Tone

LING 20: Introduction to Linguistic Analysis

UCLA · Winter 2022

Suprasegmentals

- In addition to individual sounds (**SEGMENTS**), languages also have phonetic features that hold at the level of syllables.
- These are called **SUPRASEGMENTALS**.

Tone

- In many languages, there are words that differ only in their pitch contour.
- Such languages are called **tonal languages**.

Mandarin Chinese

Mandarin has **four tones**:

- ***Segments:*** **[ma]**
  - **High even tone:** *'mother'*
  - **Rising tone:** *'hemp'*
  - **Falling-then-rising tone:** *'horse'*
  - **Falling tone:** *'scold'*

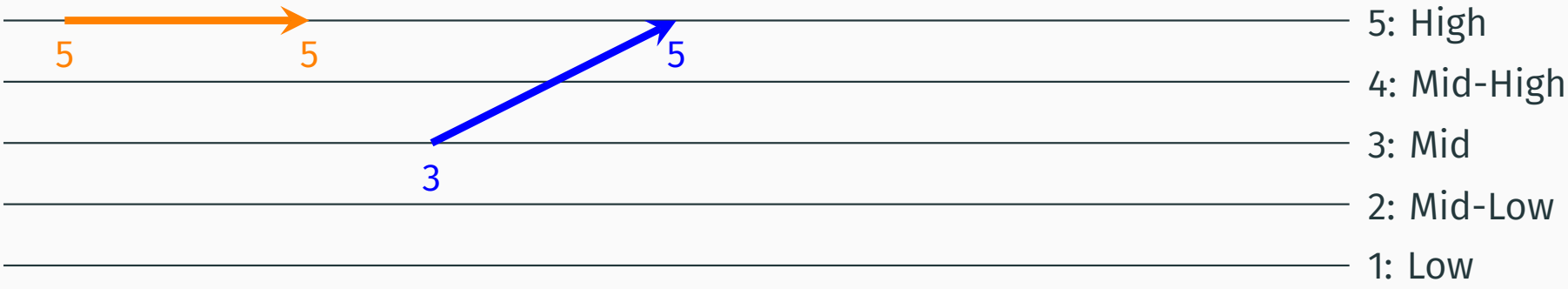
This is not a property of individual sounds, but rather a property of syllables as a whole.

