

INTRODUCTION

- To comprehend speech, listeners must quickly and efficiently employ two processes (Dahan & Tanenhaus, 2004):
 - 1) Activate lexical candidates consistent with the speech signal
 - 2) Activate semantic features of these candidates
- Under *ideal listening conditions*, listeners immediately activate many lexical candidates that match early portions of the input. Candidates compete over time until only one remains (Marslen-Wilson, 1987).
- When listening in *high-intensity noise*, adults are slower to initiate lexical access and slower to suppress lexical competition, relative to listening in quiet (Ben-David et al., 2011; Brouwer & Bradlow, 2016).
- It is unknown how the presence of a *low-intensity masker* affects the time course of real-time spoken word recognition, including lexical access and semantic activation.
- Even when word recognition accuracy is high, energetic and/or informational masking may impact real-time processing.

RESEARCH QUESTION

What are the effects of low-intensity speech-shaped noise (SSN) and two-talker speech (TTS) maskers on real-time spoken word recognition in adults with typical hearing?

METHOD

Participants

- 20 typically hearing adults (11 F, 9 M), ages 20-34 ($M = 25.8$ years)

Adaptive Masked Speech Recognition Task

- 4-alternative forced choice task using 2-down, 1-up procedure to estimate signal-to-noise ratio corresponding to 70% accuracy (SNR-70)
- Tasks completed separately in SSN and TTS
- Same visual and auditory stimuli as VWP (described below)

Visual World Paradigm (VWP) Eye-Tracking Task

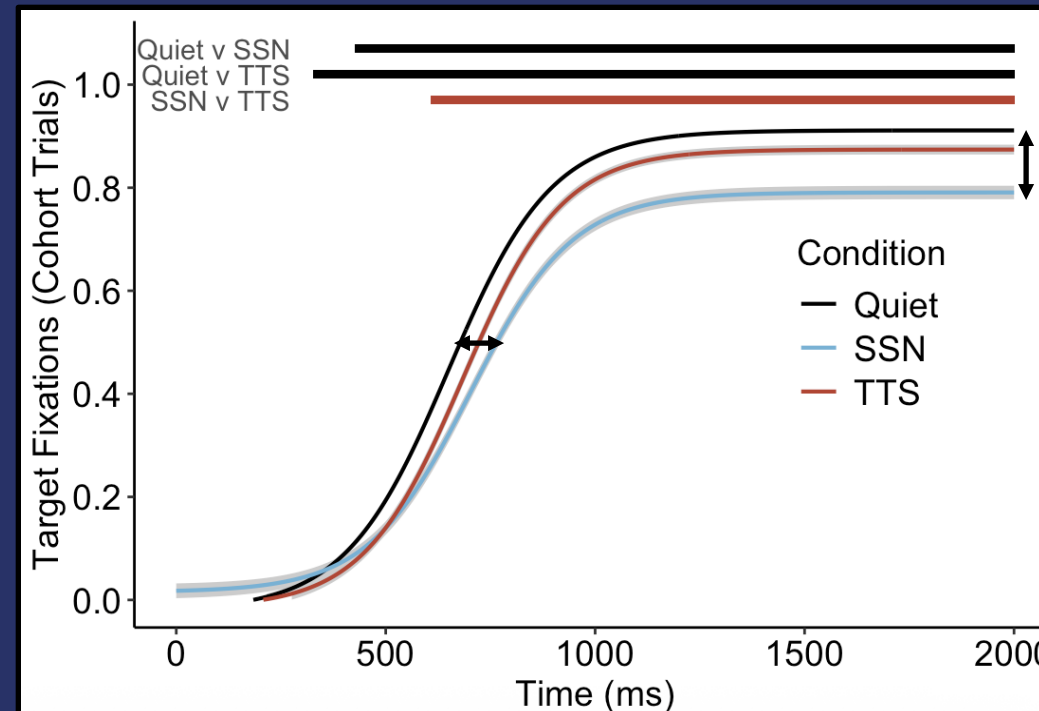
- Isolated target words presented via loudspeaker
- Screen contains four pictures: one target, two unrelated items, and either a phonologically similar cohort (e.g., *puppy*, *puppet*; **Cohort Trial**) or semantically related item (e.g., *helmet*, *armor*; **Semantic Trial**)
- Participant clicks on picture corresponding to target word
- Each participant completes 112 each of cohort and semantic trials, interleaved
- Eye movements recorded & analyzed every 4 ms
- Eye fixations index the extent to which participant is considering each item
- Analyses include only correct trials
- Each participant completed 3 conditions, counterbalanced:
 - 1) **Quiet**
 - 2) **SSN**, presented at SNR-70 + 10 dB
 - 3) **TTS**, presented at SNR-70 + 15 dB
- Individual SNRs were set with the goal that accuracy would remain at ceiling-level performance

