

Ateliers de phonologie

September 24, 2025

Invited talk

# Geminates in Maaloula Aramaic

Ghattas Eid

(a) *nōfēḵ*  
*nnōfēḵ*  
*salleḵ*  
*ssalleḵ*<sup>2</sup>

(b) *irex*  
*irrex*  
*ḵatem*<sup>3</sup>  
*ḵattem*  
*lakēṭle*  
*lakḵēṭle*<sup>4</sup>

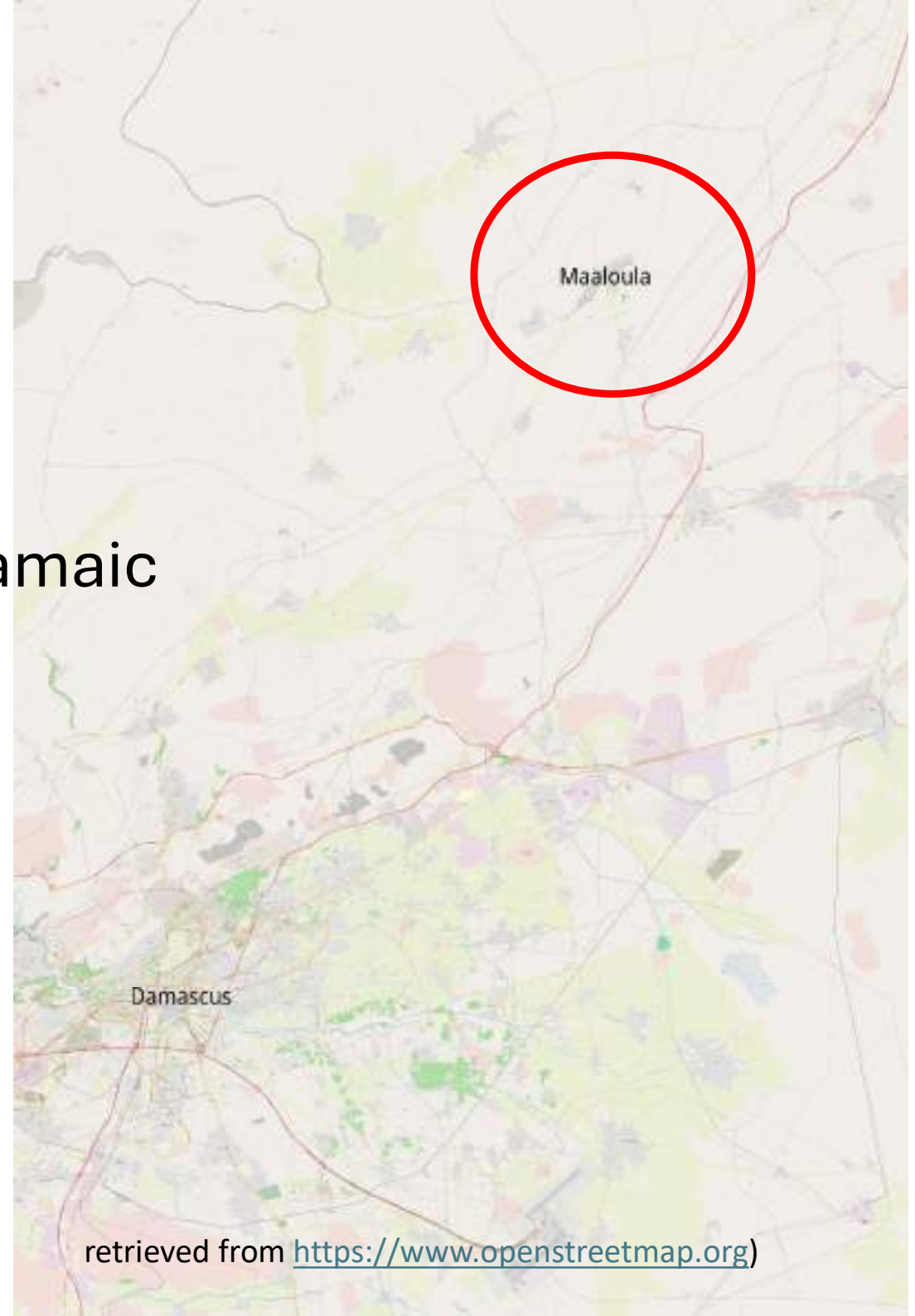
*taḵḵen*  
*naffēḵ*  
*naḥḥeč*  
*salleḵ*  
*ṣapper*<sup>6</sup>  
*šammeṣ*  
*bahheč*  
*sakḵeṭ*  
*šammet*

# Introduction

- Ghattas Eid
- research conducted at Heinrich Heine University Düsseldorf
- e-mail address: [ghattas.eid@hhu.de](mailto:ghattas.eid@hhu.de)
- talk based on my previously published work (Eid 2024: chap. 9) : <https://doi.org/10.1515/9783111447124-009>

# The language

- Aramaic
  - Neo-Aramaic
    - Western Neo-Aramaic



# The language

- Aramaic
  - Neo-Aramaic
    - Western Neo-Aramaic
      - Maaloula Aramaic
        - status: endangered (Moseley 2010; Eberhard et al.2023)

“Town of Maaloula” by [Erik Albers](#) (CC BY-SA 3.0 Wikimedia Commons)



# Geminates in Maaloula Aramaic

- It has long been known that geminates in Maaloula Aramaic can occur in word-initial, word-medial, and word-final positions (see, e.g., Arnold 1990: 17).
- These examples illustrate the contrast between singleton and geminate consonants:

<i>nōfeḵ</i>	‘he goes out’	<b>word-initial position</b>
<i>nnōfeḵ</i>	‘I go out’	
<i>irex</i>	‘it (M) became longer’	<b>word-medial position</b>
<i>irrex</i>	‘long; tall (INDF.M.SG)’	
<i>taḵḵan</i>	‘knocks (EPL)’	<b>word-final position</b>
<i>taḵḵann</i>	‘he hammered them’	

# Geminates in Maaloula Aramaic

- It can also be argued that geminates can occur across word boundaries:

<i>ex xifō</i>	‘like stones’
<i>b-besra</i>	‘with meat’
<i>hō ʕ ʕaymṭa</i>	‘this cloud’
<i>rayšiš šenna</i>	‘the top of the rock’

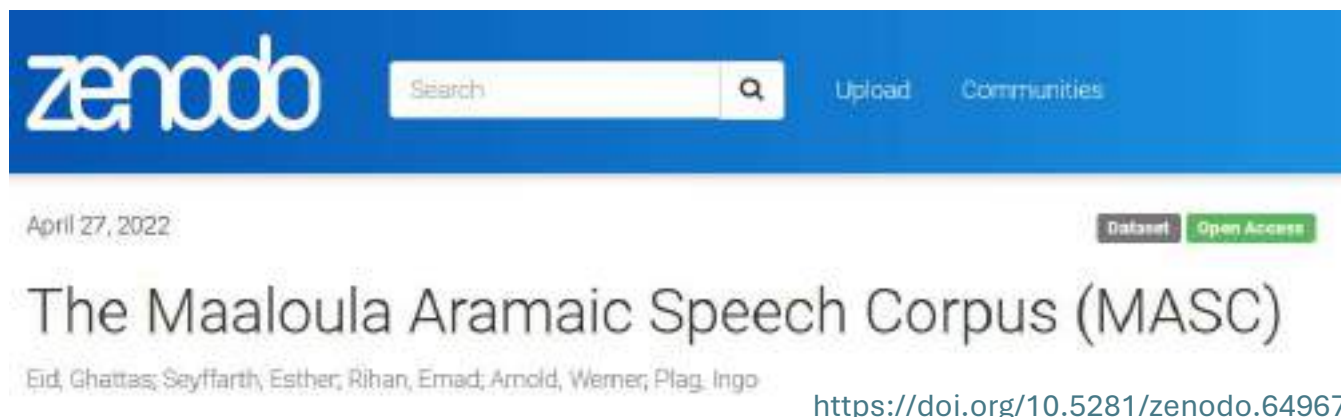
- However, not much had been known about the phonological and phonetic properties of these geminates before this study was conducted.

# Aims of the talk

- to show how Maaloula Aramaic geminates arise
- to demonstrate how they can be phonologically represented
- to illustrate how gemination interacts with other phonological processes
- to present the phonetic properties of these geminates, focusing on two acoustic correlates of gemination:
  - duration of the consonant itself
  - duration of the preceding vowel

# Data and method

# Data



(Eid et al. 2022; Eid, Seyffarth & Plag 2022)

- a list of all consonants (singletons and geminates)
- for each consonant, a list of all word tokens which contain it

# Data

- three environments were included in the study:

#___V	<i>forna</i>	‘oven’	(singleton)
	<i>ffō</i>	‘face; surface’	(geminate)
V___V	<i>baḥar</i>	‘a lot; very’	(singleton)
	<i>aḥḥaḍ</i>	‘someone (M)’	(geminate)
V___#	<i>hōš</i>	‘now’	(singleton)
	<i>hašš</i>	‘you (F.SG)’	(geminate)

# Dataset

- the dataset consisted of **78,971** observations
- all consonants occur as singletons and geminates except the marginal phonemes /ʔ/ and /g/ which occur only as singletons

Seg.	Gem.	Word	file	Prec. Seg.	Foll. Seg.	Prec. Vowel	Foll. Vowel	Envir.
ḥ	gem	aḥḥad	III.99	a	a	short	short	V_V
l	gem	ṭalla	IV.06	a	a	short	short	V_V
l	sgl	īle	III.33	ī	e	long	short	V_V
n	gem	hanna	III.10	a	a	short	short	V_V
n	sgl	ana	IV.11	a	a	short	short	V_V
n	sgl	anaḥ	III.98	a	a	short	short	V_V
n	sgl	lina	IV.04b	i	a	short	short	V_V
p	gem	šappa	IV.37	a	a	short	short	V_V
p	gem	rappa	IV.16	a	a	short	short	V_V
t	gem	batte	III.55	a	e	short	short	V_V
t	sgl	atar	III.03	a	a	short	short	V_V