Mandarin Chinese

Mandarin Chinese

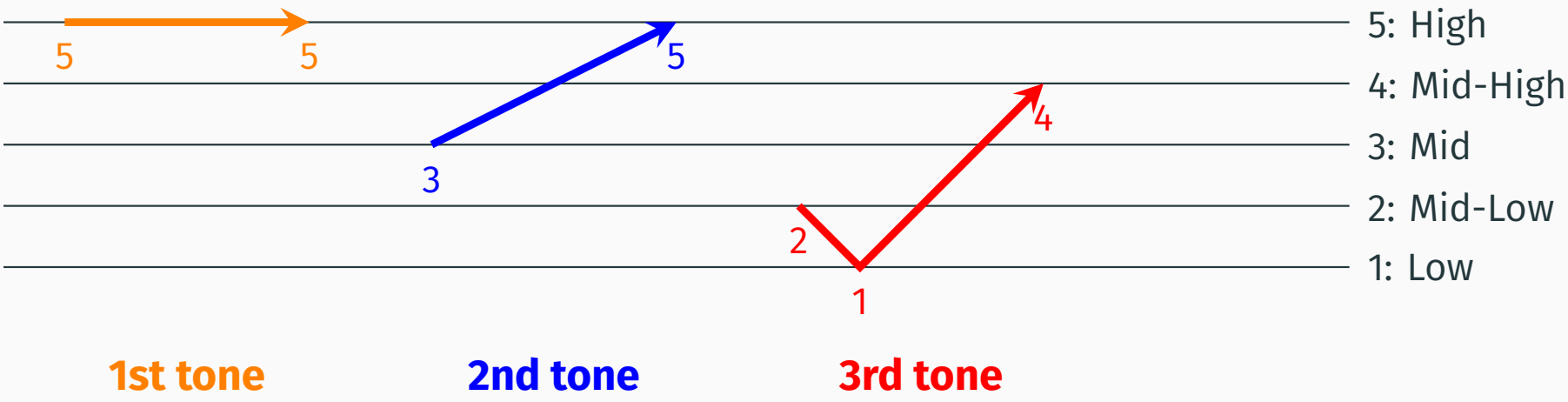
1st tone

Mandarin Chinese



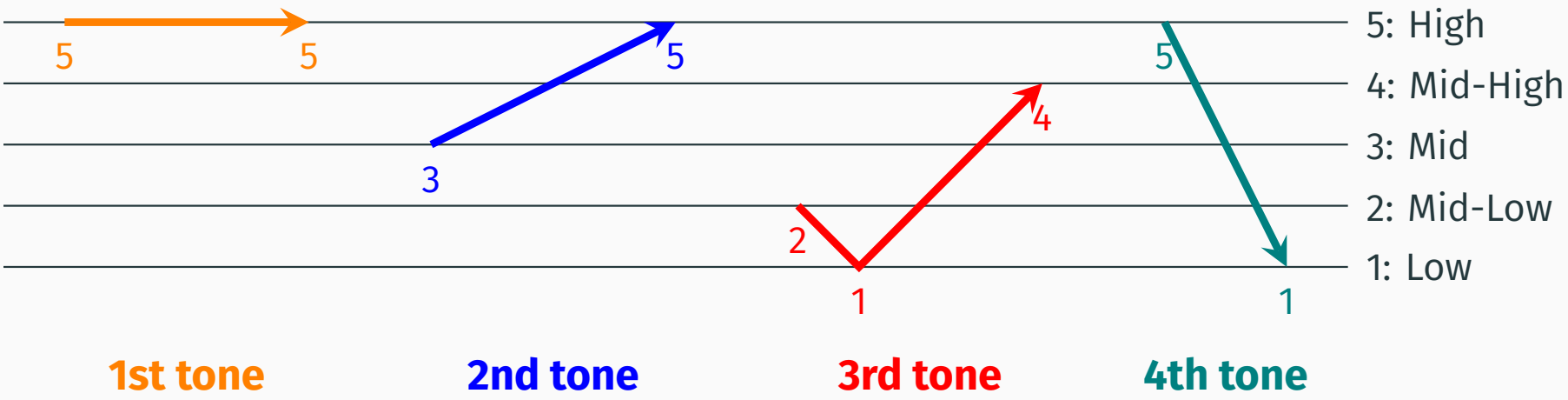
1st tone **2nd tone**

Mandarin Chinese



1st tone **2nd tone** **3rd tone**

Mandarin Chinese



Vietnamese tones

Vietnamese tones

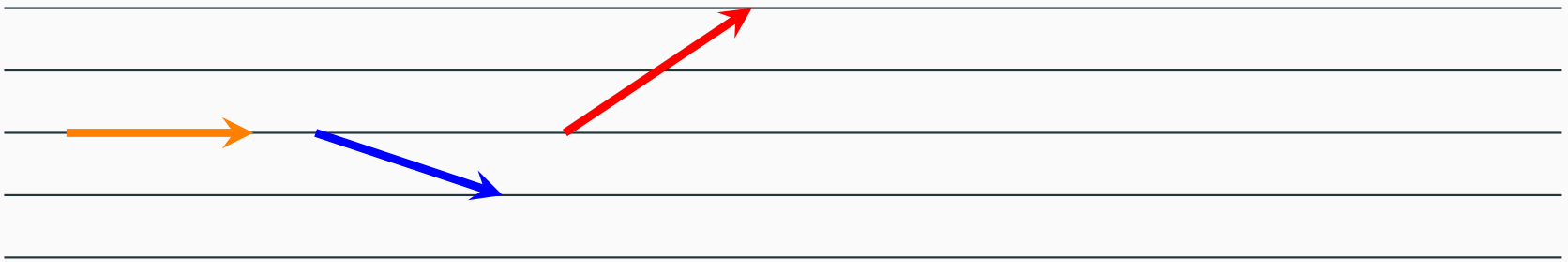
ma
‘ghost’

Vietnamese tones

ma
‘ghost’

mà
‘which’

Vietnamese tones

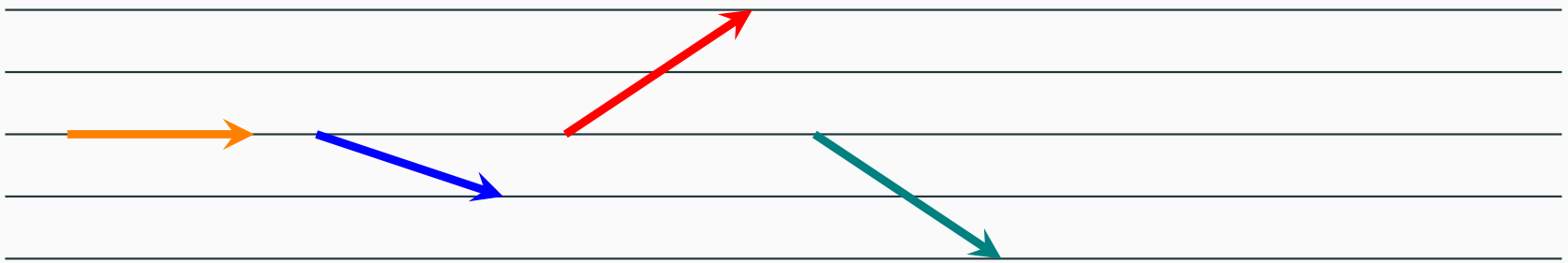


ma
‘ghost’

mà
‘which’

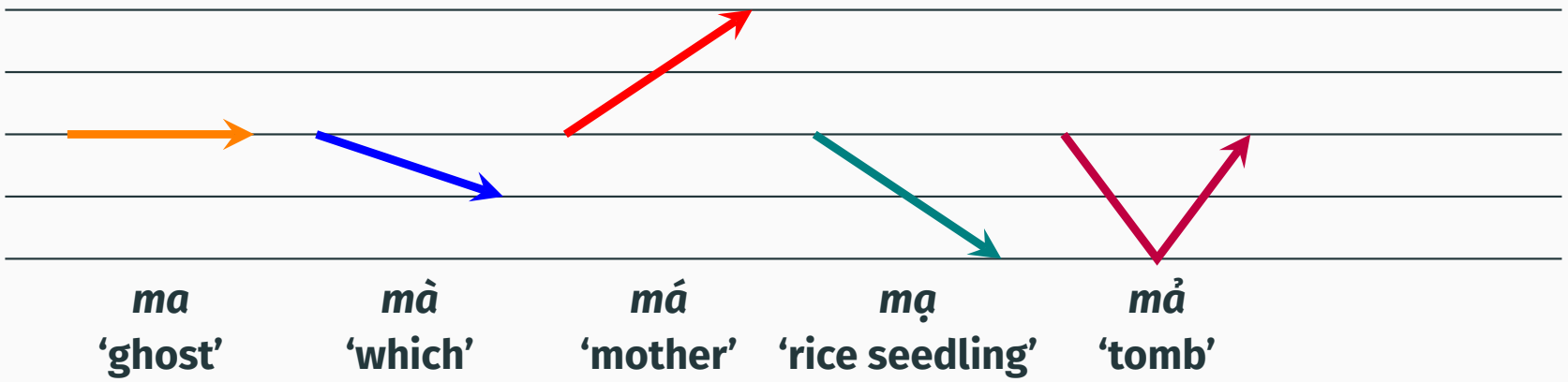
má
‘mother’

