Is tone change more rapid and irregular than segmental change? A Mixtec case study

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Tone Change

"The study of sound change has focused overwhelmingly on segmental change, while general and typological knowledge about tone change (excluding tonogenesis) lags far behind. (…) Furthermore, tone is often reported to change faster or more sporadically than segments, leaving more changes to unravel and/or less-regular sound correspondences to handle." (Campbell 2021)

"Once born, a tone is not necessarily stable." (Ratliff 2015:254)

"(…) there is a seeming lack of correspondence between the tonal systems (…) of the different dialects. Inner-dialectal splits and dialectal divergence, both lose their arbitrariness in the light of comparative and historical linguistics." (Dürr 1987:20)

faster change

irregularity &
drastic variation

large number of
correspondence sets

limited availability
of data

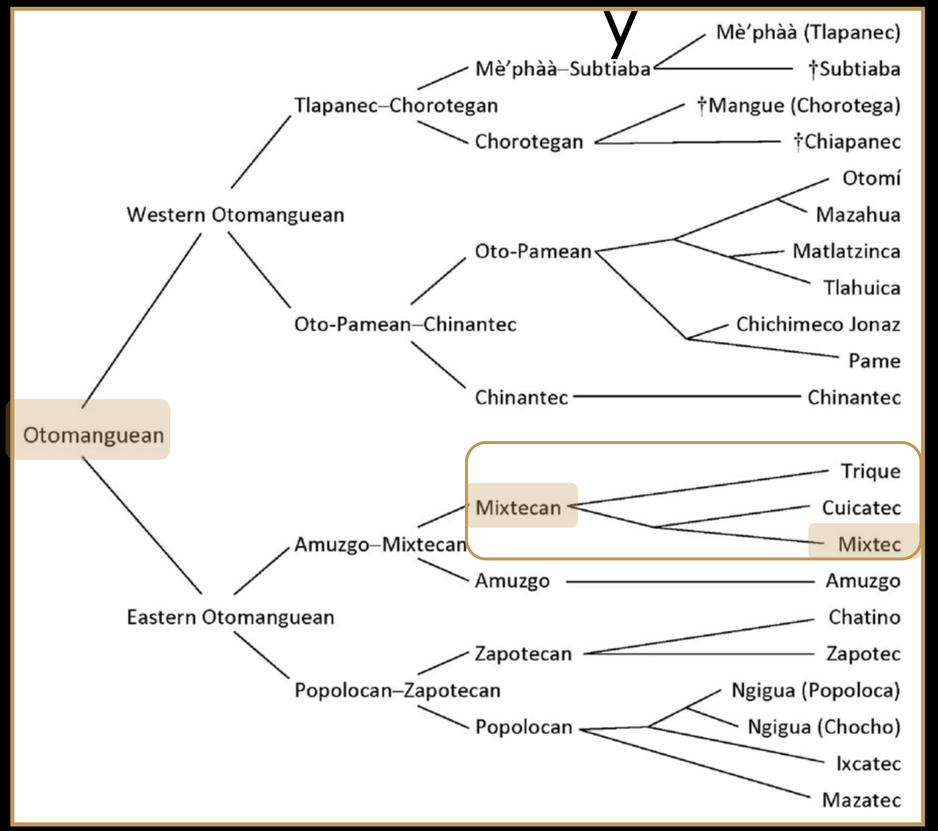
loss of conditioning
environments

Dürr 1987. Indiana 11 | *Ratliff 2015. Oxford Hb. Hist. Phon.* | Campbell 2021. *Hist. Ling. and Endangered Lang.*

The Mixtec (Tu'un Savi) languages of southern Mexico

Mapa 1. Las divisiones coloniales y contemporáneas del Ñuu Savi*.

Aguilar Sánchez 2020:24. *Ñuu Savi: Pasado, presente y futuro.* Diss U Leiden



Campbell 2017 *Lang. Linguist. Compass 11(7)*
(based on Kaufman 2006, 1988)

Tones in Mixtec: Overview

- TBU is the mora
- lexical elements are min. bimoraic
- systems analyzed with 2, 3, or 4 level tones; some with contour tones

contrastive tone melodies in Duraznos Mixtec (own data)

level tones only		
1.1	3.1	5.1
1.3	3.3	5.3
1.5	3.5	5.5

standardized notation based on Chao 1930

Chao's number	Musical comparison	Label
5	G#	high
4	F	half-high
3	E	mid
2	D	half-low
1	C	low

contrastive tone melodies in Yoloxóchitl Mixtec (Castillo García 2007)

level tones			contour tones	
1.1		5.1	1.32	
	3.2	5.2		13.2
1.3	3.3	5.3	3.52	15.3
1.5	3.5	5.5	5.25	15.5

Chao 1930. *Le maître phonétique* 8(30) | Castillo García 2007. *Descripción fonológica segmental y tonal del mixteco de Yoloxóchitl*. Diss CIESAS

Functional load of tone Mixtec

Lexicon

Form	Meaning
ni¹i¹	salt
ni¹i³	skin
ni⁵i⁵	hail
ⁿda¹ki³	broom
ⁿda¹ki⁵	pozole
ⁿda³ki³	strong
i³ʃi¹	hair
i¹ʃi⁵	hairy, bearded

Grammar

POT	INCOMPL	Meaning
kã³ã³	kã⁵ã⁵	make holes
kã¹ã³	kã⁵ã³	get used to
ki³ʔβi¹	ki⁵ʔβi¹	be sick
ki¹ʔβi³	ki⁵ʔβi³	enter
ⁿda³ⁿdo⁵so⁵	ⁿda⁵ⁿdo⁵so⁵	forget
tʃi¹ⁿdʑe³e⁵	tʃi⁵ⁿdʑe³e⁵	help

Examples from Duraznos Mixtec (own data)

Tonal reconstruction in Mixtec

basic sets
Dürr 1987:23

*HIGH-HIGH(?)	*LOW-HIGH
*LOW-LOW(?)	*HIGH-LOW

non-basic/modified sets
Swanton & Mendoza Ruíz 2021:338

pMx
*(ʔ)-A.Aʔ
*(ʔ1)-A.A
*(ʔ2)-A.A
*ʔ-A.B
*ʔ-B.Bʔ
*ʔ-B.B
*(ʔ)-B.B
*B-A.B
*(B)-A.B
*Bʔ-B.A

