Contrast and underspecification

Plan for today

- Underspecification and phonological behaviour
- Issues with lexical contrast and underspecification
- The contrastive hierarchy

Why underspecification?

Contrastive behaviour and underspecification

- We encountered underspecification on Monday to reflect predictable aspects of lexical specification
- We also mentioned ‘linking’ and Structure Preservation as fallbacks for when the phonology tries to do something weird
- We now look at the positive case for underspecification

A simple analysis of final devoicing

Table 1: The Czech consonant inventory

Manner	Labial	Coronal	Palatal	Dorsal
Stop	p b	t d	c ɟ	k g
Affricate		t͡s	t͡ʃ d͡ʒ	
Fricative	f v	s z	ʃ ʒ	x ɦ
Nasal	m	n	ɲ	
Rhotic		r r̝		
Approximant		l	j	

NOM.SG	GEN.SG	Gloss	NOM.SG	GEN.SG	Gloss
xlat	xladu	‘could’	mlat	mlata	‘hammer’
ʒlap	ʒlabu	‘manger’	xlap	xlapu	‘man’
mraːs	mraːzu	‘frost’	ɦlas	ɦlasu	‘voice’
tvaːr̝	tvaːr̝ɛ	‘cheek’	lɦaːr̝	lɦaːr̝ɛ	‘liar’
kr̝ɛn	kr̝ɛnu	‘horseradish’	dɛn	dnɛ	‘day’
dar	daru	‘gift’	t͡sar	t͡sara	‘czar’

A first attempt: [-syl] → [-voi] / _#

Does this work?

A better attempt [-syl -son] → [-voi] / _#

Sure, but observe…

- The [-son] segments are exactly the ones that contrast in [±voi]
- As noted earlier, /r/ is the 'non-nasal non-lateral non-fricative approximant'
- By contrast, 'stop' covers both [t] and [d] — we need to specify voicing to narrow it down

A third attempt

Since sonorants are predictably voiced, we are justified in positing a redundancy rule to fill in the [±voi] value. However, unlike the redundancy rules of the lexicon, it **must** come after the final devoicing rule.

Rule	da[r[ ]voi]	xla[d[+voi]]	xla[p[-voi]]
+voi → voi / _#		xlat	
[ ]voi +son → +voi	da[r[+voi]]		

More evidence for underspecification

Table 4: Voicing assimilation in Czech

Prevocalic	Preconsonantal	Gloss
plateb	pla[db]a	'payment'
hudba	hudeb	'music'
matek	matka	'mother'
sladit	sla[tk]ý	'sweet'

[-syl] → [αvoi] / _[-syl αvoi] … with Structure Preservation

Not so fast…

Prevocalic	Preconsonantal	Gloss
bydel	bydlo	'livelihood'
vyder	vydra	'otter'
světel	světlo	'light'
sester	sestra	'sister'

Sonorants are voiced, but do not trigger voicing assimilation!

This agrees with our findings yesterday that presence/absence of structure corresponds to phonological activity!

A final wrinkle

Rule	/t[v[ ]voi]á[ř[ ]voi]/	/plat[b[+]voi]a/	/xla[d[+]voi]
αvoi → αvoi / _[αvoi]	not applied in /tv/!	pladba	
[ ]voi → +voi / [v ř]	t[v[+voi]]á[ř[+]voi]		
+voi → -voi / _#	tvář̥		xlat
[ ]voi → +voi / [+son]			

Contrastive underspecification

Final devoicing again

- [-syl] → [αvoi] / _[αvoi]

  Compare with

- [-son] → [αvoi] / _[-son αvoi]

All the [-son] clause is doing is singling out segment that don't have a contrastive [±voi] specification. That seems like a hell of a coincidence.

What's redundant anyway?

Table 7: One analysis

Feature	p	b	m
voi	-	+	
nas	-	-	+

What about this?

Table 8: Another analysis

Feature	p	b	m
voi	-	+	+
nas		-	+

Here, /p/ is the only voiceless phoneme, so it is sufficient to specify it as [-voi]. We no longer need the [-nas]

How do we decide?

