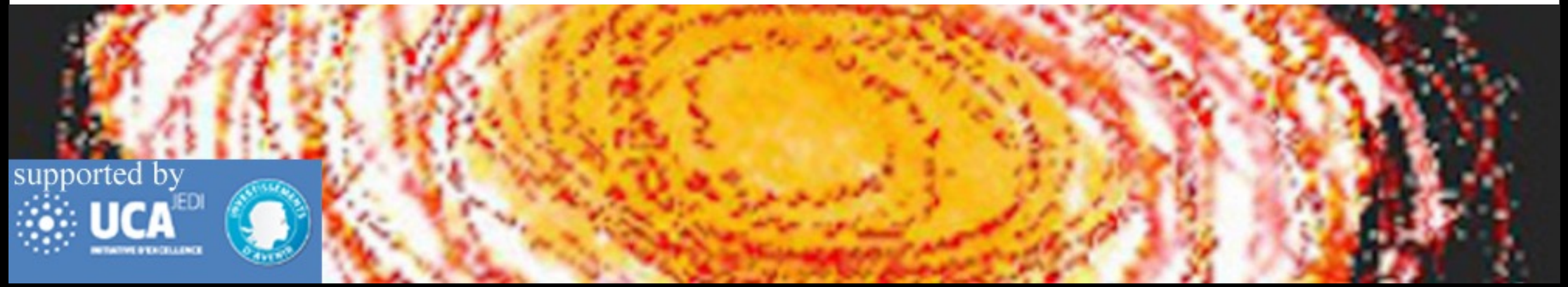
Eastern Generative Grammar (EGG)

EGG 2021 online, 26 July to 6 August



Foundations of Contrastive Hierarchy Theory

B. Elan Dresher

Class 1: Foundations of CHT in pre-generative phonology

Eastern Generative Grammar (EGG)

Monday 26 July 2021

Department of Linguistics
UNIVERSITY of TORONTO

Introduction

Course Abstract

Foundations of Contrastive Hierarchy Theory

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This course will present the foundations and main tenets of Contrastive Hierarchy Theory (CHT). CHT builds on ideas that go back to Jakobson and Trubetzkoy, adapted to the generative phonology of Chomsky and Halle. Two ideas that are central to the theory are (a) contrastive phonological primes (in my case binary features but the same holds for unary elements) are computed hierarchically, with the choice and ordering of the features being language particular; and (b) only contrastive features play a role in the phonology (the Contrastivist Hypothesis). We will demonstrate why contrastive features must be computed hierarchically, and consider the implications of this theory for whether features are innate or emergent. We will show how contrastive hierarchies work and review case studies that show how they contribute to synchronic and diachronic phonology.

Course Outline

1. Foundations of CHT in the history of phonology, with a review of key ideas found in the work of Sweet, Sapir, Trubetzkoy, Jakobson, and Halle.
   Selected readings: Dresher (2014, 2016, 2019); Dresher & Hall (2020).
2. A theory of phonological contrast: language-particular hierarchies; the Contrastivist Hypothesis; contrast and phonological activity; enhancement; markedness; the nature of features.
   Selected readings: Dresher (2009: ch. 7); Hall (2007; 2011); Ko (2018: ch. 4).
3. Contrastive hierarchies in synchronic phonology: vowel harmony, vowel reduction, consonant co-occurrence restrictions, consonantal contrasts, and loan phonology.
   Selected readings: Dresher (2021); Herd (2005); Mackenzie (2012, 2013); Spahr (2012, 2014).
4. Contrastive hierarchies in diachronic phonology.
   Selected readings: Compton & Dresher (2011); Dresher (2018): Krekoski (2017); Oxford (2015).
5. In this class we can take up outstanding questions and, depending on interest, look at new ones.

References

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Spahr, Christopher. 2014. A contrastive hierarchical account of positional neutralization. *The Linguistic Review* 31(3–4): 551–85.

Introduction

This course will present the foundations and main tenets of Contrastive Hierarchy Theory (CHT).

CHT assumes that phonology is about contrast; personally, I think that without contrast, there is no phonology, only phonetics or the physics of speech (Dresher & van der Hulst to appear).

Arguments that contrast is not relevant to phonology will be taken up in the second course next week.

Introduction

Contrastive Hierarchy Theory is built on essentially two ideas:

The first idea is that phonological primes (in my case, binary features) are computed hierarchically, with the choice and ordering of the primes being language particular.

The second hypothesis is that only contrastive primes are computed by the phonology; non-contrastive features can be added, for example by enhancement, in a post-phonological component.

Introduction

We will elaborate on these ideas throughout the course and show how the theory works.

Then we will review case studies that show how contrastive hierarchies contribute to accounting for a variety of patterns in synchronic phonology.

We will also show how contrastive hierarchies can provide illuminating accounts of diachronic phonology.

To start off, I would like to briefly show how the notion of contrast, which is central to CHT, can be found in the work of some of the greatest phonologists, starting right at the dawn of modern phonological theory in the late 19th century.

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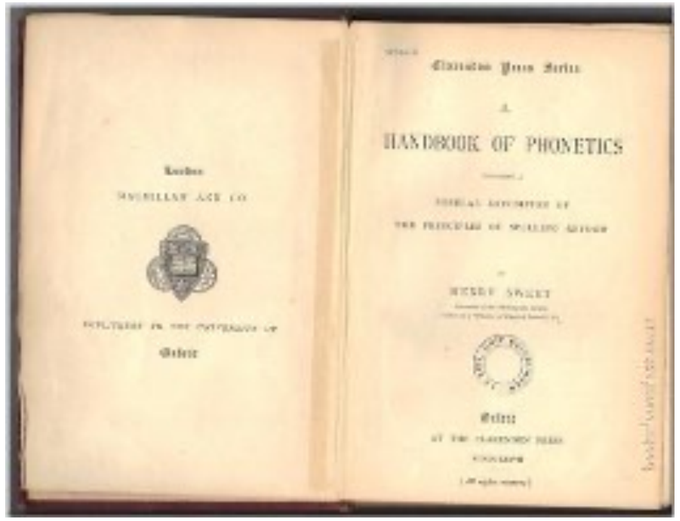
1. Sweet 1877
Contrastive Properties and
'Broad Romic' Transcription

Contrast and Broad Transcription



Henry Sweet (1877)
A handbook of phonetics.
Oxford: Clarendon Press.

Henry Sweet (1845–1912) was a Germanic philologist, phonetician, and pioneering phonologist.

According to Jones (1967: 256), Sweet was the first to distinguish a detailed phonetic transcription (what he called ‘Narrow Romic’) from a phonemic transcription suitable to an individual language (‘Broad Romic’).

Contrast and Broad Transcription

For example, the vowels in the English words *bait* and *bet* differ in three ways: the vowel in *bait* is longer and tenser than in *bet*, and is a diphthong, whereas the vowel in *bet* is a monophthong.

An accurate phonetic transcription would indicate all these distinctions; in the current notation of the International Phonetic Alphabet (IPA), they are transcribed as shown.

	Differences	IPA
bait	long, tense, +j	[eːj]
bet	short, lax, +Ø	[ɛ]

Contrast and Broad Transcription

These three differences, however, are not independent: recombining the various properties to create new vowels as shown would not result in a new word distinct from both *bait* and *bet*, but would be heard as some (perhaps odd-sounding) variant of one of these words.