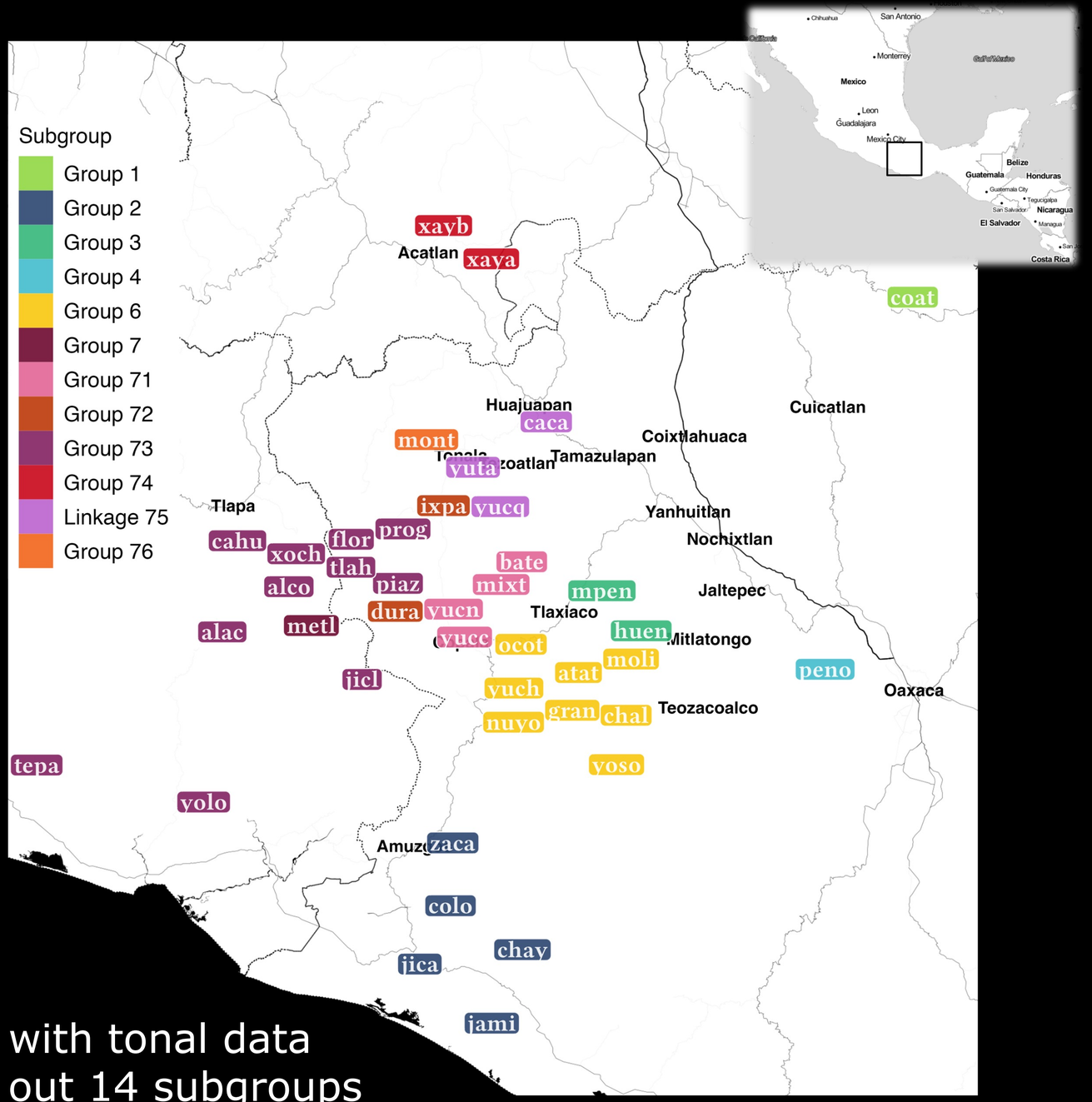
Case study

- tone is old in Mixtec
- tone change *per se*
- recent documentation efforts => more data
- variation
- previous reconstructions
- data base of segmental change

  (Auderset & Campbell in prep.)
- phylogenetic study (Auderset et al. 2023)

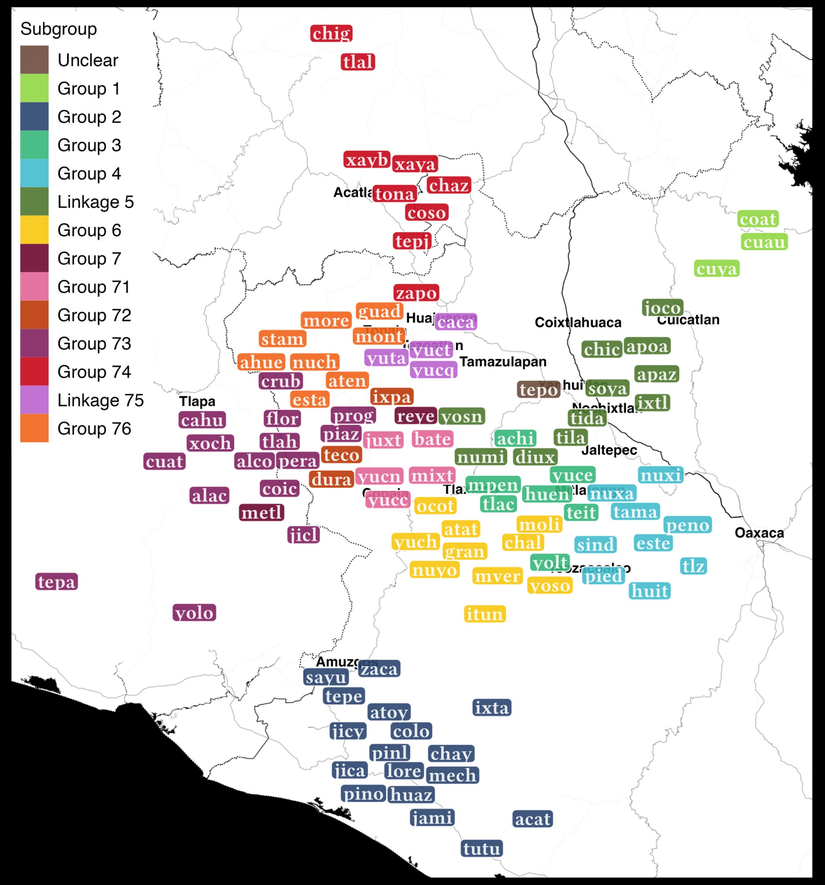
How can we empirically assess whether tone change is more rapid and irregular than segmental change or not?

