Variability of Languages in Time and Space

Phonological Typology, Consonant and Vowel inventories

- Motivation for Linguistic Typology
- Phonetics and Phonology
- Consonant and Vowel Inventories
- Segmental Processes
- Linguistic quiz to the end

Anja Nedoluzhko

Linguistic Typology

Linguistic Typology - Motivation

Linguistic analysis and comparison of language features on a large number of languages

- gives awareness of what is
  - possible
  - possible and frequent
  - almost or fully impossible
- lets us combine features, find correlations, implications
  - few consonants ≈ simple sillables
  - nasal vowels → oral vowels
- helps understand phonological data in a given language
  - *I've seen this before… Typically it goes like this…*

Linguistic Typology - Motivation

- Informs what is common/uncommon

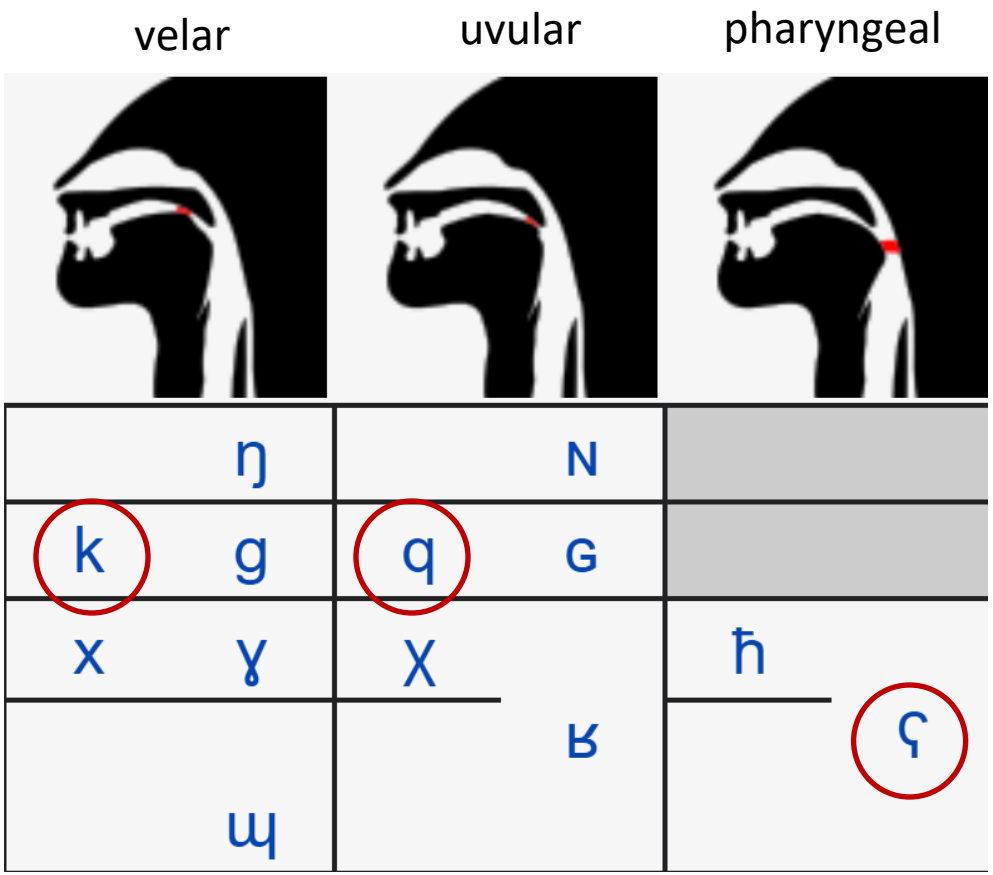
> Odden 2013: „It is very difficult to refuse a claim of the form „X is more common than Y," except if a very detailed numerical study is undertaken."

  - 'basic' SVO word order
  - anaphoricity of the definite article
  - unstressed vowel reduction, length and stress correlation
  - labialized u and ü
- Markedness
  - something atypical, variants, special cases
  - in phonology: Not all segments (sets of segments, rules) have equal status in phonological systems.

Markedness

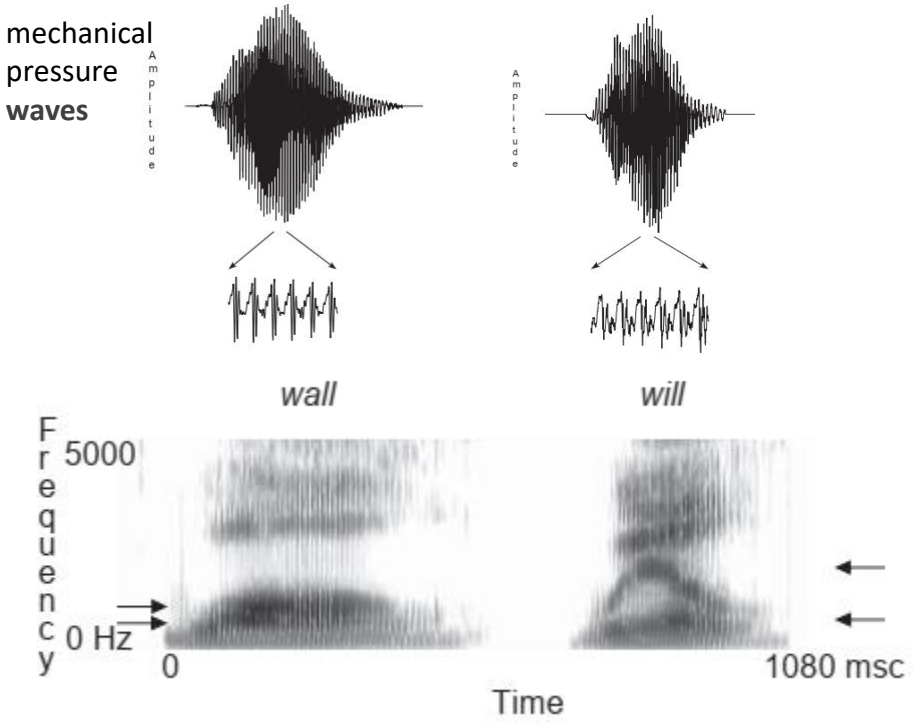
X is marked (**relative to Y**):

- [ʕ] is more marked than [q]
- [q] is more marked than [k]
- pharyngeals are marked sounds (relative to other sounds of the world's languages)



Phonetics

- **Phonetics** – the manifestation of language sound
  - Acoustic properties of language sounds



- The tools of phonetic analysis provide very detailed and precise information about the amplitude, frequency and time characteristics.
- Expanded view of the vowel part of these waveforms shows differences in the overall shape of the time-varying waveforms.
- Too much information – a lot of information needs to be discarded to get at something more general and useful.