Sweet (1877: 104) writes: “we may lay down as a general rule that only those distinctions of sounds require to be symbolized in any one language which are independently significant.”

	Differences	IPA	Non-contrasting vowels
bait	long, tense, +j	[eːj]	[eː], [ej], [e], [ɛː], [ɛj], [ɛːj]
bet	short, lax, +Ø	[ɛ]	

Contrast and Broad Transcription

Further, “if two criteria of significance are inseparably associated, such as quantity and narrowness or wideness [i.e., tenseness or laxness/BED], we only need indicate one of them.”

Sweet proposes (1877: 109–110) that in broad transcription [eːj] should be transcribed ‘ei’ (or, equivalently, ‘ej’) and [ɛ] as ‘e’.

Thus, of the three differences in the vowels, he chooses the presence of an off-glide *j* as significant, ignoring both quantity (length) and narrowness or wideness (tenseness or laxness).

	Differences	IPA	Broad
bait	long, tense, +j	[eːj]	ei or ej
bet	short, lax, +Ø	[ɛ]	e

Contrast and Broad Transcription

In this case he gives the rationale for his choice. He observes (p. 110): “The narrowness of all [English] vowels is uncertain”, especially /ij/ and /ej/.

That is, vowels can vary in the degree to which they are tense or lax without essentially changing the identity of the vowel, as long as other properties do not change.

	Differences	IPA	Broad	Narrowness not contrastive
bait	long, tense, +j	[eːj]	ei or ej	[eːj] or [ɛːj]
bet	short, lax, +Ø	[ɛ]	e	[ɛ] or [e]

Contrast and Broad Transcription

Similarly, he finds (p. 18) that “originally short vowels can be lengthened and yet kept quite distinct from the original longs.”

That is, [bɛt] (*bet*) can be lengthened to [bɛːt] without passing into *bait*, and [beːjt] (*bait*) can be shortened to [bejt] without being perceived as *bet*.

	Differences	IPA	Broad	Length not contrastive
bait	long, tense, +j	[eːj]	ei or ej	[eːj] or [ej]
bet	short, lax, +Ø	[ɛ]	e	[ɛ] or [ɛː]

Contrast and Broad Transcription

While tenseness and length can be altered without changing one vowel phoneme into another one, presumably the same is not the case for the third distinguishing property.

Adding a glide to the vowel in *bet*, or removing it from *bait*, could cause the resulting vowel to be perceived as having changed category.

	Differences	IPA	Broad	Glide is contrastive
bait	long, tense, +j	[eːj]	ei or ej	[eːj] not [eː]
bet	short, lax, +Ø	[ɛ]	e	[ɛ] not [ɛj]

Contrast and Broad Transcription

We can conclude from his discussion that Sweet's analysis posits that the contrastive properties of both the vowels in *bait* and *bet* are mid and front, with no contrastive specification for tenseness or quantity.

The difference in the two words resides in the addition of a second segment to the vowel in *bait*.

	Differences	IPA	Broad	Contrastive properties
bait	long, tense, +j	[eːj]	ei or ej	mid, front, off-glide *j*
bet	short, lax, +Ø	[ɛ]	e	mid, front

Contrast and Broad Transcription

Sweet did not propose a method for computing contrastive properties, nor did he consistently attempt to identify what the contrastive properties are for every segment (Dresher 2016).

However, we can see in his work the ideas that:

- only contrastive properties need be transcribed,
- and these properties can be identified by observing how sounds function in a language.

That is, the notion that contrast is central to phonology has its roots in the earliest work in phonological theory in the late 19th century.

References and further reading

This section is based on Dresher (2016: 54–57):

Dresher, B. Elan. 2016. Contrast in phonology 1867–1967: History and development. *Annual Review of Linguistics* 2: 53–73.

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2. Sapir 1925
'Sound Patterns' are Not Determined by Phonetics

The importance of contrast in phonology

Sweet's notion of a broad—i.e, phonemic—transcription was taken further by the American linguist Edward Sapir (1884–1939).

In the very first volume of *Language*, Sapir (1925) argues that 'sound patterns', not simply phonetics, should be the main focus of phonological theory.

But what does he mean by sound patterns? I think that sound patterns refer to the contrastive properties of the phonemes of a language.

The importance of contrast in phonology

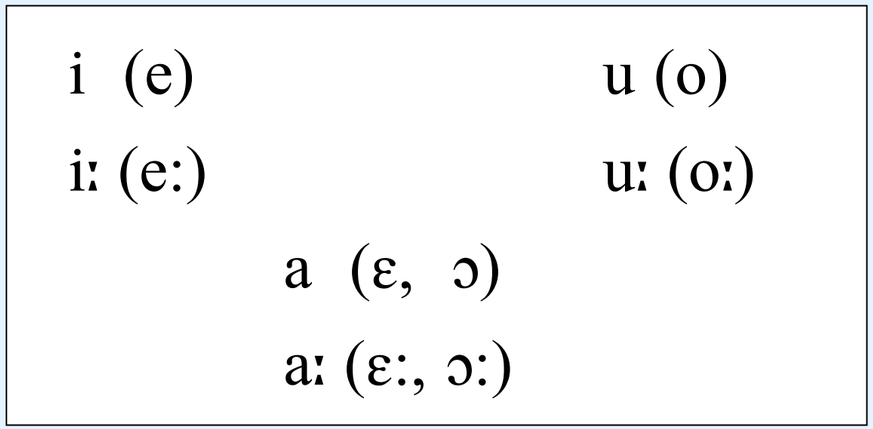
To illustrate, Sapir constructs four languages, A, B, C, and D, that drew on languages he was familiar with.

Languages A and B have identical sounds; here, we will look only at the vowels:

a	aː	ɛ	ɛː	e	eː	i	iː	u	uː	o	oː	ɔ	ɔː

Although languages A and B share these phonetic vowel sounds, the way they are organized phonemically is totally different.

Same phonetics, different pattern alignments



Language A

Language A has three short and three long contrastive vowels: /i a u/ and /iː aː uː/; the other vowels are allophones of these vowels.

Same phonetics, different pattern alignments

		front/un-rounded	back/ rounded
nonlow	short	i (e)	u (o)
	long	iː (eː)	uː (oː)
low	short	a (ɛ, ɔ)	
	long	aː (ɛː, ɔː)	

Language A

Language A has three short and three long contrastive vowels: /i a u/ and /iː aː uː/; the other vowels are allophones of these vowels.

Sapir did not have a theory of features, but one possible set of features we can assign are shown above; in terms of binary features:

[±long]	[±low]	[±front] *or* [±back] *or* [±rounded]

Same phonetics, different pattern alignments

Language B is very different: it is a seven-vowel system in which the long vowels are predictable allophones of the short ones.

i (iː, j)		u (uː, w)
e (eː)		o (oː)
ɛ (ɛː)	a (aː)	ɔ (ɔː)

Language B

Same phonetics, different pattern alignments

Language B is very different: it is a seven-vowel system in which the long vowels are predictable allophones of the short ones.

	front/un-rounded		back/ rounded
high	i (iː, j)		u (uː, w)
mid	e (eː)		o (oː)
low	ɛ (ɛː)	a (aː)	ɔ (ɔː)

Language B

Again, we can anachronistically assign a set of binary features to this vowel inventory; instead of [±long] as in A, we have another height feature, [±high]:

[±high]	[±low]	[±front] *or* [±back] *or* [±rounded]

Same phonetics, different pattern alignments

		front/un-rounded	back/ rounded
nonlow	short	i (e)	u (o)
	long	iː (eː)	uː (oː)
low	short	a (ɛ, ɔ)	
	long	aː (ɛː, ɔː)	

Language A

	front/un-rounded		back/ rounded
high	i (iː, j)		u (uː, w)
mid	e (eː)		o (oː)
low	ɛ (ɛː)	a (aː)	ɔ (ɔː)

Language B

A and B have the same sounds, their contrastive structures are very different.

