

Introduction

Research has shown a relationship between *word duration* and *the number of times it has been mentioned* in a discourse.

Increased redundancy = decreased duration

REDUCTION IN ENGLISH:

➤ Second mentions of a word are reduced in duration, with no significant effect of subsequent mentions

REDUCTION IN ASL FINGERSPELLING:

➤ Small scale studies on fingerspelling in American Sign Language (ASL) show reduction continuing past the second mention of a token.

➤ **Main hypothesis:** Fingerspelled words continue to reduce past their second mention, decreasing in the amount they reduce with each repetition.

Research questions

- 1) As fingerspelled words are repeated in a discourse, does the degree to which a word reduces vary following the second mention?
- 2) How is variation in this pattern accounted for by 1) phrasal position AND 2) distance between mentions?

Previous work on repetition reduction

➤ Old, repeated words are reduced in duration (Fowler & Housum 1987, Bell et al. 2009)

➤ Reduction does not significantly increase after second mention in English dialogue (Bell et al. 2009)

➤ ASL fingerspelling reduction appears to continue past second mention:

- Significant increase in signing rate between the second and third token (Wager 2012)
- Reduction continues across four mentions of two words (Lepic 2019)
- Increase in coarticulation across mentions (Lepic 2019, Wager 2012, Thumann 2012)

Language production theories of reduction

Reduction theorized (Aylett and Turk 2004) to be as a result of contrasting pressures of:

- producing robust communication
- efficiently expending articulatory effort

This leads to an inverse relationship between redundancy and articulatory effort.

Preliminary results

Mean log-duration of fingerspelling tokens across repetitions

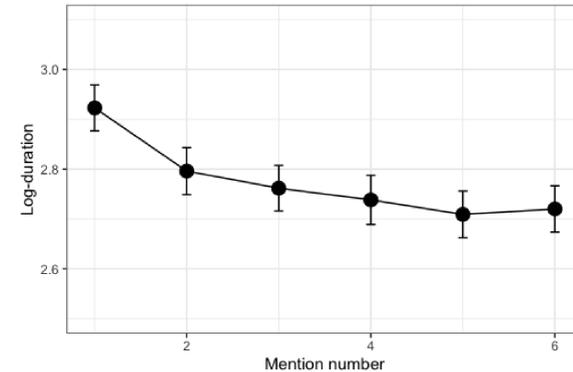


Figure 1: Effect of mention number on duration

Comparing mention means
(via Helmert contrast coding):

| Contrast | Estimate | p-value |
|-----------------------------|----------|-----------|
| 1st vs. subsequent mentions | 0.171 | <0.001*** |
| 2nd vs. subsequent mentions | 0.060 | 0.026* |
| 3rd vs. subsequent mentions | 0.038 | 0.190 |

➤ General trends in fingerspelling reduction show words reducing past the second mention.

➤ Amount of reduction decreases following the second mention.

➤ Difference between mean duration of third and subsequent mentions was not significant

Interim conclusion: Fingerspelled words show a significant pattern of reduction past their second mention, decreasing in the amount of reduction past the second mention.

The influence of phrasal position and distance between mentions

Additional analysis were conducted to test the robustness of reduction trend by testing the effect of additional factors that might influence token duration.

Log-duration of tokens by phrasal position

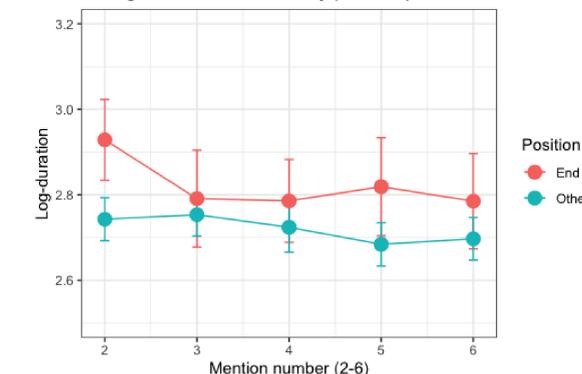


Figure 2. Mean duration of tokens by phrasal position (end vs. other)