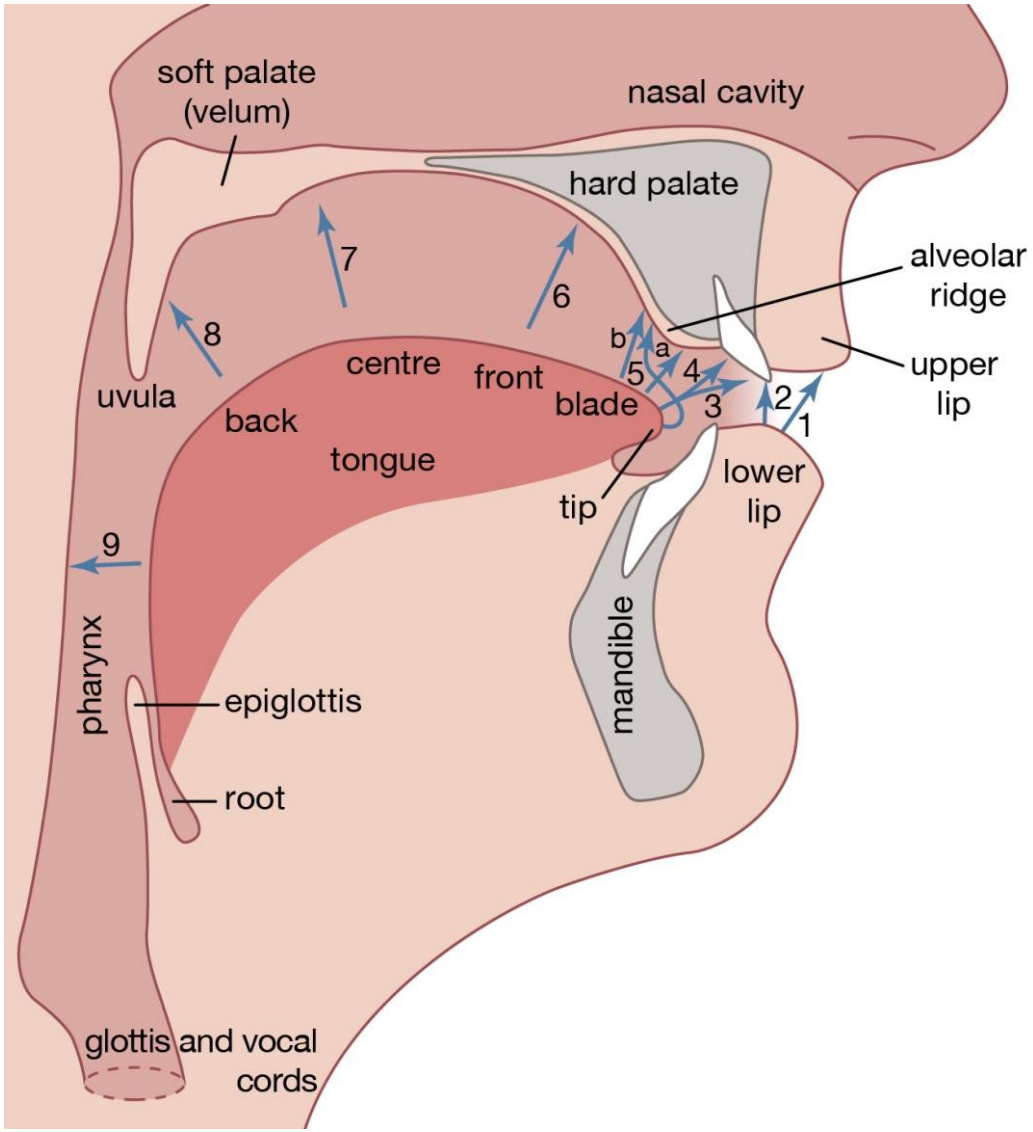
spectogram:

reducing the absolute amplitude properties of a wave at an exact time to a set of (less precise) amplitude characteristics in different frequency and time areas

Phonetics

- **Phonetics** – the manifestation of language sound
  - Acoustic properties of language sounds
  - Articulatory properties of language sounds
    - At what place in the mouth the sounds are formed and how they are formed
    - E.g. consonants are formed in the vocal tract in various places. Obstacles place and intensity define the sound quality.

Articulatory Phonetics



CONSONANTS

(1) Bilabial
(2) Labiodental
(3) Dental and interdental
(4) Alveolar
(5) Postalveolar
  (a) Retroflex
  (b) Palato-alveolar
(6) Palatal
(7) Velar
(8) Uvular
(9) Pharyngeal

Phonetics

- **Phonetics** – the manifestation of language sound
  - Acoustic properties of language sounds
  - Articulatory properties of language sounds
  - Systematic limits on what sounds and combination of sounds are possible in a human language
    - Transcription: Systems of symbols and their phonetic properties, e.g. International Phonetic Alphabet (IPA)

International Phonetic Alphabet (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			

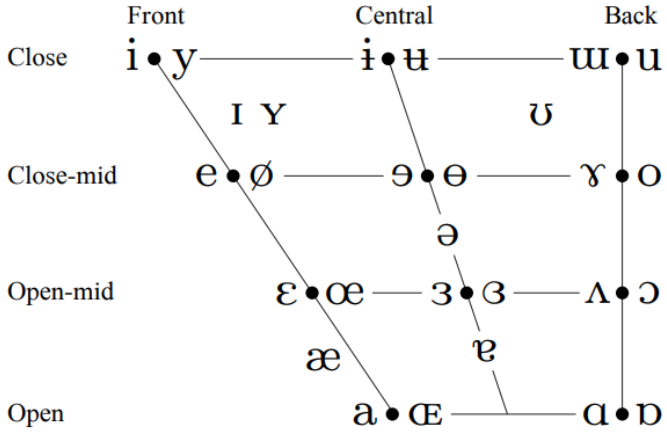
Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
ʘ Bilabial	ɓ Bilabial	’ Examples:
ǀ Dental	ɗ Dental/alveolar	pʼ Bilabial
ǃ (Post)alveolar	ʄ Palatal	tʼ Dental/alveolar
ǂ Palatoalveolar	ɠ Velar	kʼ Velar
ǁ Alveolar lateral	ʛ Uvular	sʼ Alveolar fricative

OTHER SYMBOLS

VOWELS



Phonetics and Phonology

- **Phonetics** – the manifestation of language sound
  - Acoustic properties of language sounds
  - Articulatory properties of language sounds
  - Transcription: International Phonetic Alphabet (IPA)
- **Phonology** – the study of sound systems
  - Looking for a way to represent just the essentials of language sounds, as mental objects which grammars can manipulate.
  - Reduces the great mass of phonetic information to a cognitive minimum, to a sequence of discrete segments.
  - Sounds (phonemes) are symbolic sounds, cognitive abstractions, which represent but are not the same as physical sounds.

