The Text Reception Threshold as a Measure for the Non-Auditory Components of Speech Understanding in Noise

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The online version of this presentation shows reduced results because the data analysis is still ongoing.
text reception threshold (TRT)

Visual analogue to Speech Reception Threshold

→ measure the non-auditory side of speech comprehension

"the driver looks at his watch"

46% of text visible

52% of text visible

“the driver looks at his watch”
the story of this study

**background:** reported associations of SRT with WM capacity and processing speed

weak associations of TRT with these factors

**aim:** strengthen TRT’s associations with WM capacity and speed

**approach:** 4 new TRT versions with increased speech anlogy (timing, volatility)

**evaluation:** test TRT versions along with SRTs, WM capacity, processing speed

**population:** 55 NH healthy adults, age 18 – 78

<table>
<thead>
<tr>
<th>age</th>
<th>N</th>
<th>% men</th>
<th>edu</th>
<th>PTA\textsubscript{TEST}</th>
<th>PTA\textsubscript{NON}</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>11</td>
<td>36.4</td>
<td>5.9</td>
<td>3.5</td>
<td>4.4</td>
</tr>
<tr>
<td>30-39</td>
<td>11</td>
<td>18.2</td>
<td>6.2</td>
<td>3.3</td>
<td>5.1</td>
</tr>
<tr>
<td>40-49</td>
<td>13</td>
<td>23.1</td>
<td>6.3</td>
<td>6.2</td>
<td>8.9</td>
</tr>
<tr>
<td>50-59</td>
<td>12</td>
<td>33.3</td>
<td>5.9</td>
<td>10.4</td>
<td>12.3</td>
</tr>
<tr>
<td>&gt;= 60</td>
<td>8</td>
<td>25.0</td>
<td>4.5</td>
<td>11.7</td>
<td>15.9</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>44.0</td>
<td>55</td>
<td>27.3</td>
<td>5.9</td>
<td>6.8</td>
</tr>
</tbody>
</table>

PTA calculated on octaves .5 - 4 kHz
tests administered

**SRT (speech reception threshold)**
- Signal-to-noise ratio needed to correctly understand 50% of sentences
  - lower = better
- in stationary noise ($SRT_{STAT}$) and in fluctuating noise ($SRT_{MOD}$)
- 3 test runs per masker

**TRT (text reception threshold)**
- Percentage of unmasked text needed to correctly read 50% of sentences
  - lower = better
- 5 versions
- 4 test runs per version

**RSpan (reading span)**
- Test of Working Memory (WM) capacity
- 12 blocks of 3-6 semantically correct & incorrect sentences
- task: judge semantics (good/nonsense), recall target words (subjects and objects)
- absolute no. recalled words, max = 54
  - higher = better

**LDST (letter-digit-substitution test)**
- Test of processing speed
- absolute number of correctly substituted letters
  - higher = better
TRT test versions

**TRT\textsubscript{ORIGINAL}**

The subject reads aloud a bar-masked sentence, which is built up word-wise. The full sentence remains on the screen for 3500 ms.

**TRT\textsubscript{500}**

Like $TRT\textsubscript{original}$ but the presentation time of the full sentence is reduced to 500 ms.

**TRT\textsubscript{CENTER}**

Sentence words are presented one at a time in the center of the screen.

**TRT\textsubscript{MOVING}**

Sentence words are presented one at a time at their sentence-specific positions.

**TRT\textsubscript{MEMORY}**

Like $TRT\textsubscript{500}$ but the subject reads two sentences in a row before repeating both.
The new TRT tests are more difficult, have a larger range, and a higher reliability.
summary of results & conclusions

• new TRT tests:
  more difficult, larger score range, higher reliability
  stronger associations with WM capacity and processing speed

• all TRT tests correlate with SRT\textsubscript{MOD}, some with SRT\textsubscript{STAT}

• controlling for age:
  only TRTs with memory components correlate with working memory capacity
  SRTs do not correlate with WM capacity or processing speed
  correlations of TRTs with SRTs remain, though weaker

• TRT\textsubscript{500} strongest TRT predictor for the SRT\textsubscript{MOD}
  (variance in SRT\textsubscript{MOD} explained by age and TRT\textsubscript{500}: 49%)
• TRT\textsubscript{CENTER} strongest TRT predictor for the SRT\textsubscript{STAT}
  (variance in SRT\textsubscript{STAT} explained by education and TRT\textsubscript{CENTER}: 29%)

• assumption that TRT should correlate with our (current tests of) WM capacity and processing speed needs to be revised

• other cognitive factors might be more relevant for speech understanding, i.e., linguistic skills like vocabulary size