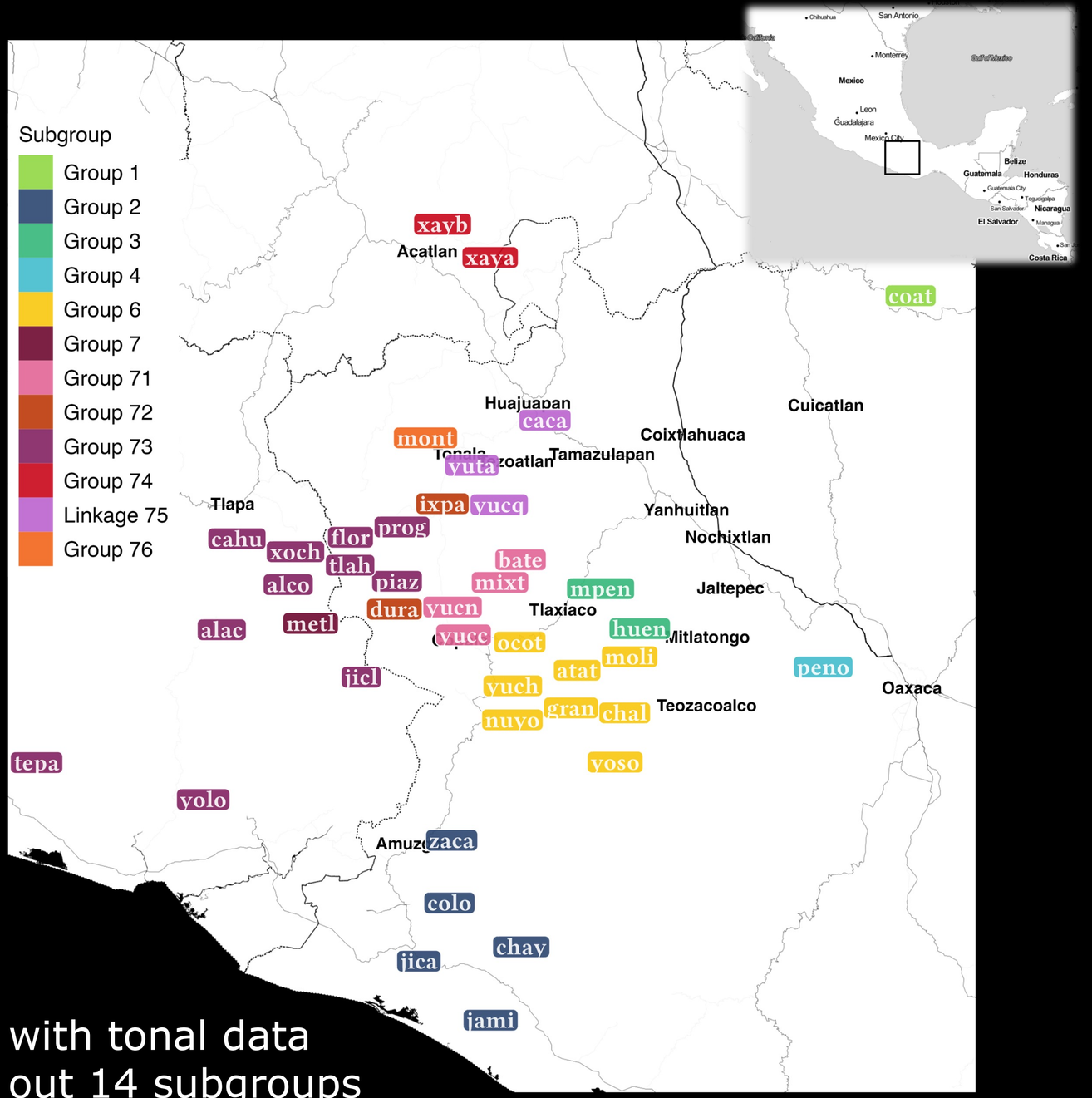
Sample



41 varieties with tonal data
covering 12 out 14 subgroups

Sample





41 varieties with tonal data
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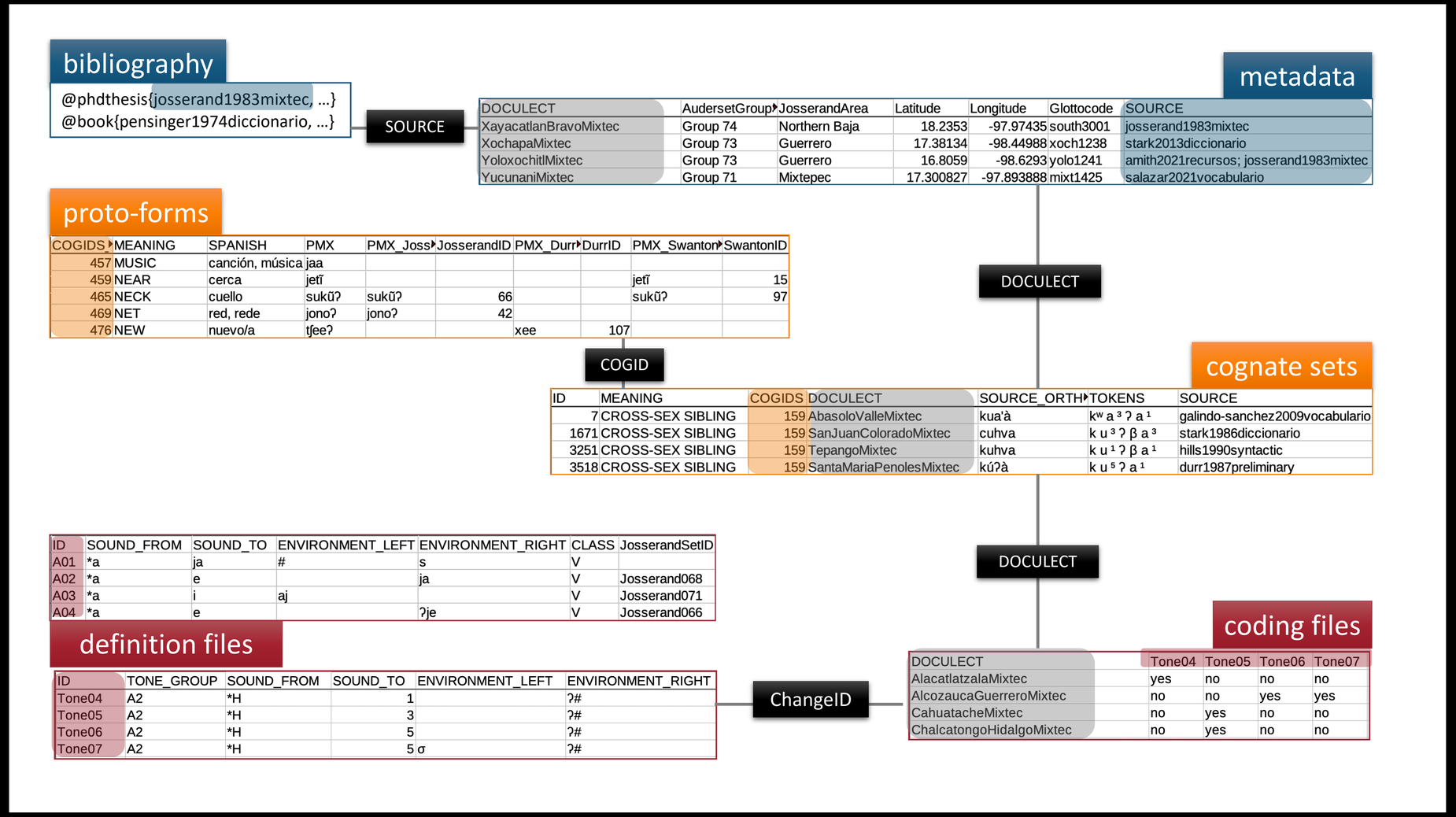
Annotation of sound changes

AUTOTYP design principles:

- modularity & connectivity
- autotypology
- separation of definition and coding files
- late aggregation



Tone correspondences & variables

Variety	ANIMAL	PALM MAT	Tones
Proto-Mixtec	*kɨᴴtɨᴴʔ	*juᴴwiᴴʔ	*HHʔ
Peñoles	kɨ¹tɨ¹	ʒu¹u¹	1.1
Zacatepec	ki³ti³ʔ	ju³βi³ʔ	3.3
Cacaloxtepec	ki³ti¹	ʒu³u¹	3.1
Xochapa	ki³ti⁵	i³βi⁵	3.5
Piedra Azul	ki³tsi¹⁵	ji³βi¹⁵	3.15

Variable	Proto-Mixtec	Reflex	Environment
Tone01	*H	1	#_
Tone02	*H	3	#_
Tone04	*H	1	_ʔ#
Tone05	*H	3	_ʔ#
Tone08	*H	15	_ʔ#