Phonemes

- The smallest distinct acoustic unit in a language that may distinguish meaning of larger units
- A phoneme does not convey meaning itself

***p**in, **t**in, **k**in, **f**in, **th**in, **s**in, **sh**in*

*di**m**, di**n**, di**ng**, di**d**, di**g**, di**sh***

*p**i**n, p**e**n, p**a**n, p**u**n, p**ai**n, p**i**ne, p**aw**n*

Phonetics and Phonology: Practice

- Are the following statements from phonetics or from phonology?
  - The sounds in the word *frame* change continuously
  - Towards the end of the word *frame*, the velum is lowered
- Why is it undesirable to use the most precise representation of the physical properties of a spoken word in discussing rules of phonology?
- Give the phonetic symbols for
  - Dental nasal
  - Labio-dental fricative
- How many phonemes are there:
  - *sit, judge, trap, fish, bite, ball, up, ox, through, often*

Phonemic Inventories Databases

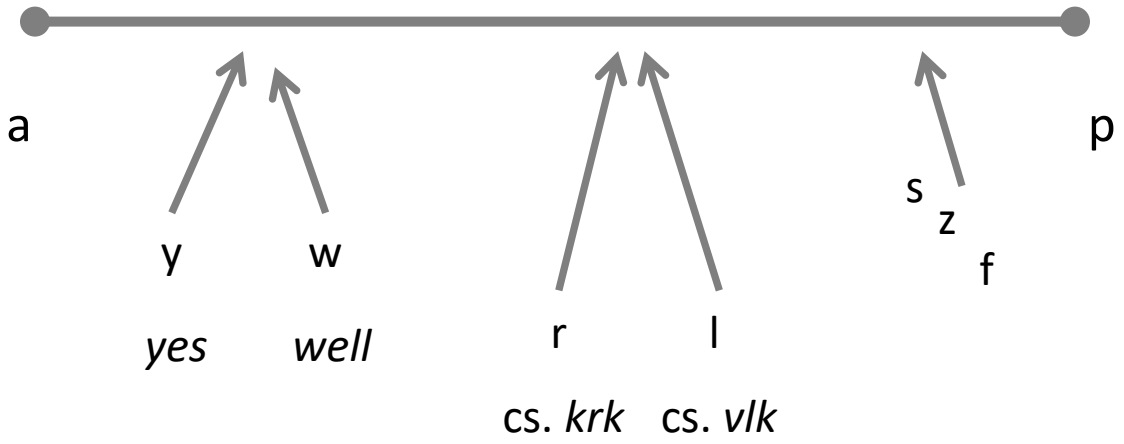
- SPA, Stanford Phonology Archive (Vihman, 1974)
  - first computerized database of phonological segment inventories, inspired by Joseph Greenberg's research on universals and his personal archive of data,
  - includes descriptions of phonemes, allophones and comments on phonological contexts for 197 languages.
- UPSID, UCLA Phonological Segment Inventory Database (Maddieson 1984, 1997)
  - statistical survey, phonemic inventories,
  - 451 languages in the last version
  - http://web.phonetik.uni-frankfurt.de/upsid.html
- Phonemic inventories within WALS (Maddieson 2013)
  - 564 languages
  - http://wals.info/
- The Database of Eurasian Phonological Inventories (Nikolaev, 2018)
  - collection and analysis of information on segmental inventories of Eurasian languages
  - https://eurphon.info/
- **PHOIBLE database** (Moran et al. 2014, updated in 2019)
  - segment inventories of 1,672 languages
  - IPA realizations
  - https://phoible.org/

Multiple Phonemic Inventories

- Phoneme analysis is a non-deterministic process
- Phonological descriptions of a particular language's speech sounds may have different sets of contrastive phonemes when analyzed by different linguists (or sometimes even by the same linguist throughout his career)
- E.g. in PHOIBLE:
  - 9 inventories for English (39 to 45 segments)
  - 4 inventories for German (39 to 41 segments)
  - 5 inventories for Spanish (25 to 45 segments)
    - reasons
      - different dialects
      - different attitudes

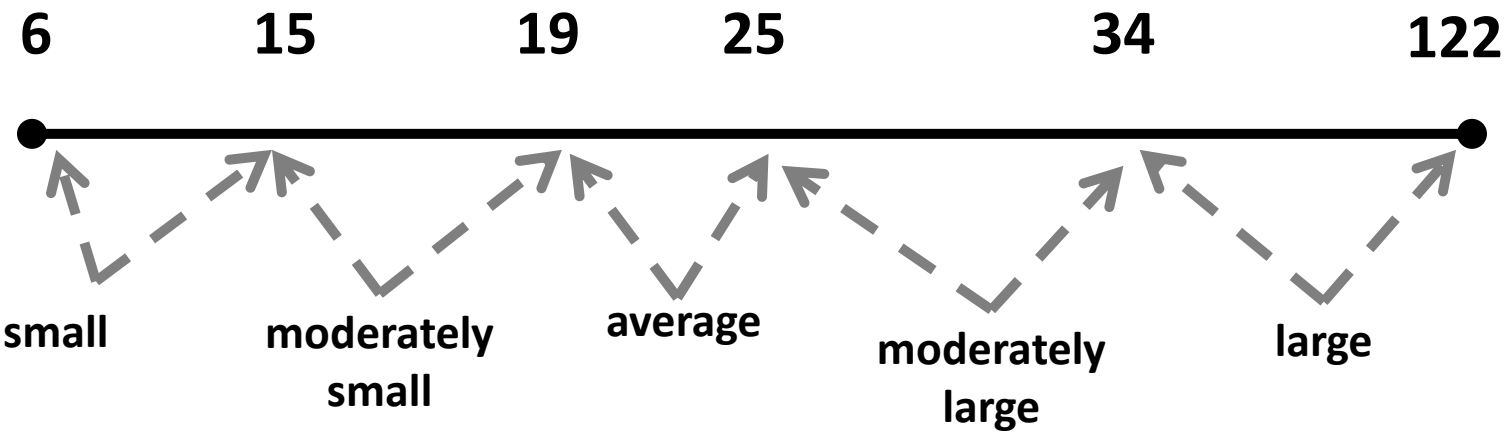
Vowels vs. Consonants

- Vowels are sounds with no audible noise produced by constriction in the vocal tract
  - make syllables
- Consonants are sounds with audible noise produced by a constriction in the vocal tract
  - obstacle
    - degree of this obstacle