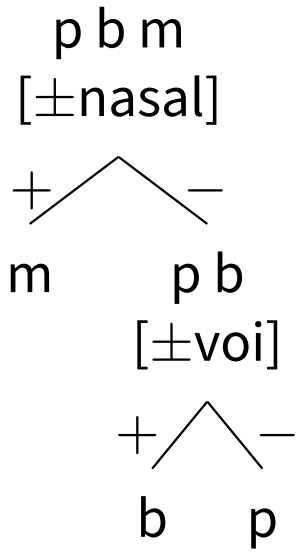
> **A hypothesis**
>
> Both are fine: this is a point of cross-linguistic variation

The Successive Division Algorithm

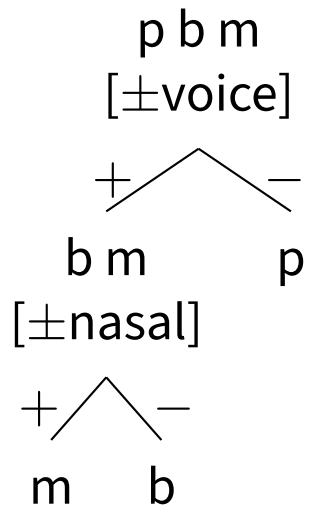
For a short(ish) description of the approach, see B. Elan Dresher. 2015. The motivation for contrastive feature hierarchies in phonology. *Linguistic Variation* 15(1). 1–40. https://doi.org/10.1075/lv.15.1.01dre; for the full-length treatment, B. Elan Dresher. 2009. *The contrastive hierarchy in phonology*. Cambridge: Cambridge University Press

- Take an inventory and assign a + or - value for some feature to every segment in that inventory
- Within each subinventory, repeat the procedure with a different feature
- Once a subinventory consists of one segment, that segment is uniquely specified: stop and do not add any more features to it
- The order of features is not universal

[nas] » [voi]: Czech



[voi] » [nas]



Prediction

Under [voi] » [nas], both voiced obstruents and sonorants have active voicing

- Île de Groix Breton[1]
  - unačypaš ‘a crew’ + ba:k ‘boat’ → unačypaž ba:k
  - trizek ‘thirteen’ + mi:s ‘month’ → trizeg mi:s

Fun with the contrastive hierarchy

Cross-linguistic variation: Ifẹ Yoruba

Based on Sandstedt[2]

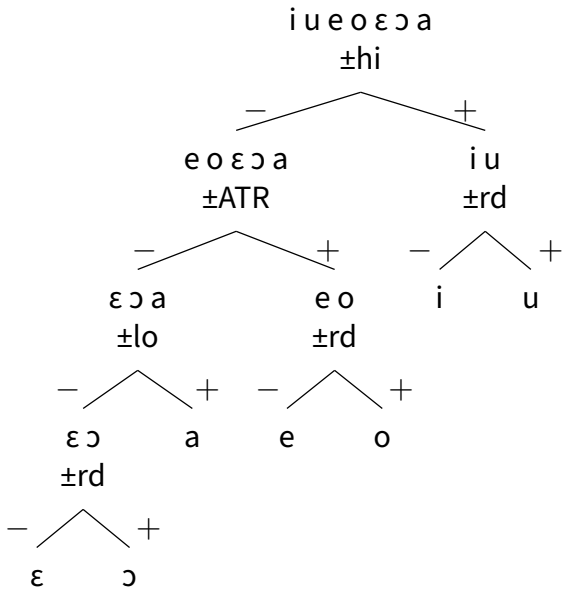
Variation in feature ordering → variation in phonological behaviour

Table 9: Ifẹ Yoruba ATR harmony again

ATR		RTR	
ògùrò	‘spurtle’	ɔrúkɔ	‘name’
eúrò	‘bitter-leaf’	èlùbɔ́	‘yam flour’
oríwo	‘boil, tumour’	ɔdídɛ	‘parrot’
èbúté	‘harbour’	ɛúrɛ́	‘goat’

[1] data from Elmar Ternes. 1970. *Grammaire structurale du breton de l’Île de Groix (dialecte occidental)*. Heidelberg: Carl Winter Universitätsverlag; analysis by Martin Krämer. 2000. Voicing alternations and underlying representations: The case of Breton. *Lingua* 110(9). 639–663; Daniel Currie Hall. 2009. Laryngeal neutralization in Breton: Loss of voice and loss of contrast. In Frederic Mailhot (ed.), *Proceedings of the 2009 annual conference of the Canadian Linguistic Association*.

[2] Jade J. Sandstedt. 2018. *Feature specifications and contrast in vowel harmony: The orthography and phonology of Old Norwegian height harmony*. Edinburgh: The University of Edinburgh dissertation.