		Quiet	SSN	TTS
SNR	Mean	-	4.2 dB	6.0 dB
	SD	-	1.5 dB	4.0 dB
	Range	-	1 to 6 dB	-2 to 13 dB
Accuracy on Cohort Trials	Mean	99.3%	95.4%	96.5%
	SD	1.9	3.2	2.2
	Range	92.0 to 100%	85.7 to 99.1%	92.9 to 100%
Accuracy on Semantic Trials	Mean	99.4%	99.4%	99.4%
	SD	1.0	1.4	1.1
	Range	96.4 to 100%	93.8 to 100%	95.5 to 100%

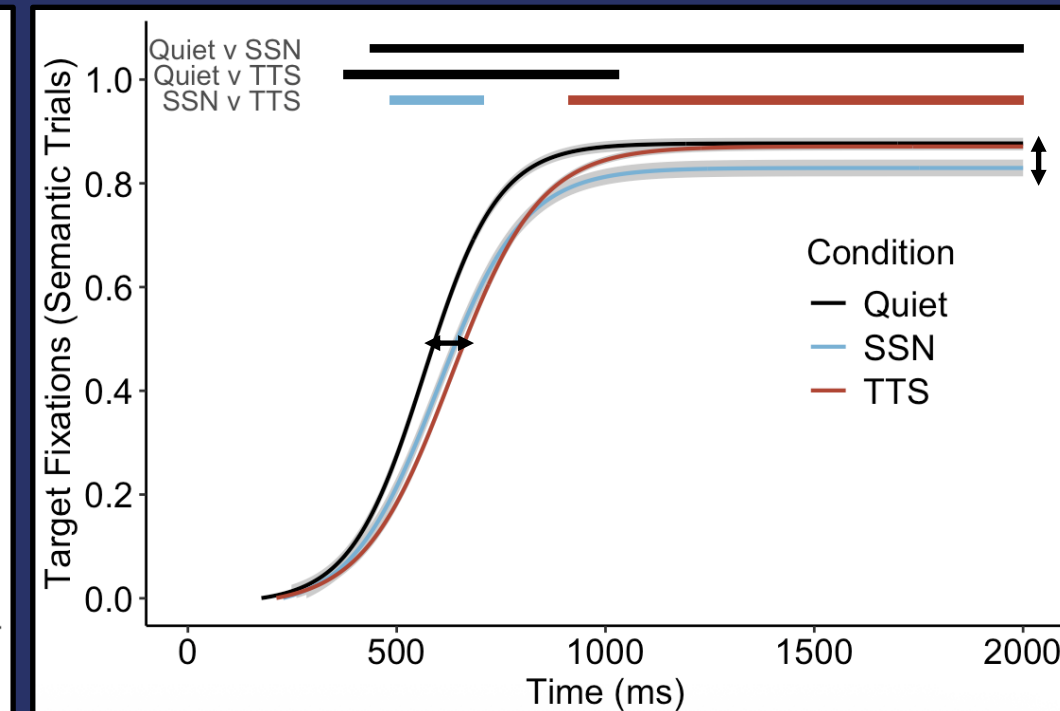
SNR and accuracy in each eye-tracking condition.