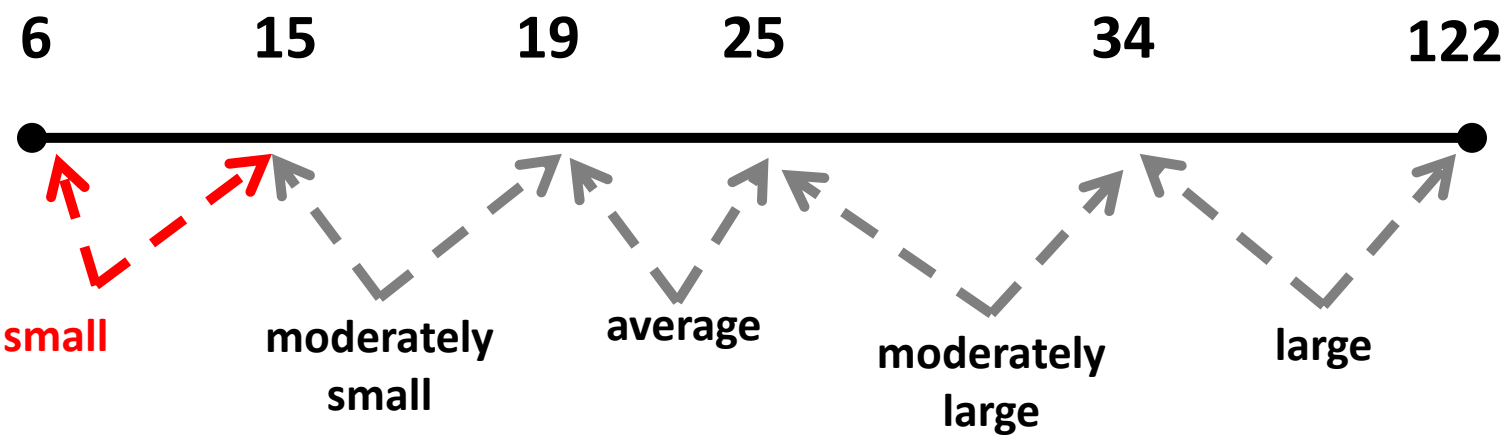


- The solution is convention
  - Typological research is still possible

WALS: Consonant Inventories



WALS: Consonant Inventories



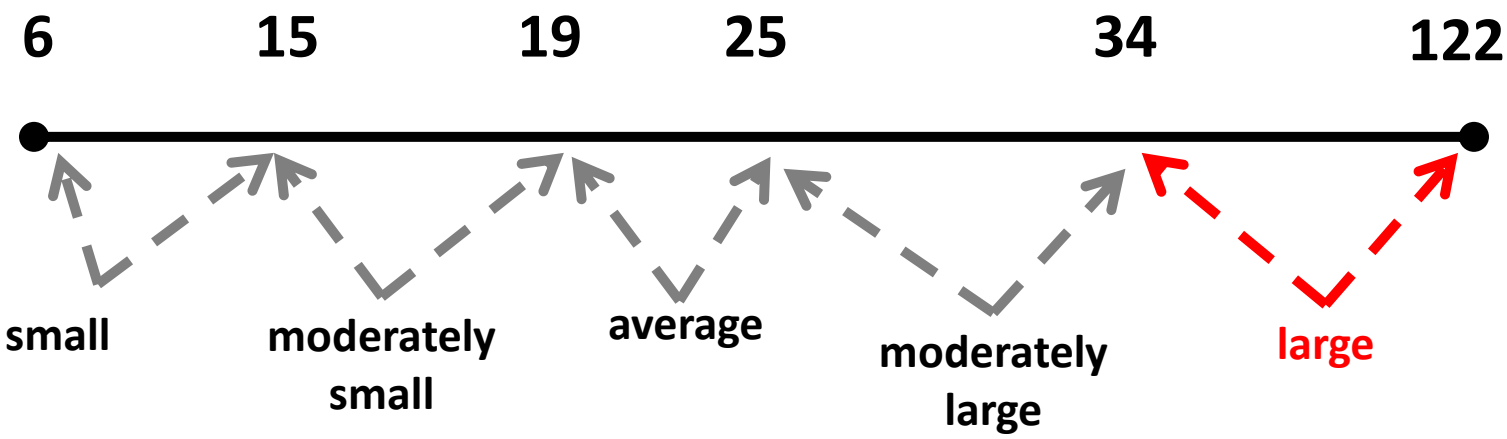
only 6 consonants
(/p, t, k, b, d, g/)

LANGUAGE | FEEDBACK

A language of Papua New Guinea

ISO 639-3	roo
Population	4,320 (Wurm and Hattori 1981).
Location	Bougainville Province, Central Bougainville district, central mountains. 28 villages.
Language Maps	Papua New Guinea, Map 13
Language Status	5 (Developing). Statutory language of provincial identity in Bougainville Autonomous Region (2007, Education Plan, Section 1.1.3), not yet implemented (2012).
Classification	North Bougainville, Rotokas
Dialects	Aita, Atsilima, Pipipaia.
Typology	SOV.
Language Development	Literacy rate in L1: 50%–75%. Literacy rate in L2: 50%–75%. Dictionary. Grammar. NT: 1982.
Language Resources	OLAC resources in and about Rotokas
Writing	Latin script [Latn].

WALS: Consonant Inventories



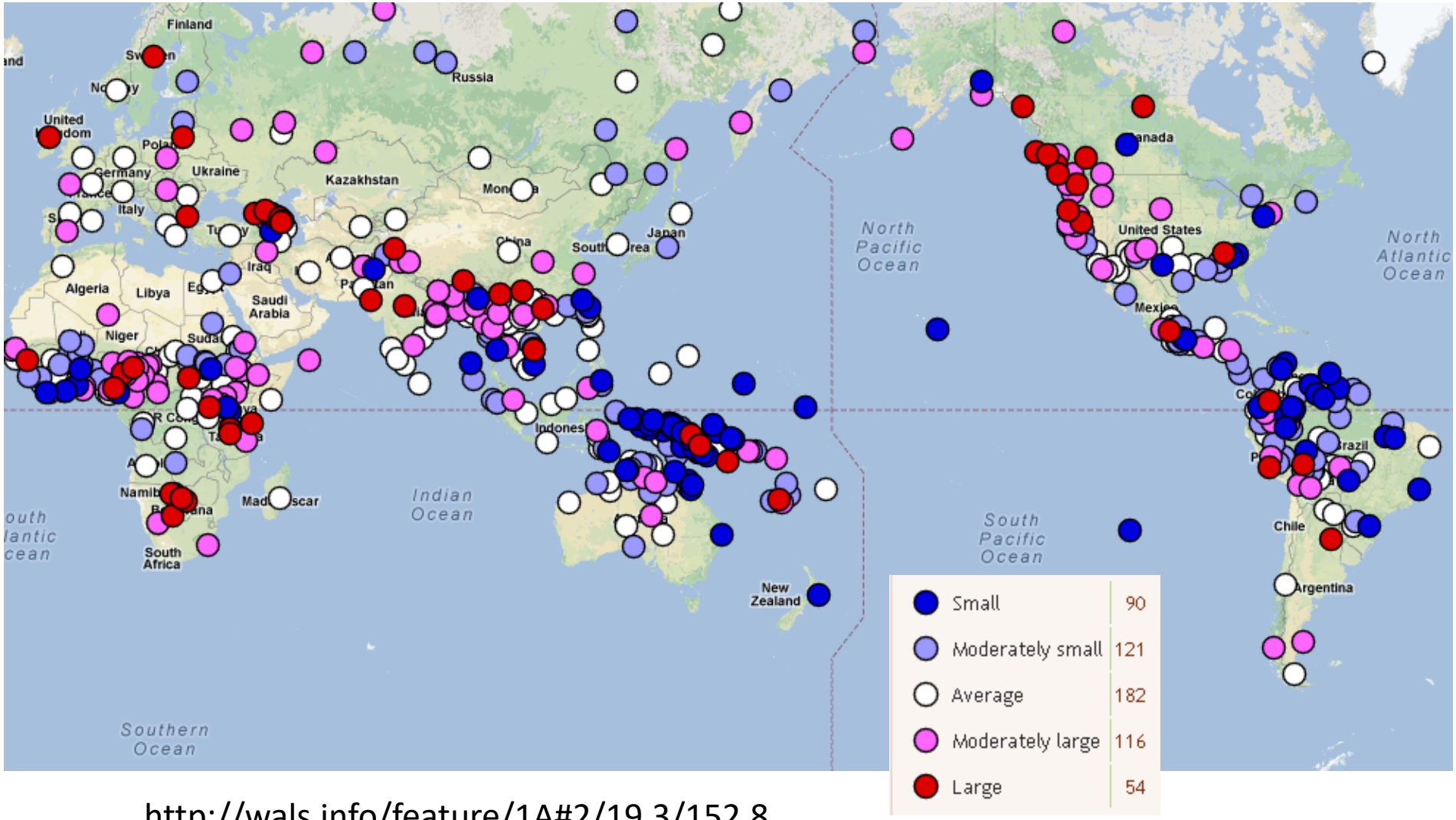
- !Xóõ (Taa, Lone Tree)
- spoken in Botswana
- Tuu languages

Why so many?