Sapir also constructs languages C and D that illustrate the converse situation: they have different sounds, but their ‘pattern alignments’ are isomorphic.

Different phonetics, similar pattern alignments

	h		w	j	l	m	n
p		t	k		q		
b		d	g		ɢ		
f		s	x		χ		

Language C

The consonants of Language C are shown on the left.

	h		v	ʒ	r	m	ŋ
p^h		t^h	k^h		q^h		
β		ð	ɣ		ʁ		
f		ʃ	ç		ħ		

Language D

These are the consonants of Language D.

Different phonetics, similar pattern alignments

	h		w	j	l	m	n
p		t		k	q		
b		d		g	ɢ		
f		s		x	χ		

Language C

Sapir arranges the phonemes this way (recall he did not have a theory of features).

	h		v	ʒ	r	m	ŋ
p^h		t^h		k^h	q^h		
β		ð		ɣ	ʁ		
f		ʃ		ç	ħ		

Language D

He justifies the positions of /v/ and /ʒ/ by their phonological behaviour: they act like /w/ and /j/, respectively, in C.

Sapir (1925)

"And yet it is most important to emphasize the fact, strange but indubitable, that a pattern alignment does not need to correspond exactly to the more obvious phonetic one."

Edward Sapir, Sound patterns in language, *Language* 1: 37–51, 1925.

Different phonetics, similar pattern alignments

h			w	j	l	m	n
p	t	k		q			
b	d	g		ɢ			
f	s	x		χ			

Language C

h			v	ʒ	r	m	ŋ
p^h	t^h	k^h		q^h			
β	ð	ɣ		ʁ			
f	ʃ	ç		ħ			

Language D

The isomorphic alignments can be understood as indicating that corresponding phonemes have the same contrastive values.

Contrastive specifications

We can match up the corresponding consonants in the two languages as in the chart below.

In each cell, the first segment is from Language C, the second is from D.

Sapir does not say what the features of each cell might be,

p/p^h	t/t^h	k/k^h	q/q^h
f/f	s/ʃ	x/ç	χ/ħ
b/β	d/ð	g/ɣ	ɢ/ʁ
m/m	n/ŋ		
l/r			
w/v	j/ʒ	h/h	

but we can (anachronistically) suggest some.

Contrastive specifications

Here is one set of possible contrastive specifications. The differences between C and D in each cell do not involve contrastive features.

		labial	coronal	dorsal	post-dorsal
obstruent	stop voiceless	p/p^h	t/t^h	k/k^h	q/q^h
	spirant	f/f	s/ʃ	x/ç	χ/ħ
	voiced	b/β	d/ð	g/ɣ	ɢ/ʁ
sonorant	nasal	m/m	n/ŋ		
	liquid	l/r			
	glide	w/v	j/ʒ	h/h	

Contrastive specifications

Some phonemes appear to be in the wrong place, suggesting that their underlying specifications are like their counterparts.

obstruent	voiceless stop	p/p^{h}	t/t^{h}	k/k^{h}	q/q^{h}
	voiceless spirant	f/f	s/ʃ	x/ç	χ/ħ
	voiced	b/β	d/ð	g/ɣ	ɢ/ʁ
sonorant	nasal	m/m	n/ŋ		
	liquid	l/r			
	glide	w/ʋ	j/ʒ	h/h	

Contrastive specifications

Some phonemes appear to be in the wrong place, suggesting that their underlying specifications are like their counterparts.

These types of examples have been much discussed in connection with how abstract Sapir's theory of phonology was (Chomsky 1964; McCawley 1967).

Less attention has been paid to the other examples, which don't appeal to abstractness, but which show the importance of establishing the contrastive properties of segments.

sonorant	nasal	m/m	n/ŋ	
	liquid	l/r		
	glide	w/v	j/ʒ	h/h

Contrastive specifications

For example, the obstruents in red are contrastively voiced and redundantly stops or spirants.

		labial	coronal	dorsal	post-dorsal
obstruent	voiceless stop	p/p^h	t/t^h	k/k^h	q/q^h
	voiceless spirant	f/f	s/ʃ	x/ç	χ/ħ
	voiced	b/β	d/ð	g/ɣ	ʛ/ʁ
sonorant	nasal	m/m	n/ŋ		
	liquid	l/r			
	glide	w/v	j/ʒ	h/h	

Contrastive specifications

No abstractness is at issue here, but we have to distinguish between contrastive and non-contrastive properties.

		labial	coronal	dorsal	post-dorsal
obstruent	voiceless stop	p/p^h	t/t^h	k/k^h	q/q^h
	voiceless spirant	f/f	s/ʃ	x/ç	χ/ħ
	voiced	b/β	d/ð	g/ɣ	ɢ/ʁ
sonorant	nasal	m/m	n/ŋ		
	liquid	l/r			
	glide	w/v	j/ʒ	h/h	

Contrast and synchronic analysis

Thus, for Sapir:

- the pattern alignment of a phoneme amounts to its contrastive status;
- this status is not determined by its phonetics, but is a function of its phonetic and phonological behaviour.

Therefore, a synchronic analysis of the phonology should, among other things, give an account of the contrastive features of each phoneme.

Of course, Sapir lacked a theory of features. For the further development of these ideas we need to turn to the work of the Prague School linguists, notably N. S. Trubetzkoy (1890–1938) and Roman Jakobson (1896–1982).

References and further reading

This section is based on Dresher (2009: 38–42; 2016: 57–58):

Dresher, B. Elan. 2009. *The contrastive hierarchy in phonology*. Cambridge: CUP.

Dresher, B. Elan. 2016. Contrast in phonology 1867–1967: History and development. *Annual Review of Linguistics* 2: 53–73.