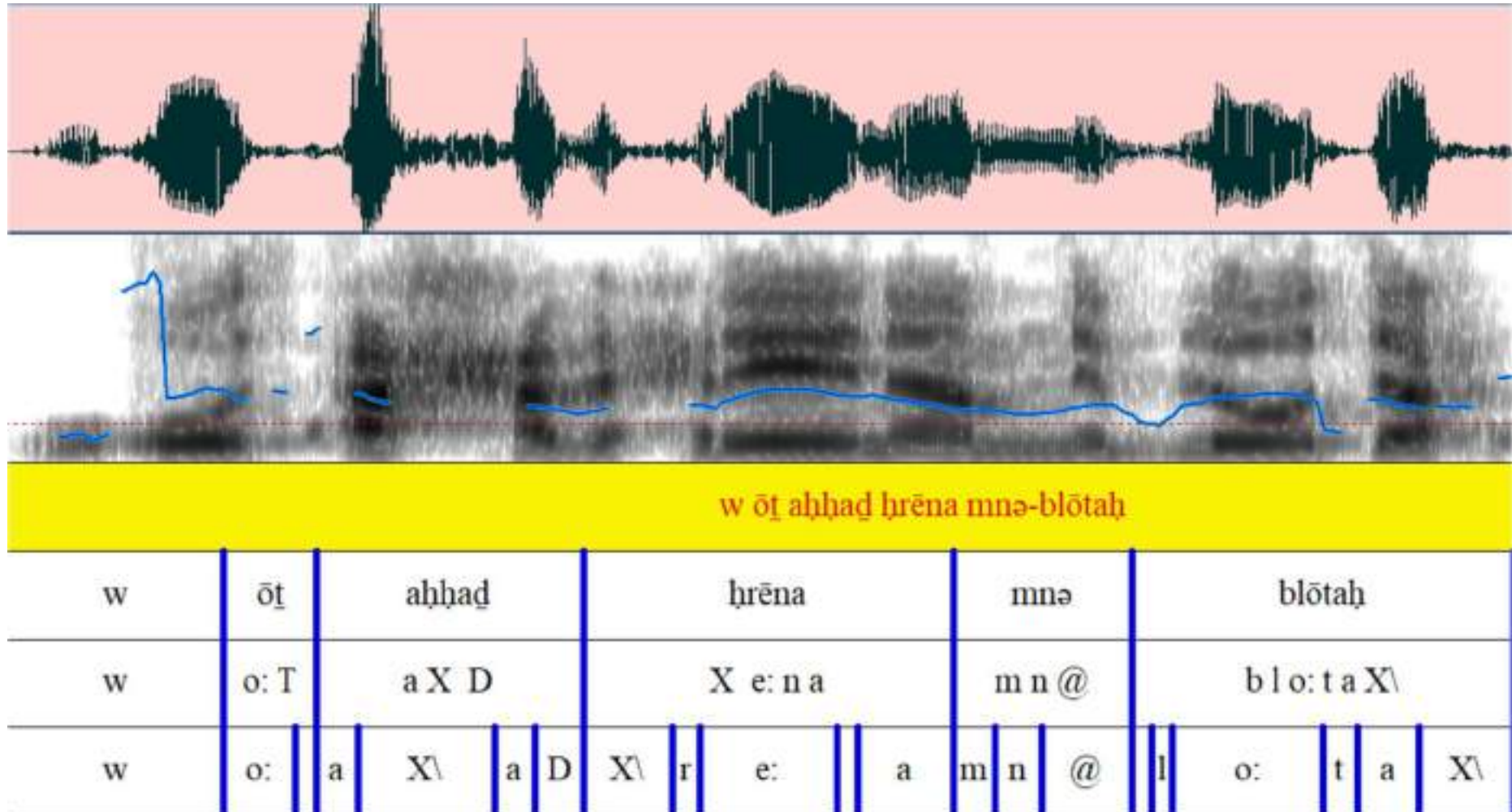
# Distribution of singletons and geminates

<b>Position</b>	<b>Singleton</b>	<b>Geminate</b>
Word-initial	32,570	225
Word-medial	14,358	12,732
Word-final	16,086	3,000
<b>Total</b>	<b>63,014</b>	<b>15,957</b>

# Distribution of short vowels and long vowels before medial and final consonants

<b>Vowels</b>	<b>Before medial singletons</b>	<b>Before medial geminate</b>	<b>Before final singletons</b>	<b>Before final geminate</b>
Short vowels	6,641	12,613	12,512	2,984
Long vowels	7,717	119	3,574	16
<b>Total</b>	<b>14,358</b>	<b>12,732</b>	<b>16,086</b>	<b>3,000</b>

# Duration measurements: The TextGrid files in MASC were used



# Duration measurements

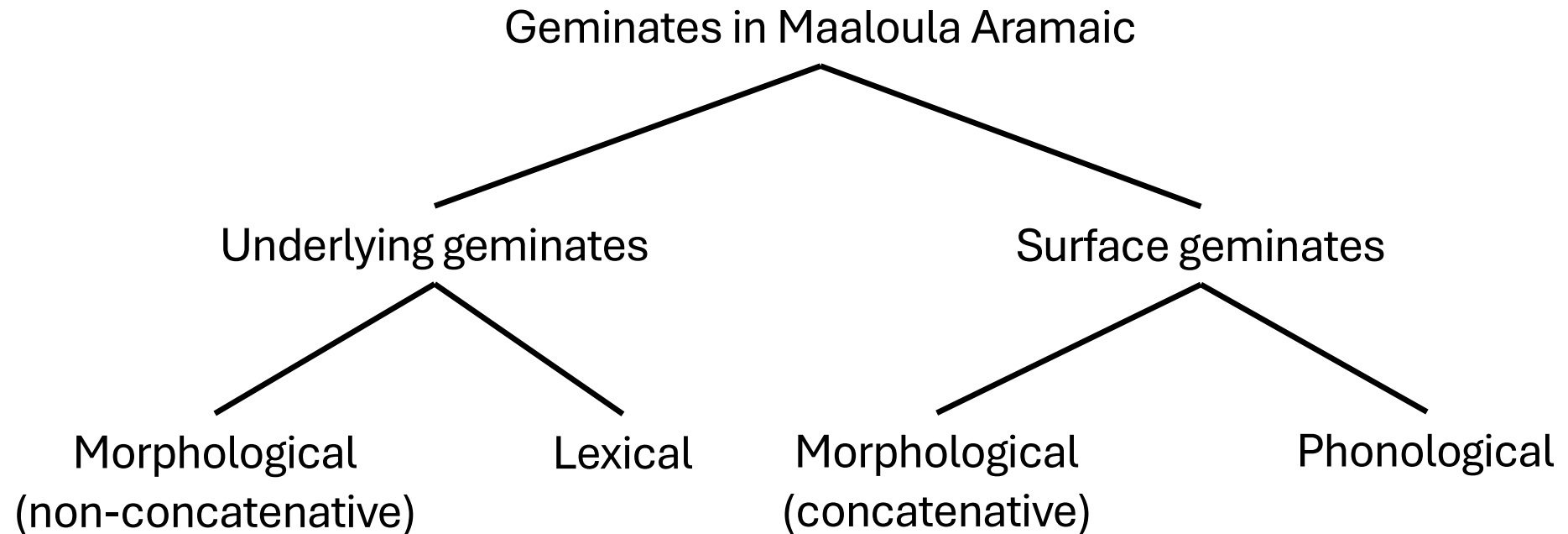
- durations were imported from the TextGrid files in MASC to the dataset

Seg.	Gem.	Word	file	Segment Duration	Prec. Seg.	Prec.Seg. Duration	Foll. Seg.	Foll.Seg. Duration	Prec. Vowel	Foll. Vowel	Envir.
ḥ	gem	aḥḥad	III.99	30	a	40	a	50	short	short	V_V
l	gem	ṭalla	IV.06	30	a	40	a	30	short	short	V_V
l	sgl	īle	III.33	30	ī	40	e	80	long	short	V_V
n	gem	hanna	III.10	30	a	40	a	40	short	short	V_V
n	sgl	ana	IV.11	30	a	30	a	30	short	short	V_V
n	sgl	anaḥ	III.98	40	a	30	a	50	short	short	V_V
n	sgl	lina	IV.04b	30	i	40	a	50	short	short	V_V
p	gem	šappa	IV.37	50	a	30	a	30	short	short	V_V
p	gem	rappa	IV.16	30	a	30	a	50	short	short	V_V
t	gem	batte	III.55	40	a	30	e	40	short	short	V_V
t	sgl	atar	III.03	30	a	30	a	50	short	short	V_V

- no manual correction of the automatically aligned boundaries was made due to the large number of tokens

