The effect of speech rate on comprehension of degraded speech

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Motivation

- Semantic prediction facilitates language comprehension at a moderate level of speech degradation[1].
- But prediction is a time consuming process[2].
- The time available to process spoken language also moderates comprehension and prediction[3].

Research Aim

- To investigate whether the increase (and decrease) in speech rate reduces (and amplifies) the facilitatory effect of semantic predictability that has been observed for *moderately degraded speech*.

Predictions

- Fast speech — Contextual facilitation will be reduced compared to normal speech.
  - Processing demand increases.
  - A limited time available to process the context and form predictions.
- Slow speech — Contextual facilitation will be increased compared to normal speech.
  - More time available to process the degraded speech and the context.
  - Effortful processing of degraded speech is reduced.

Methods

Experiment 1

- To compare Fast speech and normal speech.
  - n = 101 (66 female)
  - Age range = 18-30 years (mean age = 23.1 years)

Experiment 2

- To compare Slow speech and normal speech.
  - n = 101 (60 female)
  - Age range = 18-30 years (mean age = 23.5 years)

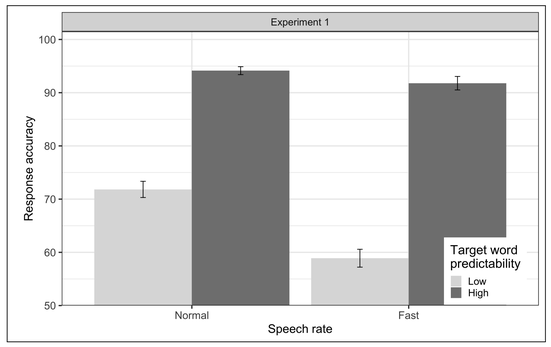
Stimuli

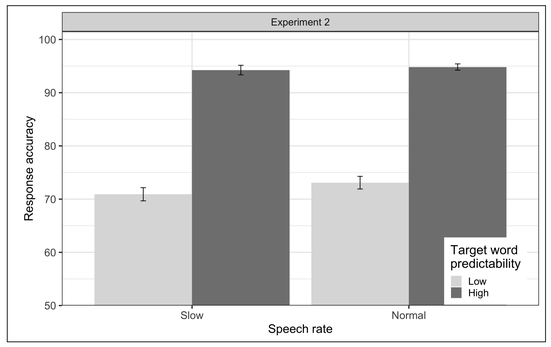
- 240 Subject-Verb-Object German sentences
  e.g., Sie jongliert die Baelle. (She juggles the balls.)
  - 2 levels of predictability: High and Low
  - Degradation: 4 channels noise vocoding
- Experiment 1: Compression factor of 0.65 to create fast speech
- Experiment 2: Expansion by a factor of 1.35 to create slow speech

Instruction

"Listen to the speech, and type in everything that you hear."

Results





Experiment 1 Estimated effects of the model accounting for the correct word recognition

Fixed effects	Estimate	Std. Error	*z* value	*p* value
Intercept	1.34	.24	5.58	<.001
Speech rate (Fast)	-.98	.24	-4.16	<.001
Target word predictability	2.42	.28	8.55	<.001
Speech rate × Target word predictability	1.06	.42	2.50	.012

Experiment 2 Estimated effects of the model accounting for the correct word recognition

Fixed effects	Estimate	Std. Error	*z* value	*p* value
Intercept	1.41	.23	6.20	<.001
Speech rate (Slow)	-.08	.14	-.57	.568
Target word predictability	2.58	.30	8.65	<.001
Speech rate × Target word predictability	.44	.27	1.65	.099

Summary

- At a moderate level of degradation, fast speech is detrimental to understanding words that are not easily predictable from the sentence context.
- More time to process degraded speech does not amplify contextual facilitation.
  - There might be an optimal trade-off between slowing down of the speech and it still remaining intelligible.
- **Implications** in the predictive language processing accounts (e.g., prediction by production[4]): to incorporate the boundary conditions (speech rate and degradation) in forming predictions.

References

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