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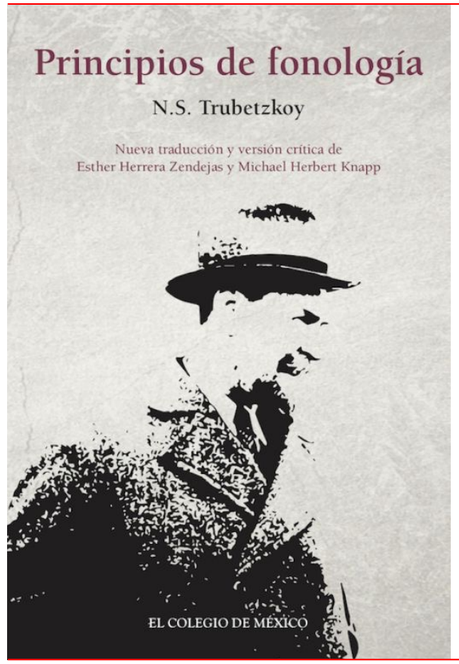
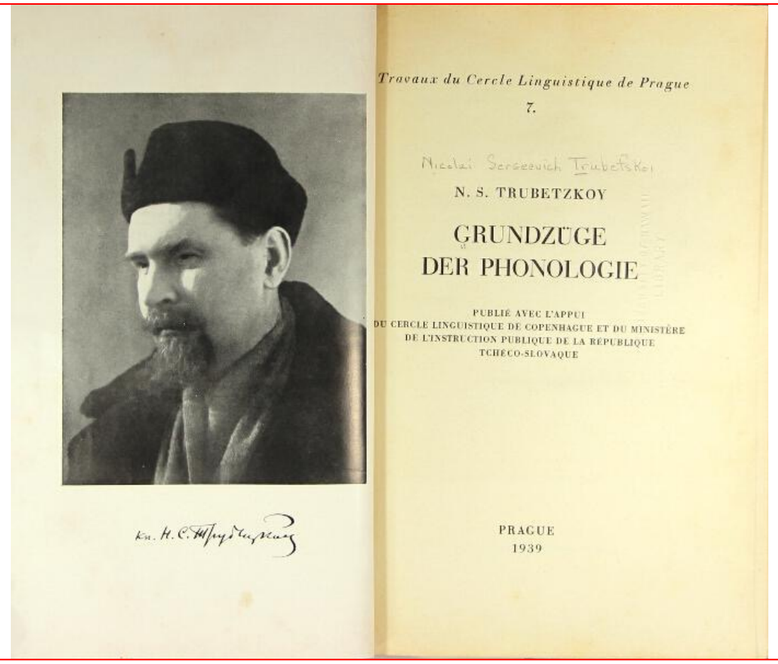
3. Trubetzkoy 1939
Phonemic Content and Contrast as 'Point of View'

Trubetzkoy's *Grundzüge der Phonologie*





N. S. Trubetzkoy's *Grundzüge der Phonologie* (1939; English version 1969, new critical Spanish edition 2019) is notable for its insights into the nature of contrast.

Phonemic content

An important notion of Trubetzkoy's is phonemic content: "By phonemic content we understand all phonologically distinctive properties of a phoneme…" (Trubetzkoy 1969: 66).

"Each phoneme has a definable phonemic content only because the system of distinctive oppositions shows a definite order or structure." (1969: 67–8)

"the content of a phoneme depends on what position this phoneme takes in the given phonemic system …" (1969: 67)

Phonemic content and structure of the system

"the system of distinctive oppositions shows a definite order or structure … the content of a phoneme depends on what position this phoneme takes in the given phonemic system …"

These remarks suggest that the phonemic content of a phoneme, that is, the set of its contrastive properties, ought to derive from its position in the system of distinctive oppositions.

Therefore, we need a way to determine a phoneme's position in the system of oppositions before we have determined its distinctive properties.

Phonemic content and structure of the system

"the system of distinctive oppositions shows a definite order or structure … the content of a phoneme depends on what position this phoneme takes in the given phonemic system …"

Trubetzkoy does not explicitly show us how to do this; however, a way of providing an order or structure to the system of contrasts is via the hierarchical branching trees that became prominent later in the work of Jakobson.

Feature hierarchies are already implicit in Trubetzkoy (1939); consider his discussion of the Latin vowel system.

The vowel system of Latin

Trubetzkoy observes that in Latin, as in many five-vowel systems, the low vowel does not participate in tonality contrasts; ‘tonality’ refers to backness or lip rounding, that is, properties that affect the second formant (F2).

That is, the low vowel /a/ is characterized only by its height; in our terms, it is assigned only the feature [+low].

Latin

	/i/	/u/
[–low]		
	/e/	/o/
[+low]	/a/	

But how can we prevent /a/ from receiving other features?

We can if we assign contrastive features in an order, in a feature hierarchy.

The vowel system of Latin

In order to exclude /a/ from receiving tonality features, it is necessary to order [±low] at the top of the feature hierarchy: this has the effect of separating /a/ from the other vowels.

Since /a/ is already uniquely distinguished, it will receive no further features.

Latin

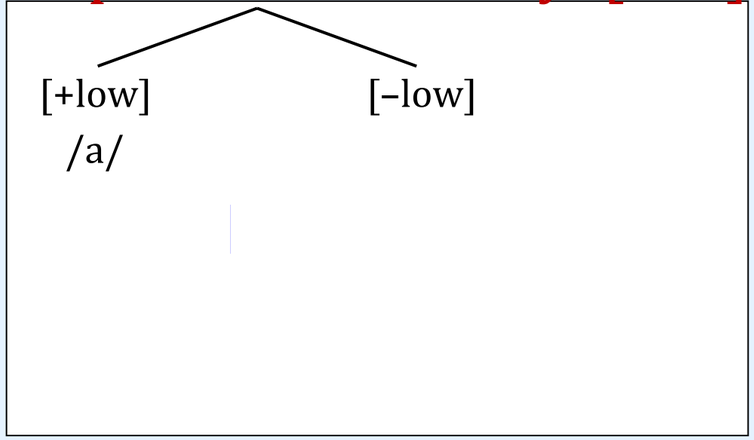
/i/ /u/

[–low]

/e/ /o/

[+low] /a/

Top of the hierarchy: [low]

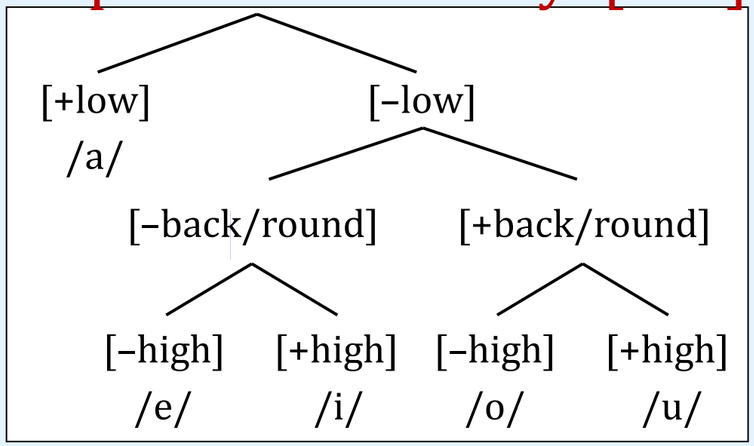


The vowel system of Latin

What the other two (or, more unusually, three) features are depends on the evidence from the language.

Common five-vowel systems use the features [±back] or [±round] and [±high].

Top of the hierarchy: [low]



Feature hierarchies

The notion of a feature hierarchy is only implicit in Trubetzkoy's discussion of the Latin vowel system.

Invoking a feature hierarchy is a way to make sense of his analysis.

In the case of Polabian, however, Trubetzkoy explicitly refers to a hierarchy.

Polabian: “A certain hierarchy”

He observes (1969: 102–3; 2019: 156) that “a certain hierarchy existed” in the vowel system of Polabian, whereby the contrast between front and back vowels is higher than the contrast between rounded and unrounded vowels.

Looking at the high vowels, for example, this means that /ü/ is closer to /i/ than it is to /u/; the contrast between unrounded i and rounded ü is a sub-classification of the front vowels.