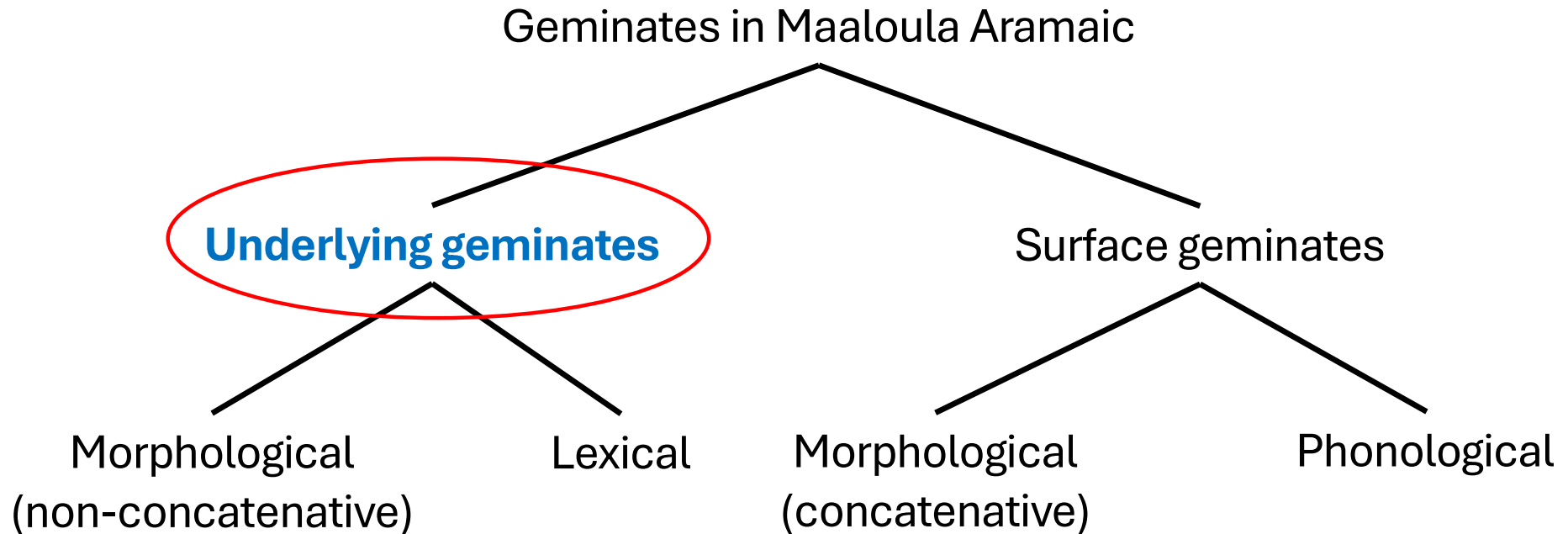
# How Maaloula Aramaic gemminates arise

# Types of geminates in Maaloula Aramaic



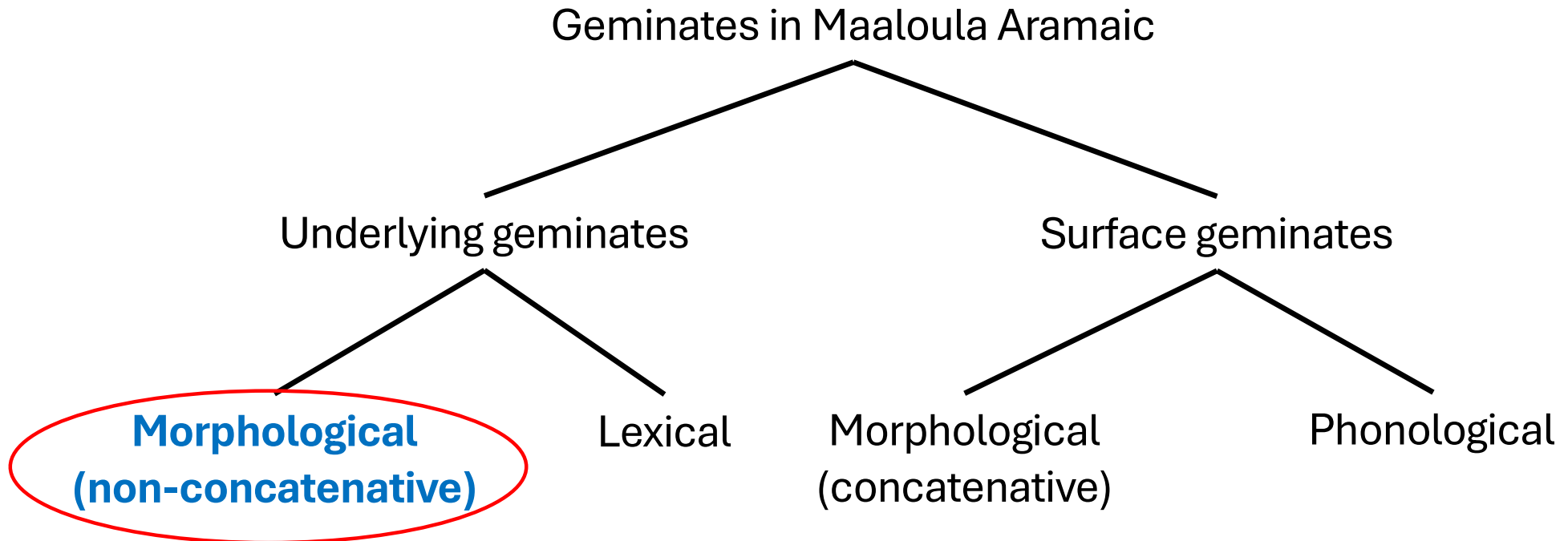
(for types of geminates in general see, e.g., Hayes 1986; Galea 2016; Ben Hedia 2019)

# Types of geminates in Maaloula Aramaic



- part of the underlying representation of words and not the result of
  - any synchronic phonological processes
  - the concatenation of identical phonemes across morphological boundaries

# Types of geminates in Maaloula Aramaic



- the result of non-concatenative morphological processes

# Morphological underlying geminates: Example 1

- the perfect forms of many **Form I** verbs are generated from trilateral roots by a pattern which geminates C<sub>2</sub>
- these examples are inflected for 3M.SG

Root		Pret.	Subj.	Pres.	Perf.
<i>tkn</i>	‘to become’	<i>itken</i>	<i>yitkan</i>	<i>tōken</i>	<i>ta<sup>kk</sup>en</i>
<i>nfk</i>	‘to go out’	<i>infek</i>	<i>yinfuk</i>	<i>nōfek</i>	<i>na<sup>ff</sup>ek</i>
<i>nhč</i>	‘to go down’	<i>inheč</i>	<i>yinhuč</i>	<i>nōheč</i>	<i>na<sup>h</sup>heč</i>
<i>slk</i>	‘to go up’	<i>islek</i>	<i>yisla<sup>k</sup></i>	<i>sōlek</i>	<i>sallek</i>
<i>ʕbr</i>	‘to come in’	<i>iʕber</i>	<i>yiʕbar</i>	<i>ʕōbar</i>	<i>ʕa<sup>pp</sup>er</i>

(see Arnold 1990: 55–59, 67-78 for Form I verbs)

# Morphological underlying geminates: Example 2

- **Form II** verbs have C<sub>2</sub> geminated
- compare these **Form I** and **Form II** preterit verbs inflected for 3M.SG and derived from the same root

<b>xtb</b>	Form I: <i>ix<b>t</b>ab</i>	<i>‘he wrote’</i>
	Form II: <i>xat<b>t</b>eb</i>	<i>‘he made someone write’</i>
<b>skt</b>	Form I: <i>isk<b>k</b>aṭ</i>	<i>‘he fell’</i>
	Form II: <i>sak<b>k</b>et</i>	<i>‘he made someone fall’</i>
<b>šmč</b>	Form I: <i>iš<b>m</b>eč</i>	<i>‘he remained silent’</i>
	Form II: <i>šam<b>m</b>eč</i>	<i>‘he silenced someone’</i>
<b>rkd</b>	Form I: <i>irk<b>k</b>aḍ</i>	<i>‘he danced’</i>
	Form II: <i>rak<b>k</b>eḍ</i>	<i>‘he made someone dance’</i>

(see Arnold 1990: 59–60, 78–82 for Form II verbs)

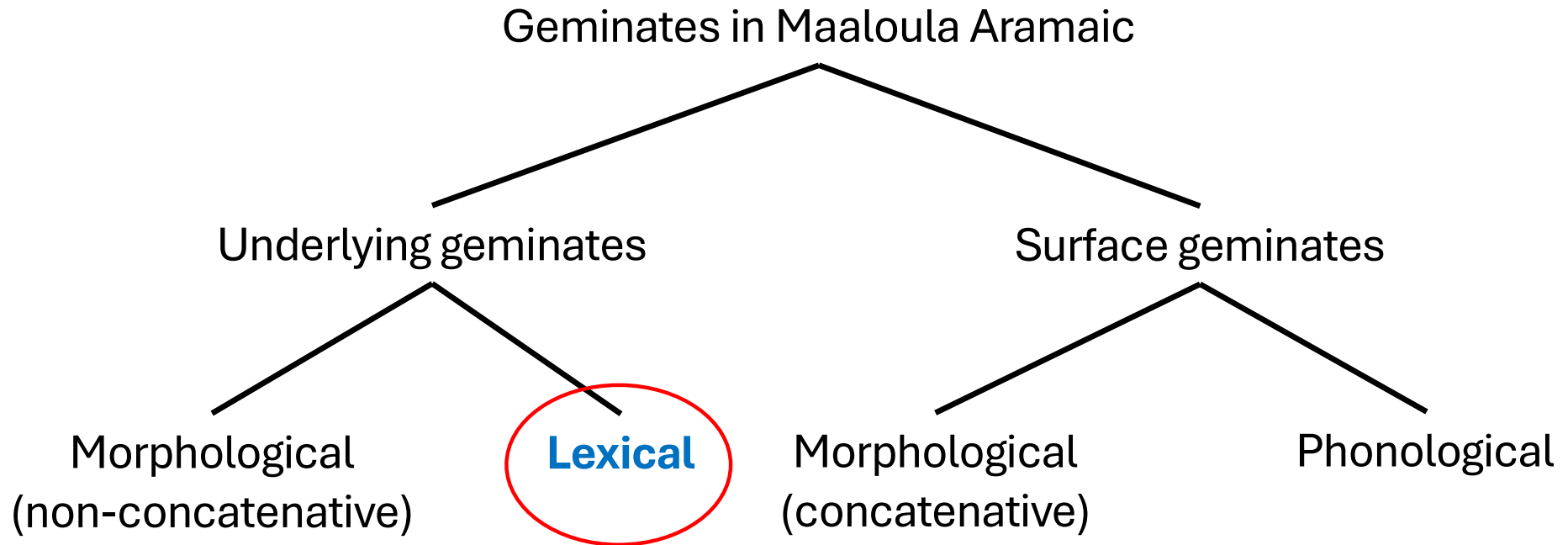
# Morphological underlying geminates: Example 3

- the subjunctive of **Form I** verbs whose  $C_2 = C_3$  is generated by a pattern which geminates  $C_1$  when inflected, e.g., for 3M.SG

Root	Preterit	Subjunctive	Present
<i>lmm</i> ‘to collect’	<i>alam</i>	<i>yillum</i>	<i>lōmem</i>
<i>tḵḵ</i> ‘to knock’	<i>ataḵ</i>	<i>yittuḵ</i>	<i>tōḵeḵ</i>
<i>sbb</i> ‘to swear at’	<i>asab</i>	<i>yissub</i>	<i>sōbeḅ</i>
<i>tll</i> ‘to show’	<i>atal</i>	<i>yittul</i>	<i>tōlel</i>
<i>ršš</i> ‘to sprinkle’	<i>araš</i>	<i>yirruš</i>	<i>rōšeš</i>
<i>zčč</i> ‘to throw’	<i>azač</i>	<i>yizzuč</i>	<i>zōčeč</i>
<i>ṭbb</i> ‘to topple’	<i>aṭab</i>	<i>yittub</i>	<i>ṭōbeḅ</i>

(see Arnold 1990: 59, 133–135 for these verbs)

# Types of geminates in Maaloula Aramaic



- no morphologically motivated alternation between a singleton and a geminate

# Lexical geminates

- examples

*pp*ōfča ‘loaf (of bread)’

ḥ*luff*ašīta ‘(dung) beetle’

ḥaš*opp*a ‘Sunday’

*ff*ō ‘face; surface’

