# Typology: Lecture IV Phonetics/Phonology and The Lexicon

Christian Bentz University of Tübingen

May 10, 2017



WORDS BONES GENES TOOLS Tracking Linguistic, Cultural, and Biological Trajectories of the Human Past



< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □

## OVERVIEW

PHONETICS AND PHONOLOGY Consonants Vowels Tones **Inventory Sizes** Small Inventories Large Inventories **Common and Uncommon Segments Common Segments** Rare: Clicks Rare: Ejectives THE LEXICON Introduction Core Vocabulary Loanwords

Color Terms

# PHONES, PHONEMES & ALLOPHONES

## A phoneme

- ► is the abstract class of all sounds (phones) that have the same function of distinguishing different word forms and meanings
- described as the smallest contrastive linguistic unit which can give rise to a minimal pair (e.g. English *bet* /bɛt/ and bat /bæt/)

Example:

- /r/ (alveolar trill) or /R/ (uvular trill) are both variants (allophones) of the phoneme /r/ in German
- /a/ and /a:/ are both allophones of the phoneme /a/ in Spanish, but not in German: Wall (rampart) vs. Wahl (election)

The phonemes (also called segments) of a language form its sound system.

# THE INTERNATIONAL PHONETIC ALPHABET (2015)

#### THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

ONSONANTS	(PULMONIC)
-----------	------------

	Bib	bial	Labico	dental	Den	ыl	Alve	olar	Postal	lveolar	Retr	oflex	Pal	at al	Ve	dar	Uvi	alar	Phary	ngcal	Glo	et al
Plosive	р	b					t	d			t	d	с	đ	k	g	q	G			2	
Naval		m		ŋ				n				η		ր		ŋ		Ν				
Inill		в						r										R				
Tap or Flap				v				ſ				r										
Fricative	φ	β	f	٧	θ	ð	s	z	ſ	3	s	Z,	ç	j	х	Y	χ	R	h	S	h	ĥ
Lateral fricative							ł	ķ	_								_					
Approximant				υ				1				÷		j		щ						
Lateral approximant								1				t		Á		L						

Close

Close-mid

Open-mid

#### CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
() Black	6 manual	Examples
Destal	d Densitatveolar	р' вына
(Post)abreolar	∮ Palatal	[' Dental alveolar
+ Palatoalveolar	of veter	k' veter
Alveolar lateral	G Uniter	S' Alveolar fricative

#### OTHER SYMBOLS

OTHER SYMBOLS		Oper
A Voiceless labial-velar fricative	C Z Alveole-palatal fricatives	
W Voiced labial-velar approximant	Voiced alveolar lateral flap	
U Voiced labial-palatal approximant	fj Simultaneous ∫ and X	
H Voiceless epiglottal fricative		
§ Voiced epiglettal tricative	Affricates and double articulations can be represented by two symbols	s ko
2 Entellottal plosting	joined by a tie bar if necessary.	

DL	DIACRITICS Some diacritics may be placed above a symbol with a descender, e.g. []										
	Voiceless	ņ	ģ		Breathy voiced	þ	a	, Denal L	ģ		
Ļ	Voiced	ş	ţ	~	Creaky voiced	þ	a	_ Apical _ E	ģ		
h	Aspirated	ť	$\mathbf{d}^{\mathrm{h}}$		Lingeolabial	ţ	d	_ Laminal \$	ģ		
,	More rounded	ò		w	Labialized	ť	dw	~ Nasalized	ê		
	Less rounded	ş		j	Palatalized	tj	dj	n Nasal release	dn		
	Advanced	ų		Y	Velarized	tY	dŸ	1 Lateral referee	d1		
_	Retracted	ę		2	Pharyngealized	t٢	$q_{\ell}$	No audible rolease	ď		
	Centralized	ë		~	Velarized or phar	yngesli	ned	ł			
ř	Mid-centralized	ē			Raised	ę	Ť-	voiced alveolar fricative)			
	Syllabic	ņ		,	Lowered	ę.	β-	voiced bilabial approximant	)		
	Non-syllabic	ĕ			Advanced Teega	e Root	ę				
÷	Rhoticity	ð	æ		Retracted Tongue	Root	ę				



- founa trían
- Half-long
- Reasonable A
- Minor (foot) group
- inking (absence of a break)

ŏ ar A Ricia

- 107 letters represent consonants and vowels
- ▶ 31 diacritics to further modify these
- ► 19 suprasegmental features (length, tone, stress, intonation)

# THE INTERNATIONAL PHONETIC ALPHABET (2015)

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

CONSONANT	S (PULM	ONIC)													c	2015	5 IPA
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retri	dex	Pola	ы	Ve	slar	U	ular	Phary	ngeal	Gk	anal
Plosive	рb			t d		t	þ	с	đ	k	g	q	G			2	
Nasal	m	nj		n			η		n		ŋ		Ν				
Trill	в			r									R				
Tap or Plap		v		ſ			ť										
Fricative	φβ	f v	θð	S Z	J 3	ş	Z,	ç	j	х	¥	χ	R	ħ	S	h	ĥ
Lateral fricative				1 3													
Approximant		υ		L			ł		j		щ						
Lateral approximent				1			l		λ		L						

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

VORTES.