Clic sounds – in many languages of Southern Africa, articulated with two points of contact in the mouth, one forward and one at the back

How to pronounce click sounds?
https://www.youtube.com/watch?v=31zzMb3U0iY

WALS: Consonant Inventories



http://wals.info/feature/1A#2/19.3/152.8

Typology for Consonant Inventories: Correlations

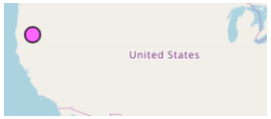
- Hypothesis (Lindblom - Maddieson, 1988): There is an overall relationship between the size of a consonant inventory and the kind of consonants it includes.

Languages with special consonants by consonant inventory size

C's inventory size	special C's	glottalized C's
small	8.7%	8.7%
moderately small	13.1%	10.7%
average	22.1%	21.5%
moderately large	27.4%	39.3%
large	40.7%	66.7%

Typology for Consonant Inventories

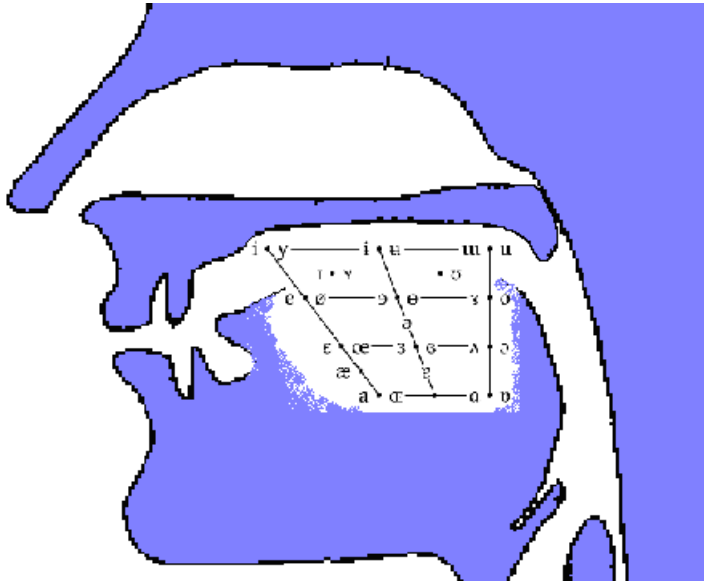
- Place of articulation: Most languages have one laryngeal consonant, 'easier' pronounced (/h/ > /ʔ/ > /ɦ/)
- Manner of articulation: stops > fricatives, nasals



- Most languages have at least one fricative (Klamath only /s/)
- Most languages have glides /w j/ – but in some languages, /w j/ do not contrast with high vowels
- Most languages have at least one nasal (some n. American languages lack them)

Vowel Quality Inventories

- Three scales
  - Front – Central – Back
  - Close – Mid – Open
  - Rounded - Unrounded
- Typological issues
  - e.g. Front rounded vowels > back unrounded vowels (inventories like English are unusual)
- No correlation between vowel and consonant inventories (Justeson-Stephens, 1984)

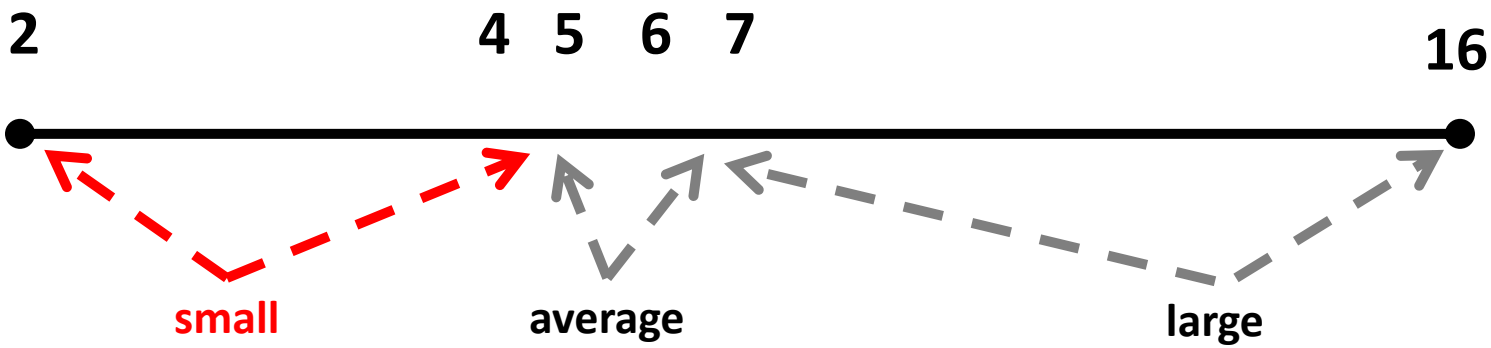


VOWELS

	Front	Near front	Central	Near back	Back
Close	i • y		ɨ • ʉ	ɯ • u	
Near close		I • Y		• ʊ	
Close mid	e • ø		ɘ • ɵ	ɤ • o	
Mid			ə		
Open mid	ɛ • œ		ɜ • ɞ	ʌ • ɔ	
Near open		æ	ɐ		
Open		a • Œ–a		ɑ • ɒ	

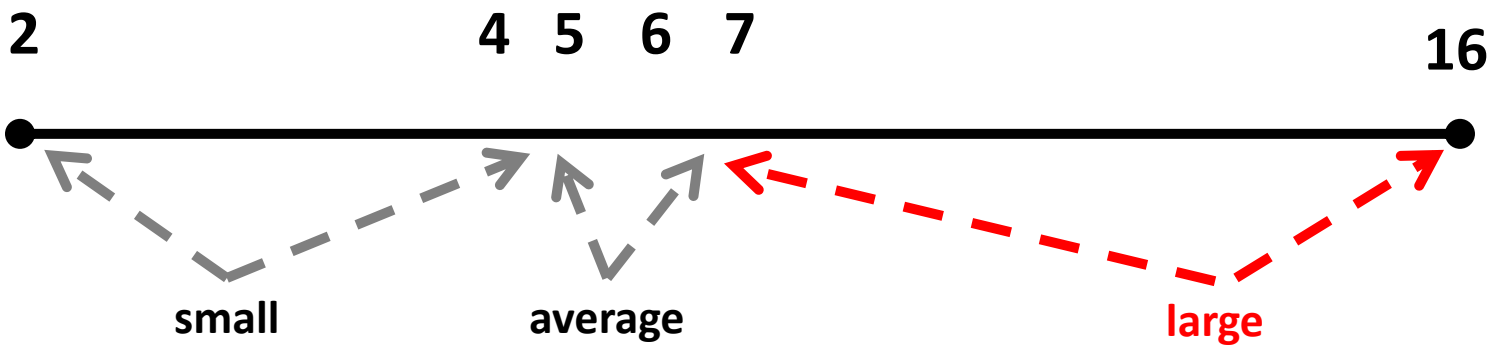
Vowels at right & left of bullets are rounded & unrounded.