*nawella* ‘(weaving) loom’

ḥ*akkōra* ‘roof’

- some lexical geminates are the result of historical assimilation

*hanna* < \*hā*dn*ā ‘this (M.SG)’

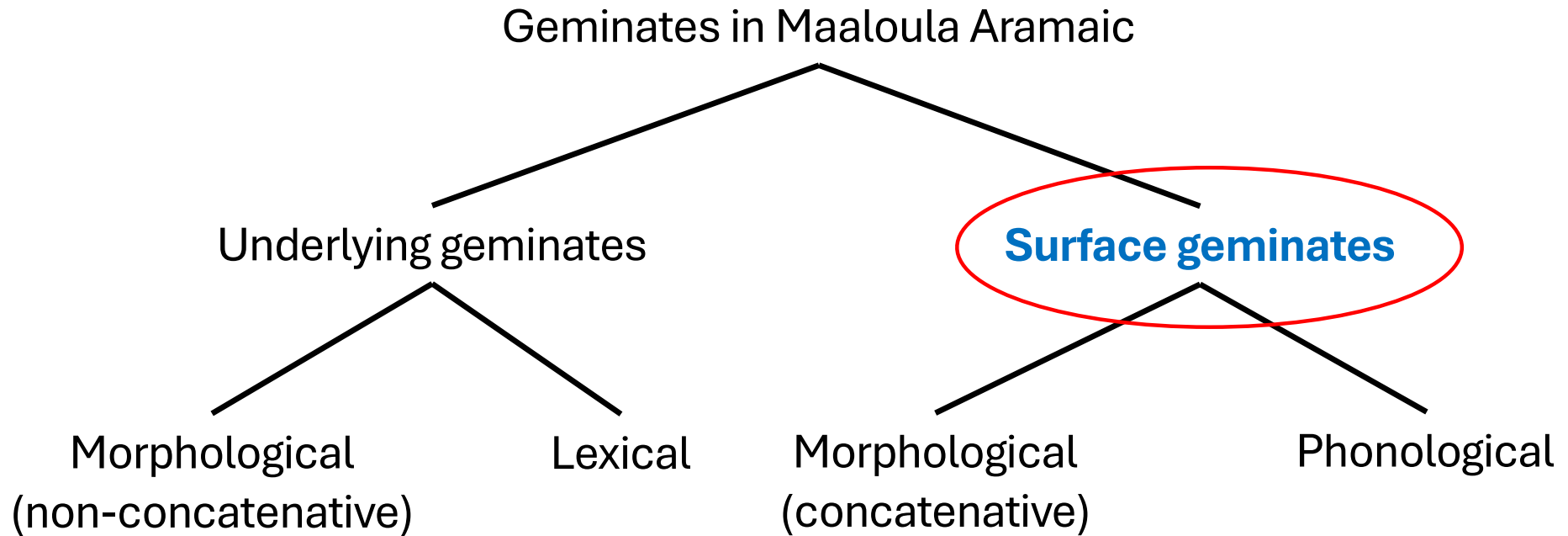
*erra*ḥ < \*e*lra*ḥ < *lra*ḥ ‘down; below; under’

ḥ*du*čča < \*ḥ*dutta* < \*ḥ*dūt*tā ‘bride’

examples collected from Spitaler (1938: 37)

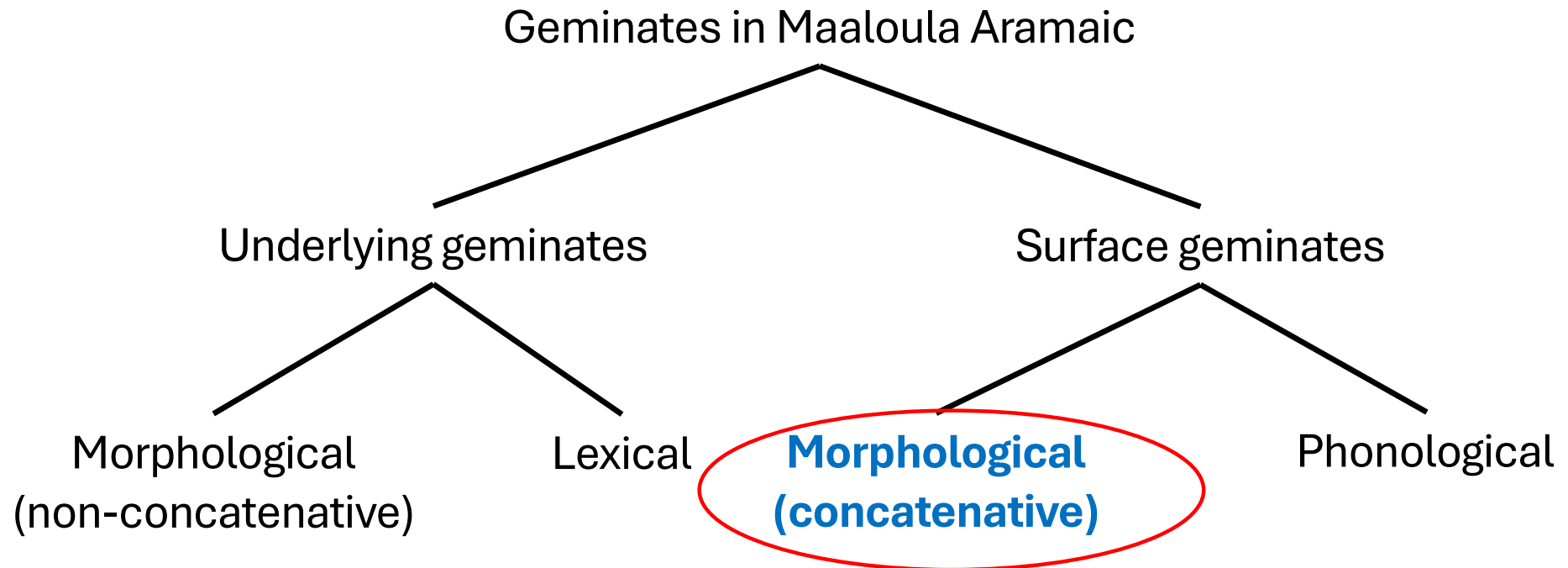
- however, they have become lexicalized, and the historical segments which have undergone the change no longer surface

# Types of geminates in Maaloula Aramaic



- created through morphosyntactic and phonological processes

# Types of geminates in Maaloula Aramaic



# Morphological surface geminates

- They arise through morphosyntactic processes when two identical consonants are concatenated across:

- morpheme boundaries

*n-nōfeḵ-∅*

1-go out.PRS-M.SG

‘I (M) go out.’

- word boundaries

*ex*

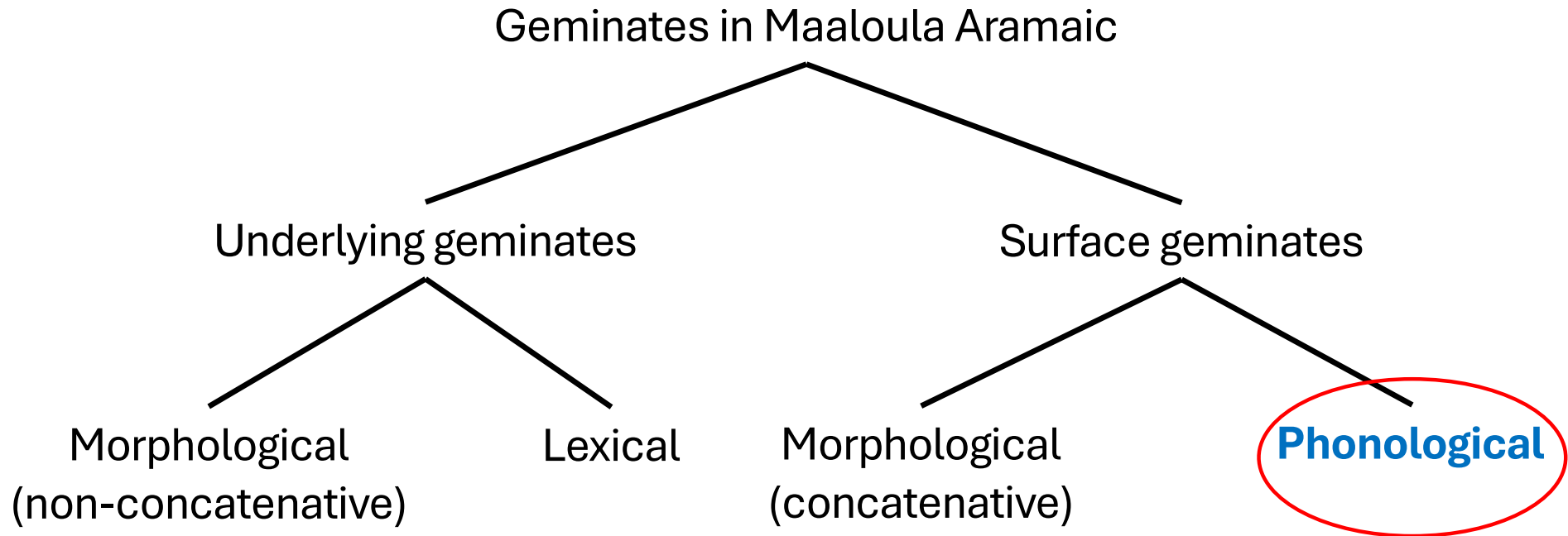
like

‘like stones’

*xif-ō*

stone-PL

# Types of geminates in Maaloula Aramaic



- result of phonological processes (e.g., assimilation) when two underlyingly different consonants become identical at the surface level

# Example of phonological geminates

- geminates resulting from the assimilation of /l/ to a following coronal:

*payt**it** tidōye* /payt-**l**tid-āy-e/ ‘his parents’ house’

but *payt**il** ġabrōna* /payt-**l**ġabrōn-a/ ‘the man’s house’

*yarḥ**ič** čammuz* /yarḥ-**l**čammuz/ ‘the month of July’