CONSONANTS (NON-PULMONIC)



DL	ACRITICS Sort	e discritice	may be placed above a symbol with a descender, e.g. I	
	Veiceless	û ģ	_ Breathy roised b a _ Denail t c	
J	Veiced	S L	_ Creaky voiced b a _ Apical t c	
h	Aspirated	th dh	_ Lingueldial t d _ Locial t d	
7	More rounded	ç.	w Labsalued tw dw ~ Namized ê	
,	Less rounded	0	J rotation tj dj <sup>n</sup> Nativiase C	n
ï	Advanced	ų.	Y Velation t d d Latent release C	μ
	Retracted	ę	S Procynapolized the dS ' No matthe release C	ľ
"	Centralized	ë	- Velasteed or pharyngealteed	
*	Mid-contralized	ê	Raised C ( J = volced abveolar fricative)	
	Syllable	ņ	Lewered $\hat{\mathbf{e}} = (\hat{\boldsymbol{\beta}} = \text{voiced blabial approximant})$	
	Nea-ryllabic	ę	Advanced Tengae Reet - C	
4	Rhoticity	ə a	Restanced Tempse Root C	

Book i•v i . 11 uu+u Π. L Y e.0 9.0 Y+0 à E+00-3+3-14-5 12 æ a+n a.c. Where combols arroar in mirs, the one SUPPASEGMENTALS. Primary stress founa'ttfan : Long er \* Half-here C Extra-short Č Minor (foot) aroup Major (intonation) group Syllable break Ji.ækt Linking (absence of a break)

# TOMES AND WORD ACCENTS LENIL CONTOLE C = 1 Ingin C = 1

Focus on

- Fricatives
- Clicks
- ► Ejectives
- Tones



PHONETICS AND PHONOLOGY ••••••••••••••••••••••

## PULMONIC CONSONANTS

Plosive

Nasal

Trill

Tap or Flap

Fricative Lateral

fricative

Lateral

approxima

Approximant



[http://scriptsource.org/cms/scripts/page.php?item\_id=entry\_detail&uid=vgkauynhzh]

Sac

## PULMONIC CONSONANTS



Lateral flap: 1 =1. Other symbols: '=| ph ph "c hc p p|| t't=' e e m mée| tf téres

[http://scriptsource.org/cms/scripts/page.php?item\_id=entry\_detail&uid=vgkauynhzh]

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □

PHONETICS AND PHONOLOGY 

## **NON-PULMONIC CONSONANTS**



CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
🛈 Bilabial	6 Bilabial	, Examples:
Dental	d Dental/alveolar	p' Bilabial
(Post)alveolar	🕈 Palatal	t' Dental/alveolar
+ Palatoalveolar	f Velar	k' velar
Alveolar lateral	G Uvular	S' Alveolar fricative

[http://scriptsource.org/cms/scripts/page.php?item\_id=entry\_detail&uid=vgkauynhzh]

500

pharyngeal wall

## PHONETICS AND PHONOLOGY

## VOWELS



#### [https://en.wikipedia.org/wiki/Vowel]



<ロト < 団 > < 三 > < 三 > < 三 > < 三 > < ○ < ○ </p>

## TONES

#### TONES AND WORD ACCENTS

	LEVEL	C	CONTO	OUR
ő	or $\neg \frac{\text{Extra}}{\text{high}}$	ě °	r /	Rising
é	High	ê	Ν	Falling
ē	- Mid	ĕ	1	High rising
è	Low	ĕ	۲	Low rising
ề	$\Box$ Extra low	è	ላ	Rising- falling
↓	Downstep	70	Hobal	rise
↑	Upstep	$\mathbf{N}$	Hobal	fall

"A language is a tone language if the **pitch of the word** can change the **meaning of the word**. Not just its nuances, but its core meaning." [Yip, Moira (2002). Tone. Cambridge University Press]

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □

# TONES

Т	ON	JES	AND	WORI	D	A	CCE	ENTS
	LE	VEI	_			СС	NTO	DUR
ő	or	٦	Extra high	ě	Ś	or	Λ	Rising
é		٦	High	ê	į		Ν	Falling
ē		Н	Mid	ē	Ś		1	High rising
è		┛	Low	ĕ			۲	Low rising
ề			Extra low	ě			イ	Rising- falling
Ŷ	Do	wns	step	7	7	Gle	obal	rise
1	Up	step	,	7	L.	Gle	obal	fall

## Example

[yau] in Cantonese

high level 'worry' high rising 'paint (noun)' mid level 'thin' low level 'again' very low level 'oil' low rising 'have'

[yuori] in Dagaare (Ghana)

yùòrí 'penis' yúórì 'name'

[Yip (2002)]