Methods & Analysis

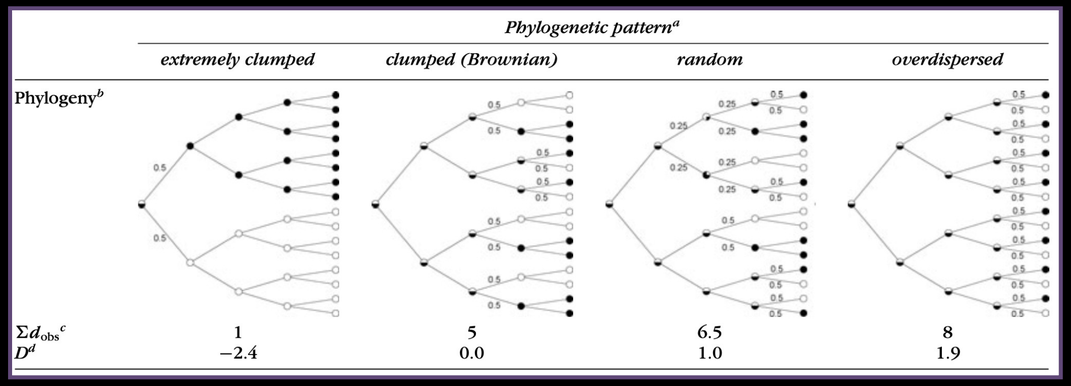
Phylogenetic signal:

D-metric

- sum of sister-clade differences across a tree
- for binary traits

coded sound changes

sample of 1000 trees from posterior distribution
(Auderset et al. 2023)



	Phylogenetic pattern[a]			
	extremely clumped	*clumped (Brownian)*	*random*	*overdispersed*
Phylogeny[b]				
Σd_{obs}[c]	1	5	6.5	8
D^d	−2.4	0.0	1.0	1.9

Evolutionary rates:

Hidden Markov Model

- transition rates between presence and absence of a trait across a tree
- all rates differ