RESULTS

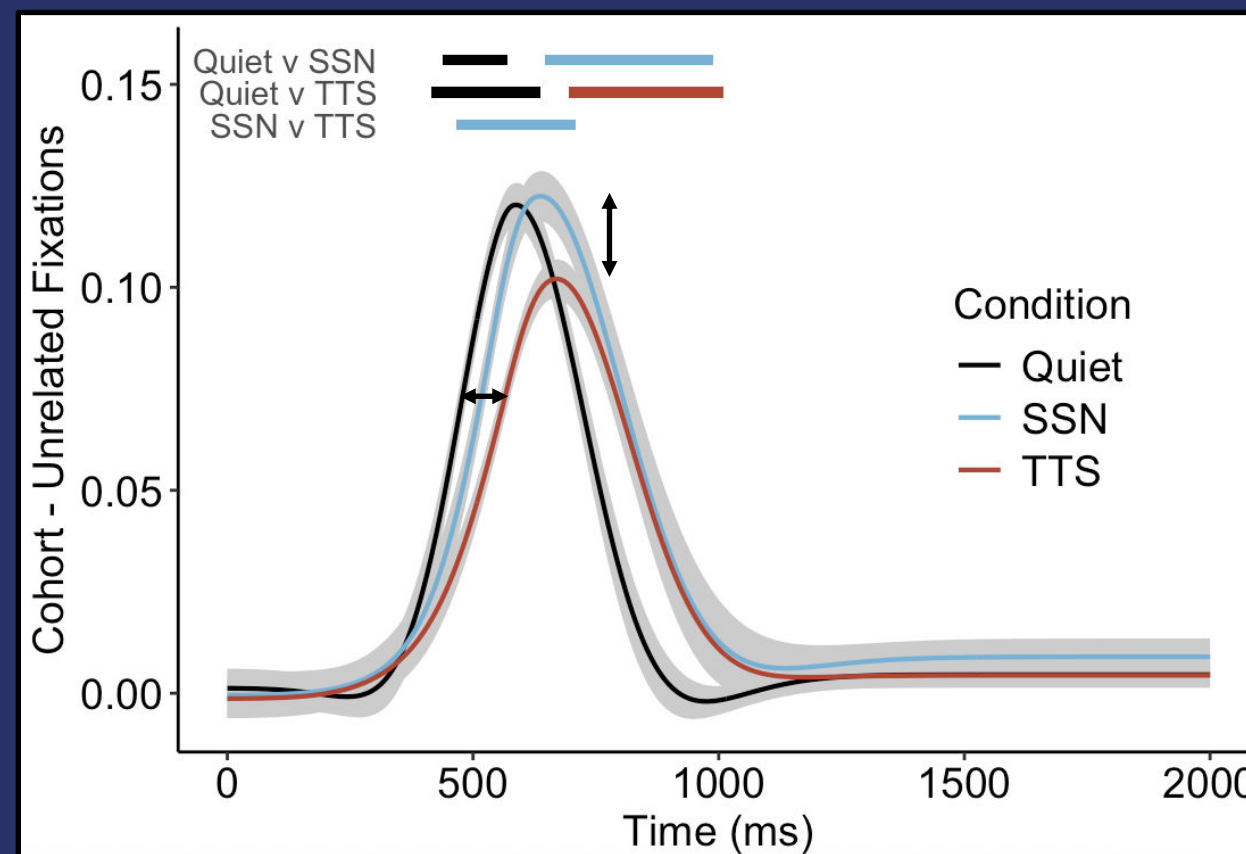
Looks to Target - Cohort Trials Only



Looks to Target - Semantic Trials Only



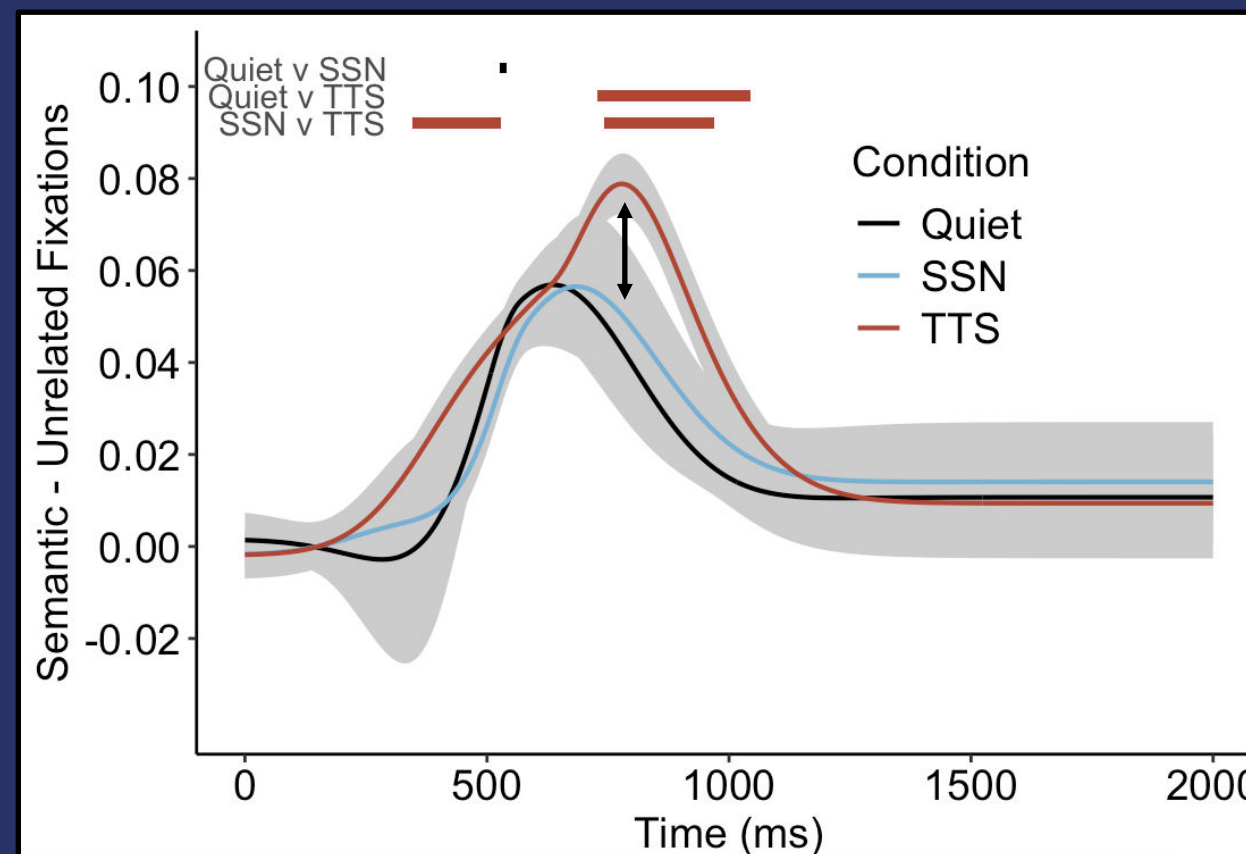
Looks to Cohort Competitor



Note: Horizontal bars = time periods during which groups significantly differ

Cohort fixations (lexical competition) are delayed in both SSN and TTS, but reduced only in TTS.

Looks to Semantic Competitor



Semantic fixations (semantic activation) are overactivated in TTS and unaffected in SSN.

CONCLUSIONS

- Relative to listening in quiet, the presence of both low-intensity SSN and TTS delayed lexical access in adults with typical hearing, even when accuracy was unaffected and no phonological competitors were present.
- TTS, and to a lesser extent SSN, reduces adults' commitment to the target at the end of the trial.
- Both SSN and TTS delayed lexical competition (cohort fixations). However, only TTS reduced lexical competition.