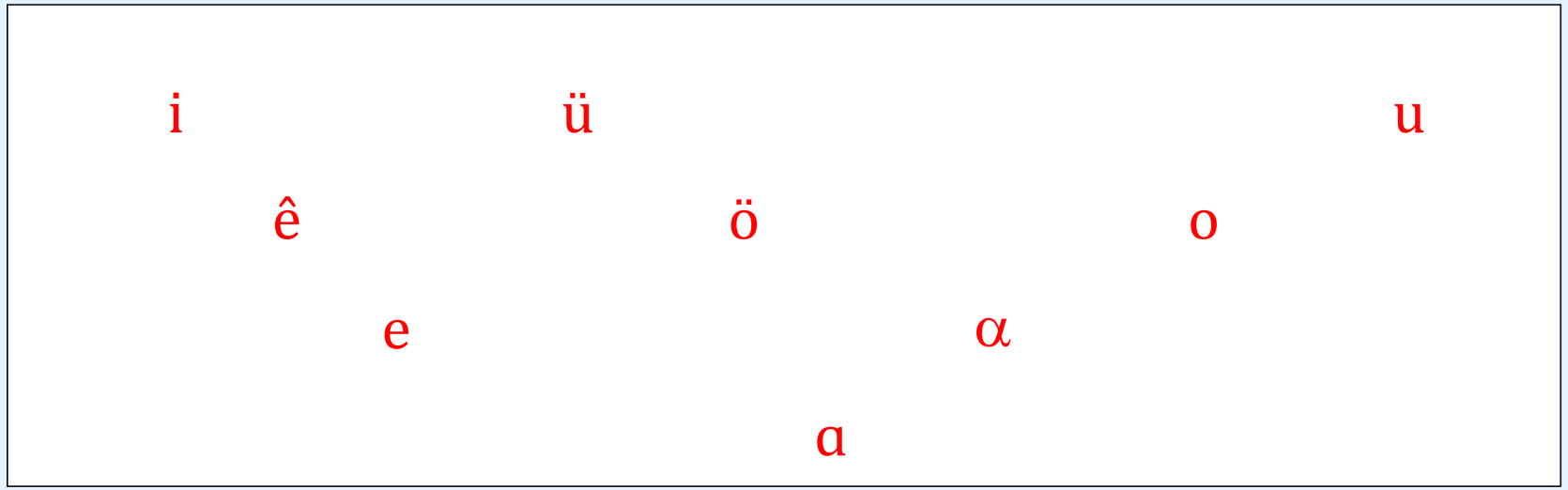
Polabian

Front		Back
Unrounded	Rounded	
i	ü ———	u

The Polabian vowel system

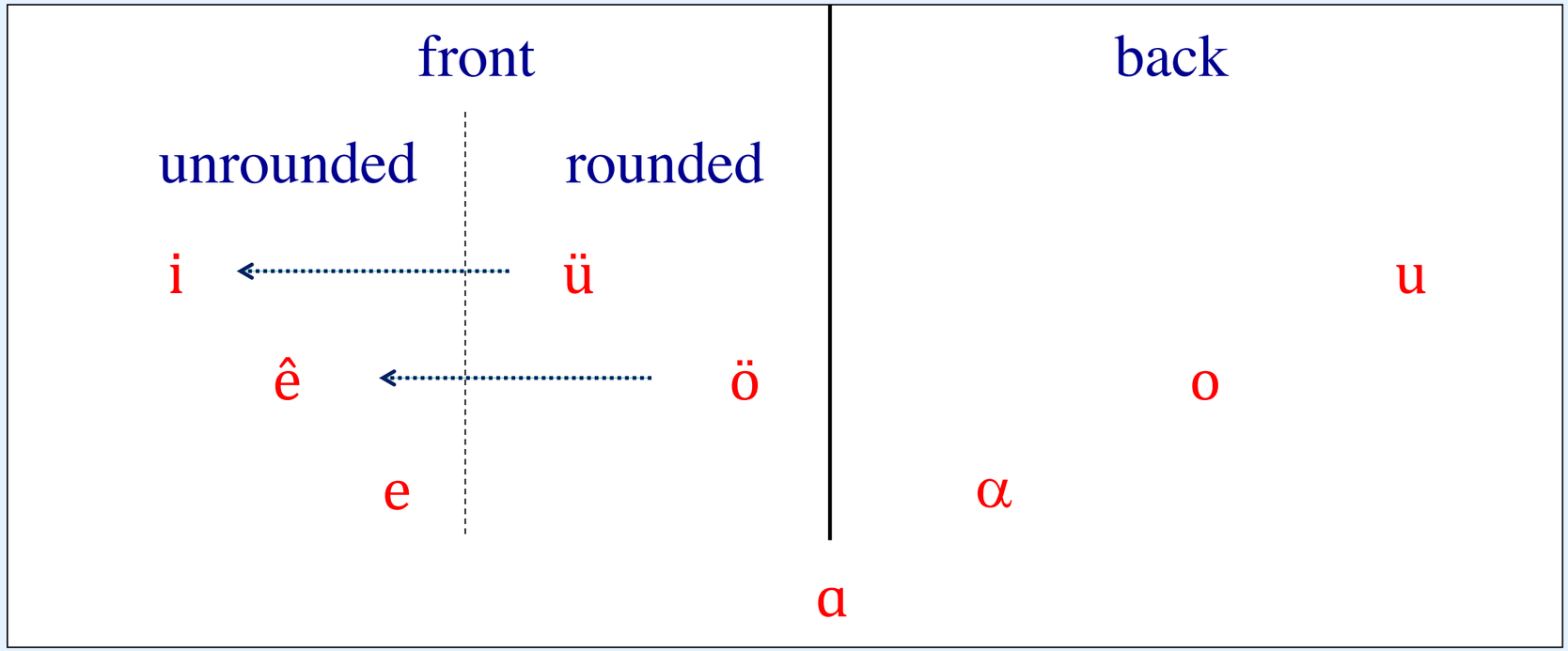
This is the vowel chart of Polabian as presented by Trubetzkoy.

It’s a bit strange (which I’ll come back to), but his reasons for saying that ü is closer to i than to u are clear enough.