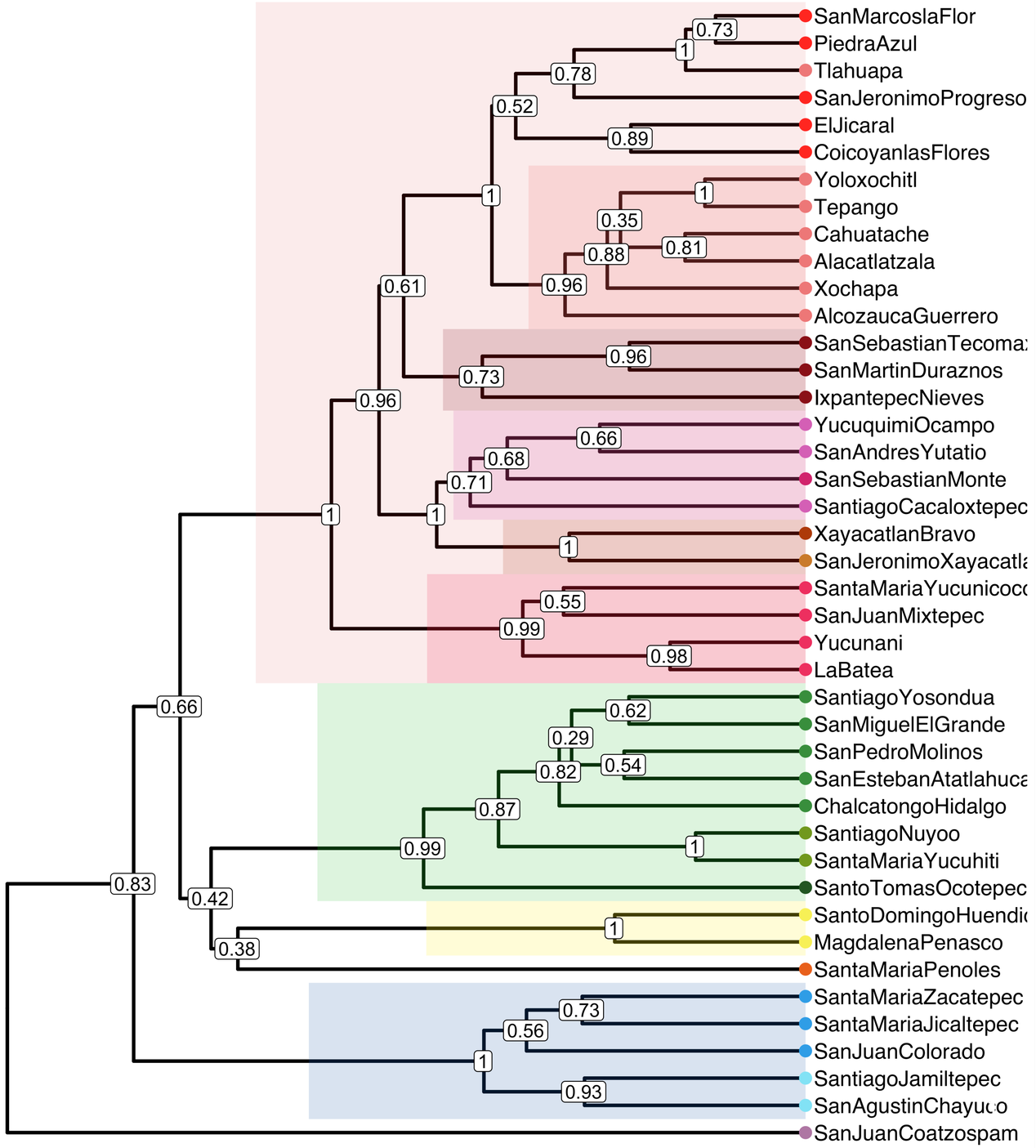
Phylogenetic Trees

- M(aximum) C(lade) C(redibility) tree

colors represent subgroups

node numbers = posteriors

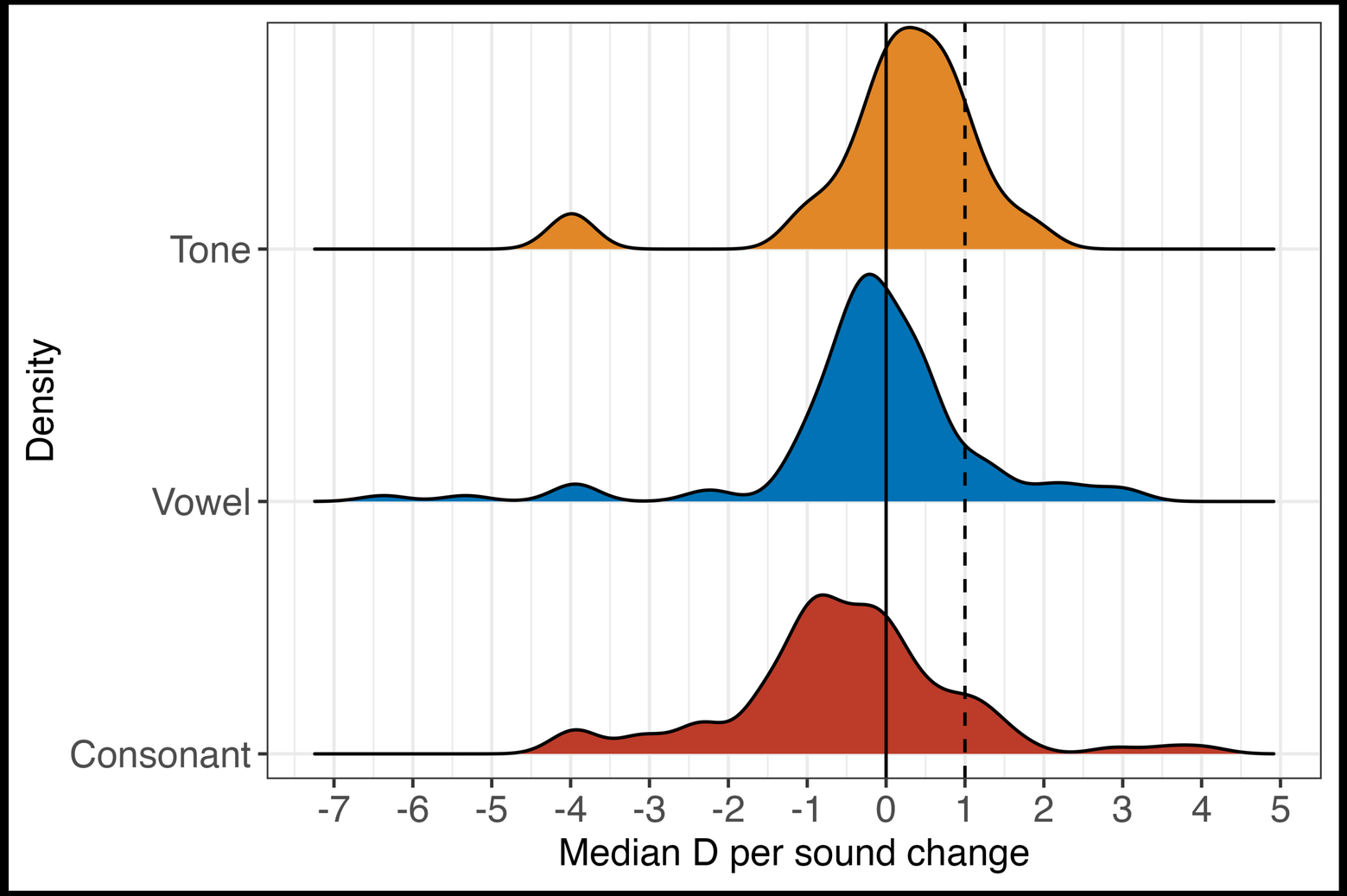
0.7-1	well supported
0.5-0.7	weakly supported
<0.5	low/no support



Auderset et al. 2023. *Journal of Language Evolution*

Phylogenetic signal in sound changes

Are tone changes distributed over subgroups significantly differently from segmental changes?

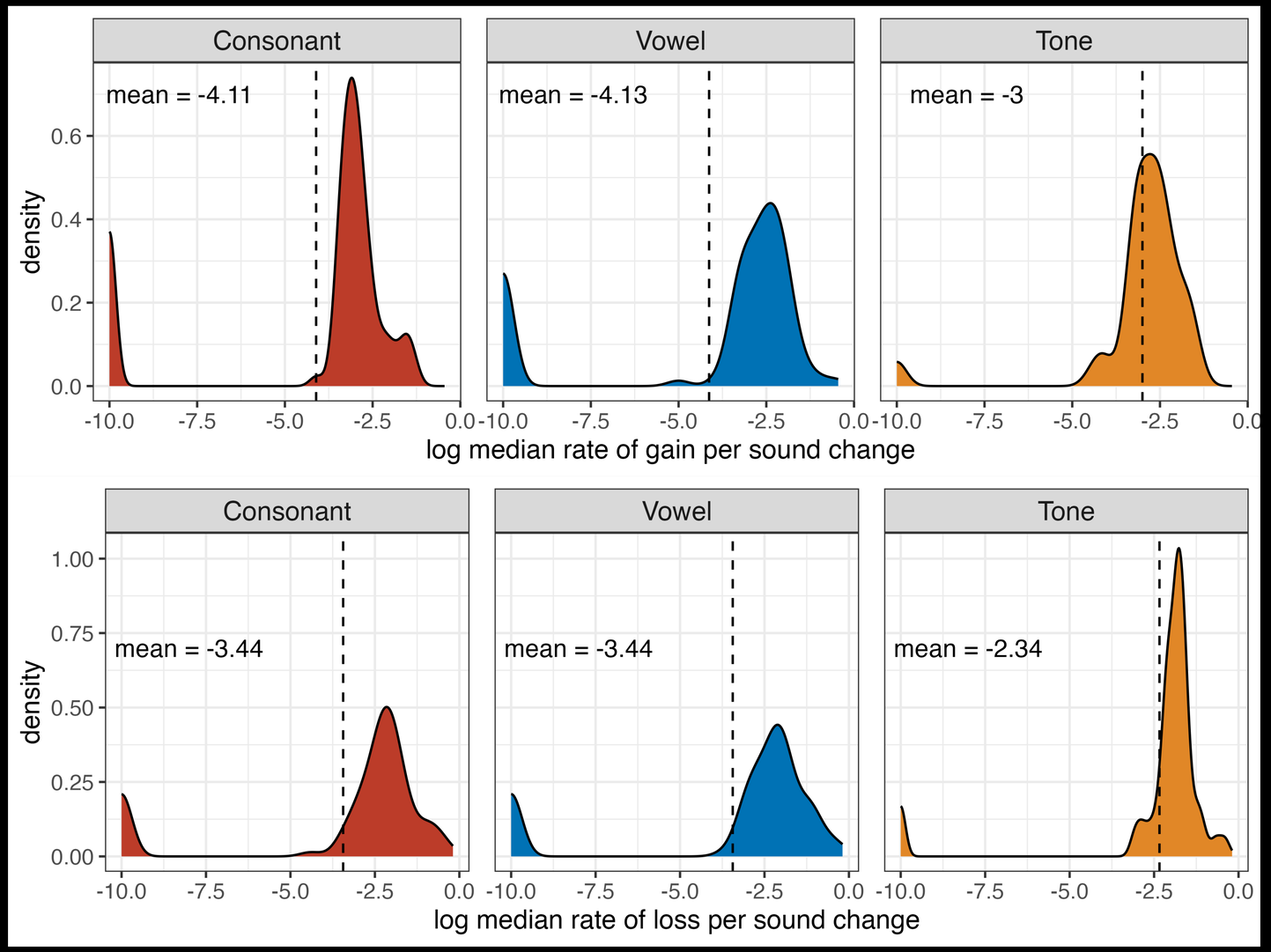


Interpretation of *D*

D < 0	overclumped
D ~ 0	clumped
D ~ 1	random
D < 1	overdispersed

Rate of change of sound changes

Are tone changes generally gained and lost faster than segmental ones?