- TTS, but not SSN, resulted in increased semantic activation.

DISCUSSION

- Even when word recognition accuracy is very high, low-intensity SSN and TTS maskers delay lexical access and reduce lexical resolution among young adults with typical hearing.
- The perceptual glimpsing afforded by TTS (but not SSN) may support better lexical resolution and listeners' confidence in the word they think they hear.
- The presence of low-intensity noise or competing talkers appears to reduce real-time speech processing efficiency in young adults with typical hearing, even when word recognition accuracy remains excellent.

REFERENCES

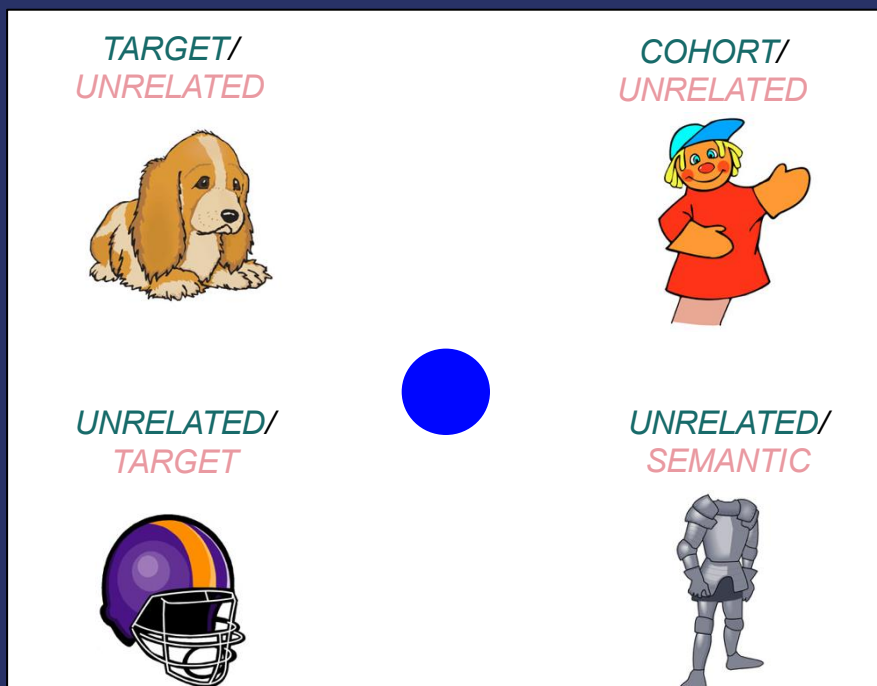
Ben-David et al. (2011). *JSLHR*, 54, 243-262.
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Example of visual stimuli. Items labeled by their roles in a cohort trial vs. a semantic trial.