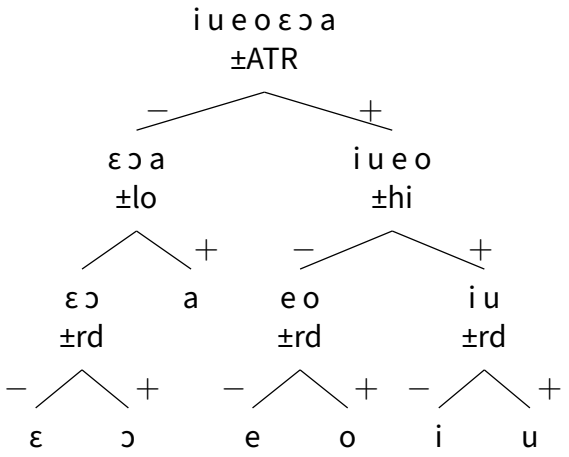


- [+hi] vowels are transparent to ATR harmony
- The hierarchy is [hi] » [ATR]
- [+hi] vowels lack [ATR] specifications and remain inert

Cross-linguistic variation: Standard Yoruba

Ifẹ Yoruba	Standard Yoruba	Gloss
ɔrúkɔ	orúkɔ	‘name’
ɛ̀lùbɔ́	èlùbɔ́	‘yam flour’
ɔdídɛ	odídɛ	‘parrot’
ɛúrɛ́	ewúrɛ́	‘goat’

- Same inventory, but [+hi] vowels initiate a new harmonic span
- [ATR] » [hi]



What have we learned from this?

- 'Contrast' is defined at the level of the system
  - Not on pairwise comparison
  - Not on a priori markedness considerations
- 'The same' phonological unit can have different representations in different languages
- The presence of a particular phonetic property (like [+ATR] in Ifẹ Yoruba high vowels) does not guarantee associated phonological behaviour

Underspecification and variation

Persistent underspecification

- We are now considering an architecture where underspecification is not just for the lexicon, but for the phonology too
- How does this relate to phonetics?

> **i** A hypothesis
>
> Lack of phonological specification is associated with phonetic variability

This is actually a hypothesis developed in the phonetic literature,[3] albeit often without an explicit theory of what counts as contrastive.

Languages with no laryngeal contrast

- Hyman,[4] a candidate universal:

  All languages have voiceless stops

[3] e.g. Patricia Keating. 1988a. The window model of coarticulation: articulatory evidence. *UCLA Working Papers in Phonetics* 69; Patricia Keating. 1988b. Underspecification in phonetics. *Phonology* 5(2). 275–292. https://doi.org/10.1017/S095267570000230X.

[4] Larry M. Hyman. 2008. Universals in phonology. *The Linguistic Review* 25(1–2). 83–137.

As a **descriptive** universal, it is falsified by languages like Yidiŋ that have a single series of stops described as [b d ɟ g]

As an **analytical** universal, it is a statement about a theoretical object — so what are the stops of Yidiŋ?

Phonetic variation and underspecification

- Kakadelis:[5] three languages with no laryngeal contrast
  - Bardi: persistent voicing and manner variation in all stops
  - Sierra Norte de Pueblo Nahuatl: variable voicing in all stops, lenition in velars
  - Arapaho: no voicing, manner lenition of labials

Conclusion: these languages have the same system of contrast, but different phonetics, so contrast does not matter

[5] Stephanie M. Kakadelis. 2018. *Phonetic properties of oral stops in three languages with no voicing distinction*. New York, NY: Graduate Center, City University of New York dissertation.

An alternative

Based on[6]