Interpretation of log rates:

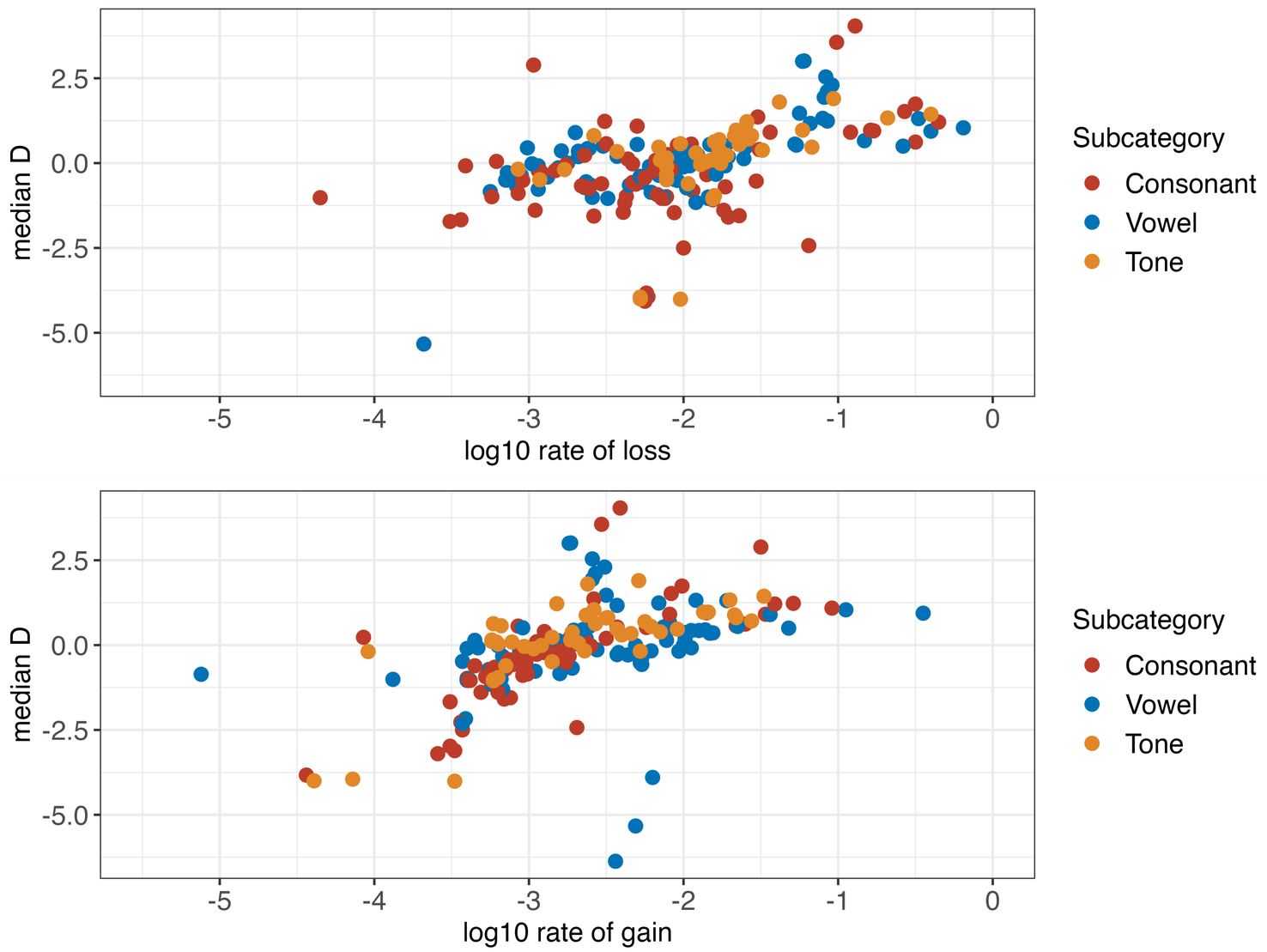
0	fast
-5	slower
-10	no change

Summary

no signal

strong signal

Rate of loss and gain (log10) against D colored by type of sound change variable



slower ⟷ faster

Recap & Limitations

- Do tones change faster than segments? ✗
- Do tone changes show less phylogenetic signal than segmental changes? ✗

- lack of reliable data & skewed sample
- underspecification of conditioning environments
- model assumptions

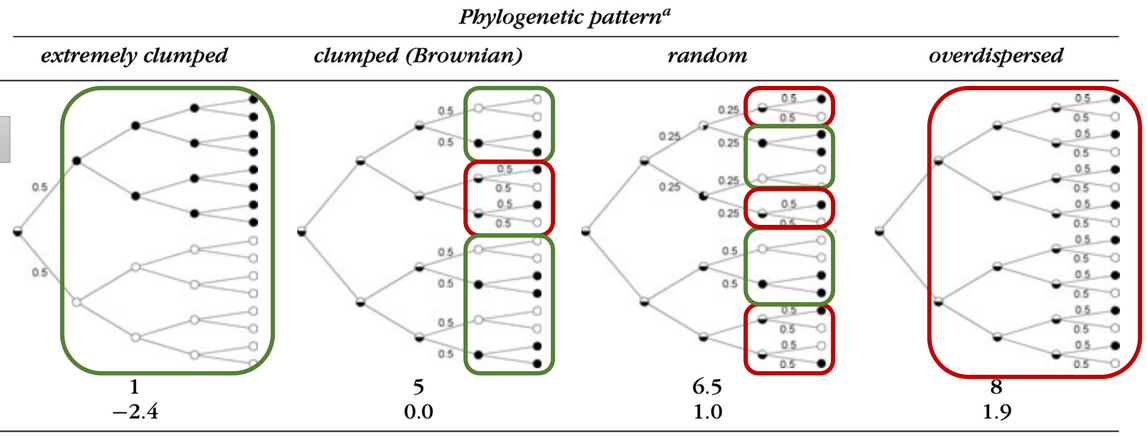
Outlook

- replication in other language families
- bottom-up, typological data base of sound change including tone
- relationship of functional load in tone and language change processes

D-metric

black circle = sound change present
white circle = sound change absent

distribution of sound change across a tree/within a language family



high phylogenetic signal / D negative

the distribution of the presence and absence of the sound change aligns with subgroups

phylogenetic signal / D around 0

the distribution of the sound change aligns with most lower-level subgroups (green), but not all (red)