## TONES

Т	ON	IES	AND	WORD	AC	CE	INTS			
	LE	VEI	_	CONTOUR						
ế	or	٦	Extra high	ě	or	Λ	Rising			
é		۲	High	ê		N	Falling			
ē		Н	Mid	é		1	High rising			
è		4	Low	ĕ		1	Low rising			
ề			Extra low	ĩ	,	۲	Rising- falling			
↓	Do	wns	step	7	Glo	bal	rise			
↑	Up	step	,	$\mathbf{N}$	Glo	bal	fall			

## Problems

- orthography does sometimes not reflect tones (e.g. logographic script of Mandarin Chinese)
- if it does reflect tones then there are inconsistencies

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □

▲□▶ ▲□▶ ▲ 臣▶ ▲ 臣▶ ― 臣 … のへぐ

# TONE MARKING IN AFRICA

High tone	acute accent	á
Low tone	grave accent	à or a (unmarked)
Mid tone	level accent	ā or a (unmarked)

Extra high	two acute accents	ã
Extra low	two grave accents	à

Falling	acute plus grave	â
Rising	grave plus acute	ă
[Yip (2002)]		

## TONE MARKING IN ASIA

### Chao Tone Letters

High tone	ta <sup>55</sup>	tak <sup>5</sup> (short syllable)
Mid tone	ta <sup>33</sup>	tak <sup>3</sup> (short syllable)
High rising (contour)	ta <sup>35</sup>	·
Mid low falling (contour)	ta <sup>31</sup>	
low falling-rising (complex)	$ta^{214}$	
low rising-falling (complex)	ta <sup>231</sup>	

#### Pinyin\*

High tone	mā	i.e. ma <sup>55</sup>
High rising	má	i.e. ma <sup>35</sup>
Falling	mà	i.e. ma <sup>41</sup>
Low falling-rising	mǎ	i.e. ma <sup>21(4)</sup>

\*Note the difference to African diacritics!

[Yip (2002)]

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □

# TONE MARKING IN THE AMERICAS

High tone (level) $si^1$  (single number)\*Low tone (level) $si^4$ High rising (contour) $si^{3-2}$  (with or without hyphen)High falling (contour) $si^{2-3}$ 

\*Note that the numbers are inverted compared to the Asian system (!)

[Yip (2002)]

## TONE OCCURRENCE

#### Segments

Showing 1 to 51 of 51 entries (filtered from 2,160 total entries)

Name 🔶	Representation v	Description						
Search	Search	Tone						
1	533/2155 (25%)	MODIFIER LETTER HIGH TONE BAR						
4	527/2155 (24%)	MODIFIER LETTER LOW TONE BAR						
4	277/2155 (13%)	MODIFIER LETTER MID TONE BAR						
N	141/2155 (7%)	IODIFIER LETTER HIGH TONE BAR - MODIFIER LETTER LOW TONE BAR						
A. Contraction of the second s	119/2155 (6%)	MODIFIER LETTER LOW TONE BAR - MODIFIER LETTER HIGH TONE BAR						
1	68/2155 (3%)	MODIFIER LETTER EXTRA-HIGH TONE BAR						
1	53/2155 (2%)	MODIFIER LETTER EXTRA-LOW TONE BAR						
N	52/2155 (2%)	MODIFIER LETTER EXTRA-HIGH TONE BAR - MODIFIER LETTER EXTRA-LOW TONE BAR						
A	38/2155 (2%)	MODIFIER LETTER EXTRA-LOW TONE BAR - MODIFIER LETTER EXTRA-HIGH TONE BAR						
a l	33/2155 (2%)	MODIFIER LETTER LOW TONE BAR - MODIFIER LETTER MID TONE BAR						
4	31/2155 (1%)	MODIFIER LETTER MID TONE BAR - MODIFIER LETTER LOW TONE BAR						
1	16/2155 (1%)	MODIFIER LETTER HIGH TONE BAR - MODIFIER LETTER MID TONE BAR						

## [Phoible database]

## TONE COMPLEXITY

Bafut (AA)	bafut	49	18	21	10
Buli (Ghana) (GM)	Buli	46	13	23	10
Ticuna (SPA)	Ticuna	38	11	18	9
Vengo (AA)	babungo (grassfields bantu, ring)	82	17	56	9
Nizaa (GM)	Nizaa	90	23	58	9
Konkomba (AA)	konkomba	42	12	22	8
Gwandara 1 (GM)	Gwandara (Karshi)	46	10	28	8
Gwandara 2 (GM)	Gwandara (Cancara)	52	12	32	8
Gwandara 3 (GM)	Gwandara (Toni)	48	12	28	8
Gwandara 4 (GM)	Gwandara (Gitata)	64	21	35	8
Gwandara 5 (GM)	Gwandara (Koro)	48	12	28	8
Gwandara 6 (GM)	Gwandara (Nimbia)	65	14	43	8
Dan (GM)	Dan	92	40	44	8
Attie (GM)	Attie	47	15	24	8
Nuclear Bassa (AA)	bassa	36	7	22	7
Kom (Cameroon) (AA)	kom	75	9	59	7
Lamnso' (AA)	nso'	45	12	26	7
Sochiapam Chinantec (PH)	Sochiapan Chinantec	39	14	18	7
Soninke (GM)	soninke (kaedi (MRT))	50	15	28	7
Mambwe-Lungu (GM)	cilungu	36	10	19	7
Ngiti (GM)	Ngiti	56	5	44	7
Vietnamese (SPA)	Vietnamese	39	12	21	6
lu Mien (SPA)	Yao	49	8	35	6

