

# Phonological vowel length interacts with final lengthening

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## Introduction

### Research question and aim of the study

- Is final lengthening (FL) sensitive to phonological length?
- Do languages preserve length contrasts in final (pre-pausal) syllables? Can FL neutralize a length contrast?
- How do languages with a length contrast differ from languages without such a contrast?

The aim of this paper is to provide a cross-linguistic overview of FL in languages with and without a phonological quantity opposition.

## Background

- Final lengthening is hypothesised to be a universal property of languages (Fletcher 2010)
- FL may possibly be grounded in motor constraints, deceleration of motor activity (e.g. Berkovits 1994, Weismer & Ingrisano, 1979)
- On the other hand, linguistic constraints may also affect lengthening, as shown for languages with a phonological vowel length contrast: Finnish, Hungarian and Estonian (Nakai et al. 2012, Krull 1997, White et al. 2020)
- Word-final syllables seem to be particularly prone to neutralization of phonological quantity opposition (Myers and Hansen, 2007)
- Besides neutralization, other scenarios might be conceivable, such as e.g. enhancement of the quantity contrast in FL

## Methodology

### Speech corpus data from 15 languages

- 15 languages from the DoReCo corpus (Seifart et al. 2022)
- Ca. 10K hand-aligned word tokens per language
- Exclusion of disfluencies, code-switching and filled pauses
- Segmental alignments added with MAUS (Schiel 2004), using the language-independent model with a minimum segment duration of 30 ms

### Measurements

- Duration of Vs in final syllable followed by a pause vs. duration of Vs in non-final positions; excluded disfluencies (filled pauses, false starts), code-switching, as well as segments adjacent to disfluencies
- Statistical analysis using R (3.6.2), libraries: ggplot2 (graphics), lme4 for Linear Mixed Effect Models with Length (long versus short)\*Category (final vs. non-final) for each language as fixed effects; speaker code, right phonemic context, left phonemic context as random effects

