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Clear speech promotes speaking rate normalization



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Introduction

In circumstances that challenge speech comprehension (e.g., loud room, hearing-impaired listener), talkers tend to use **clear speech**, which is generally slower and louder (Pichory et al., 2005, 2006; Uchikawa, 2005)

In better listening conditions (e.g., quiet room, normal-hearing listener), talkers tend to use **conversational speech**, which is generally faster and less loud

Other research shows that changes in speaking rate can alter speech perception (Wolfe & Liberman, 1979; Summerfield, 1982; Stilp, 2020)

- For example, if a sentence is spoken quickly, the next sound can be perceived as having a longer voice onset time (e.g., /t/ in "tier")
- If a sentence is spoken slowly, the next sound can be perceived as shorter voice onset time (e.g., /d/ in "deer")
- This is called a **temporal contrast effect**

We tested whether **clear** and **conversational** speech (and their differences in speaking rate) produce a temporal contrast effect

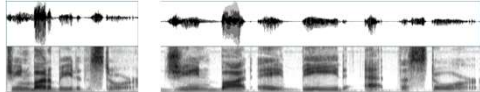
Methods

Participants

22 native English speakers with no known hearing impairments

Stimuli

Context Sentences: "Jean bought a bead from the store" spoken by a male talker (Ferguson, 2004)



Conversational version
1342 ms duration
5.22 syllables / sec

Clear version
3351 ms duration
2.09 syllables / sec

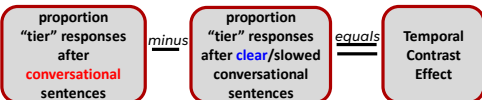
Slowed conversational version

- Multipled the duration of the **conversational** sentence by 2.5, making its duration 3351 ms (same as **clear** version)

Targets: Series of 10 words varying from "deer" to "tier"

Procedure

- Conducted on Gorilla (Anney-Traflet et al., 2020)
- Headphone screen (Wood et al., 2017)
- Practice: 20 sentences paired with endpoint "deer" & "tier"
 - ≥80% categorization accuracy needed to continue to test
- Test: 160 trials in each of two blocks
 - Block 1: **Clear** vs. **Conversational** sentences
 - Block 2: **Slow** (slowed Conversational) vs. **Conversational** sentences



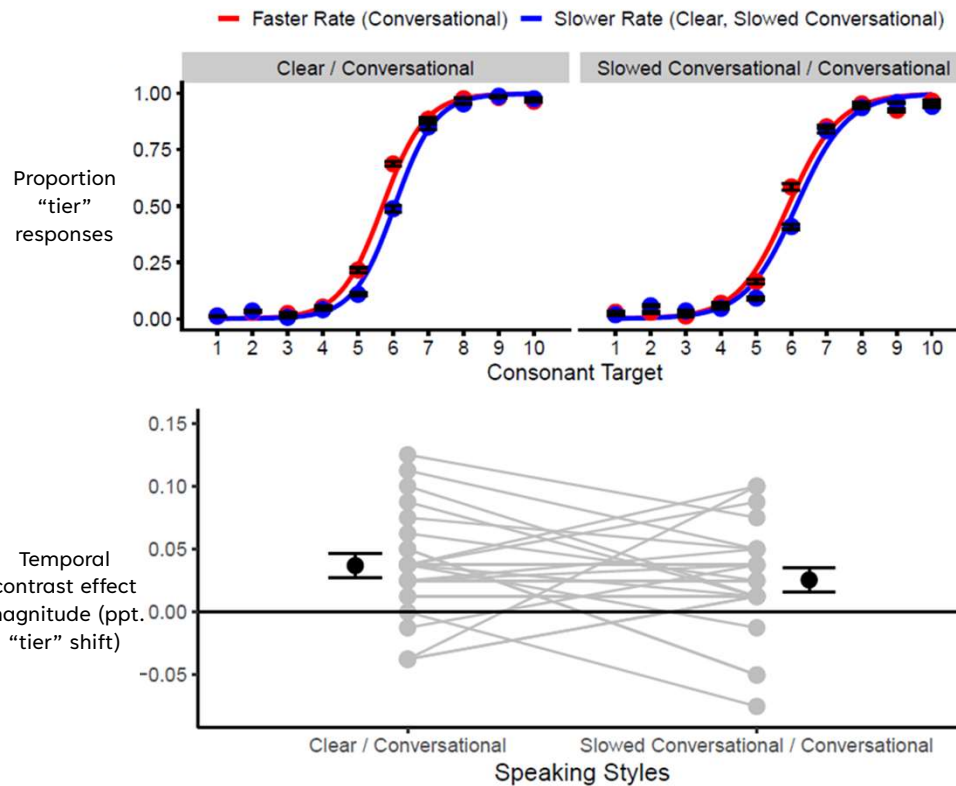
Results

Clear speech can induce temporal contrast effects,

LMER fixed effect of Rate: $Z = 4.89, p < .001,$

and the magnitude was *not* different using slowed conversational speech,

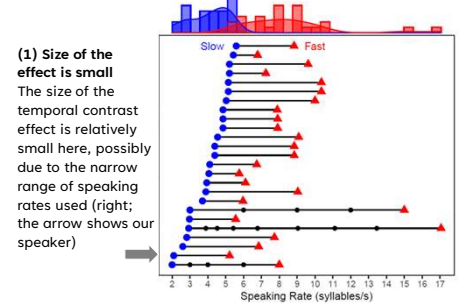
LMER Rate-by-Block interaction: $Z = -1.57, p = .12$



Stimuli, data, & analysis scripts available: osf.io/uq29c

Discussion

Clear speech can produce temporal contrast effects: Slow (**clear**, slowed conversational) and fast (**conversational**) sentences produce similar size contrast effects in word recognition



(1) **Size of the effect is small**
The size of the temporal contrast effect is relatively small here, possibly due to the narrow range of speaking rates used (right; the arrow shows our speaker)

(2) **Not everyone produces clear speech the same way**
The talkers from the Ferguson (2004) database were not instructed to change speaking rate in the different conditions. Large variability exists in how different talkers produce clear speech. Left are speaking rates for 40 talkers all saying "Jean bought a bead from the store" in **clear** and **conversational** styles.

Due to this extreme variability in speaking rate, results might depend upon the talker chosen and the instructions talkers receive as to how produce clear speech

(3) **Clear speech might alter perception of speech sounds in unintended ways**

Speakers might slow down to make their speech more intelligible to people with a communication barrier (hearing loss, nonnative speakers), but it could alter temporal cues that listeners use to perceive speech sounds

References

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