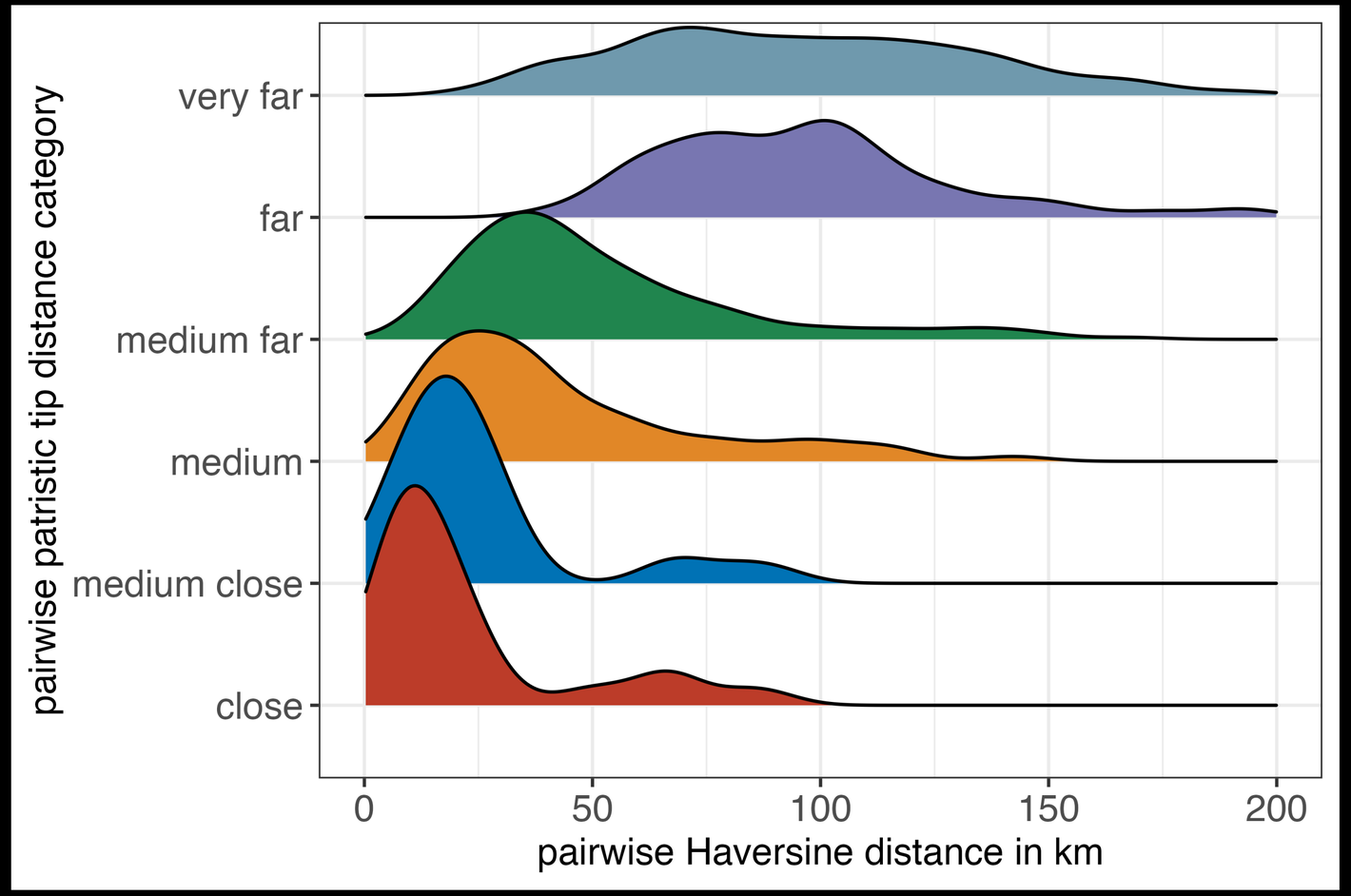
random / D around 1

the distribution of the sound change aligns with subgroups in some cases (green), but not in others (red)