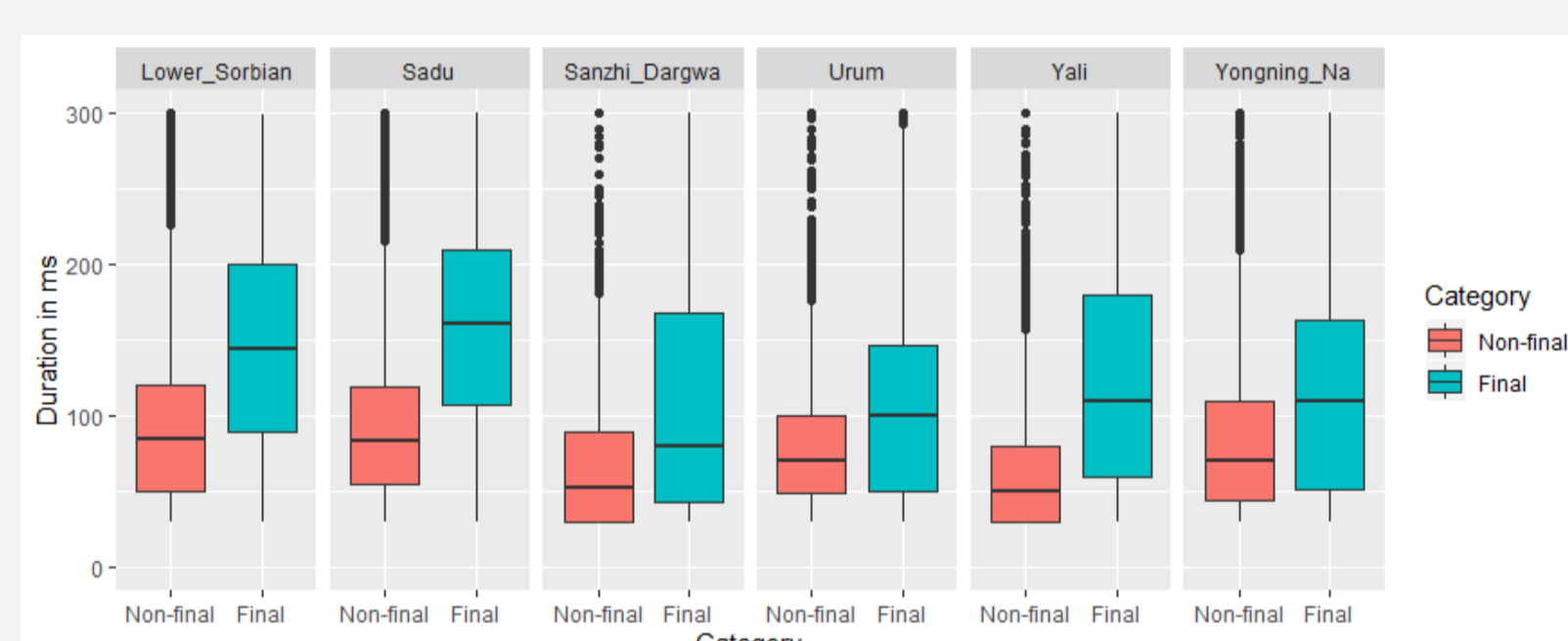
### The 15 languages investigated

Language	Family/Phylum	V length?	Language	Family/Phylum	V length?
1) Arapaho	Algic	yes	10) Lower Sorbian	Indo-European	no
2) Beja	Afro-Asiatic	yes	11) Sadu	Sino-Tibetan	no
3) Bora	Boran	yes	12) Sanzhi Dargwa	Nakh-Dagestanian	no
4) Fanbyak	Austronesian	yes	13) Urum	Turkic	no
5) Kamas	Uralic	yes	14) Yali	Nuclear Trans New Guinea	no
6) Mojeno Trinitario	Arawak	yes	15) Yongning Na	Sino-Tibetan	no
7) Movima	(isolate)	yes			
8) Resigaro	Arawak	yes			
9) Svan	Kartvelian	yes			

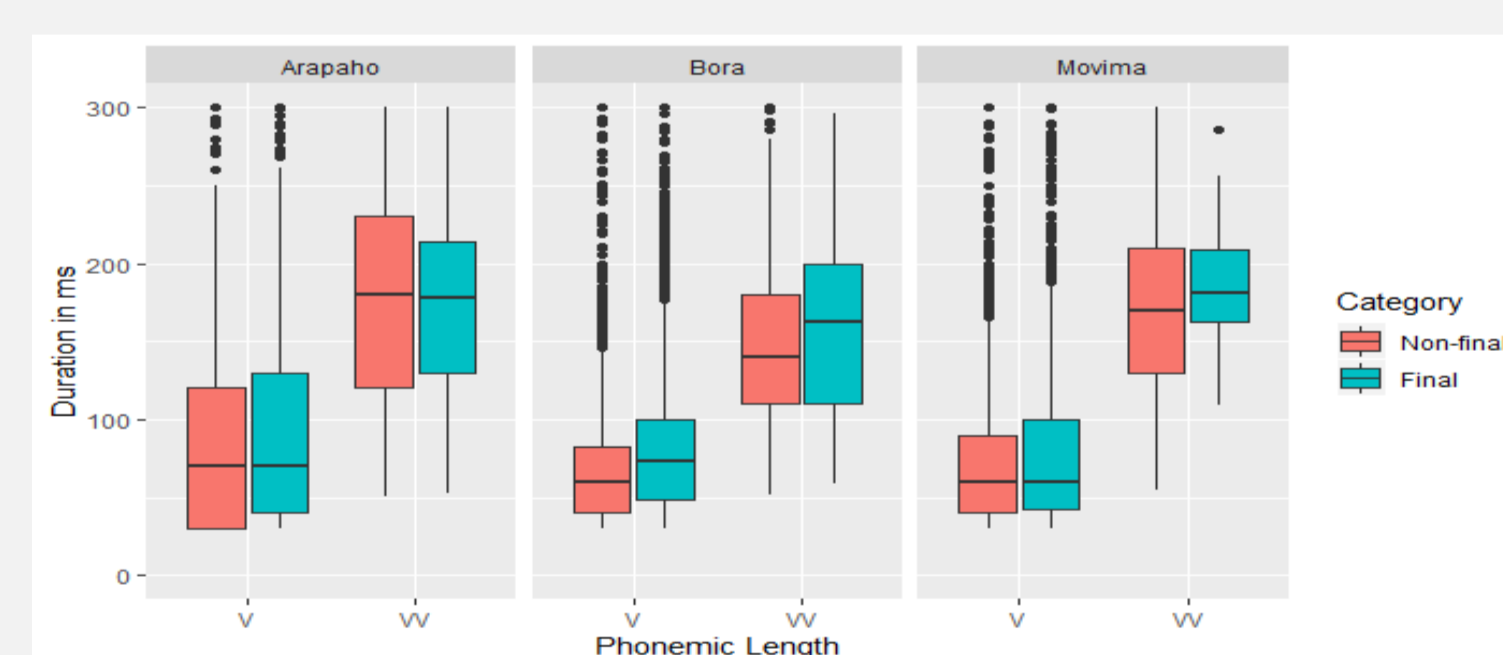
All data originally come from documentation projects of small or endangered languages. Within DoReCo, these datasets undergo consistency checks and standardization procedures and receive additional alignments at the word and segment level.

