, 2011
 - Zekveld et al., 2010
- Memory tasks
 - Amichetti et al., 2013



Expectations

Speech Response-Times

- Latency of word recall is larger when task demands are increased by increasing noise levels

Dual-Task Paradigms

- Primary Task performance (words correct) remains the same in single– and dual-task conditions
- Latency of the secondary task response (RT) increases from single- to dual-task conditions
 - RT is further delayed when task demands are increased by increasing noise levels

The purpose of this study was to compare two measures of processing load (Speech Response-Time and Dual-Task Paradigm) in school-age children to examine the effects of listening difficulty within each method.

Participants

37 children with normal hearing

Thresholds ≤ 15 dB HL from 250-8000 Hz

6.0 to 12.92 years of age ($M = 8.92$, $SD = 2.22$)

Dual-Task Paradigm

Primary Task: Recognition of Isophonemic AB word lists

+4, 0, -4 dB SNR in multi-talker babble (Boothroyd, 2008)

Secondary Task: Visual monitoring task



Measures of Processing Load

Speech Response-Time

Vocal RT using the primary task (word recognition)

- Time elapsed from onset of stimulus to onset of response

Dual-Task Paradigm

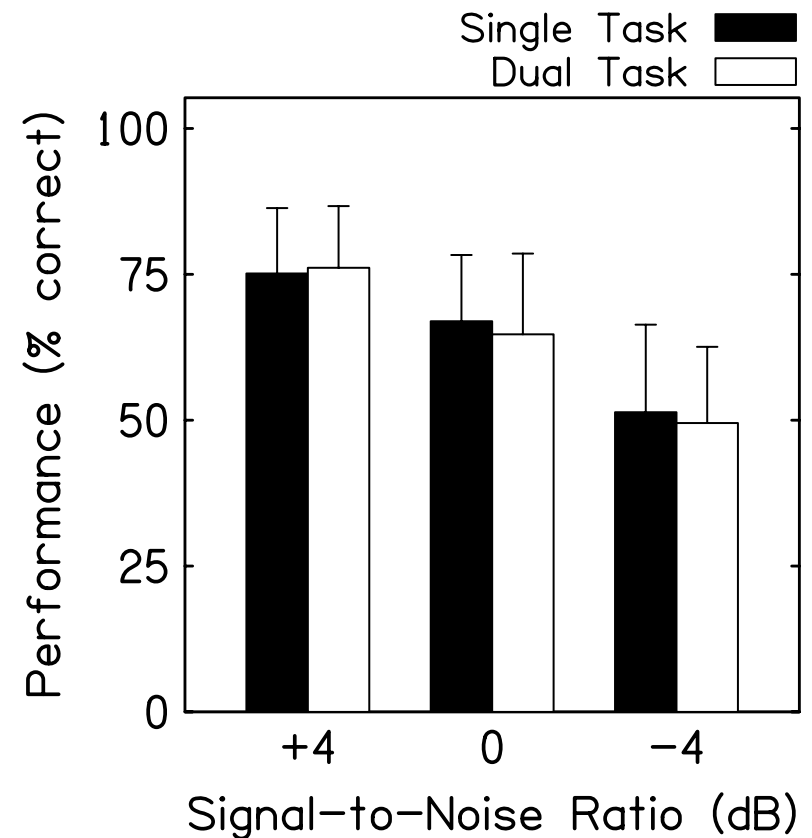
Visual RT using a dual-task paradigm

- Time elapsed from flash to button press
- Percent change = $100 * \frac{\text{dual task} - \text{single task}}{\text{single task}}$

Results: Word Recognition

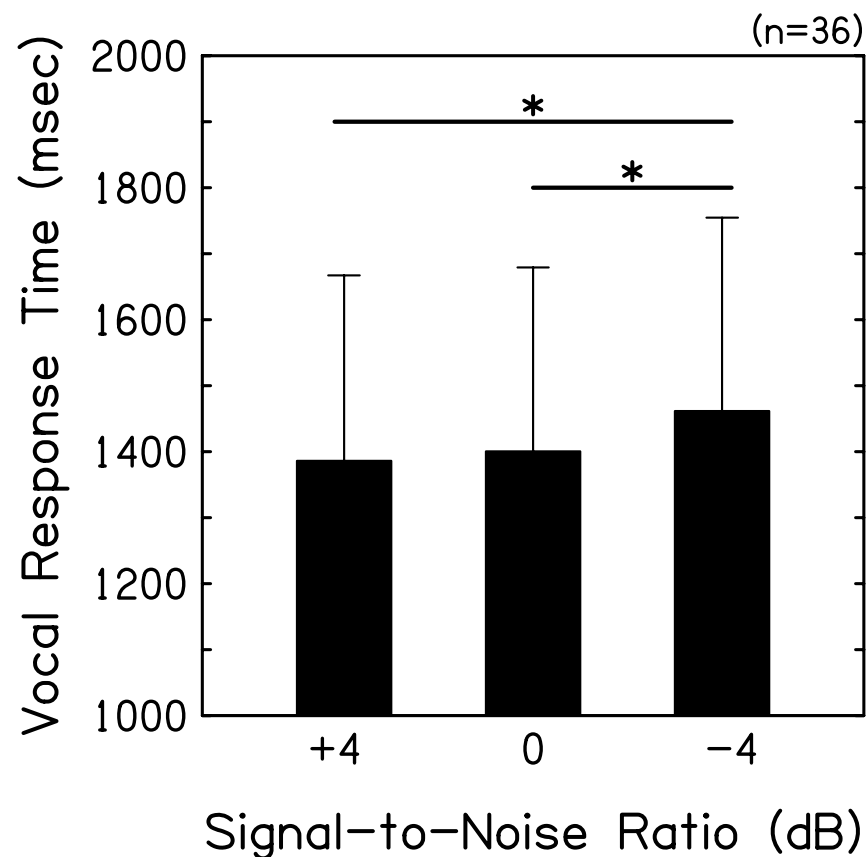
No difference in word recognition performance between single- and dual-task conditions ($p=.445$)

