

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.

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text reception threshold (TRT)

Visual analogue to Speech Reception Threshold

→ measure the non-auditory side of speech comprehension



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 analogy (timing, volatility)

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

population: 55 NH healthy adults, age 18 – 78

	age	N	% men	edu	PTA _{TEST}	PTA _{NON}
	< 30	11	36.4	5.9	3.5	4.4
	30-39	11	18.2	6.2	3.3	5.1
	40-49	13	23.1	6.3	6.2	8.9
	50-59	12	33.3	5.9	10.4	12.3
	>= 60	8	25.0	4.5	11.7	15.9
total	44.0	55	27.3	5.9	6.8	9.0

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

T	W	C	G	J	V	B	D	P	V	P	T	D	C	B
3	1	8	7	9	5	2	6	4	5					



TRT test versions

TRT_{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.

TRT₅₀₀

Like *TRT_{original}* but the presentation time of the full sentence is reduced to 500 ms.

TRT_{CENTER}

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

TRT_{MOVING}

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

TRT_{MEMORY}

Like *TRT₅₀₀* but the subject reads two sentences in a row before repeating both.



means, SDs, reliabilities

		mean	SD	range	ICC	SEM
SRTs	SRT_{MOD}	-7.56	1.64	8.40	.43	1.24
	SRT_{STAT}	-3.09	.83	3.60	.52	.58
TRTs	TRT_{ORIGINAL}	55.99	2.81	13.80	.64	1.69
	TRT₅₀₀	58.89	4.41	18.30	.81	1.92
	TRT_{CENTER}	59.73	5.36	26.10	.79	2.46
	TRT_{MOVING}	62.71	5.41	22.50	.83	2.23
	TRT_{MEMORY}	64.30	6.27	27.10	.79	2.87
Cognition	RSpan	18.93	5.62	27.00	n/a	n/a
	LDST	36.58	6.60	29.00	n/a	n/a
Others	age	43.95	14.18	60.00	n/a	n/a
	PTA	6.80	5.03	21.25	n/a	n/a
	education	5.85	1.25	4.00	n/a	n/a

n/a – not applicable

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_{MOD} , some with SRT_{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_{500} strongest TRT predictor for the SRT_{MOD}
(variance in SRT_{MOD} explained by age and TRT_{500} : 49%)
- TRT_{CENTER} strongest TRT predictor for the SRT_{STAT}
(variance in SRT_{STAT} explained by education and TRT_{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