## Results

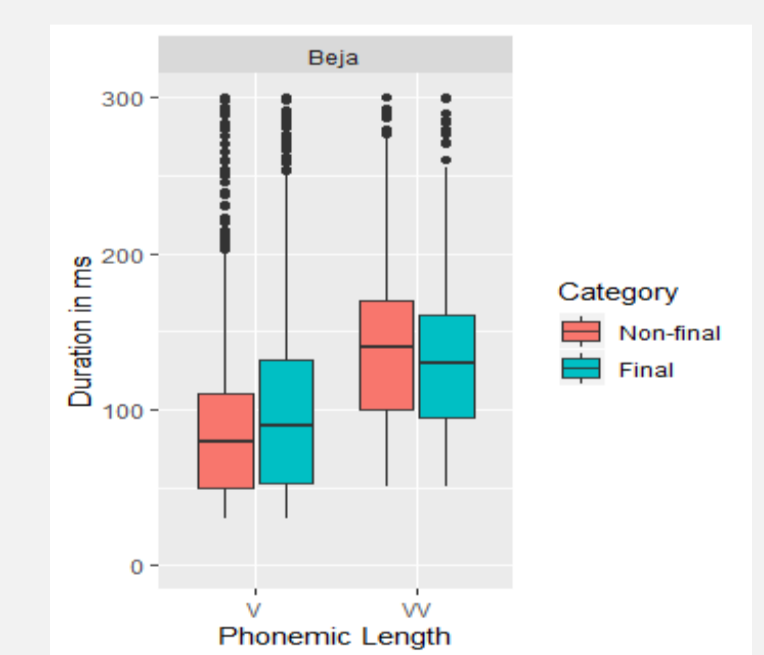
### FL in lang. without length contrast



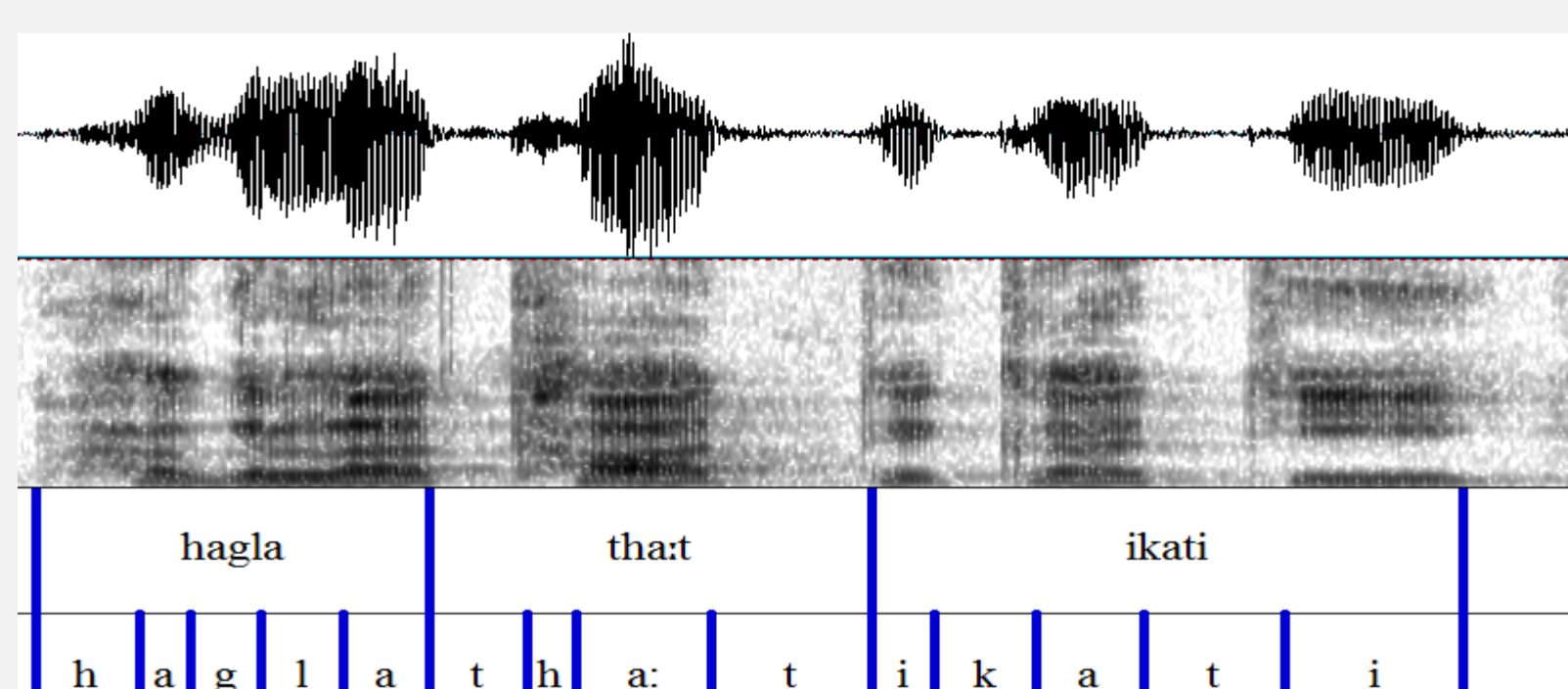