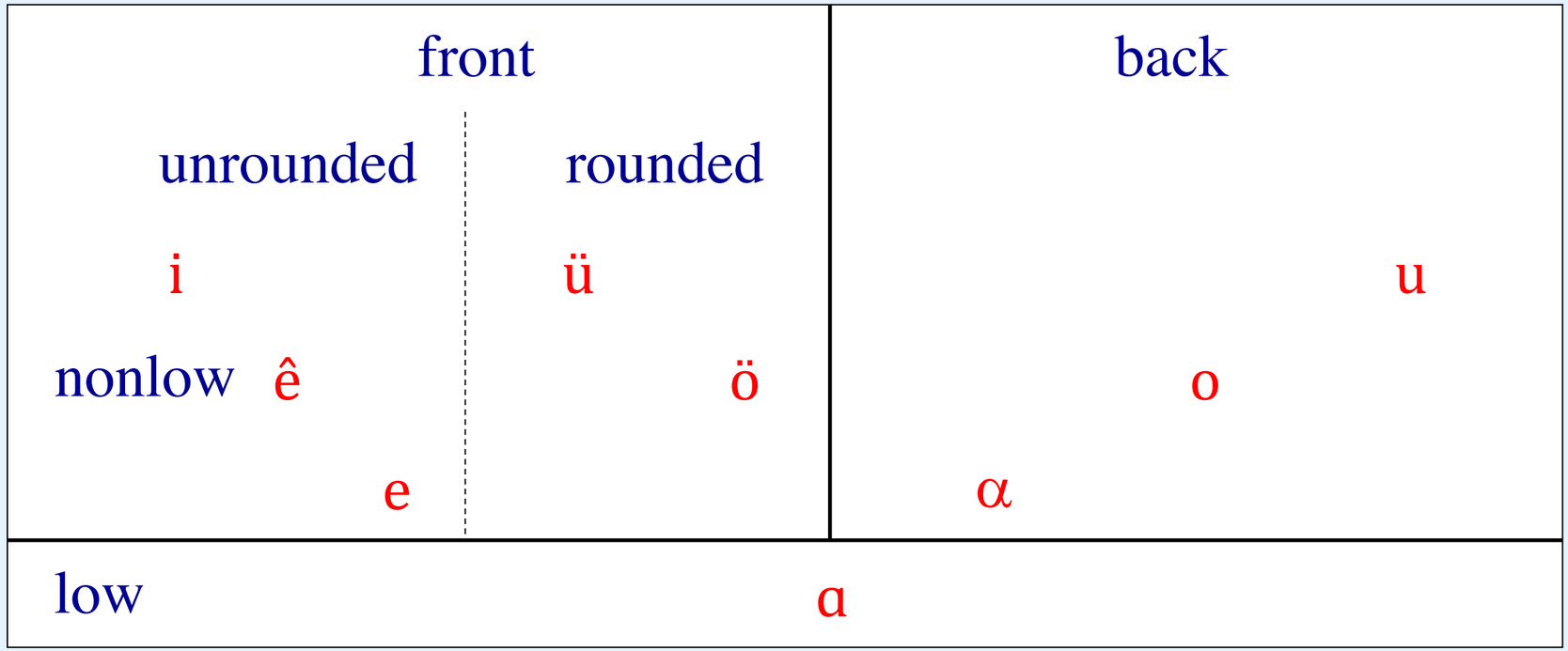
The Polabian vowel system

His evidence is that the oppositions between back and front vowels are constant, but those between rounded and unrounded vowels of the same height can neutralize to the unrounded vowels.



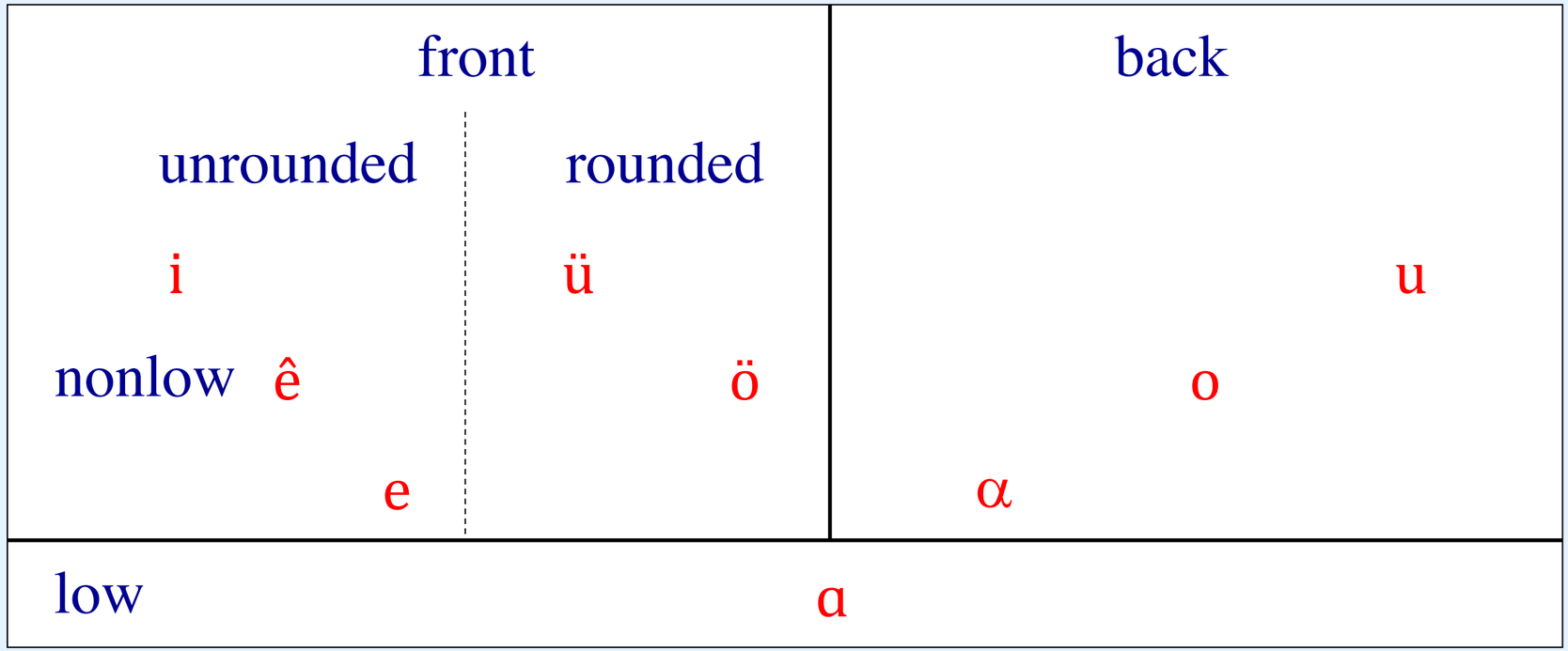
The Polabian vowel system

Further, palatalization in consonants is neutralized before all front vowels and before ‘the maximally open vowel ɑ which stood outside the classes of timbre’ (1969: 102; 2019: 156).