## [Phoible database]

# PNAS

# Climate, vocal folds, and tonal languages: Connecting the physiological and geographic dots

Caleb Everett<sup>a,1</sup>, Damián E. Blasi<sup>b,c</sup>, and Seán G. Roberts<sup>d</sup>

<sup>a</sup>University of Miami, Coral Gables, FL 33124; <sup>b</sup>Max Planck Institute for Mathematics in the Sciences, 04103 Leipzig, Germany; <sup>c</sup>Max Planck Institute for Evolutionary Anthropology, 04103 Leipzig, Germany; and <sup>d</sup>Max Planck Institute for Psycholinguistics, 6525 XD Nijmegen, The Netherlands

Edited by E. Anne Cutler, University of Western Sydney, Penrith South, New South Wales, Australia and approved December 24, 2014 (received for review September 9, 2014)



Fig. 1. Distribution of languages with complex tone (red dots) and without complex tone (blue dots) in the ANU database. Darker shading on map corresponds to lower MH.

## PHONEME (SEGMENT) INVENTORY SIZES



# SMALL INVENTORY: PIRAHA (11 SEGMENTS)

#### Consonants (Pulmonic)

	84	abial	Labk	idental	0	ental	AV	eciar	Post	alveolar 🛛	<b>Pr</b>	rates	Pa	latel	. Ve	er -	U.	alar 🛛	Phar	yngeal	GA	(68)
Plosive	P	b			1										k	q					2	
Nazal																						
Tra																						
Tap or Plap																						
Fricative																					h	
Lateral fricative																						
Approximant																						
Lateral																						
approximant																						

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

#### Consonants (Non-Pulmonic)

	Clicks	Voiced implosives						
	Blackal		Blabial					
	Dertal		Dental/alveolar					
	(Post)alveolar		Palatal					
÷	Palatoalveolar		Velar					
Ť.	Alveolar lateral		Uvular					

#### Vowels



Where symbols appear in pairs, the one to the right represents a rounded vowel

#### [Phoible database]

#### Sources

Sheldon, Stephen N, 1974

D. L. Everett 1982

#### Rodrigues, A. D. 1980



・ロト (四) (日) (日) (日) (日) (日)

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □

# LARGE INVENTORY: !XÓÕ (161 SEGMENTS)

#### Inventory !Xoo (GM)

Source name: 1Xóõ

Segment list IPA chart

#### **Consonants (Pulmonic)**

	Bit	ibial	Labi	odental	De	ental	Alv	eolar	Postalveolar		Retroflex		Palatal		Velar		Uvular		Pharyngeal		Glottal		
Plosive	р	b			1	d	t	d							÷	k	g	q	G			?	
Nasal		m				0									р								
Tril						I																	
Tap or Flap						£																	
Fricative	φ		f		θ		S		ſ						j.	x		Х				h	
Lateral fricative							+																
Approximant																							
Lateral								1.1															
approximant								1.1															