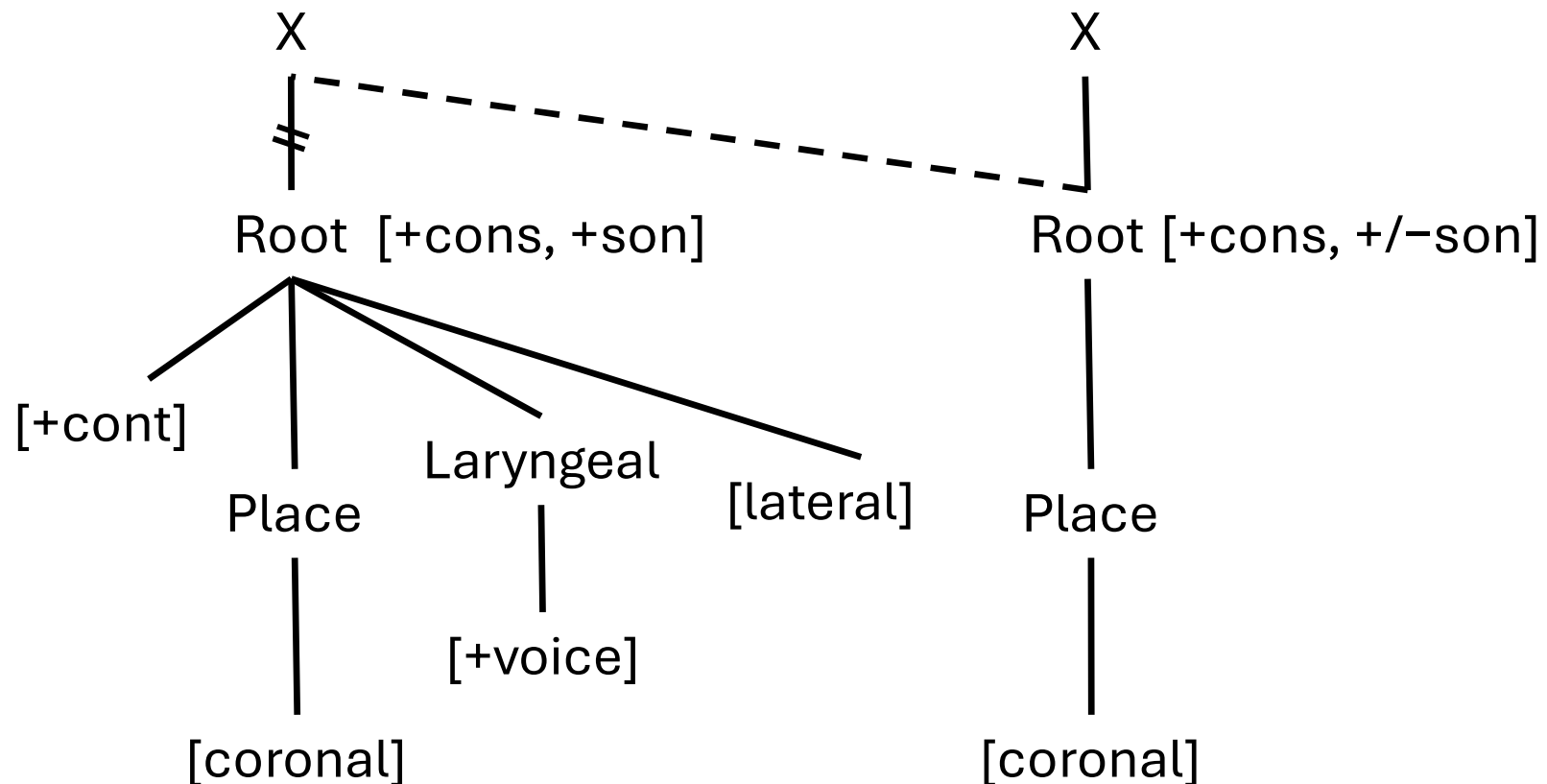
but *yarḥ**il** iyyar* /yarḥ-**l**iyyar/ ‘the month of May’

*berč**is** sōba* /ber-T-**l**sāb-a/ ‘the mayor’s daughter’

but *berč**il** malka* /ber-T-**l**malk-a/ ‘the king’s daughter’

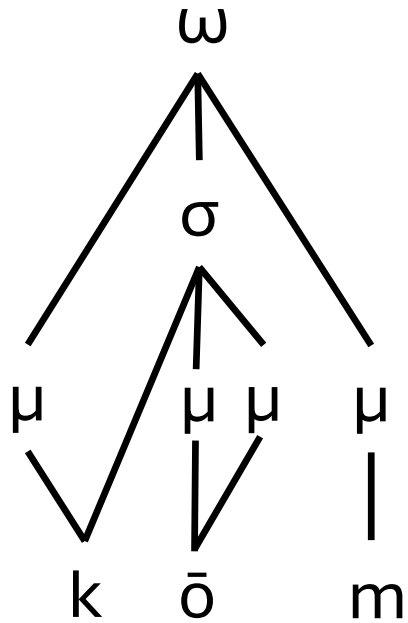
# Example of phonological geminates

- *assimilation of /l/ to a following coronal (feature-geometrical representation)*

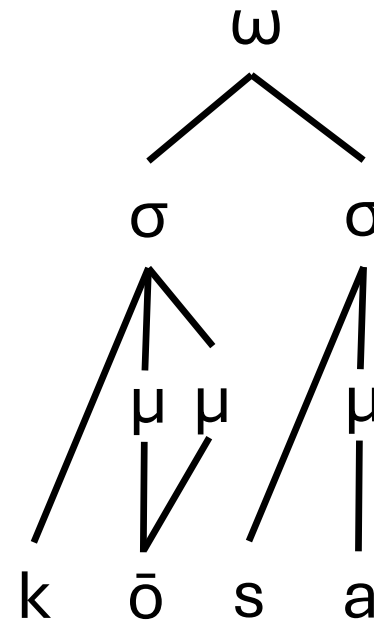


# Word-initial geminates

# Moraic representation



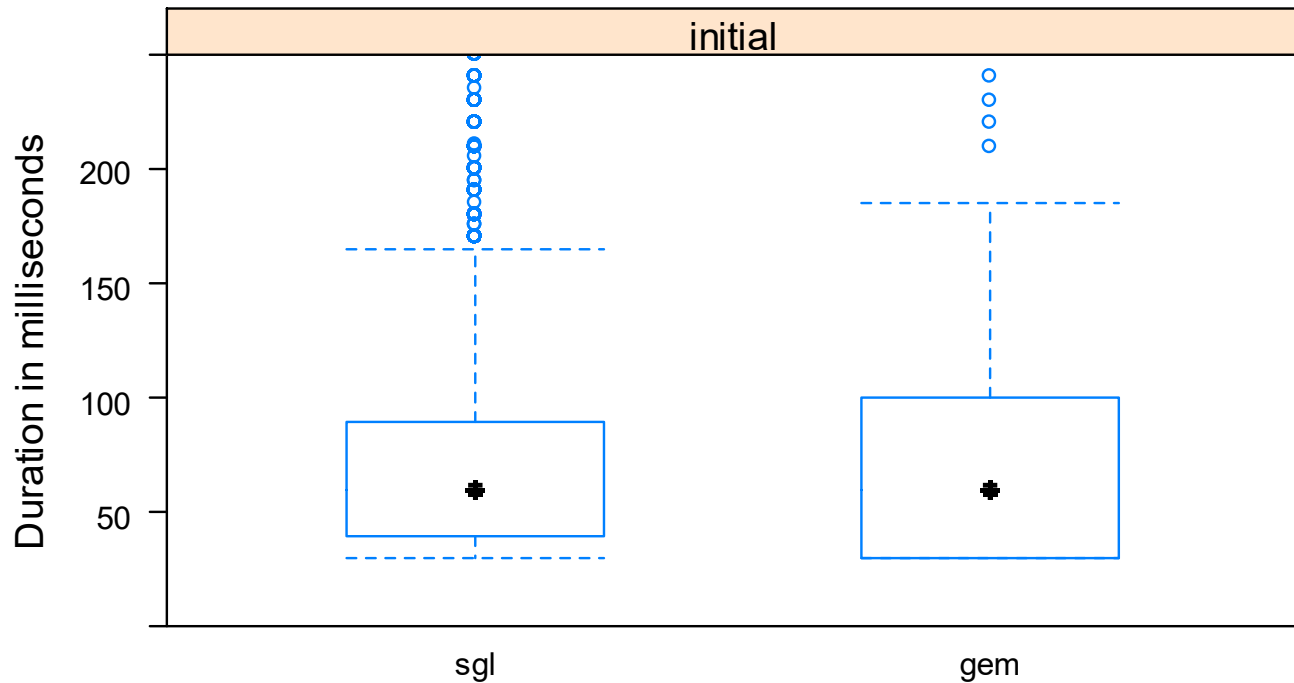
*kkōm* 'black (INDF.F.SG)'



*kōsa* '(drinking) glass/cup'

(following Hayes 1989; see also Davis 2011 for general discussion, and Davis & Ragheb 2014 for an analysis of Arabic in these terms)

# Consonant duration in word-initial position



Singleton			Geminate			Ratio	<i>P</i>
Median	Mean	SD	Median	Mean	SD		
60.00	74.70	79.07	60.00	81.53	98.14	<b>1:1.09</b>	<b>0.597</b>

# Why is this result unexpected?

- reasons:

1. The distinction between a word-initial singleton and a word-initial geminate can be heard and has long been marked in the published transcripts.

2. Some of these geminates are the result of the concatenation of two morphemes:

/n-nāfeḵ/ → [ ' nnō.feḵ ] 'I (M) go out'

This concatenation of consonants makes one expect a longer duration.