Performance significantly reduced with each increase in noise level ($p<.001$)



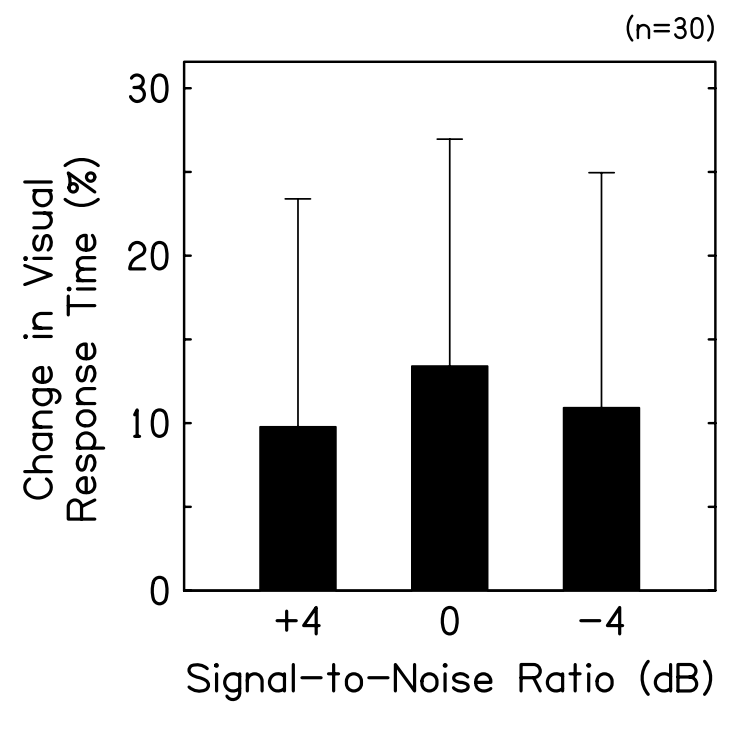
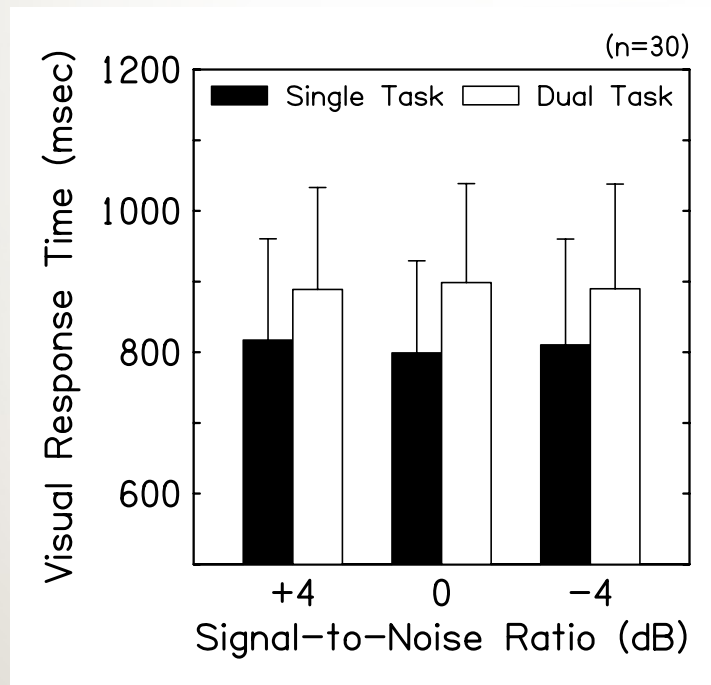
Results: Speech Response-Time

Vocal RT was longer in more difficult SNR conditions ($p < .001$).



Results: Dual-Task Paradigm

Visual RT was significantly longer in dual-task condition compared to single-task condition ($p < .001$).



No significant percent change in Visual RT as SNR became poorer ($p = .893$).

Conclusions

When demands on task completion were increased by worsening the SNR, children showed increases in processing load as measured by the Speech Response-Time method but not the Dual-Task Paradigm.

Discussion & Future Directions

- Correct vs Incorrect Responses
- Secondary Task Difficulty
 - Picou & Ricketts (2014)
 - Simple vs Semantic processing
 - Howard, Munro, & Plack (2010)
 - Memory-based
- Up next: children with hearing loss

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