Vietnamese tones

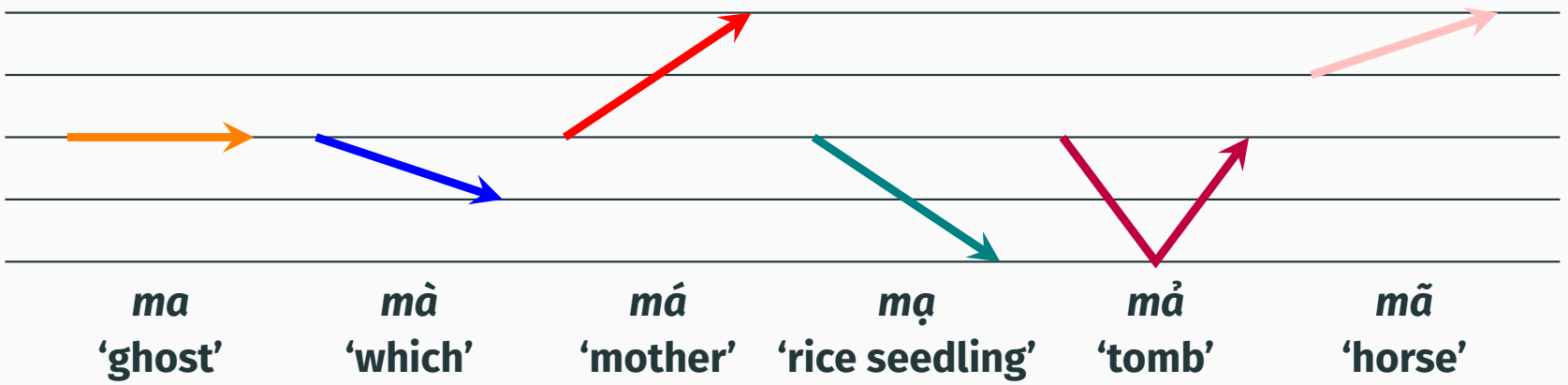


ma	*mà*	*má*	*mạ*
‘ghost’	‘which’	‘mother’	‘rice seedling’

Vietnamese tones



Vietnamese tones



Chatino tones

Chatino tones

jha^{A}
‘tortilla’