3. Word-initial geminates and word-initial singletons interact differently with resyllabification.

# Derivation to illustrate the interaction with resyllabification

‘two loaves’

/t̥arč ppāb-an/

t̥ar.<č> ppā.ban

't̥ar.<č> 'ppā.ban

't̥ar.<č> 'ppō.ban

't̥ar.<č> ə 'ppō.ban

't̥ar.čəp. 'pō.ban

['t̥ar.čəp. 'pō.ban]

‘two cubits’

/t̥arč drāŋ/

t̥ar.<č> <d̥>.rā.<ŋ>

't̥ar.<č> <d̥>. 'rā.<ŋ>

't̥ar.<č> <d̥>. 'rō.<ŋ>

't̥ar.<č> ə<d̥>. 'rō.<ŋ>

't̥ar.čəd̥. 'rō.<ŋ>

['t̥ar.čəd̥. 'rō.<ŋ>]

syllabification

stress assignment

/ā/ rounding

vowel epenthesis

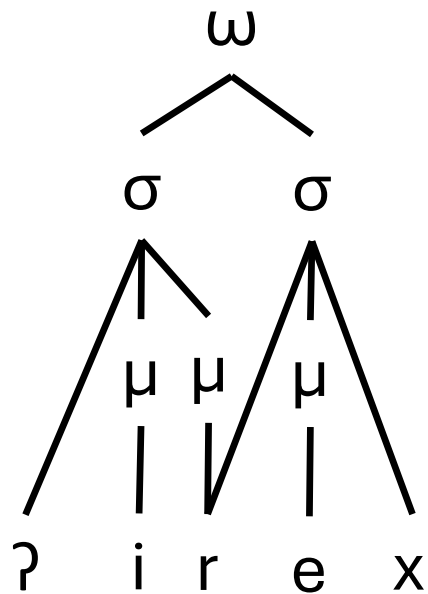
**resyllabification**

# Possible reasons for this unexpected result

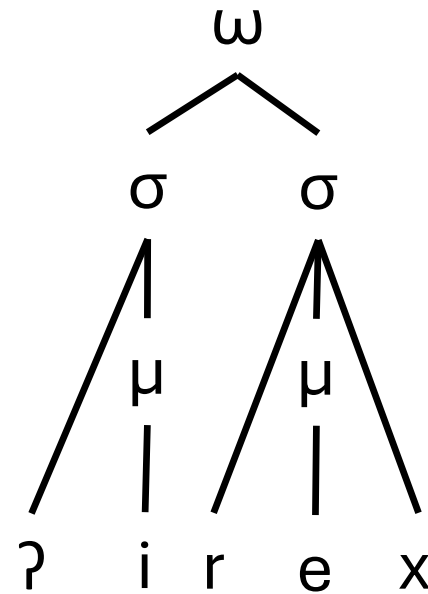
- the relatively small number of observations:
  - **225** tokens with word-initial **geminate**s
  - 32,570 tokens with word-initial singletons
- errors in the automatic segmentation of the TextGrid files
- future research is needed

# Word-medial geminates

# Moraic representation



*irrex* 'long; tall (INDF.M.SG)'



*irex* 'it (M) became longer'

(following Hayes 1989; see also Davis 2011 for general discussion, and Davis & Ragheb 2014 for an analysis of Arabic in these terms)

# Geminates and vowel epenthesis

- geminates cannot be split by an epenthetic vowel
- this property is called “integrity” by Hayes (1986)
- an underlying /GGC/ does not undergo vowel epenthesis (i.e., \*[GəGC])
  - /dokk-T-a/ → \*[dokəkta] ‘place’
- compare with /CCC/ → [CəCC]
  - /samk-T-a/ → [saməkta] ‘fish (SG)’

# What happens to preconsonantal geminates?

- in Maaloula Aramaic, /GG/ is degeminated in preconsonantal position (Arnold 1990: 17)

/d <b>o</b> kk-T-a/	→ [d <b>o</b> ḳṭa]	‘place’
/mʕa <b>rr</b> -T-a/	→ [mʕa <b>r</b> ṭa]	‘cave’
/xa <b>ff</b> -T-a/	→ [xa <b>f</b> ṭa]	‘shoulder’

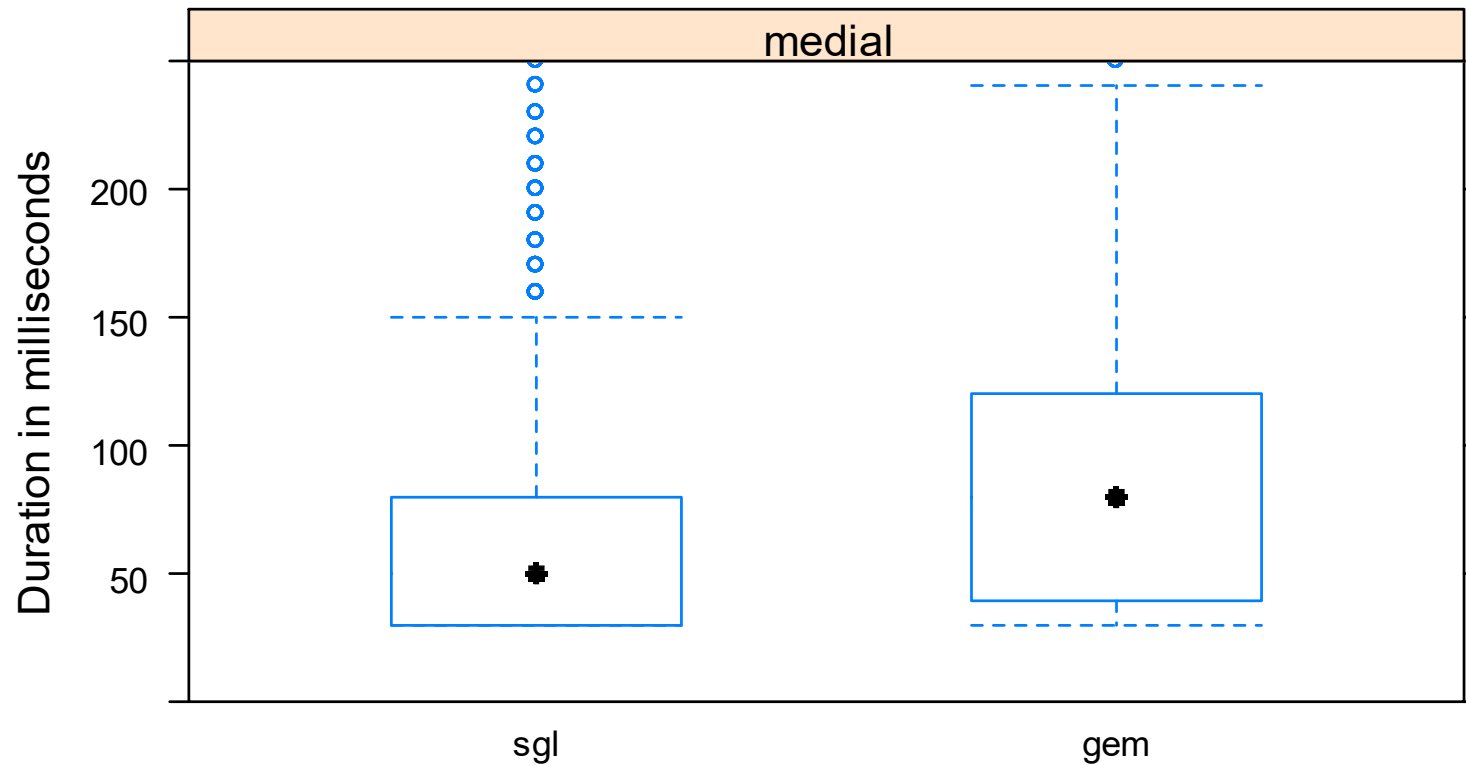
- preconsonantal degemination is also known in other Semitic languages

(see, e.g., Cowell 1964 for Damascus Arabic; Jastrow 1993 for Turoyo; Watson 2002 for San’ani Arabic)

# Derivation to illustrate preconsonantal degemination

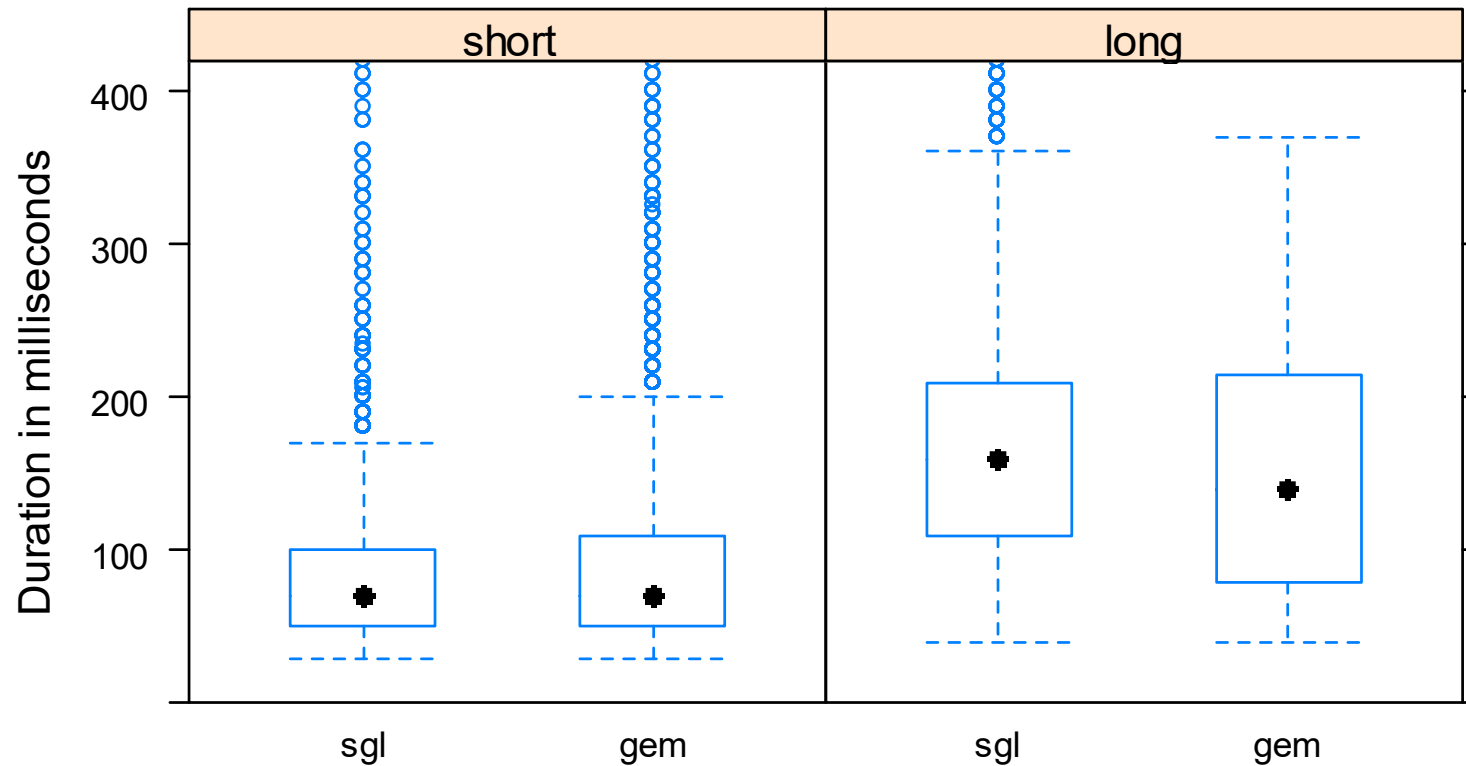
‘place’	‘places’	
/d <sub>o</sub> kk-T-a/	/d <sub>o</sub> kk-ā-T-a/	
d <sub>o</sub> kk <sub>ta</sub>	d <sub>o</sub> kkā <sub>ta</sub>	/T/ spirantization
d <sub>o</sub> k <sub>ta</sub>	–	<b>preconsonantal degemination</b>
d <sub>o</sub> k. <sub>ta</sub>	d <sub>o</sub> k.kā. <sub>ta</sub>	syllabification
'd <sub>o</sub> k. <sub>ta</sub>	d <sub>o</sub> k.'kā. <sub>ta</sub>	stress assignment
–	d <sub>u</sub> k.'kā. <sub>ta</sub>	pretonic raising
–	d <sub>u</sub> k.'kō. <sub>ta</sub>	/ā/ rounding
['d <sub>o</sub> k. <sub>ta</sub> ]	[d <sub>u</sub> k.'kō. <sub>ta</sub> ]	