Vowel Quality Inventories

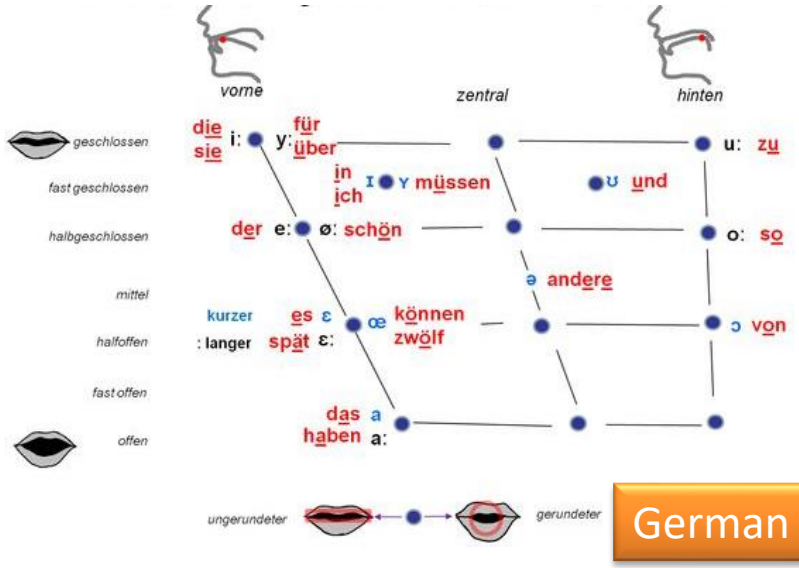


Yimas (Papua New Guinea): 2

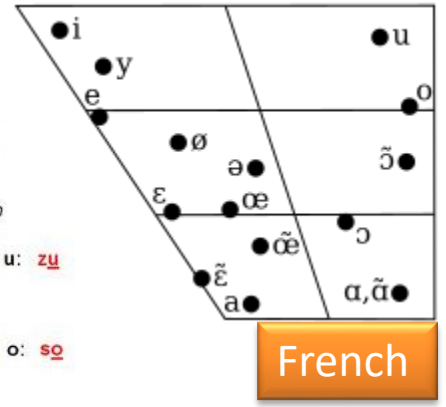
Vowel Quality Inventories



Yimas (Papua New Guinea): 2

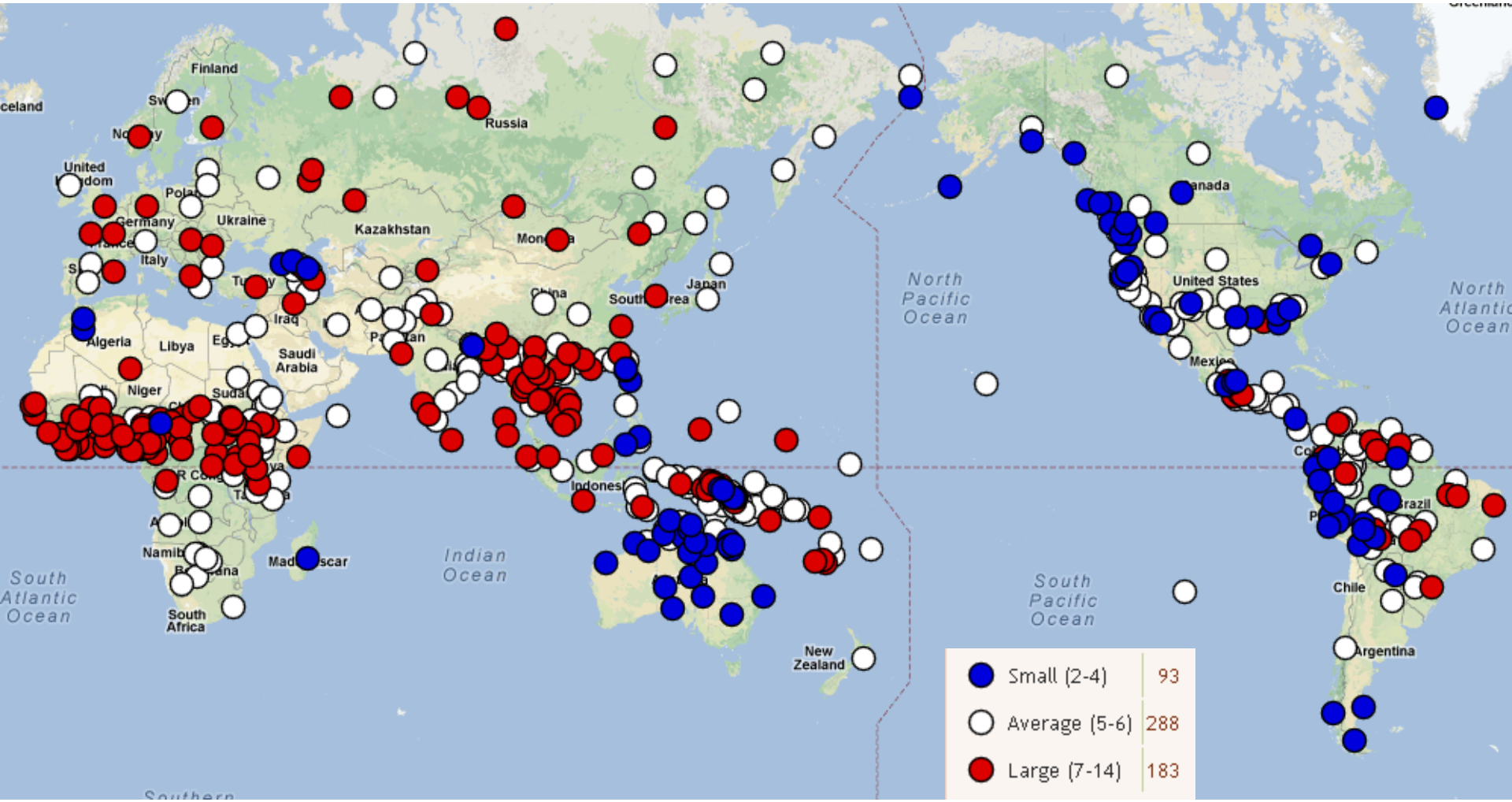


German



French

Vowel Quality Inventories



https://wals.info/chapter/2

Why such inventories and not others?