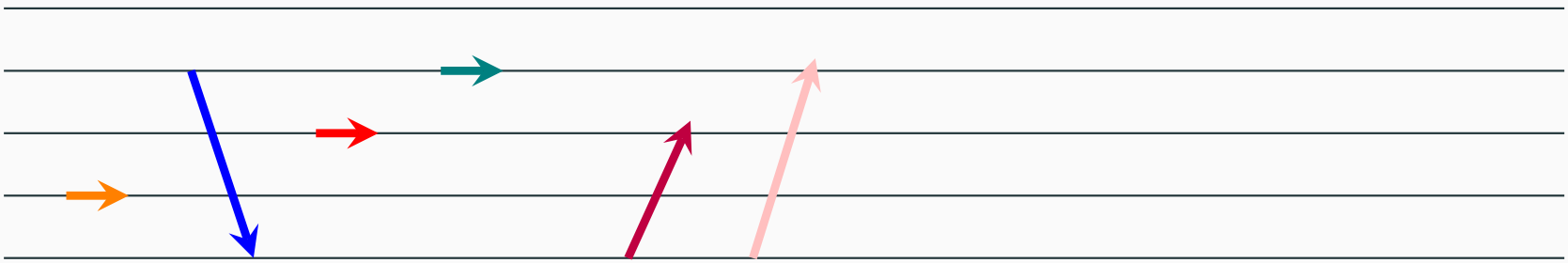
Chatino tones

Chatino tones

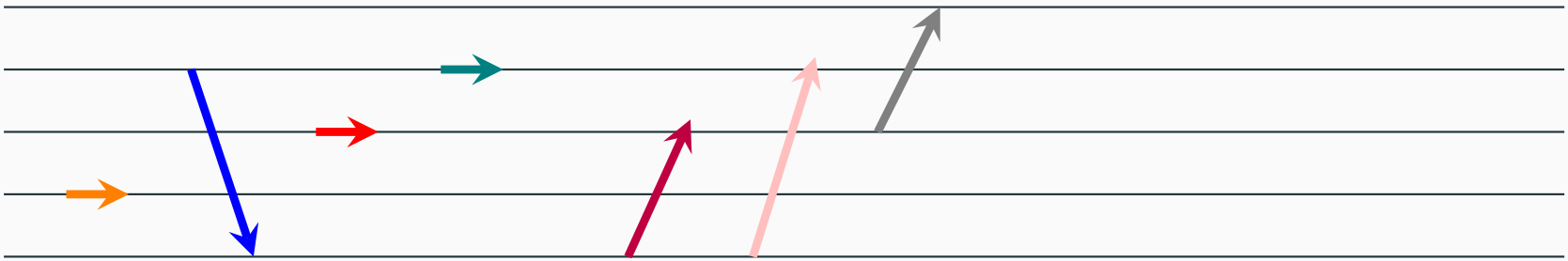
Chatino tones

Chatino tones

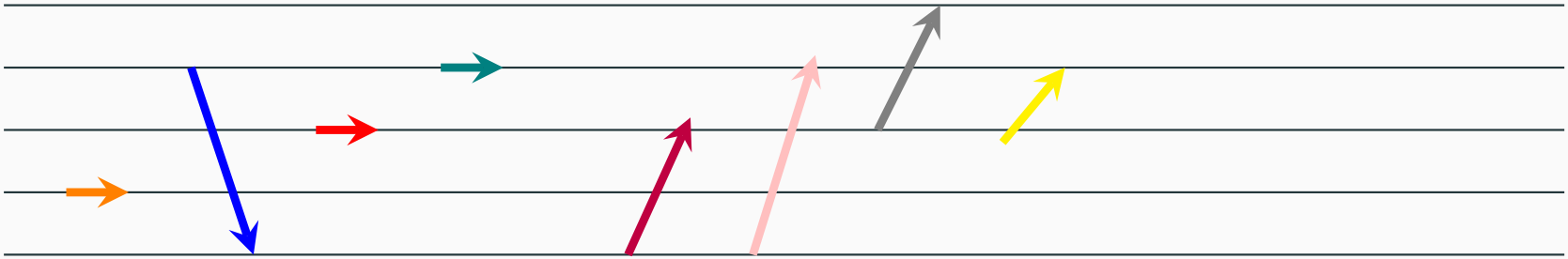
Chatino tones



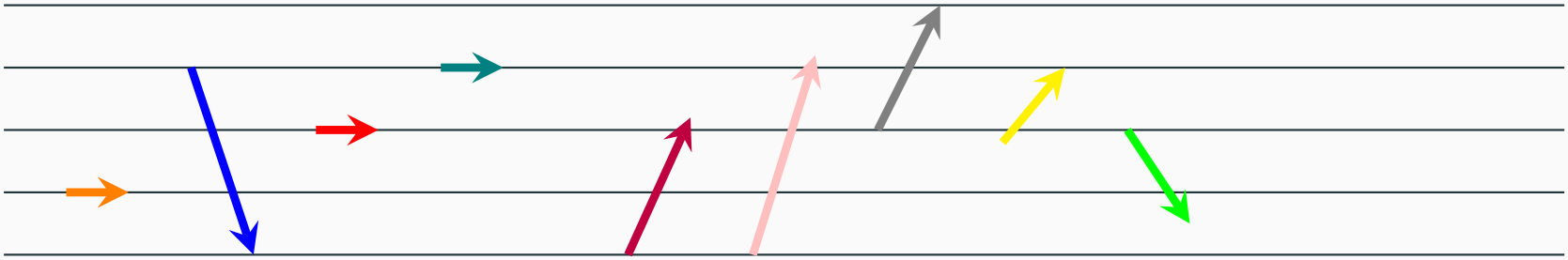
Chatino tones



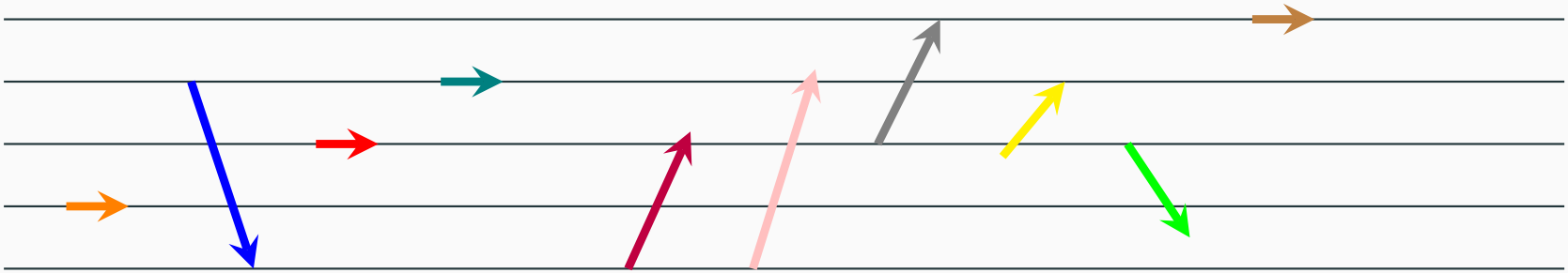
Chatino tones



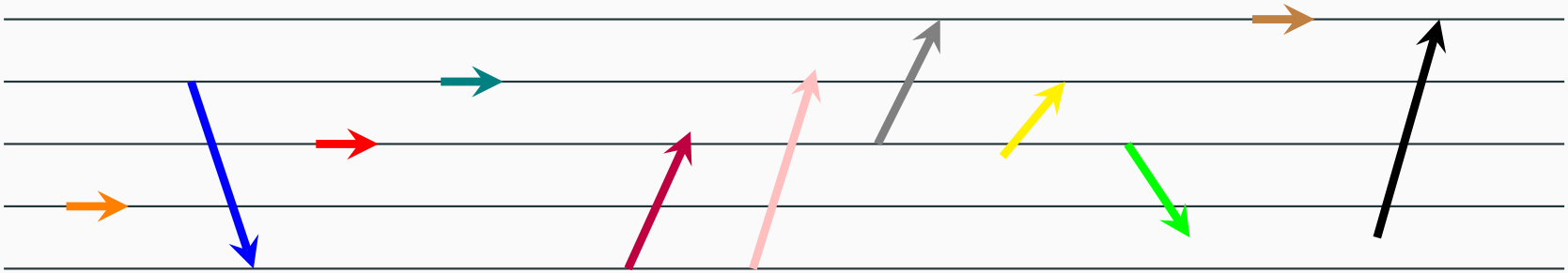
Chatino tones



Chatino tones



Chatino tones



Preview: Stress

- Another kind of suprasegmental is **STRESS**, where some syllables are typically more prominent than others:

  (1) [bə.næ.nə] ‘banana’ → [bə.ˈnæ.nə]
  [kæ.nə.də] ‘Canada’ → [ˈkæ.nə.də]

- Grammatical rules can be sensitive to stress (and other suprasegmentals):

  (2) **-freaking- infixation:**
  [kæ.lɪ.ˈfɔɹ.njə] ‘California’
  a. Cali-freaking-fornia
  b. *Ca-freaking-lifornia

- We will talk more about stress in a week or so!