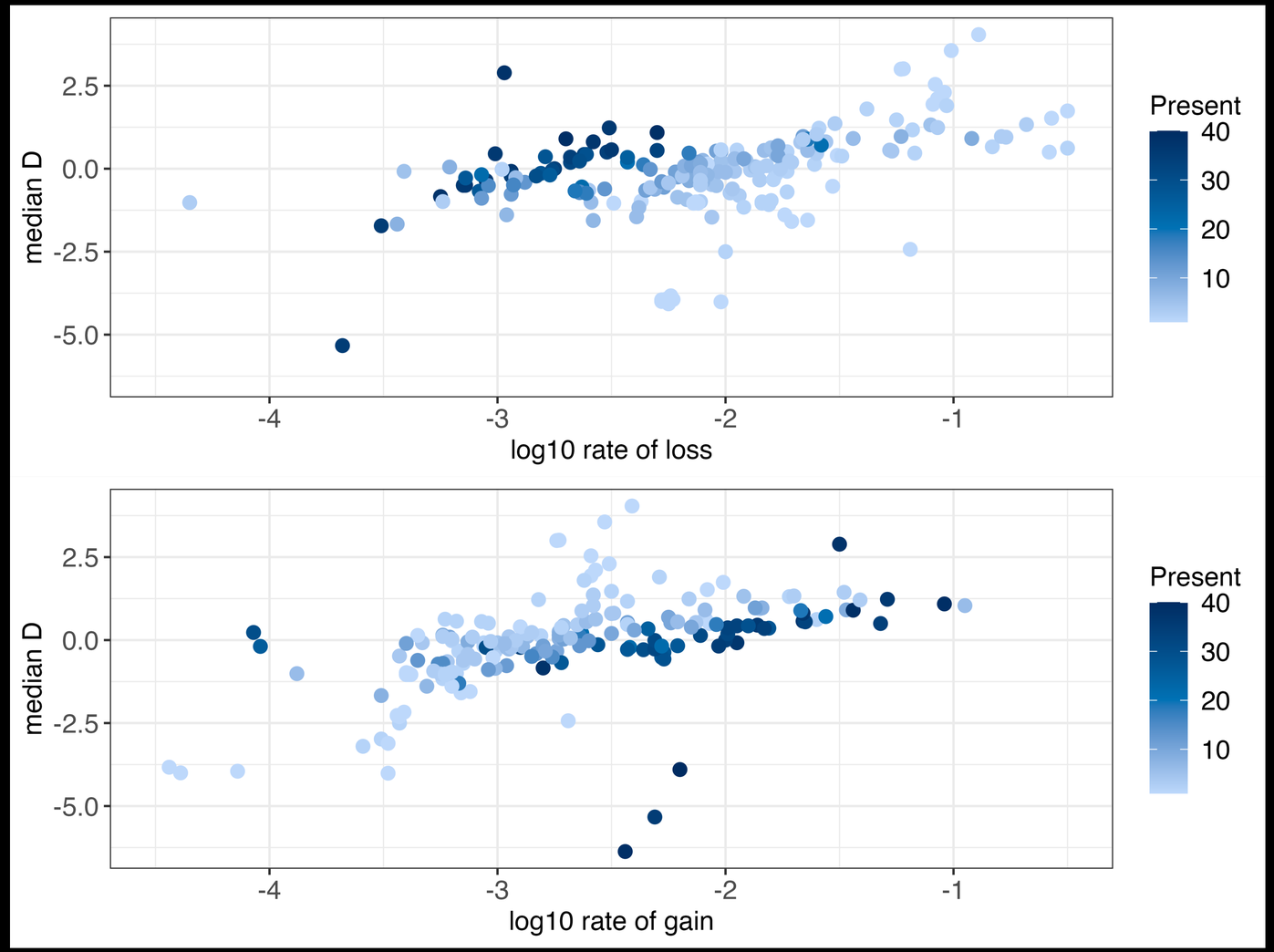
overdispersed/ D over 1

the distribution of the sound change does not align with any groupings

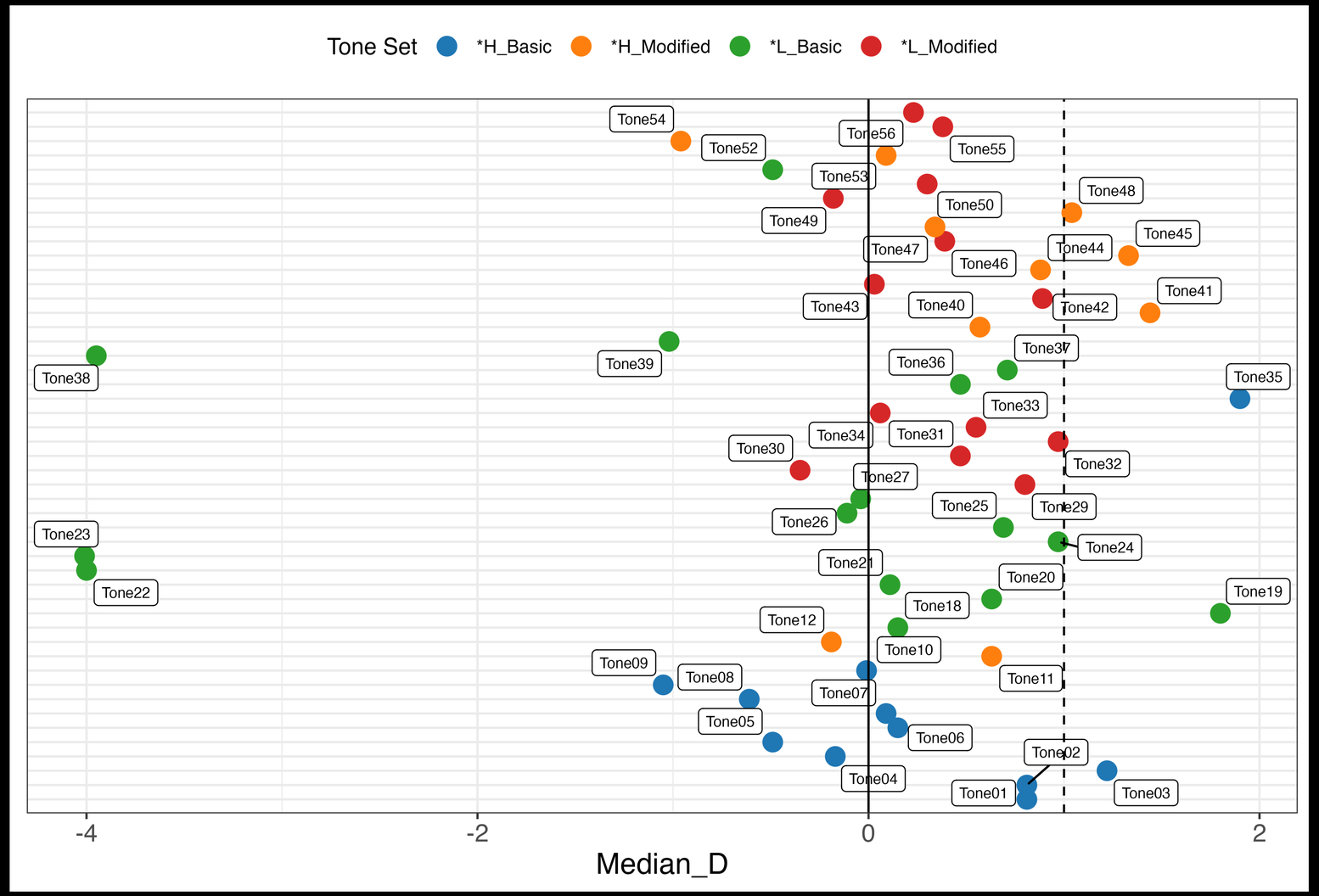
Geographic and genealogical distance



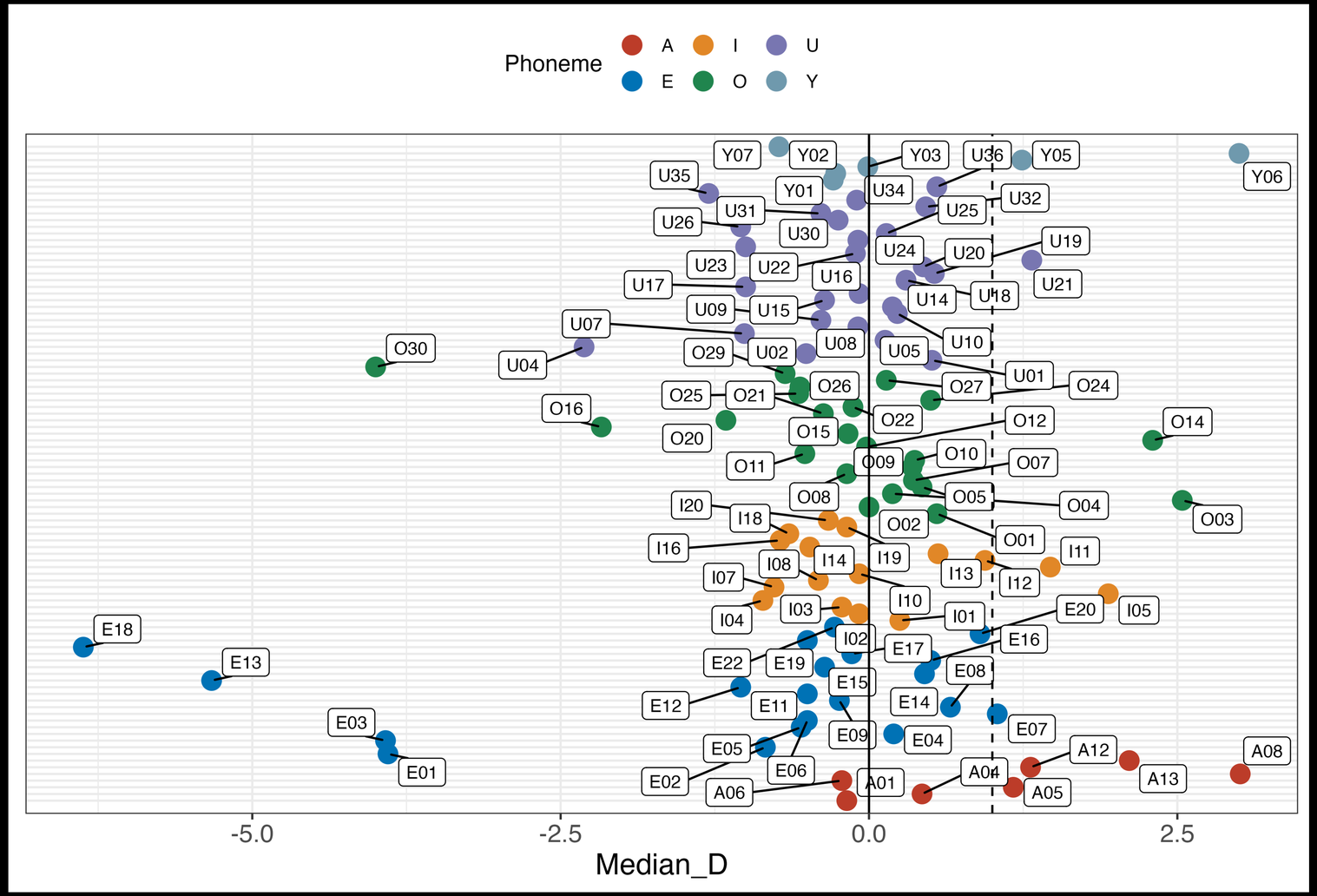
Presence/absence – rates – D-metric



D-metric tone change



D-metric vowels



D-metric consonants