- Why are phoneme inventories such as they are?
- Most of research proposes explanations based on speech production and/or perception
  - *Perceptual factors*
  - *Articulatory factors*

  } often compete

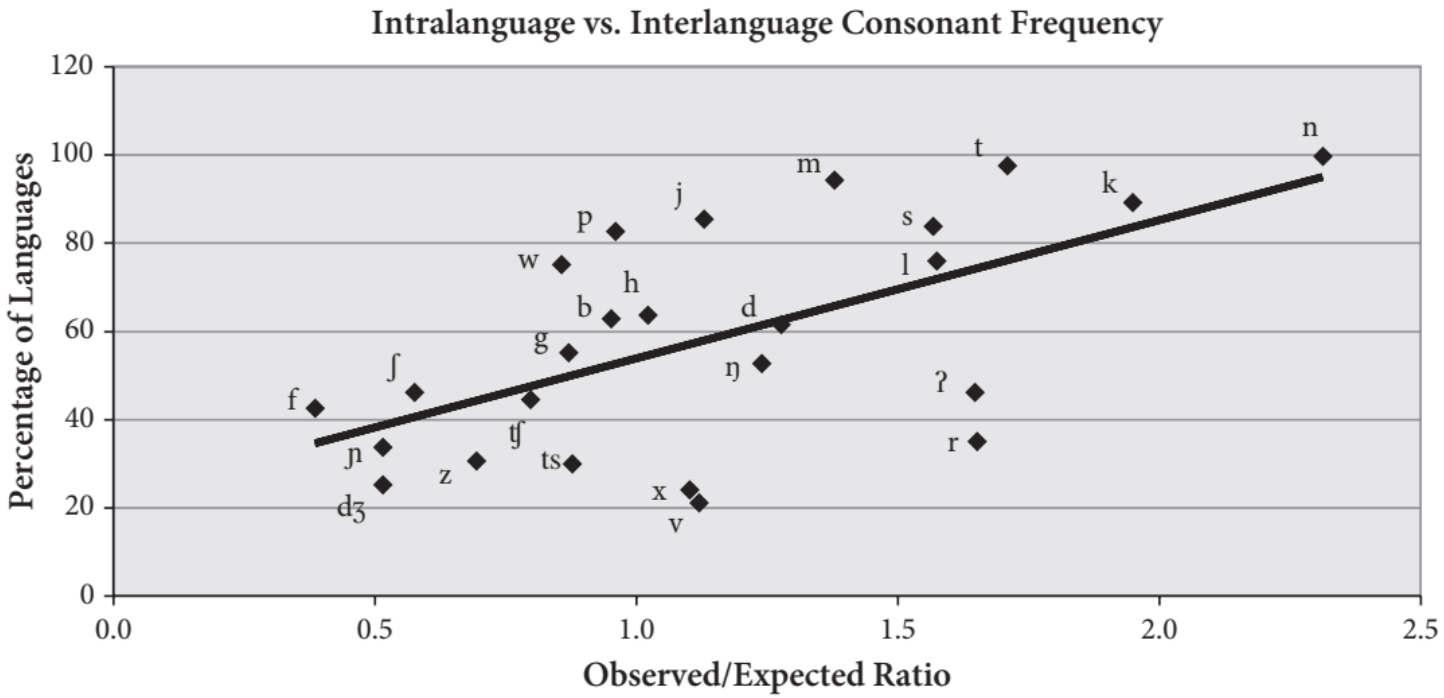
  (maximization of perceptual distinctness and minimization of articulatory effort)
- Liljencrants and Lindblom (1972): Adaptive Dispersion Theory

> Phoneme inventories are preferable to the extent they possess contrasts that are maximally distinct in the perceptual domain.

	Most common	Liljencrants and Lindblom predicted
3 vowels	i u a — 19 of 24	i u a
4 vowels	i e o a — 9 of 34	i u ɛ a

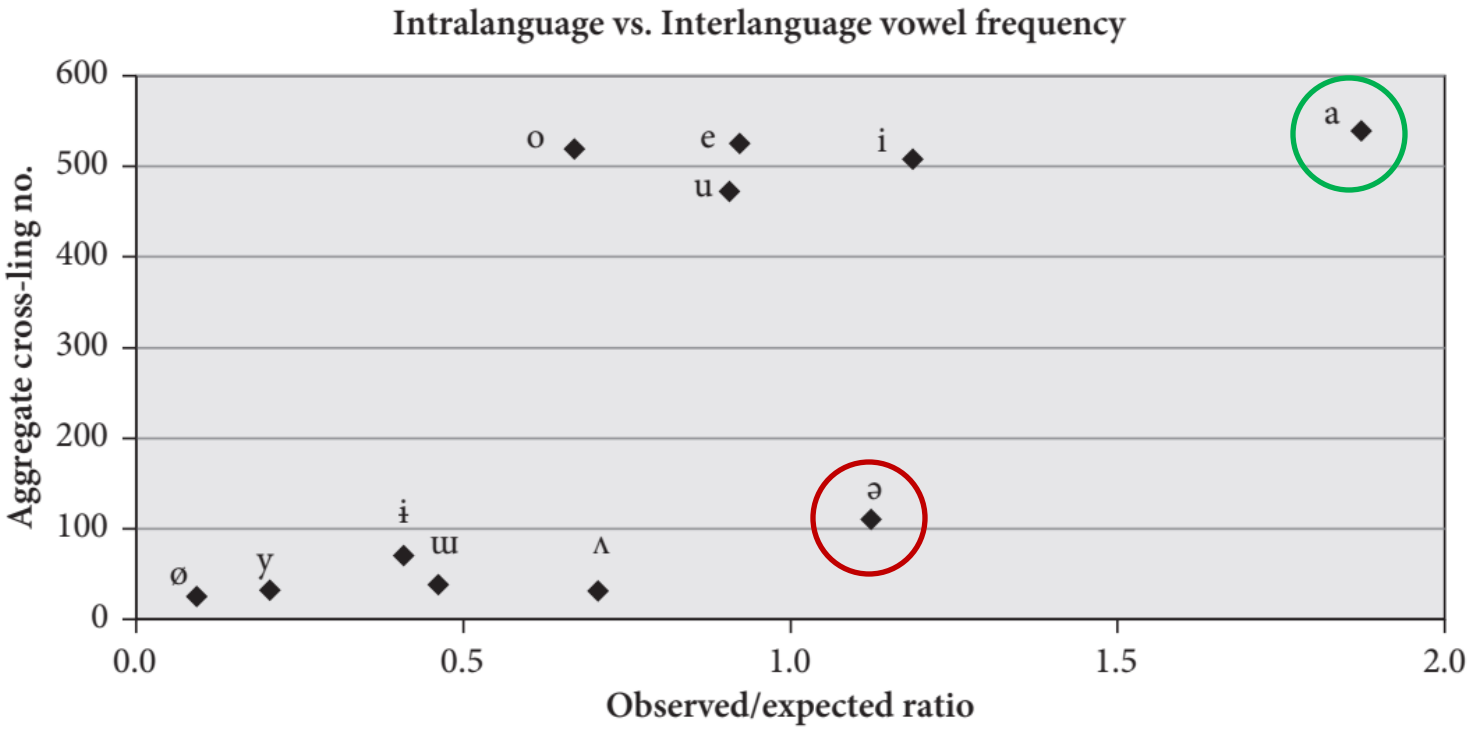
Frequency Distributions Within Languages: Consonants

There is a strong correlation between the typologically most common consonants and their frequency within languages



Frequency Distributions Within Languages: Vowels

Schwa [Ə] occurs with greater frequency within languages than three of the cardinal vowels /e, o, u/, even though schwa is considerably less common across languages.