Feature-changing rules and the English plural

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Refresher

- We have seen two interconnected parts of language:
  1. a finite set of idiosyncratic, memorized **basic elements** (words, sounds, …)
  2. **rules** manipulating these elements (syllabification)

→ **Heuristic for analysis:**
Everything **predictable** is handled by a **rule**.

A new type of rule

- We are going to look at a second type of rule.
- These rules are used when a **phonotactic constraint** is violated within a language.
- These rules then **change a sound** so that the result satisfies the phonotactic constraint.

The English plural

[kæbz]

[θɪŋz]

[muvz]

[skɔɹz]

[dē͡jz]

[lō͡wdz]

[bɑlz]

[kæps]

[nɛts]

[biks]

[kʌfs]

[mā͡wθs]

[bē͡jsɨz]

[wɪʃɨz]

[fɛzɨz]

[ɛdʒɨz]

[bætʃɨz]

The English plural

[kæb**z**]

[θɪŋ**z**]

[muv**z**]

[skɔɹ**z**]

[de͡j**z**]

[lo͡w̃d**z**]

[bɑl**z**]

[kæp**s**]

[nɛt**s**]

[bik**s**]

[kʌf**s**]

[ma͡w̃θ**s**]

[be͡jsɨ**z**]

[wɪʃɨ**z**]

[fɛzɨ**z**]

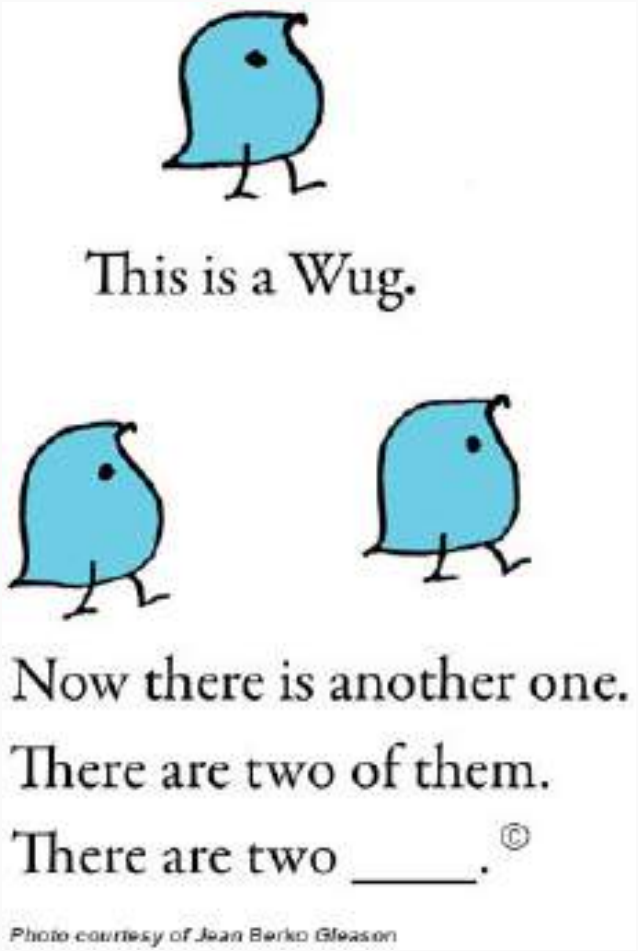
[ɛdʒɨ**z**]

[bætʃɨ**z**]

Productivity

(http://www.bu.edu/cas/magazine/spring12/signs/)

Productivity



(http://www.bu.edu/cas/magazine/spring12/signs/)

- The form of the plural is not just memorized.
- Therefore, there must be a **rule** that picks out the right form.

The English plural

[kæb**z**]

[θɪŋ**z**]

[muv**z**]

[skɔɹ**z**]

[de͡j**z**]

[lo͡w̃d**z**]

[bɑl**z**]

[kæp**s**]

[nɛt**s**]

[bik**s**]

[kʌf**s**]

[ma͡w̃θ**s**]

[be͡jsɨ**z**]

[wɪʃɨ**z**]

[fɛzɨ**z**]

[ɛdʒɨ**z**]

[bætʃɨ**z**]

The English plural

[kæb**z**]	[kæp**s**]
[θɪŋ**z**]	[nɛt**s**]
[muv**z**]	[bik**s**]
[skɔɹ**z**]	[kʌf**s**]
[de͡j**z**]	[ma͡wθ**s**]
[lo͡w**z**]	
[bɑl**z**]	

[be͡jsɨ**z**]

[wɪʃɨ**z**]

[fɛzɨ**z**]

[ɛdʒɨ**z**]

[bætʃɨ**z**]

The English plural

[kæb**z**]	[kæp**s**]
[θɪŋ**z**]	[nɛt**s**]
[muv**z**]	[bik**s**]
[skɔɹ**z**]	[kʌf**s**]
[de͡j**z**]	[ma͡wθ**s**]
[lo͡w**z**]	
[bɑl**z**]	

[be͡jsɨ**z**]

[wɪʃɨ**z**]

[fɛzɨ**z**]

[ɛdʒɨ**z**]

[bætʃɨ**z**]

- **[z]:** after vowels and voiced consonants
- **[s]:** after voiceless consonants

The English plural

[kæb**z**]	[kæp**s**]
[θɪŋ**z**]	[nɛt**s**]
[muv**z**]	[bik**s**]
[skɔɹ**z**]	[kʌf**s**]
[de͡j**z**]	[ma͡wθ**s**]
[lo͡w**z**]	
[bɑl**z**]	

[be͡jsɨz]

[wɪʃɨz]

[fɛzɨz]

[ɛdʒɨz]

[bætʃɨz]

- **[z]:** after vowels and voiced consonants
- **[s]:** after voiceless consonants

} ***predictable!***

Complementary distribution

Terminology: Complementary distribution

When two elements occur in **mutually exclusive environments**, they are in **COMPLEMENTARY DISTRIBUTION**.

