# Comparing reduction across the ASL lexicon: Fingerspelling and lexical signs

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## Introduction

*Cross modal trend: The repetition of an item in discourse corresponds to a decrease in its duration (Fowler & Housum 1987, Hoetjes et al. 2014)*

➢ In models of language production: This duration reduction associated with balancing reducing articulatory effort with comprehension (Aylett & Turk 2004)

➢ Structural and articulatory constraints of different linguistic systems, like that of fingerspelling and of lexical signs in American Sign Language (ASL), may exhibit different possibilities in reducing articulatory effort

### Research question
**Do articulatory and structural differences between lexical signs and fingerspelled words result in different degrees of duration reduction?**

### Reduction, modality, and the structure of ASL

*Potential differences in degree of reduction exhibited across modalities:*

➢ Duration reduction does not significantly increase after second mentions in spoken languages (Bell et al. 2009 for English, Vajrabhaya & Kapatsinski 2011 for Thai)

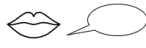➢ Fingerspelling in ASL has been shown to reduce over more than two mentions (Wager 2012, Lepic 2019)

| Category | Mentions | Duration reduction? |
|---|---|---|
| Spoken languages | 1 to 2 | ✓ |
| | 2 to 3+ | ✗ |
| ASL Fingerspelling | 1 to 2 | ✓ |
| | 2 to 3+ | ✓ |
| ASL Signs | 1 to 2 | ??? |
| | 2 to 3+ | ??? |

*Figure 1: Effect on duration across mentions in signed and spoken languages*

Could structural differences between fingerspelling and lexical signs be responsible for how they reduce across repetitions?

➢ Fingerspelling relies more on sequential phonological organization
➢ Signing relies more on simultaneous phonological organization

### Primary hypothesis
**Fingerspelled words will reduce to a greater degree and show continued reduction over more repeated mentions than lexical signs**
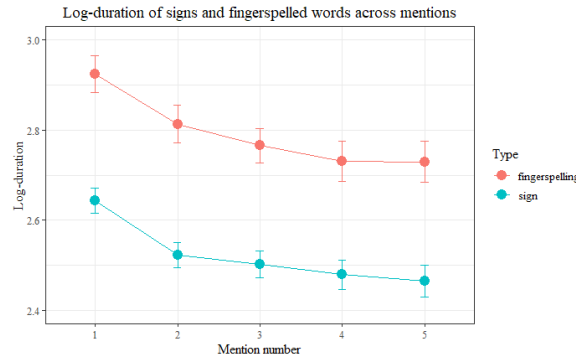
## Results



*Figure 2: The effect of mention number on duration, separated by category in the lexicon*

### Analysis:

The effect of mention number and type (fingerspelling or sign) was analyzed, accounting for the effect of phrasal position. Table 1 indicates the significant results within the analysis:

| Fixed effect | Estimate | Standard Error | p-value |
|---|---|---|---|
| Mention number 1 vs. 2-5 | 0.149 | 0.018 | <0.001*** |
| Mention number 2 vs. 3-5 | 0.059 | 0.016 | <0.001*** |
| Phrasal Position | 0.15 | 0.010 | <0.001*** |
| Type (sign vs. fingerspelling) | 0.243 | 0.018 | <0.001*** |
| *Random effects included for signer and word/sign* | | | |

*Table 1: Significant results for the factors included in the analysis*

➢ **No interaction** between mention number and category in the lexicon (sign or fingerspelling)

**Results overview:** Both categories, signs and fingerspelling, show reduction past second mentions. While fingerspelled words were longer on average, there was no interaction between type and duration.

## Discussion

**Contrary to the initial hypothesis**, fingerspelled words and lexical signs show strikingly similar patterns in reduction:

➢ Although different in overall length, both categories in the lexicon continue reducing past second mentions, with category type not significantly influencing differences in the trajectory of reduction

### Explanations:

Although fingerspelling and lexical signs differ considerably in their articulation and structure, similarities in reduction patterns could be due to shared properties of the manual-visual modality.

➢ Signs and fingerspelled words are longer, on average, than spoken words (Bellugi & Fischer 1972) and so they may have more room to reduce without a loss in comprehension

➢ The effort required to move articulators with larger mass than those used in speech might result in additional pressure to reduce articulatory effort in articulating signs and fingerspelled words

## Methodology

### Dataset
Corpus analysis of repeated tokens from online video corpus

➢ Annotated corpus of publicly available online videos in ASL

➢ Encompasses a variety of genres and styles (politics, news, cooking, lifestyle, health, and more)

➢ Corpus of items used for analysis targets forms with multiple mentions (between 3 and 5), composed of the following:

| Category | Number |
|---|---|
| Signers | 33 |
| Fingerspelled words | 112 unique words *(511 individual tokens)* |
| Lexical signs | 225 unique signs *(939 individual tokens)* |

*Table 2: Analysis dataset overview*

### Annotation

➢ Annotation conducted in ELAN

➢ *Information annotated for each token:* 1) Fingerspelled word and sign identity 2) Duration 3) Mention number 4) Phrasal position

### Analytic methods

Analysis conducted using linear mixed effects models (LMER):

➢ Examined the difference in log-transformed duration between forms at each mention, comparing duration at each mention number to subsequent mentions (Helmert contrast coding)

➢ Included phrasal position to control for effects of phrase final lengthening

➢ Tested for an interaction between category type in the lexicon (fingerspelled word vs. lexical sign) and mention number

*An interaction between mention number and category would indicate differing patterns in reduction between fingerspelled words and lexical signs*

**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. ● **Bellugi,** U., & Fischer, S. (1972). A comparison of sign language and spoken language. *Cognition*, 1 ● **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. ● **Hoetjes,** M., Krahmer, E., & Swerts, M. (2014). Do repeated references result in sign reduction? *Sign Language & Linguistics*, 17. 79● **Lepic,** R. (2019). A usage-based alternative to "lexicalization" in sign language linguistics. *Glossa: a journal of general linguistics*, 4. ● **Vajrabhaya,** P., & Kapatsinski, V. (2011). There is more to the story: First-mention lengthening in Thai interactive discourse. In *ICPhS* ● **Wager,** D. S. (2012). *Fingerspelling in American Sign Language: A case study of styles and reduction*. The University of Utah.