Phoneme Inventories: Summary

- Although there is a large number of sounds attested in languages of the world, most languages only employ a relatively small subset of them to make contrasts.
- There are certain consonants and vowels that are much more common than others both cross-linguistically and within languages.
  - There is an extensive literature about the phonetic and phonological motivations for phoneme inventories.
- Changes: Constantly evolving nature of the lexicon leads to changes in intra-language frequency distribution of phonemes.

Phonological Rule Typology: Segmental Processes

- Assimilation (*bags* [bæg**z**])

Nom. sg.	Dim. (nom.sg.)	Loc.sg.	
stol	stol^{j}ik	stol^{j}e	'table'

- Long-distance assimilation (e.g. harmony)
- Dissimilation (*pilgrim* ← lat. *peregrinus*)
- Fortition, Lenition, Deletion and compensatory lengthening (*p[ə]ˈtato, p[Ø]ˈtato*)
- Epenthesis (e.g. *oputimisuto* in Japanese as syllable repair, etc.)
- Metathesis (more sporadic, more diachronic)

VC metathesis in Late Common Slavic (Townsend and Janda 1996: 60–1)

Late Common Slavic	*Gloss*	*Polish*	*Bulgarian*
gôr**d**ŭ	'enclosure'	gr**o**d	gr**a**d
gol**v**á	'head'	gw**o**wa	gl**a**vá
s**ól**ma	'straw'	ww**o**ma	sl**á**ma
mel**k**ó	'milk'	ml**e**ko	ml^{j}**á**ko

Example of Assimilation: Vowel Harmony

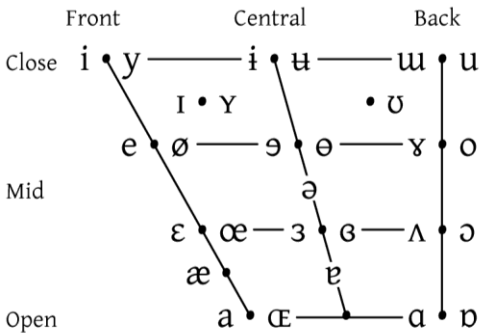
- A type of long-distance assimilatory phonological process involving vowels,
- A vowel or vowels in a word are changed to sound similarly (thus "in harmony").
- In languages with vowel harmony, there are constraints on which vowels may be found near each other.
- Many agglutinative languages have vowel harmony.

FRONT		BACK	
e	ö	a	o
i	ü	ı	u

Turkish

Vowel Harmony

- Vowel harmony
  - Front-back (Turkish, Hungarian)
  - Height (N. Salentino)
  - Rounding (Turkish)
- Variations in Rounding Harmony
  - Kirghiz – all vowels assimilate in rounding to preceding vowels except that [a] does not assimilate to [u]
  - Turkish – only high vowels undergo, all round vowels trigger
  - Sakha (Yakut) – high vowels undergo, round vowels trigger; nonhigh vowels undergo if same height as trigger
  - Mongolian – only nonhigh vowels undergo, only nonhigh vowels trigger
  - Yawelmani – vowels undergo if same height as trigger



Phonological Rule Typology: Segmental Processes

- A more complex problem than segment inventory typology, requires more language-particular commentary and analysis.
- All spoken languages have phonological rules, but not all rules are found in every language.
  - may be in certain language families but not in the others, e.g. rounding harmony common in Turkic languages
- Most phenomena affecting segments may be explained by minimizing articulating effort and enhancing perceptual salience.

Vowel Harmony in Hungarian

háború	‘war’
háborúról	‘about war’
bűn	‘guilt’
bűntelen	‘guiltless’
bűnről	‘about guilt’
út	‘way’
útról	‘about way’
keserű	‘bitter’
keserűség	‘bitterness’
keserűsó	‘bitter salt’
kör	‘ring’

körút	‘ring way’
körről	‘about ring’
bátor	‘brave’
bátorságról	‘about braveness’
bátortalan	‘not brave’
föld	‘field’
földtelen	‘fieldless’
burgonya	‘potato’
burgonyaföld	‘potato field’
sötét	‘dark’
sötétség	‘darkness’

1. Which words are compounds and why?
2. Which of the following words can be divided into parts?

földtan, földnek, háborúellenes, Budapest, burgonyalevés, óraütés, hőálló, bűnöző.

3. Translate into Hungarian:
guiltlessness, about field, about potato, wayless

Joan Bybee. *Phonology and Language Use*. Cambridge University Press, 2003

Matthew K. Gordon. *Phonological Typology*. Oxford University Press, 2016

Dryer, Matthew S. & Haspelmath, Martin (eds.) 2013.
The World Atlas of Language Structures Online. Leipzig: Max Planck Institute for Evolutionary Anthropology.

David Odden. *Introducing Phonology*. Cambridge University Press, 2013

Paul de Lacy (eds.). *The Cambridge Handbook of Phonology*. Cambridge University Press, 2007

Ian Maddieson. *Typology of Phonological Systems*. In: Jae Jung Song (ed.) The *Oxford Handbook of Linguistic Typology*, Oxford University Press, 2010. Moran, Steven, McCloy, Daniel, and Wright, Richard (eds) (2014). PHOIBLE Online. Leipzig: Max Planck Institute for Evolutionary Anthropology. (Available online at <http://phoible.org>)

Liljencrants, Johan and Lindblom, Bjorn (1972). Numerical simulation of vowel quality systems: the role of perceptual contrast. Language 48: 839–62.

Schwartz, Jean-Luc, Boë, Louis-Jean, Valle´e, Nathalie, and Abry, Christian (1997). The Dispersion-Focalization Theory of vowel systems. Journal of Phonetics 25: 255–86

Lindblom, Björn and Maddieson, Ian (1988). Phonetic universals in consonant systems, in Larry Hyman and Charles N. Li, Language, Speech and Mind: Studies in Honour of Victoria A. Fromkin. New York: Routledge, 62–78.

Firchow, Irwin and Jacqueline, and David Akoitai, compiler. 1973. Vocabulary of Rotokas-Pidgin-English. Ukarumpa, P. N. G.: Summer Institute of Linguistics

Firchow, I. and Firchow, J. 1969. An abbreviated phoneme inventory. Anthropological Linguistics 11. 271-276

Lindblom, Björn and Maddieson, Ian. 1988. Phonetic Universals in Consonant Systems. In Li, C. and Hyman, L. M. (eds.), Language, Speech and Mind, 62-78. London: Routledge.

Maddieson, Ian (1984). Patterns of Sounds. Cambridge: Cambridge University Press.

Handbook of phonological data from a sample of the world's languages : a report of the Stanford Phonology Archive / compiled and edited by John H. Crothers ... [et al.]

Marilyn M. Vihman. *Phonology Archive Coding Manual*. Stanford University, 1974