Duration vs. distance between tokens

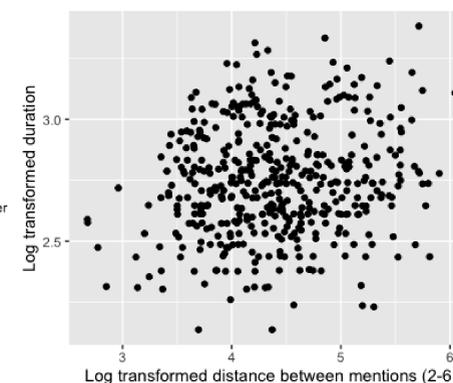


Figure 3. Comparing token duration and distance from preceding token

The effect of mention number, phrasal position, and distance between tokens was analyzed using linear mixed models.

| Fixed effect | Estimate | Standard Error | t value | p-value |
|---------------------------|----------|----------------|---------|-----------|
| Mention number | -0.016 | 0.004 | -3.463 | <0.001*** |
| Position (other) | -0.091 | 0.016 | -5.596 | <0.001*** |
| Distance between mentions | 0.055 | 0.011 | 4.867 | <0.001*** |

Random effects included for signer and token

➤ Phrase final tokens are significantly longer in duration

➤ Significant, positive relationship between distance between mentions and duration

Methodology

Dataset

➤ Corpus drawn from wider machine learning dataset (Shi et al. 2019) of fingerspelled tokens.

➤ Encompasses a variety of genres and styles (politics, news, cooking, lifestyle)

➤ Corpus subset used for analysis targets words with multiple mentions (between 3 and 6)

Dataset composition:

| Category | Number |
|-------------------|--------|
| Signers | 34 |
| Words | 103 |
| Individual tokens | 549 |

Annotation

➤ Annotation conducted in ELAN.

➤ *Information annotated for each token:* 1) Target sequence 2) Length 3) Letters spelled 4) Mention number 5) Phrasal position (beginning, end, other)

Conclusions & Implications

Results from corpus analysis show:

➤ A robust tendency for repeated fingerspelled words continue to reduce past their second mention, as noted in previous smaller studies.

➤ The amount of reduction decreases past the second mention.

➤ Variation in results can at least partially be accounted for by controlling for phrasal position.

➤ Increased distance between mentions mediates reduction effects. Potential explanations:

- Listener centered: Predictability and intelligibility within discourse
- Speaker centered: Priming effects

Study findings confirm previous work, while providing additional insights into the trajectory of reduction across mentions.

Selected references: Aylett, M., & Turk, A. (2004). The smooth signal redundancy hypothesis: A functional explanation for relationships between redundancy, prosodic prominence, and duration in spontaneous speech. *Language and speech*, 47. • Bell, A., Brenier, J. M., Gregory, M., Girand, C., & Jurafsky, D. (2009). Predictability effects on durations of content and function words in conversational English. *Journal of Memory and Language*, 60. • Fowler, C. A., & Housum, J. (1987). Talkers' signaling of "new" and "old" words in speech and listeners' perception and use of the distinction. *Journal of memory and language*, 26. • Lepic, R. (2019). A usage-based alternative to "lexicalization" in sign language linguistics. *Glossa: a journal of general linguistics*, 4. • Nespors, M., & Sandler, W. (1999). Prosody in Israeli Sign Language. *Language and Speech*, 42. • Shi, B., Martinez Del Rio, A., Keane, J., Brentari, D., Shakhnarovich, G., & Livescu, K. (2019). Fingerspelling recognition in the wild with iterative visual attention. *arXiv preprint*. • Thumann, M. A. (2012). Fingerspelling in a word. *Journal of Interpretation*, 19. • Wager, D. S. (2012). *Fingerspelling in American Sign Language: A case study of styles and reduction*. The University of Utah.