### FL in lang. with length contrast



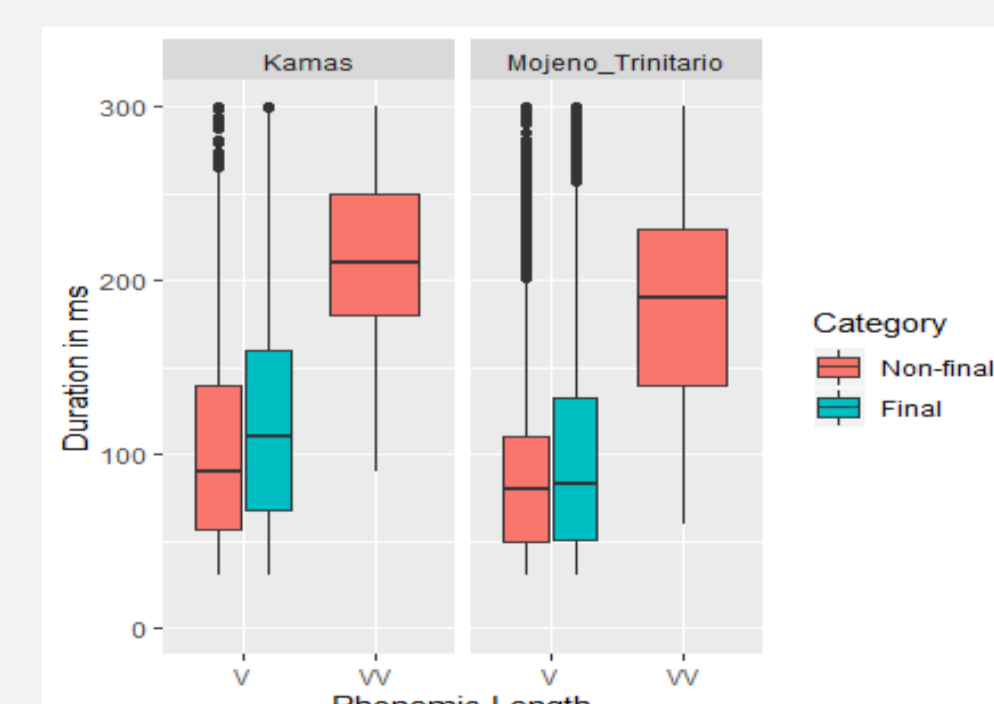
Arapaho, Bora, Movima: Length effect, no significant category effect (= no FL)