- English plural:
  - **[z]:** after vowels and voiced consonants
  - **[s]:** after voiceless consonants
- One occurs in precisely those environments where the other never occurs.
- In other words, it is possible to **predict** from the preceding sound whether [z] or [s] will occur as the plural element.

→ ***The plural forms [z] and [s] are in complementary distribution.***

Good and bad codas in English

Good codas:

[kʌsp] [mæsk]

[kʌps] [meɪ̯ks]

[ɹæpt] [lɑkt]

[mʌst] [fɪʃt]

[fɹɑθt]

[mæts]

[eɪ̯tθ]

Bad codas:

*[kʌsb] *[mæsg]

*[kʌpz] *[meɪ̯kz]

*[ɹæpd] *[lɑkd]

*[mʌsd] *[fɪʃd]

*[fɹɑθd]

*[mætz]

*[eɪ̯tð]

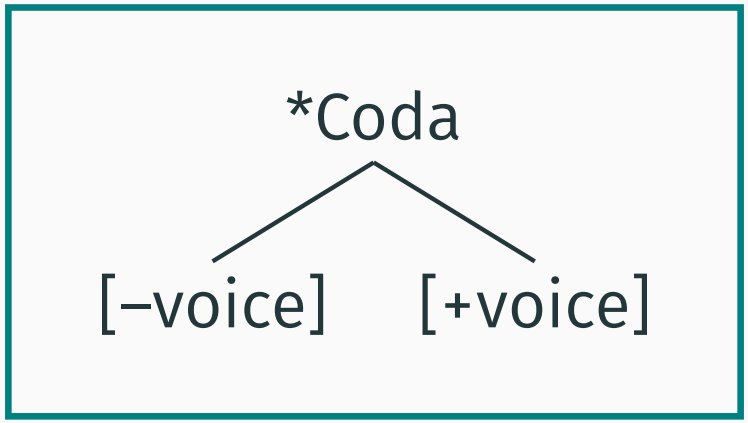
More good codas

Good codas:

[tʌbz]	[bʌgz]
[ɹɑbd]	[sʌmd]
[fɪzd]	[bænd]
[lægd]	[ɹɑŋd]
[bẽj͡ðd]	[dɹɛmt]
[ɑdz]	[ɹænt]
[ɹəlivd]	[ɪŋk]

A constraint on English codas

Constraint:
A voiceless sound may not be immediately followed by a voiced sound within the same coda.



The English plural

[kæb**z**]	[kæp**s**]
[θɪŋ**z**]	[nɛt**s**]
[muv**z**]	[bik**s**]
[skɔɹ**z**]	[kʌf**s**]
[de͡j**z**]	[ma͡wθ**s**]
[lo͡w̃d**z**]	
[bɑl**z**]	

[be͡jsɨz]

[wɪʃɨz]

[fɛzɨz]

[ɛdʒɨz]

[bætʃɨz]

- **[z]:** after vowels and voiced consonants
- **[s]:** after voiceless consonants

} ***predictable!***

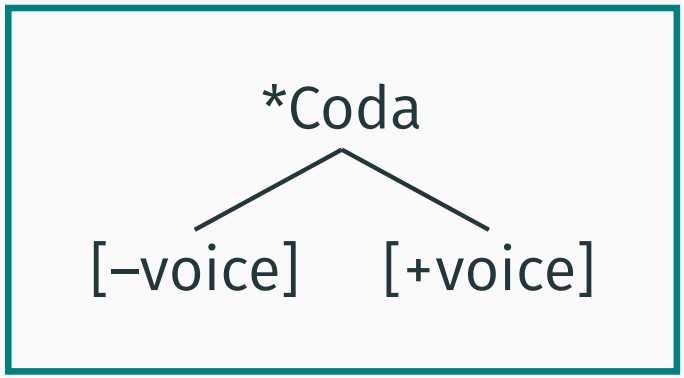
Back to the English plural

- **Generalization:**
  - **[z]:** after vowels and voiced consonants
  - **[s]:** after voiceless consonants

Back to the English plural

- **Generalization:**
  - **[z]:** after vowels and voiced consonants
  - **[s]:** after voiceless consonants

- **Constraint:**
  A voiceless sound may not be immediately followed by a voiced sound within the same coda.



The general picture

- The plural element has **a single underlying form**.
- This form sometimes gives rise to violations of a **phonotactic constraint**.
- A **rule** is applied to change a sound so that the constraint is no longer violated.

The English plural system: Part 1

- **Underlying form:**
  /z/

- **Phonotactic constraint:**
  *[–voice] [+voice] in coda

- **Rule:**
  /z/ becomes [s] if preceded by a [–voice] consonant in the same coda

Notation

- By assumption, the underlying form is what a speaker has memorized, and in some cases this form is changed by a phonological rule.
- It is useful to have a way of distinguishing between a word's representation in the speaker's memory and how it is actually pronounced.