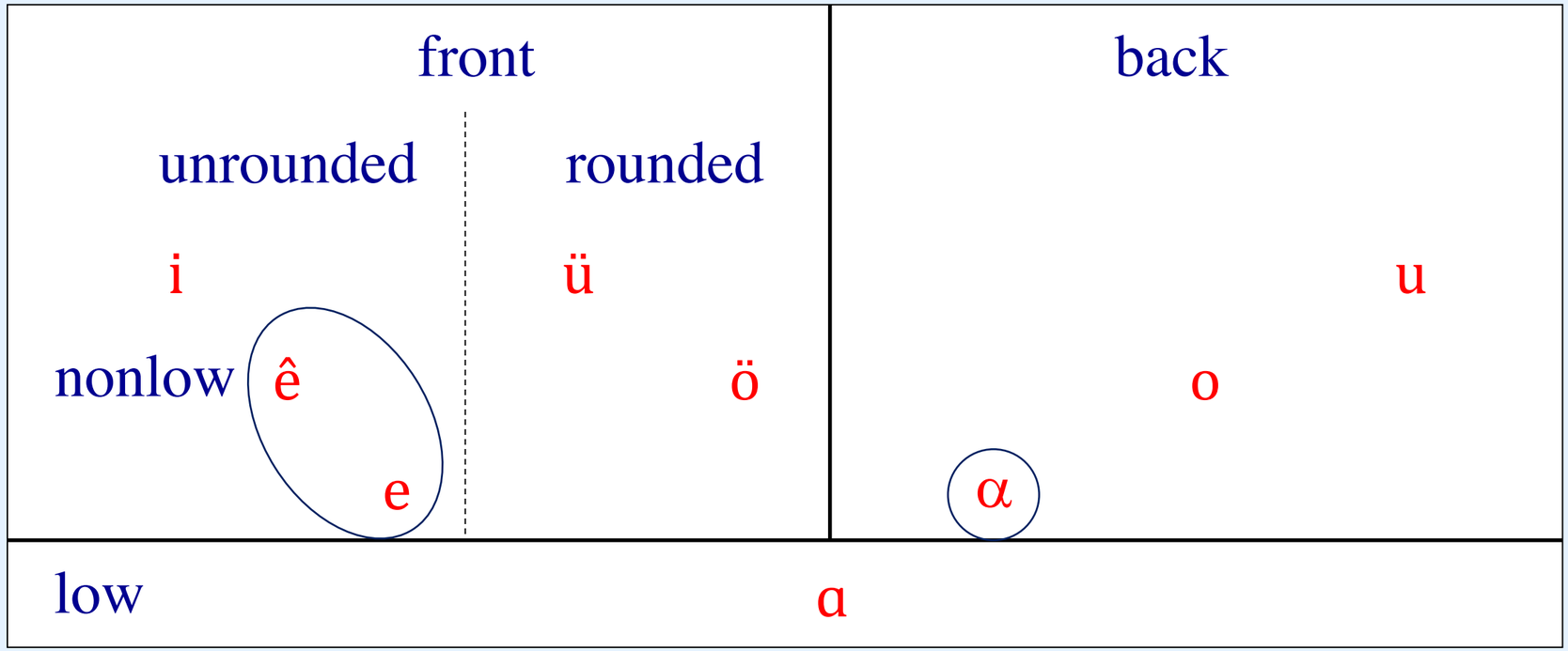
The Polabian vowel system

Trubetzkoy observes further: “the properties of lip participation were phonologically irrelevant for the back vowels.” That is, unlike in the front vowels, rounding is not a distinctive phonological property of the back vowels.



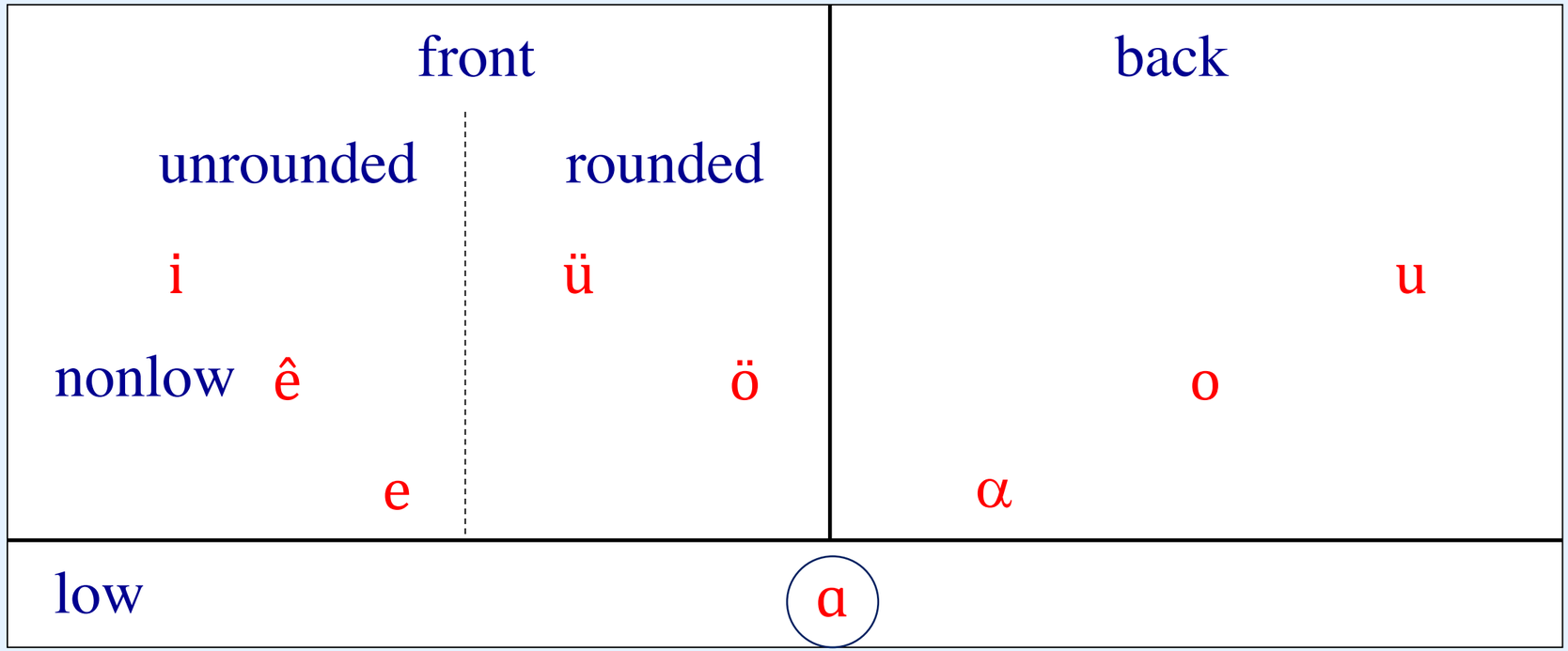
The Polabian vowel system

While Trubetzkoy's general point is clear, his presentation of the Polabian vowel system is hard to understand: What vowel is /α/? What are the phonetic values of /ê/ and /e/?