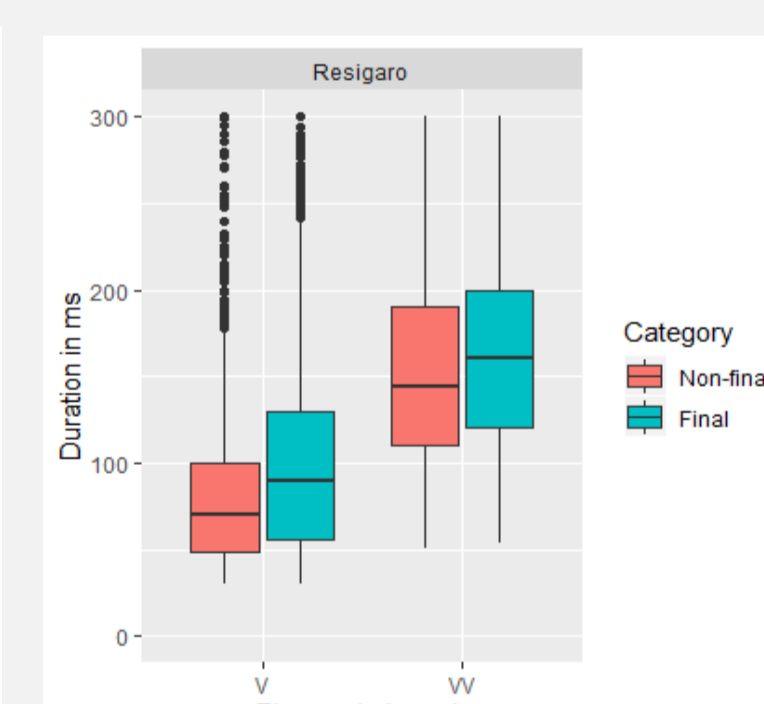
Beja: Length effect, Category effect, Interaction effect, FL inhibited in long vowels compared to short vowels