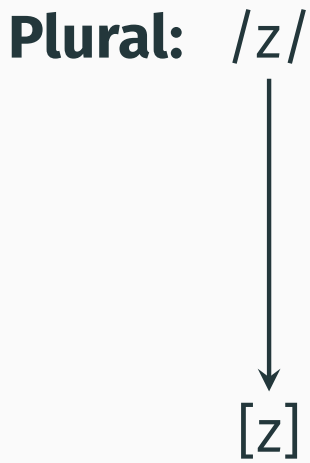
→ Actual spoken sounds are enclosed between square brackets: "[ ]"

→ Underlying forms are represented between slashes: "/ /"

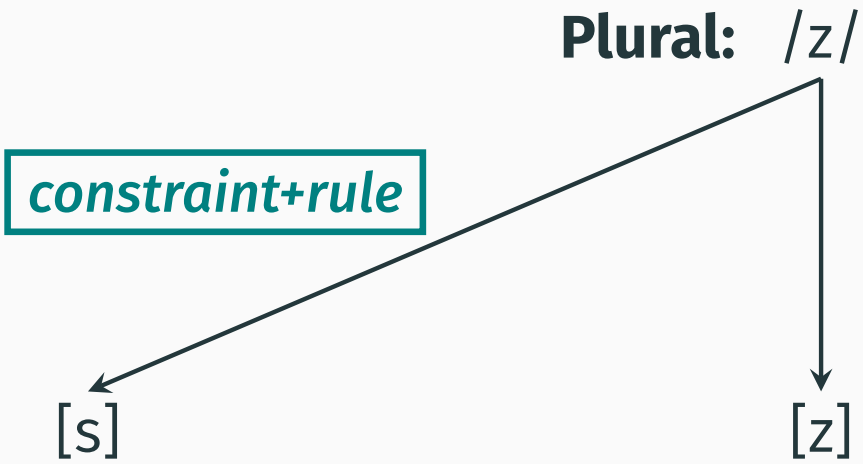
The English plural: Part 1

Plural: /z/

The English plural: Part 1



The English plural: Part 1



Why not /s/?

- **Question:**
  Why did we pick /z/ as the underlying form? Could we instead have picked /s/ and postulated a rule that changes it to [z]?

- **Answer: No**

- **Reason:**
  We assume that rules that change sounds apply **only if a phonotactic constraint would be violated otherwise**. The plural element is [z] in many cases in which [s] would **not** violate a phonotactic constraint.

Why not /s/?

‘boys:’ [bɔ͡ɪz] *[bɔ͡ɪs]

Why not /s/?

‘boys:’ [bɔ͡ɟz] *[bɔ͡ɟs] ***but:*** [vɔ͡ɟs] *‘voice’*

Why not /s/?

'boys:'	[bɔ͡ɟz]	*[bɔ͡ɟs]	***but:***	[vɔ͡ɟs]	*'voice'*
'scores:'	[skɔɹz]	*[skɔɹs]			

Why not /s/?

'boys:'	[bɔ͡ɟz]	*[bɔ͡ɟs]	***but:***	[vɔ͡ɟs]	*'voice'*
'scores:'	[skɔɹz]	*[skɔɹs]	***but:***	[hɔɹs]	*'horse'*

Why not /s/?

'boys:'	[bɔ͡ɟz]	*[bɔ͡ɟs]	***but:***	[vɔ͡ɟs]	*'voice'*
'scores:'	[skɔɹz]	*[skɔɹs]	***but:***	[hɔɹs]	*'horse'*
'dens:'	[dɛnz]	*[dɛns]			

Why not /s/?

'boys:'	[bɔ͡ɪz]	*[bɔ͡ɪs]	***but:***	[vɔ͡ɪs]	*'voice'*
'scores:'	[skɔɹz]	*[skɔɹs]	***but:***	[hɔɹs]	*'horse'*
'dens:'	[dɛnz]	*[dɛns]	***but:***	[dɛns]	*'dense'*

Why not /s/?

‘boys:’	[bɔ͡jz]	*[bɔ͡js]	***but:***	[vɔ͡js]	*‘voice’*
‘scores:’	[skɔɹz]	*[skɔɹs]	***but:***	[hɔɹs]	*‘horse’*
‘dens:’	[dɛnz]	*[dɛns]	***but:***	[dɛns]	*‘dense’*
‘falls:’	[fɑlz]	*[fɑls]			

Why not /s/?

'boys:'	[bɔ͡ɟz]	*[bɔ͡ɟs]	***but:***	[vɔ͡ɟs]	*'voice'*
'scores:'	[skɔɹz]	*[skɔɹs]	***but:***	[hɔɹs]	*'horse'*
'dens:'	[dɛnz]	*[dɛns]	***but:***	[dɛns]	*'dense'*
'falls:'	[fɑlz]	*[fɑls]	***but:***	[fɑls]	*'false'*

Why not /s/?

'boys:'	[bɔ͡ɟz]	*[bɔ͡ɟs]	***but:***	[vɔ͡ɟs]	*'voice'*
'scores:'	[skɔɹz]	*[skɔɹs]	***but:***	[hɔɹs]	*'horse'*
'dens:'	[dɛnz]	*[dɛns]	***but:***	[dɛns]	*'dense'*
'falls:'	[fɑlz]	*[fɑls]	***but:***	[fɑls]	*'false'*

Conclusion:

- The codas [s], [ɹs], [ns], and [ls] do not violate any phonotactic constraints of English.
- If the underlying form of the plural were /s/, we would incorrectly predict that the plural forms are *[bɔ͡ɟs], *[skɔɹs], *[dɛns], and *[fɑls].