# Consonant duration in word-medial position



Singleton			Geminate			Ratio	<i>P</i>
Median	Mean	SD	Median	Mean	SD		
50.00	65.06	51.96	80.00	88.42	59.64	<b>1:1.36</b>	<0.001

# Durations of the preceding vowels



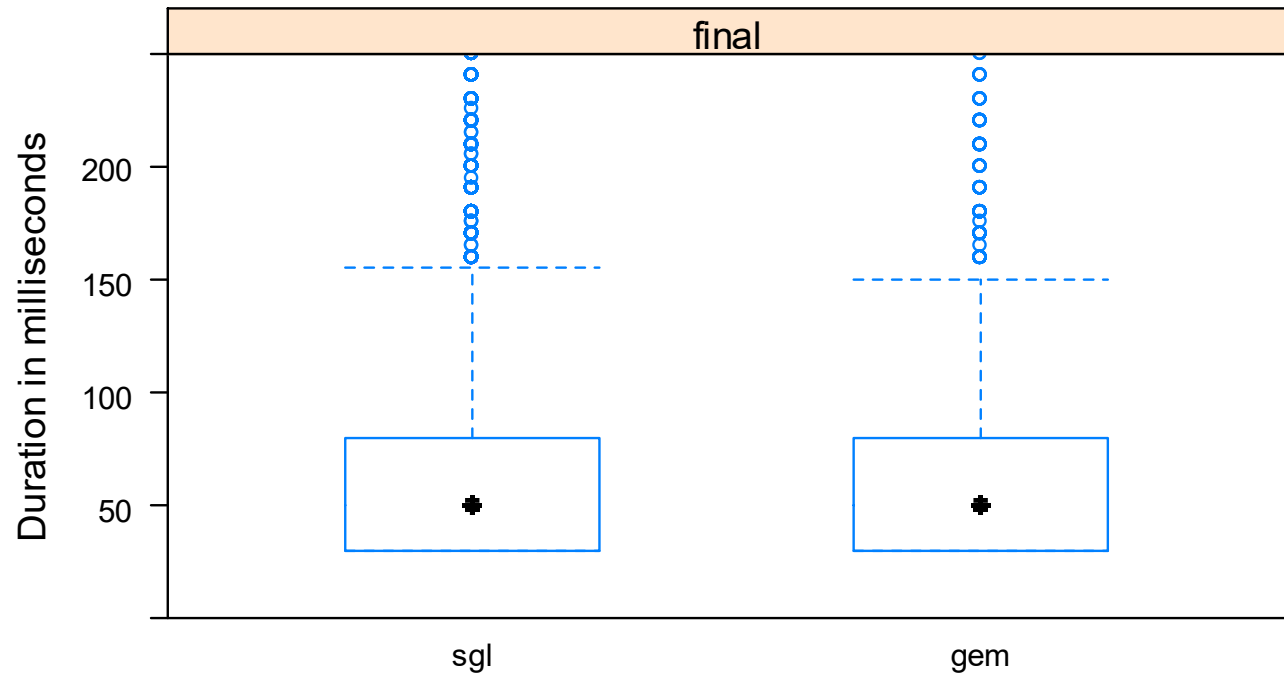
	Before singletons			Before geminates			Ratio	<i>P</i>
	Median	Mean	SD	Median	Mean	SD		
Short	70.00	82.75	48.75	70.00	89.56	67.45	<b>1:1.08</b>	<0.001
Long	160.00	168.16	98.94	140.00	159.08	97.65	<b>1:0.95</b>	0.157

# Comparing the results

- the differences in preceding vowel duration are not as large as the difference in consonant duration
- **conclusion:** consonant duration is the primary correlate of word-medial gemination in Maaloula Aramaic
- cross-linguistic evidence provides support for this finding
  - Maaloula Aramaic 1:1.36
  - Buginese 1:1.65 (Cohn, Ham & Podesva 1999)
  - Madurese 1:1.55 (Cohn, Ham & Podesva 1999)
  - Toba Batak 1:2.2 (Cohn, Ham & Podesva 1999)
  - Italian 1:1.9 (Payne 2005)
  - Lebanese Arabic 1:2.15 and 1:1.82 depending on the length of the previous vowel (Khattab & Al-Tamimi 2014)  
(see also Galea 2016: Chapter 3)

# Word-final geminates

# Consonant duration in word-final position



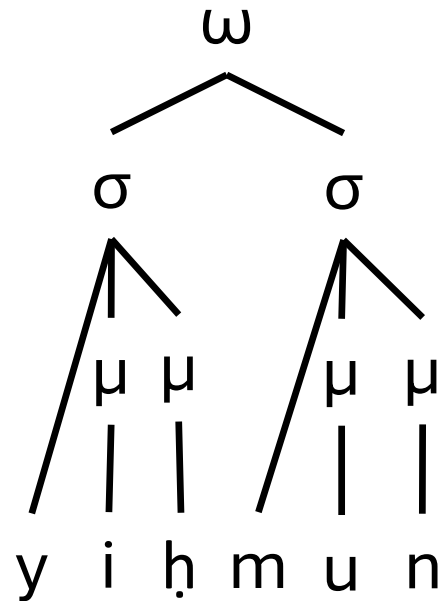
**Unexpected result!**

Singleton			Geminate			Ratio	<i>P</i>
Median	Mean	SD	Median	Mean	SD		
50.00	71.13	69.03	50.00	70.93	62.11	<b>1:0.99</b>	<b>0.321</b>

## What arguments are still there to support the claim that Maaloula Aramaic has word-final geminates?

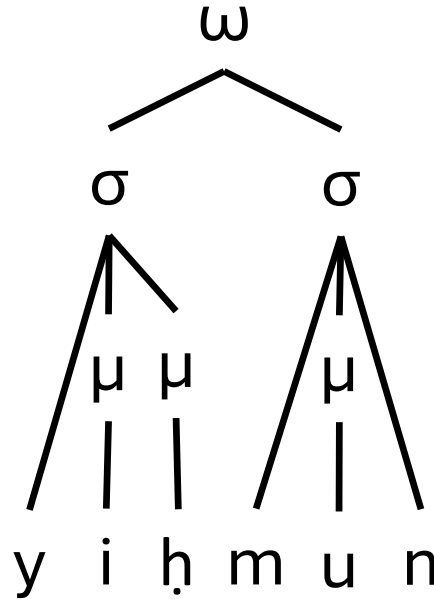
- Three arguments, two phonological and one phonetic:
  1. the interaction between word-final gemination and stress
  2. the interaction between word-final gemination and resyllabification
  3. the duration of the preceding vowel

# 1. Interaction with stress



*yihmunn*

‘(that) they (M) see them’



*yihmun*

‘(that) they (M) see’

- word-final geminates and word-final singletons contribute differently to the weight of the final syllable
- and therefore interact differently with word stress:  
[yih. 'munn] vs. ['yih.mun]

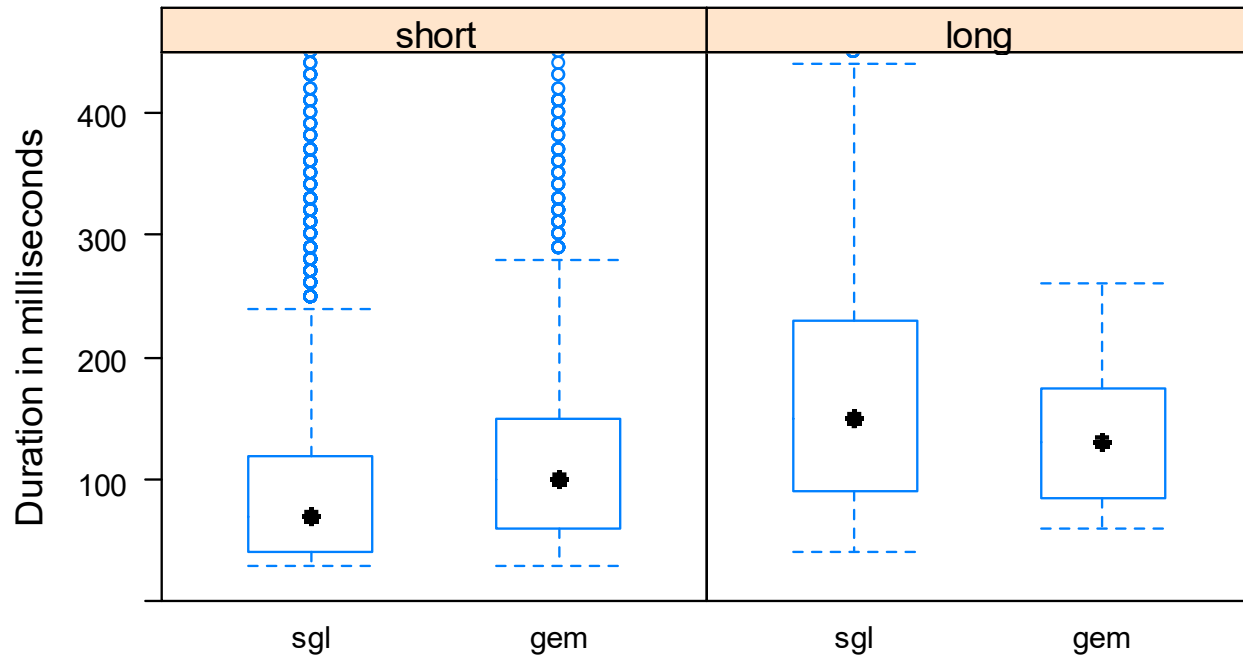
## 2. Interaction with resyllabification