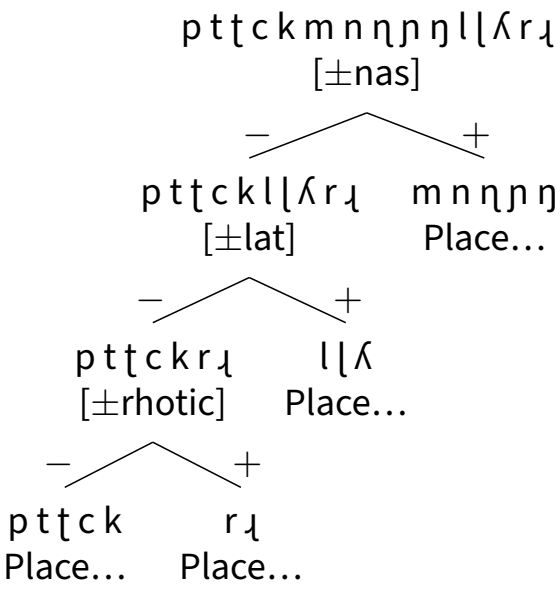


Figure 1: Bardi contrastive hierarchy

[6] Pavel Iosad. Forthcoming. Why the search for rarities must take phonology seriously. In Cormac Anderson, Shelece Easterday & Natalie Kuzmenkova (eds.), *Rarities in phonetics and phonology: Evolutionary, structural, typological and social dimensions*. Berlin: Language Science Press.

On the importance of featural analysis in typology, see Lass;[7] Vaux.[8] For applications of the contrastive hierarchy in typological analysis, see Dresher, Oxford & Harvey;[9] Youssef.[10] For more examples of contrastive hierarchies and synchronic variation, see Natvig;[11] Purnell, Raimy & Salmons[12]

[7] Roger Lass. 1984. *Phonology: An introduction to basic concepts*. Cambridge: CUP.

[8] Bert Vaux. 2009. The role of features in a symbolic theory of phonology. In Eric Raimy & Charles Cairns (eds.), *Contemporary views on architecture and representations in phonology* (Current Studies in Linguistics 48), 75–97. Cambridge, MA: MIT Press.

[9] B. Elan Dresher, Will Oxford & Christopher Harvey. 2018. Contrastive feature hierarchies as a new lens on typology. In Larry M. Hyman & Frans Plank (eds.), *Phonological typology* (Phonetics and Phonology 23), 273–311. Berlin: De Gruyter. https://doi.org/10.1515/9783110451931-008.

[10] Islam Youssef. 2021. Contrastive feature typologies of Arabic consonant reflexes. *Languages* 6(3). 141. https://doi.org/10.3390/languages6030141

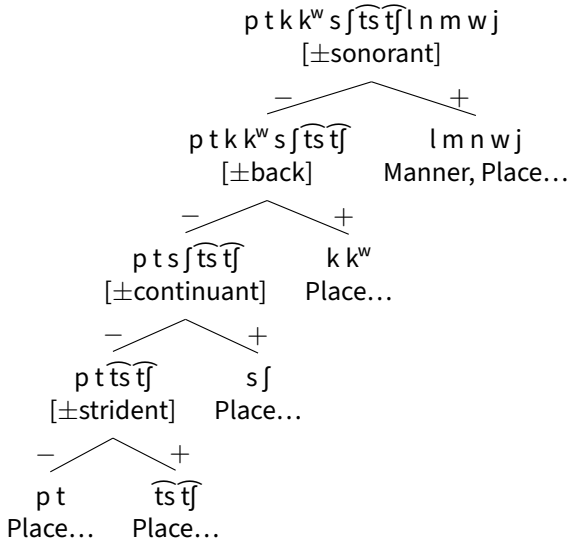


Figure 2: Sierra Norte de Pueblo Nahuatl contrastive hierarchy

Contrastive hierarchies and sound change

Contrast shift

- We have seen that the same inventory could be described in terms of different contrastive hierarchies, and thus different patterns of predicted phonological behaviour

> **i** A proposal
>
> Covert reinterpretation of featural specification is a possible type of historical change

Dresher, Harvey & Oxford:[13] 'contrast shift'

[13] B. Elan Dresher, Christopher Harvey & Will Oxford. 2014. Contrast shift as a type of diachronic change. *North East Linguistic Society (NELS)* 43(1). 103–116.

Anglo-Frisian Brightening

- Traditional picture: PGmc /æ:/ > PWGmc /a:/ > OE, OFris /æ:/
- Motivation
  - PGmc /æ:/ is uncontroversial
  - PWGmc /a:/ is on the basis of back reflexes in OHG, for example
  - AF /æ:/ is securely attested
- Hogg:[14] the changes are driven by contrast

[14] Richard M. Hogg. 1992. *A grammar of Old English*. Vol. 1: *Phonology*. Oxford: Blackwell.