The English plural

[kæb**z**]

[θɪŋ**z**]

[muv**z**]

[skɔɹ**z**]

[de͡j**z**]

[lo͡w̃d**z**]

[bɑl**z**]

[kæp**s**]

[nɛt**s**]

[bik**s**]

[kʌf**s**]

[ma͡w̃θ**s**]

[be͡js**ɨz**]

[wɪʃ**ɨz**]

[fɛz**ɨz**]

[ɛdʒ**ɨz**]

[bætʃ**ɨz**]

Where does [ɨz] occur?

[ɨz]:
after [s], [z], [ʃ], and [ʒ]

[z] + [s]:
only after sounds other than [s], [z], [ʃ], and [ʒ]

→ **Complementary distribution**

→ ***Predictable!***

More impossible codas

*[sz]	*[zz]	*[ʃz]	*[ʒz]
*[ss]	*[zs]	*[ʃs]	*[ʒs]
*[sʃ]	*[zʃ]	*[ʃʃ]	*[ʒʃ]
*[sʒ]	*[zʒ]	*[ʃʒ]	*[ʒʒ]

A look at the IPA

CONSONANTS (PULMONIC) © 2018 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

Picking out [s], [z], [ʃ], and [ʒ]

$$\begin{bmatrix} \text{+fricative} \\ \text{–dental} \\ \text{–labiodental} \\ \text{–glottal} \end{bmatrix}$$

Picking out [s], [z], [ʃ], and [ʒ]

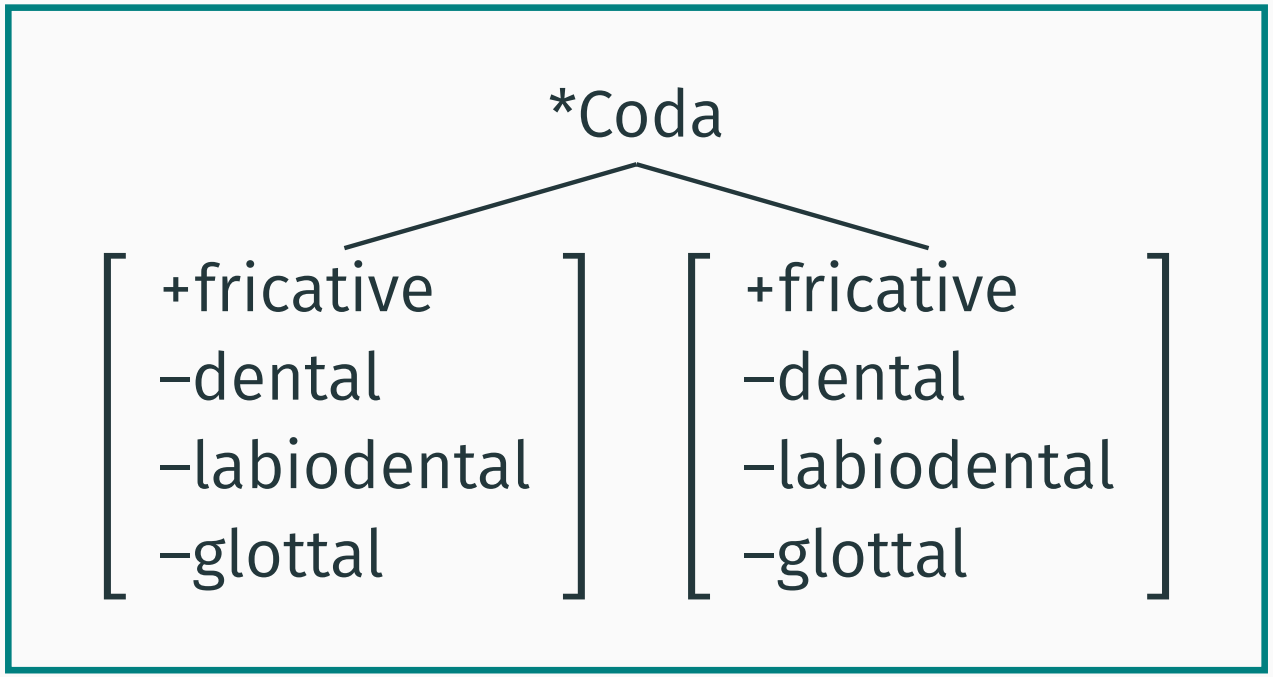
$$\begin{bmatrix} +\text{fricative} \\ -\text{dental} \\ -\text{labiodental} \\ -\text{glottal} \end{bmatrix}$$

Side note:
[–glottal] is not technically necessary here because [h] never occurs in coda position in English, so we don't need to worry about [h] when formulating a constraint on English codas.

A second coda constraint

Constraint:

A non-dental, non-labiodental, and non-glottal fricative may not be immediately followed by another non-dental, non-labiodental, non-glottal fricative within the same coda.



Where does [ɨz] occur?

[ɨz]:
after [s], [z], [ʃ], and [ʒ]

[z] + [s]:
only after sounds other than [s], [z], [ʃ], and [ʒ]

The general picture (rept.)

- The plural element has **a single underlying form**.
- This form sometimes gives rise to violations of a **phonotactic constraint**.
- A **rule** is applied to change a sound so that the constraint is no longer violated.

The English plural system: Part 2

- **Underlying form:**
  /z/

- **Phonotactic constraint:**
  $$*\begin{bmatrix}+\text{fricative}\\-\text{dental}\\-\text{labiodental}\\-\text{glottal}\end{bmatrix}\begin{bmatrix}+\text{fricative}\\-\text{dental}\\-\text{labiodental}\\-\text{glottal}\end{bmatrix}\text{ in coda}$$

- **Rule:**
  /z/ becomes [ɨz] if it is immediately preceded by a
  $$\begin{bmatrix}+\text{fricative}\\-\text{dental}\\-\text{labiodental}\\-\text{glottal}\end{bmatrix}\text{ consonant in the same coda}$$

The English plural: Overview