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

## Note: !Xóõ is not to be confused with !Xu in UPSID.

## [Phoible database]

**I** | | | |

= nac

# LARGE INVENTORY: !XÓÕ (161 SEGMENTS)

#### **Other Segments**

u KX	CALL STREET CALL AND A THE
ph	LATIN SMALL LETTER P - MODIFIER LETTER SMALL H
e	LATIN SMALL LETTER E - MODIFIER LETTER SMALL REVERSED GLOTTAL STOP
Gh	LATIN LETTER SMALL CAPITAL G - MODIFIER LETTER SMALL H
q!x	LATIN SMALL LETTER SCRIPT G - LATIN LETTER RETROFLEX CLICK - LATIN SMALL LETTER X
all	LATIN SMALL LETTER SCRIPT G - LATIN LETTER LATERAL CLICK
ql	LATIN SMALL LETTER SCRIPT G - LATIN LETTER DENTAL CLICK
q!	LATIN SMALL LETTER SCRIPT G - LATIN LETTER RETROFLEX CLICK
qŧ	LATIN SMALL LETTER SCRIPT G - LATIN LETTER ALVEOLAR CLICK
tx	LATIN SMALL LETTER T - LATIN SMALL LETTER X
²n 👘	MODIFIER LETTER GLOTTAL STOP - LATIN SMALL LETTER N
u	LATIN SMALL LETTER U - COMBINING TILDE BELOW
ĩm	MODIFIER LETTER GLOTTAL STOP - LATIN SMALL LETTER M
u	LATIN SMALL LETTER U - COMBINING DIAERESIS BELOW
GO	LATIN LETTER SMALL CAPITAL G - LATIN LETTER BILABIAL CLICK
k!	LATIN SMALL LETTER K - LATIN LETTER RETROFLEX CLICK
kŧ	LATIN SMALL LETTER K - LATIN LETTER ALVEOLAR CLICK
ĸİ	LATIN SMALL LETTER K - LATIN LETTER LATERAL CLICK
ĸÏ	LATIN SMALL LETTER K - LATIN LETTER DENTAL CLICK
dx	LATIN SMALL LETTER D - LATIN SMALL LETTER X
k x	LATIN SMALL LETTER K - LATIN LETTER LATERAL CLICK - LATIN SMALL LETTER X
нË — Г	MODIFIER LETTER MID TONE BAR
G!	LATIN LETTER SMALL CAPITAL G - LATIN LETTER RETROFLEX CLICK
k h	LATIN SMALL LETTER K - LATIN LETTER LATERAL CLICK - MODIFIER LETTER SMALL H
kľ '	LATIN SMALL LETTER K - LATIN LETTER LATERAL CLICK - MODIFIER LETTER APOSTROPHE
gikx'	LATIN SMALL LETTER SCRIPT G LATIN LETTER DENTAL CLICK - LATIN SMALL LETTER K LATIN SMALL LETTER X MODIFIER LETTER APOSTROPHE
kOx'	LATIN SMALL LETTER K - LATIN LETTER BILABIAL CLICK - LATIN SMALL LETTER X - MODIFIER LETTER APOSTROPHE
qO	LATIN SMALL LETTER Q - LATIN LETTER BILABIAL CLICK
alh	LATIN SMALL LETTER Q - LATIN LETTER DENTAL CLICK - MODIFIER LETTER SMALL H
kjix'	LATIN SMALL LETTER K - LATIN LETTER LATERAL CLICK - LATIN SMALL LETTER X - MODIFIER LETTER APOSTROPHE
'nO	MODIFIER LETTER GLOTTAL STOP - LATIN SMALL LETTER N - LATIN LETTER BILABIAL CLICK
kx'	LATIN SMALL LETTER K - LATIN SMALL LETTER X - MODIFIER LETTER APOSTROPHE
Οg	LATIN SMALL LETTER ENG - COMBINING RING BELOW - LATIN LETTER BILABIAL CLICK
k‡x'	LATIN SMALL LETTER K - LATIN LETTER ALVEOLAR CLICK - LATIN SMALL LETTER X - MODIFIER LETTER APOSTROPHE
qlx	LATIN SMALL LETTER SCRIPT G - LATIN LETTER LATERAL CLICK - LATIN SMALL LETTER X
dh	LATIN SMALL LETTER D - MODIFIER LETTER SMALL H
qh	LATIN SMALL LETTER Q - MODIFIER LETTER SMALL H
NG	LATIN LETTER SMALL CAPITAL N - LATIN LETTER SMALL CAPITAL G - LATIN LETTER DENTAL CLICK - LATIN SMALL LETTER Q - MODIFIER LETTER SMALL H
d'kx'	LATIN SMALL LETTER D - COMBINING BRIDGE BELOW - MODIFIER LETTER APOSTROPHE - LATIN SMALL LETTER K - LATIN SMALL LETTER X - MODIFIER LETTER APOSTROPHE
q	LATIN SMALL LETTER Q - MODIFIER LETTER APOSTROPHE
allow	ATIN WALL LETTER SCHOLD A LATIN ETTER DETROLES VILVE LATIN WALL LETTER VILLATIN WALL LETTER VILLATING WALL LETTER ADOPTIONNE

MODIFIER LETTER GLOTTAL STOP - LATIN SMALL LETTER N - LATIN LETTER DENTAL CLICK

## TEN MOST COMMON SEGMENTS ACROSS THE WORLD

## Segments

Showing 1 to 100 of 2,160 entries

Name 🔶	Representation 🚽	Description
Search	Search	Search
m	2053/2155 (95%)	LATIN SMALL LETTER M
k	2016/2155 (94%)	LATIN SMALL LETTER K
i	1998/2155 (93%)	LATIN SMALL LETTER I
a	1961/2155 (91%)	LATIN SMALL LETTER A
j	1901/2155 (88%)	LATIN SMALL LETTER J
u	1873/2155 (87%)	LATIN SMALL LETTER U
р	1873/2155 (87%)	LATIN SMALL LETTER P
w	1812/2155 (84%)	LATIN SMALL LETTER W
n	1742/2155 (81%)	LATIN SMALL LETTER N
S	1663/2155 (77%)	LATIN SMALL LETTER S

[Phoible database]