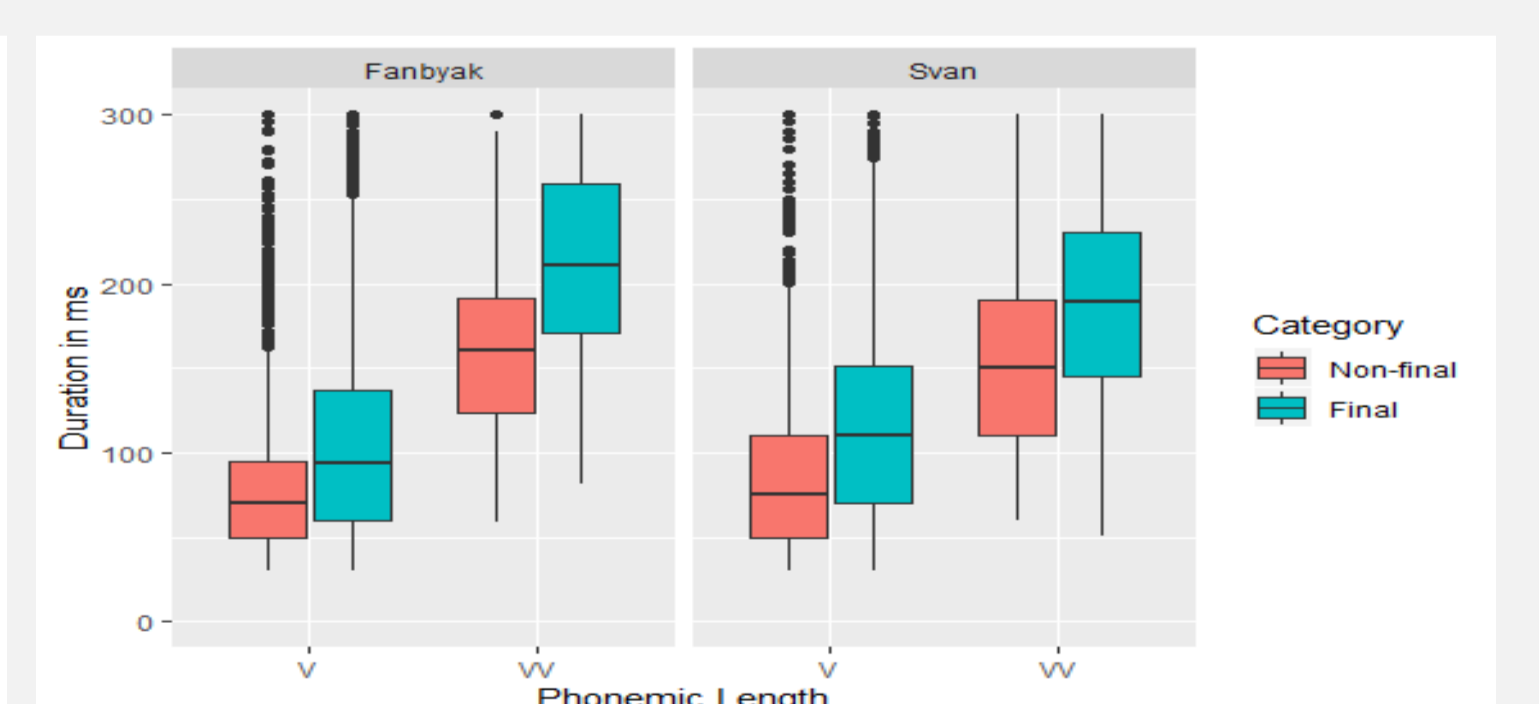
Final lengthening in Beja: The initial /i/ in the word *ikati* is half as long as the pre-pausal /i/ (100 ms vs. 200 ms)



Kamas, Mojeno Trinitario: no VV in final position (phonotactics)



Resigaro: Length effect, small but not significant category effect



Fanbyak, Svan: Length effect, category effect, Interaction: enhancement in final position

Language	Phon. Length	N in non-final position	N in final position
Arapaho	N	7567	1662
Arapaho	L	3770	661
Beja	N	14043	1768
Beja	L	9601	1483
Bora	N	19359	2491
Bora	L	3281	134
Fanbyak	N	9198	1603
Fanbyak	L	436	93
Kamas	N	16936	3999
Kamas	L	153	
Mojeno Trinitario	N	18047	2283
Mojeno Trinitario	L	532	
Movima	N	17016	2872
Movima	L	1506	28
Resigaro	N	14100	2896
Resigaro	L	2448	469
Svan	N	15921	2054
Svan	L	1698	141

Vowel counts: VV were overall less frequent in final position

## Discussion and future work

- The presence and degree of FL heavily depend on whether a language has a phonological vowel length contrast
- All languages without a vowel length contrast showed strong and consistent effects of FL
- Languages with a length contrast showed a remarkably complex picture, from no interaction (Arapaho, Bora, Movima) or suppression of FL (Beja) to small category effects (Resigaro) or contrast enhancement (Fanbyak, Svan)
- It was never the case that a short V in final position was lengthened to the extent that its mean duration exceeded that of a long VV
- Future directions: Disentangle final and pre-final lengthening, in particular for languages with known processes of pre-final lengthening and/or iambic stress => This might explain the apparent lack of FL in languages such as Movima, which has a regular process of pre-final lengthening at the word level

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