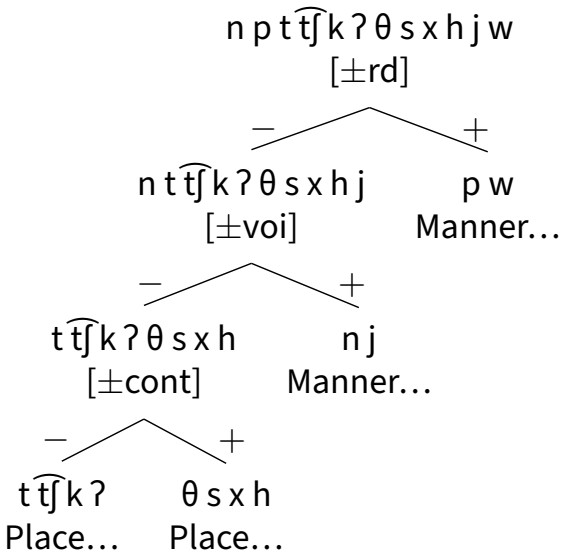


Figure 3: Arapaho contrastive hierarchy

Table 11: Proto-Germanic long vowels

Height	Front	Back
High	iː	uː
Mid	eː	oː
Low	æː	aː

- /æː/ is *contrastively* front
- WGmc /aː/ merges with /oː/

Table 12: Proto-West-Germanic long vowels

Height	Front	Back
High	iː	uː
Mid	eː	oː
Low	æː	

- There is only one low vowel /æː/: frontness is *noncontrastive*
- This may mean that it has a broader range of phonetic realizations

Table 13: Anglo-Frisian long vowels

Height	Front	Back
High	iː	uː
Mid	eː	oː

Height	Front	Back
Low	æː	ɑː

- OE, OFris: /ai/ > /aː/ (PGmc *stainaz* > OE *stān*)
- The 'changes' of /æː/ involve not rules of fronting and backing but the phonetic realization of the long vowel in a changing system of contrast

Formalizing contrast shift

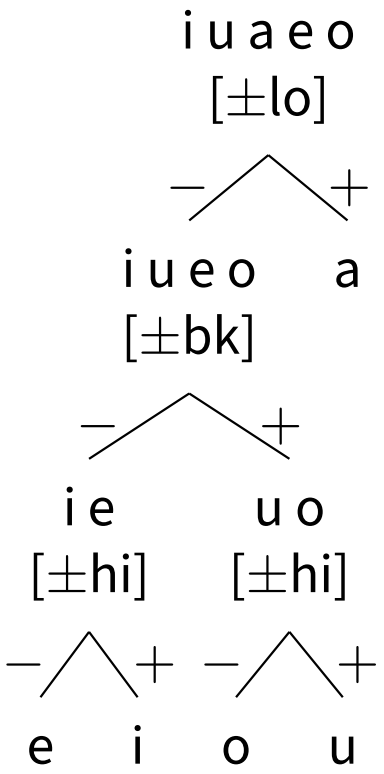


Figure 4: Proto-West Germanic contrastive hierarchy

- This is consistent with the Proto-Germanic phonological system:
  - /a/-umlaut: lowering of /i u/ to /e o/: change in [±hi]
  - Raising of /e/ to /i/ before /i/ (and sometimes /u/): change in [±hi]

Anglo-Frisian

Extension of [±bk] contrast to [+lo] branch ('cloning')

Implementing the shift

- Promotion of [±hi] so that it becomes relevant to [+bk] vowels
- Necessarily, this demotes [±lo]

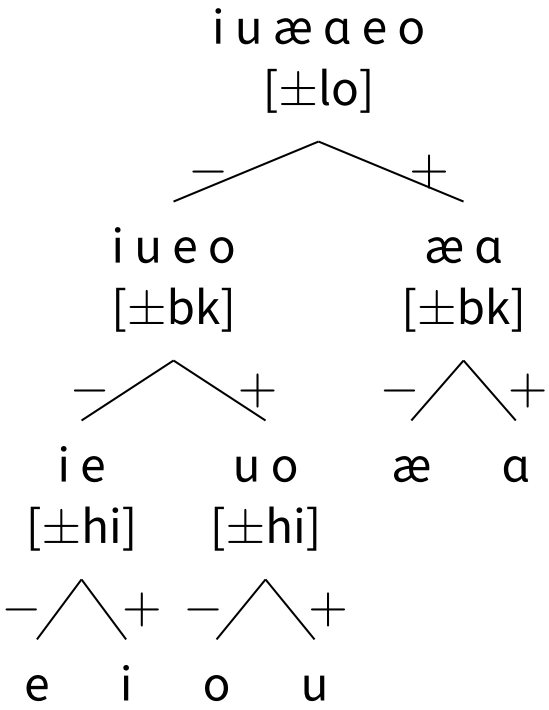


Figure 5: Anglo-Frisian contrastive hierarchy

Cloning and new vowels

We can now clone the [+rd] branch to accommodate [-bk +rd] vowels, which phonemicize at this stage