## RARE: CLICKS

#### Segments

\$ Name	Representation	Description
Search	Search	Click
k!	14/2155 (1%)	LATIN SMALL LETTER K - LATIN LETTER RETROFLEX CLICK
kļ	12/2155 (1%)	LATIN SMALL LETTER K - LATIN LETTER DENTAL CLICK
k	8/2155 (0%)	LATIN SMALL LETTER K - LATIN LETTER LATERAL CLICK
ŋ!	8/2155 (0%)	LATIN SMALL LETTER ENG - LATIN LETTER RETROFLEX CLICK
k! <sup>h</sup>	8/2155 (0%)	LATIN SMALL LETTER K - LATIN LETTER RETROFLEX CLICK - MODIFIER LETTER SMALL H
кļ <sup>ь</sup>	7/2155 (0%)	LATIN SMALL LETTER K - LATIN LETTER DENTAL CLICK - MODIFIER LETTER SMALL H
g!	6/2155 (0%)	LATIN SMALL LETTER SCRIPT G - LATIN LETTER RETROFLEX CLICK
gl	6/2155 (0%)	LATIN SMALL LETTER SCRIPT G - LATIN LETTER DENTAL CLICK
kj.	5/2155 (0%)	LATIN SMALL LETTER K - LATIN LETTER DENTAL CLICK - COMBINING X BELOW
ณ	5/2155 (0%)	LATIN SMALL LETTER ENG - LATIN LETTER DENTAL CLICK - COMBINING X BELOW
וומ	5/2155 (0%)	LATIN SMALL LETTER ENG - LATIN LETTER LATERAL CLICK
k	5/2155 (0%)	LATIN SMALL LETTER K - LATIN LETTER LATERAL CLICK - MODIFIER LETTER SMALL H
n	5/2155 (0%)	LATIN SMALL LETTER ENG - LATIN LETTER DENTAL CLICK
k‡	4/2155 (0%)	LATIN SMALL LETTER K - LATIN LETTER ALVEOLAR CLICK

Showing 1 to 100 of 173 entries (filtered from 2,160 total entries)

#### [Phoible database]

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □

## RARE: CLICKS



[Güldmann, Tom (2007). Clicks, genetics, and "proto-world" from a linguistic perspective. *ULPA*.]

◆ロト ◆舂 ト ◆臣 ト ◆臣 ト ○臣 - のへで

PHONETICS AND PHONOLOGY

イロト イポト イヨト イヨト 三日

990

## CLICKS AS PART OF PROTO-LANGUAGE?



[Nielsen et al. (2017). Tracing the peopling of the world through genomics. *Nature*.]

## ANATOMICAL BIAS IN CLICK SPEAKERS?



Figure 1. Three participants producing [!] (at the moment before release) in a static MRI sequence (10 second sustained articulation). From left to right, palate shape varies from steep to shallow; in correspondence with this, tongue blade placement is increasingly more anterior.

[Dediu & Moisk (2015). Anatomical biasing of click learning and production: An MRI and 3D palate imaging study. In: *Proceedings of the 18th International Congress of Phonetic Sciences (ICPhS 2015).*]

# **RARE: EJECTIVES**

#### Segments

Showing 1 to 100 of 140 entries (filtered from 2,160 total entries)

Name	Representation	Description
Search	Search	Apol
k'	183/2155 (8%)	LATIN SMALL LETTER K - MODIFIER LETTER APOSTROPHE
Ŋ.	145/2155 (7%)	LATIN SMALL LETTER T - COMBINING MINUS SIGN BELOW - LATIN SMALL LETTER ESH - MODIFIER LETTER APOSTROPHE
ť.	141/2155 (7%)	LATIN SMALL LETTER T - MODIFIER LETTER APOSTROPHE
p'	135/2155 (6%)	LATIN SMALL LETTER P - MODIFIER LETTER APOSTROPHE
ts'	96/2155 (4%)	LATIN SMALL LETTER T - LATIN SMALL LETTER S - MODIFIER LETTER APOSTROPHE
q'	65/2155 (3%)	LATIN SMALL LETTER Q - MODIFIER LETTER APOSTROPHE
8	55/2155 (3%)	LATIN SMALL LETTER T - COMBINING BRIDGE BELOW - MODIFIER LETTER APOSTROPHE
k**	49/2155 (2%)	LATIN SMALL LETTER K - MODIFIER LETTER SMALL W - MODIFIER LETTER APOSTROPHE
tł'	24/2155 (1%)	LATIN SMALL LETTER T - LATIN SMALL LETTER L WITH BELT - MODIFIER LETTER APOSTROPHE
J\$'	24/2155 (1%)	LATIN SMALL LETTER T - COMBINING BRIDGE BELOW - LATIN SMALL LETTER S - COMBINING BRIDGE BELOW - MODIFIER LETTER APOSTROPHE
c'	23/2155 (1%)	LATIN SMALL LETTER C - MODIFIER LETTER APOSTROPHE
d	20/2155 (1%)	LATIN SMALL LETTER Q - MODIFIER LETTER SMALL W - MODIFIER LETTER APOSTROPHE
s'	14/2155 (1%)	LATIN SMALL LETTER S - MODIFIER LETTER APOSTROPHE
k':	13/2155 (1%)	LATIN SMALL LETTER K - MODIFIER LETTER APOSTROPHE - MODIFIER LETTER TRIANGULAR COLON