- word-final geminates and word-final singletons interact differently with resyllabification:

‘all villages’	‘some firewood’	
/xu <b>ll</b> blāt-ā/	/ḵal <b>les</b> dlūḵ-a/	
xull <b>.lā.tā	ḵal.les <d̥>.lū.ḵa	syllabification
' <b>xull</b> <b>.lā. 'tā	'ḵal.les <d̥>. 'lū.ḵa	stress assignment
'xull <b>.la. 'tā	–	pretonic shortening
'xull <b>.la. 'tō	–	/ā/ rounding
'xull ə<b>.la. 'tō	'ḵal.les ə<d̥>. 'lū.ḵa	vowel epenthesis
'xul.l <b>əb</b> .la. 'tō	'ḵal.le. <b>səd̥</b> . 'lū.ḵa	<b>resyllabification</b>
['xu <b>l</b> .ləb.la. 'tō]	['ḵal.le. <b>səd̥</b> . 'lū.ḵa]	

# 3. Duration of the preceding short vowel

**short:**  
difference in duration may be due to stress assignment



**long:**  
result based on a small sample – few words end in VVG# (16 tokens)

	Before singletons			Before geminates			Ratio	<i>P</i>
	Median	Mean	SD	Median	Mean	SD		
<b>Short</b>	70.00	97.58	80.32	100.00	123.15	91.61	<b>1:1.26</b>	<b>&lt;0.001</b>
Long	150.00	180.79	129.36	130.00	137.50	59.39	1:0.76	0.262

# Open question

- these three arguments provide support for a distinction between geminates and singletons in word-final position
- however, these arguments do not explain why word-final geminates have the same duration as word-final singletons
- I propose that a degemination process is at work here
- word-final degemination is known in other Semitic languages (see, e.g., Cowell 1964 for Damascus Arabic; Jastrow 1993 for Turoyo)
- I argue that the domain of the degemination process in Maaloula Aramaic is the phonological phrase

# Phrase-final degemination

‘who is old’	‘old’	
/ti ʕomr-e ra <b>bb</b> /	/ra <b>bb</b> b-ʕomr-a/	
ti ʕom.re rabb	rabb <b>.ʕom.ra	syllabification
ti 'ʕom.re 'rabb	'rabb <b>.'ʕom.ra	stress assignment
–	'rabb ə<b>.'ʕom.ra	vowel epenthesis
–	'rab. <b>bəb</b> .'ʕom.ra	resyllabification
ti 'ʕom.re 'rab	–	<b>phrase-final degemination</b>
[ti 'ʕom.re 'ra <b>b</b> ]	['ra <b>b</b> . <b>bəb</b> .'ʕom.ra]	

- phrase-final degemination is ordered after stress assignment and resyllabification
- this rule ordering explains why underlying geminates interact with stress and resyllabification before they degeminate in phrase-final position

# Summary

# Summary: Geminates in Maaloula Aramaic

- geminates in Maaloula Aramaic can be classified as either underlying geminates or surface geminates
  - underlying geminates can be morphological or lexical
  - surface geminates are created through morphosyntactic or phonological processes

# Summary: Word-initial geminates

- previous accounts as well as phonological, morphological, and auditory arguments support the view that Maaloula Aramaic has word-initial geminates
- however, the acoustic results show no significant difference in duration
- potential reasons for this result:
  - small number of words which start with a geminate
  - errors in the automatic segmentation of the TextGrid files
- unsolved issue
- worthy of future research because word-initial geminates are not as common cross-linguistically and are not as widely investigated as word-medial geminates (Muller 2001; Davis 2011; Galea 2016)

# Summary: Word-medial geminates

- previous accounts as well as phonological, morphological, and auditory arguments support the view that Maaloula Aramaic has word-medial geminates
- the acoustic results support this view: singleton-to-geminate duration ratio is **1:1.36**
- the differences in preceding vowel duration did not turn out to be as large as the difference in consonant duration
- this result
  - shows that consonant duration is the primary correlate of word-medial gemination
  - supports the cross-linguistic evidence reported by previous research (e.g., Cohn, Ham & Podesva 1999; Payne 2005; Khattab & Al-Tamimi 2014; Galea 2016)

# Summary: Word-final geminates

- the durations of geminates and singletons were nearly identical
- this could be due to the neutralizing effect of a phrase-final degemination rule
- the application of this rule after the other phonological processes explains why word-final singletons and word-final geminates interact differently with
  - word stress
  - resyllabification
  - the preceding vowel

# Thank you

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# References

- Arnold, Werner. 1990. *Das Neuwestaramäische: V. Grammatik*. Wiesbaden: Otto Harrassowitz.
- Arnold, Werner. 1991a. *Das Neuwestaramäische: III. Volkskundliche Texte aus Ma`lūla*. Wiesbaden: Otto Harrassowitz.
- Arnold, Werner. 1991b. *Das Neuwestaramäische: IV. Orale Literatur aus Ma`lūla*. Wiesbaden: Otto Harrassowitz.
- Arnold, Werner. 2003. Semitisches Tonarchiv (SemArch). Heidelberg University. <http://semarch.ub.uni-heidelberg.de/>
- Ben Hedia, Sonia. 2019. *Gemination and degemination in English affixation: Investigating the interplay between morphology, phonology and phonetics* (Studies in Laboratory Phonology 8). Berlin: Language Science Press. <https://doi.org/10.5281/zenodo.3232849>
- Ben Hedia, Sonia & Ingo Plag. 2017. Gemination and degemination in English prefixation: Phonetic evidence for morphological organization. *Journal of Phonetics* 62. 34–49. <https://doi.org/10.1016/j.wocn.2017.02.002>
- Boersma, Paul & David J. Weenink. 2021. Praat. Doing phonetics by computer [Computer program]. Version 6.1.49, retrieved from <http://www.praat.org/>
- Bussmann, Hadumod. 1996. *Routledge dictionary of language and linguistics*. (Trans.) Gregory Trauth & Kerstin Kazzazi. London: Routledge.
- Cohn, Abigail C., William H. Ham & Robert J. Podesva. 1999. The phonetic realization of singleton-geminate contrasts in three languages of Indonesia. In *Proceedings of the 14th International Congress of Phonetic Sciences (ICPhS-14)*, 587–590. San Francisco, CA. [https://www.internationalphoneticassociation.org/icphs-proceedings/ICPhS1999/papers/p14\\_0587.pdf](https://www.internationalphoneticassociation.org/icphs-proceedings/ICPhS1999/papers/p14_0587.pdf)

# References

- Cowell, Mark W. 1964. *A reference grammar of Syrian Arabic*. Washington, DC: Georgetown University Press.
- Davis, Stuart. 2011. Geminates. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren Rice (eds.), *The Blackwell companion to phonology*, vol. 2, 873–897. Malden, MA & Oxford: Wiley-Blackwell. <https://doi.org/10.1002/9781444335262.wbctp0037>
- Davis, Stuart & Marwa Ragheb. 2014. Geminate representation in Arabic. In Samira Farwaneh & Hamid Ouali (eds.), *Perspectives on Arabic Linguistics XXIV-XXV*, 3–19. Amsterdam: John Benjamins. <https://doi.org/10.1075/sal.1.04dav>
- Eberhard, David M., Gary F. Simons & Charles D. Fennig (eds.). 2023. *Ethnologue: Languages of the world*. 26th edn. Dallas, Texas: SIL International. Online version: <https://www.ethnologue.com/language/amw/>
- Eid, Ghattas. 2024. *The Phonology of Maaloula Aramaic*. Düsseldorf: Düsseldorf University Press. <https://doi.org/10.1515/9783111447124>
- Eid, Ghattas, Esther Seyffarth & Ingo Plag. 2022. The Maaloula Aramaic Speech Corpus (MASC): From printed material to a lemmatized and time-aligned corpus. In *Proceedings of the 13th Conference on Language Resources and Evaluation (LREC 2022)*, 6513–6520. Marseille. <http://www.lrec-conf.org/proceedings/lrec2022/pdf/2022.lrec-1.699.pdf>
- Eid, Ghattas, Esther Seyffarth, Emad Rihan, Werner Arnold & Ingo Plag. 2022. The Maaloula Aramaic Speech Corpus (MASC). Düsseldorf: Heinrich-Heine-Universität Düsseldorf. Zenodo. <https://doi.org/10.5281/zenodo.6496714>

# References

- Galea, Luke. 2016. *Syllable structure and gemination in Maltese*. Cologne: University of Cologne Doctoral dissertation. <http://kups.ub.uni-koeln.de/id/eprint/6934>
- Hayes, Bruce. 1986. Inalterability in CV phonology. *Language* 62(2). 321–351. <https://doi.org/10.2307/414676>
- Hayes, Bruce. 1989. Compensatory lengthening in moraic phonology. *Linguistic Inquiry* 20(2). 253–306.
- Jastrow, Otto. 1993. *Laut- und Formenlehre des neuaramäischen Dialekts von Mīdin im Ṭūr ʿAbdīn*. 4th edn. Wiesbaden: Harrassowitz.
- Khattab, Ghada & Jalal Al-Tamimi. 2014. Geminate timing in Lebanese Arabic: The relationship between phonetic timing and phonological structure. *Laboratory Phonology* 5(2). 231–269. <https://doi.org/10.1515/lp-2014-0009>
- Moseley, Christopher (ed.). 2010. *Atlas of the World's Languages in Danger*. 3rd edn. Paris: UNESCO Publishing. <https://unesdoc.unesco.org/ark:/48223/pf0000187026>
- Muller, Jennifer S. 2001. *The phonology and phonetics of word-initial geminates*. Ohio State University Doctoral dissertation. [http://rave.ohiolink.edu/etdc/view?acc\\_num=osu1364226371](http://rave.ohiolink.edu/etdc/view?acc_num=osu1364226371)
- Payne, Elinor M. 2005. Phonetic variation in Italian consonant gemination. *Journal of the International Phonetic Association* 35(2). 153–181. <https://doi.org/10.1017/S0025100305002240>
- Spitaler, Anton. 1938. *Grammatik des neuaramäischen Dialekts von Ma ʿlūla (Antilibanon)*. Leipzig: F.A. Brockhaus. <http://dx.doi.org/10.25673/36802>
- Watson, Janet C. E. 2002. *The phonology and morphology of Arabic*. Oxford: Oxford University Press.