Summary

- Modified Contrastive Specification allows to carefully formalize traditional insights into the role of contrast in diachronic change

> ⚠ Warning
>
> I'm not saying anything about the mechanism of this change, or claiming that the contrast system is **causing** these changes!

Conclusion

Modified Contrastive Specification allows us to make explicit some key insights

- Precise scope of lexical contrast
- Link between presence of structure and phonological activity
- Link between phonological inactivity and phonetic variation
- Diachronic change

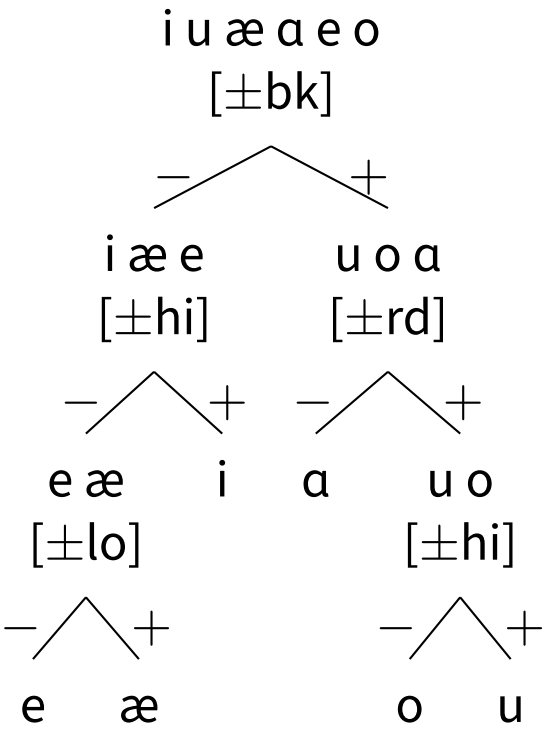


Figure 6: Another contrastive hierarchy for Anglo-Frisian

Oh and by the way…

The alleged problems for the phoneme identified by Halle can be solved with the contrastive hierarchy.[15]

[15] B. Elan Dresher & Daniel Currie Hall. 2020. The road not taken: *The Sound Pattern of Russian* and the history of contrast in phonology. *Journal of Linguistics* 57(2). 405–444. https://doi.org/10.1017/s0022226720000377.

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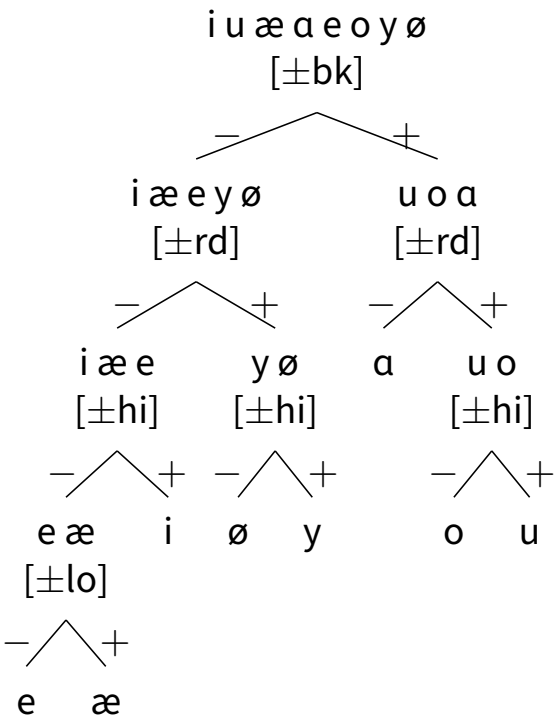

Figure 7: Now with front rounded vowels

Hall, Daniel Currie. 2009. Laryngeal neutralization in Breton: Loss of voice and loss of contrast. In Frederic Mailhot (ed.), *Proceedings of the 2009 annual conference of the Canadian Linguistic Association*.

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