### [Phoible database]



## Evidence for Direct Geographic Influences on Linguistic Sounds: The Case of Ejectives

#### Caleb Everett\*

Department of Anthropology, University of Miami, Coral Gables, Florida, United States of America



Figure 1. Plot of the locations of the languages in the sample. Dark circles represent languages with ejectives, clear circles represent those without ejectives. Clusters of languages with ejectives are highlighted with white rectangles. For illustrative purposes only. Inset: Lat-long plot of polygons executing 1500 m in elevation. Adapted from Figure 4 in [8]. The six major inhabitable areas of high elevation are highlighted with white rectangles. For illustrative purposes only. Inset: Lat-long plot of polygons executing 1500 m in elevation. Adapted from Figure 4 in [8]. The six major inhabitable areas of high elevation are highlighted with a dilplaces is major inhabitable areas of high elevation are highlighted with a dilplaces are and adjacent regions.

## THE LEXICON

- ► is the **base vocabulary** of a language
- A major subgrouping consists of open and closed class items, i.e. content words (nouns, verbs, adjectives), and function words (prepositions, conjunctions, articles, etc.)
- items can be added to open classes via word-formation,
   i.e. derivation and compounding
- inflected forms are typically not counted as separate lexical items

[see also Velupillai (2012)]

▲ロト ▲ 理 ト ▲ 王 ト ▲ 王 - の Q (~

# DIFFERENT TYPES OF LEXICA

- Mental lexicon: vocabulary items that individual speakers can access
- Dictionary: Set of all lexical items that are used by a speaker population/community (given a threshold for usage)
- Lexicon of a whole language: probably infinite due to productivity of compounding, derivation and neologisms

## WHICH LANGUAGE HAS THE BIGGEST LEXICON?

There is no systematic research on this topic, let alone a consensus. There are several reasons for this:

- 1. problems with the **definition of "word"**, e.g. including/excluding derivation, compounding, inflection
- 2. problems with the **text basis for meaningful comparison**, e.g. different registers, styles, genres etc. More generally, no language is fully parallel with any other language
- 3. fear of **misinterpretation**, e.g. nationalist claims regarding which is the "best", "most expressive" language

However, note that all of these issues are pervasive in other areas of linguistic inquiry too

< □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □

# ADAPTIVE LEXICA AND LINGUISTIC RELATIVITY

## Hypothesis

The structure of a language affects the ways in which its speakers conceptualize their world

⇒ Lexicon: The more important a concept is to a culture the more it might be subdivided. Famous example: The *words-for-snow controversy* 

## WORDS FOR SNOW



[Whorf, Benjamin L. (1956). Science and linguistics. In: John B. Carroll (ed.), *Language*, *Thought*, and *Reality*. *Selected writings of Benjamin Lee Whorf*. MIT Press.] "[...] Another example of the same kind, the words for SNOW in Eskimo, may be given. Here we find one word, *aput*, expressing SNOW ON THE GROUND; another one, *qana*, FALLING SNOW; a third one, *piqsirpoq*, DRIFTING SNOW; and a fourth one, *qimuqsuq*, A SNOWDRIFT."

[Boas, Franz (1911). *Handbook of American Indian Languages*. Washington: Government Printing Office. pp. 26-27.]

## WORDS FOR SNOW: REVISITED



Fig 1. Results of cross-language surveys. Top panels: Library survey. (a) Locations associated with 13 languages that use the same term for ice and snow, and (b) 37 languages that use different terms. (c) Temperatures associated with the locations shown in (a) and (b). Bottom panels: IDS+ data. (d) Locations associated with 21 languages that use the same term for ice and snow, and (e) 145 languages that use different terms. (f) Temperatures associated with the locations shown in (d) and (e). Map data for this and all subsequent figures are from naturalearthdata.com.

[Regier et al. (2016). Languages support efficient communication about the environment: Words for snow revisited. *PLOS One.*]

## THE IDEA OF A CORE VOCABULARY

Old Eng.	Mod. Eng.	Cognates	Latin	Spanish	Cognates
eall and	all and	+ +	omnēs et (or — que)	todos y	- +
dēor æsc æt bæc fūl rind belg	animal ashes at back bad bark belly	- + + - +	animal cinis in dorsum malus cortex venter	animal cenizos a espaldo malo corteza vientre	+++++++++++++++++++++++++++++++++++++

[Swadesh, Morris (1952). Lexico-statistic dating of pre-historic ethnic contacts: With special reference to North American Indians. Proceedings of the American Philosophical Society, Vol. 96, No. 4.]

## SWADESH LIST

Originally 200, later 100 items which are unlikely to be borrowed.

all (of a number), and, animal, ashes, at, back (person's), bad (deleterious or unsuitable), bark (of tree), because, belly, berry (or fruit), big, bird, to bite, black, blood, to blow (of wind), bone, breathe, to burn (intrans.).

child (young person rather than as relationship term), cloud, cold (of weather), to come, to count, to cut, day (opposite of night rather than time measure), to die, to dig, dirty, dog, to drink, dry (substance), dull (knife), dust, ear, earth (soil), to eat, egg, eye.

[Swadesh, Morris (1952). Lexico-statistic dating of pre-historic ethnic contacts: With special reference to North American Indians. Proceedings of the American Philosophical Society, Vol. 96, No. 4.]

▲ロト ▲ 理 ト ▲ 王 ト ▲ 王 - の Q (~

# LOANWORDS

- ► Lexical items **borrowed** from one language into another
- typical outcome of language contact situations
- "disturb" the phylogenetic relationships between languages and hence pose challenges for reconstruction

# BORROWING SCALE (LEXICON)

Language Contact, Creolization, and Genetic Linguistics

SARAH GREY THOMASON & TERRENCE KAUFMAN

- 1. **Casual contact**: Content words, non-basic vocabulary before basic vocabulary
- 2. Slightly more intense contact: Function words (conjunctions, adverbial particles)
- 3. **More intense contact**: Function words (adpositions), and derivational morphology

...

[Thomason & Kaufman (1988). *Language Contact, Creolization, and Genetic Linguistics*. University of California Press.]

## ENGLISH LOANWORDS



#### 42% of the vocabulary analyzed are loanwords [World Loanword Database]

# Ket Loanwords



10% of the vocabulary analyzed [World Loanword Database]

# COLOR TERMS



## Two major hypotheses:

- There is a finite inventory of 11 colors from which languages pick their basic terms
- 2. While not all languages name the same set of colors, there are universal implicational hierarchies of which colors are picked

[Berlin, Brent & Paul Kay (1969). *Basic Color Terms. Their Universality and Evolution.* CSLI Publication.]

# BASIC COLOR TERMS: IMPLICATIONAL HIERARCHY



[Berlin, Brent & Paul Kay (1969). *Basic Color Terms. Their Universality and Evolution*. CSLI Publication.]

◆ロト ◆舂 ト ◆臣 ト ◆臣 ト ○臣 - のへで

## BASIC COLOR TERMS: IMPLICATIONAL HIERARCHY

BLACK, WHITE: Jalé (Papua New Guinea)
BLACK, WHITE, RED: Tiv (Nigeria)
BLACK, WHITE, RED, YELLOW: Ibo (Nigeria)
BLACK, WHITE, RED, GREEN: Ibibio (Nigeria)
BLACK, WHITE, RED, YELLOW, GREEN: Tzeltal (Mexico)
BLACK, WHITE, RED, YELLOW, GREEN, BLUE: Plains Tamil (India)
BLACK, WHITE, RED, YELLOW, GREEN, BLUE, BROWN: Nez Perce (State of Washington)

[Moravcsik, Edtih A. (2012). *Introducing Language Typology*. Cambridge University Press. p. 57]



# **The World Color Survey**

The World Color Survey (WCS) was initiated in the late 1970's to test the hypotheses advanced by Berlin and Kay ( $\underline{1969}$ ) regarding

- (1) the existence of universal constraints on cross-language color naming, and
- (2) the existence of a partially fixed evolutionary progression according to which languages gain color terms over time.

[http://www1.icsi.berkeley.edu/wcs/]

## WORLD COLOR SURVEY

"In the WCS investigation, an average of 24 native speakers of each of 110 unwritten languages were asked (1) to name each of 330 Munsell chips, shown in a constant, random order, and (2), exposed to a palette of these chips and asked to to pick out the best example(s) ("foci") of the major terms elicited in the naming task."



[http://www1.icsi.berkeley.edu/wcs/data.html]

## COLOR TERMS AND TECHNOLOGICAL COMPLEXITY?

#### § 2.1 Basic color lexicon and technological/cultural complexity

In addition to the fact that the stages of complexity of color vocabulary have a temporal ordering, there appears to be a positive correlation between general cultural complexity (and/or level of technological development) and complexity of color vocabulary. All the languages of highly industrialized European and Asian peoples are Stage VII, while all representatives of early Stages (I, II, and III) are spoken by peoples with small populations and limited technology, located in isolated areas. However, this kind of correlation cannot be established with precision until concepts such as "level of technological development" and "degree of cultural complexity" are better understood and more precisely measured than they are at present. Such information as we have, although vague, suggests that the sequence of elaboration of color lexicon is an evolutionary one accompanying, and perhaps a reflex of, increasing technological and cultural advancement.

[Berlin, Brent & Paul Kay (1969). *Basic Color Terms. Their Universality and Evolution*. CSLI Publication.]

## THANKS. SEE YOU NEXT WEEK!