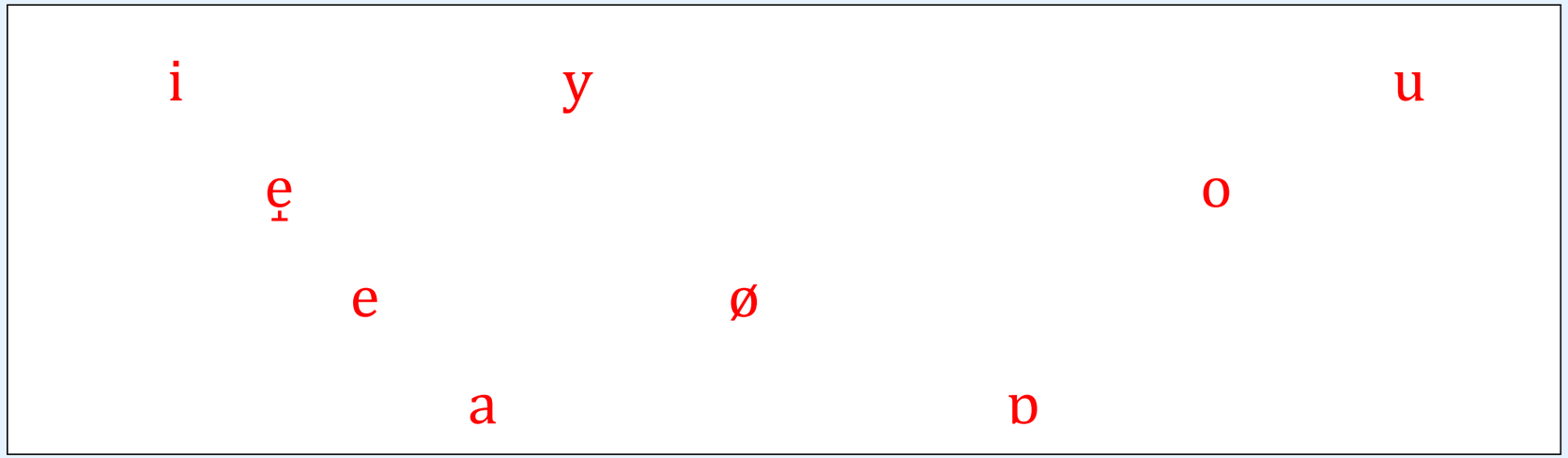
The Polabian vowel system

Finally, why does /ɑ/, the vowel ‘outside the classes of timbre’, pattern with the front vowels in neutralizing palatalization? The new Spanish edition by Herrera Zendeyas and Knapp (Trubetzkoy 2019) sheds some light on this example.



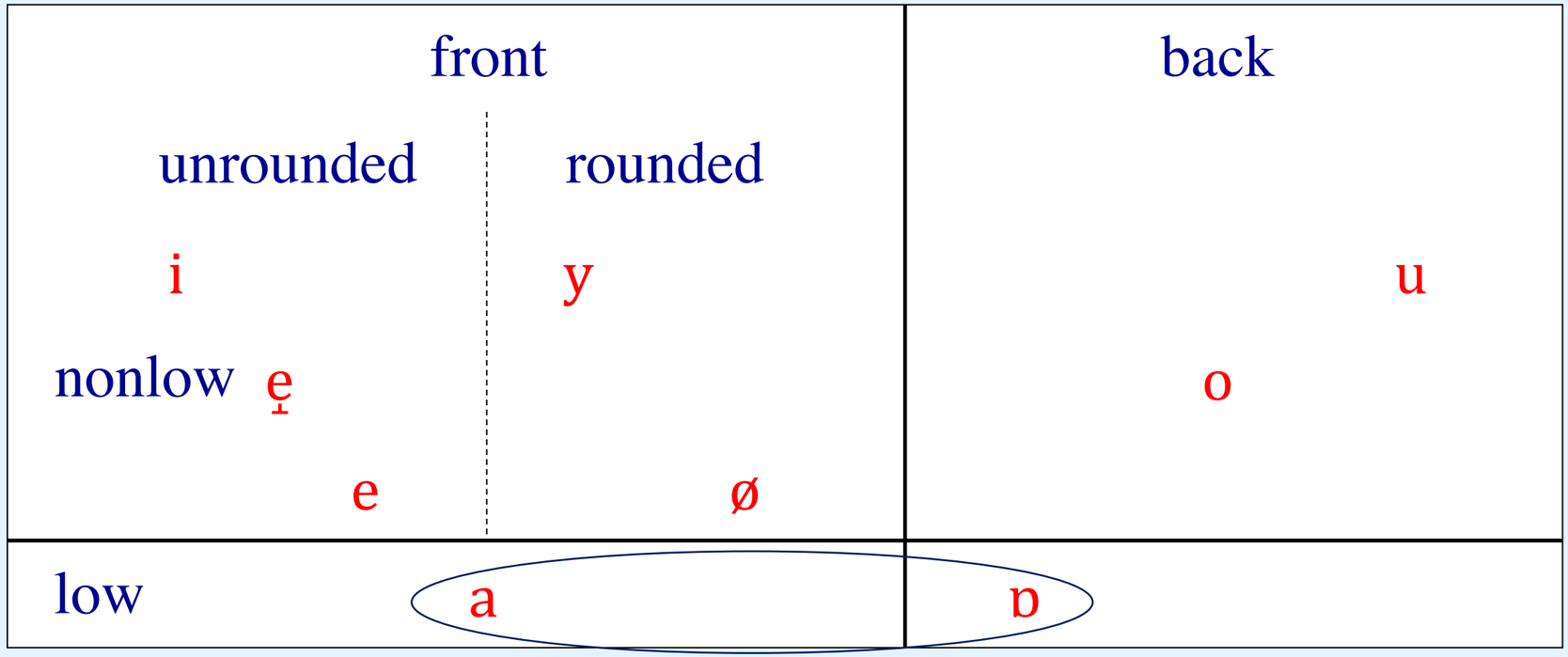
The Polabian vowel system

Next to Trubetzkoy's vowel chart, they present (2019: 157) an alternative more natural-looking chart by Polański (1993: 798–9).



The Polabian vowel system

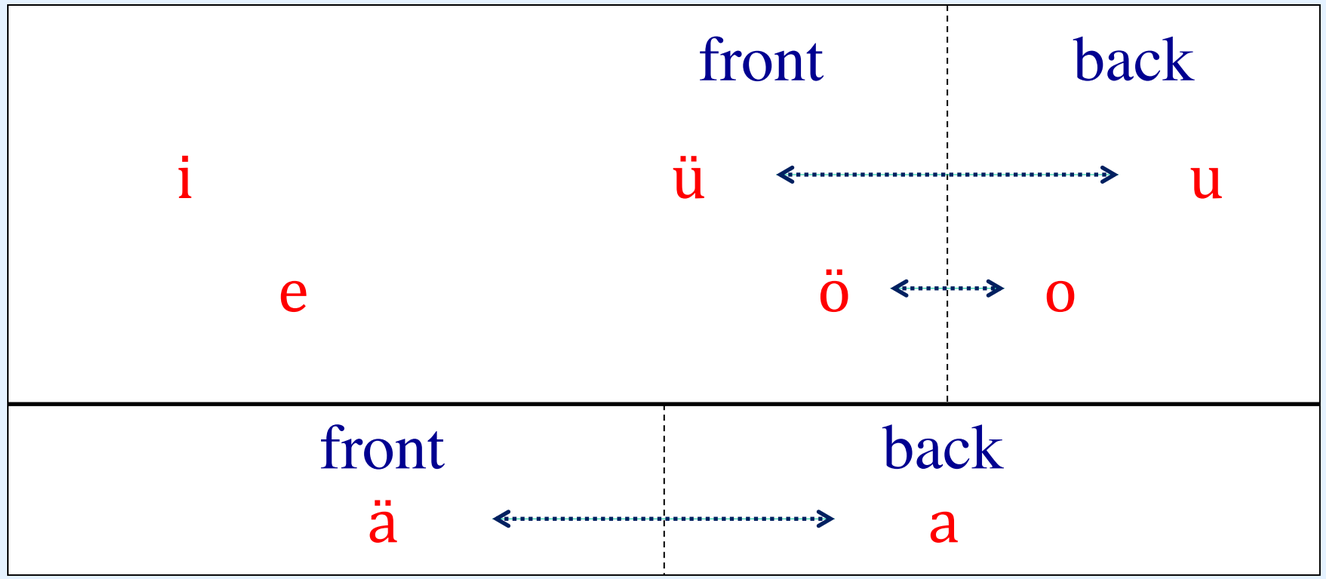
Now it becomes clear why /a/ patterns with the front vowels. It's because it's contrastively front in opposition to back /ɒ/.



The Finnish vowel system

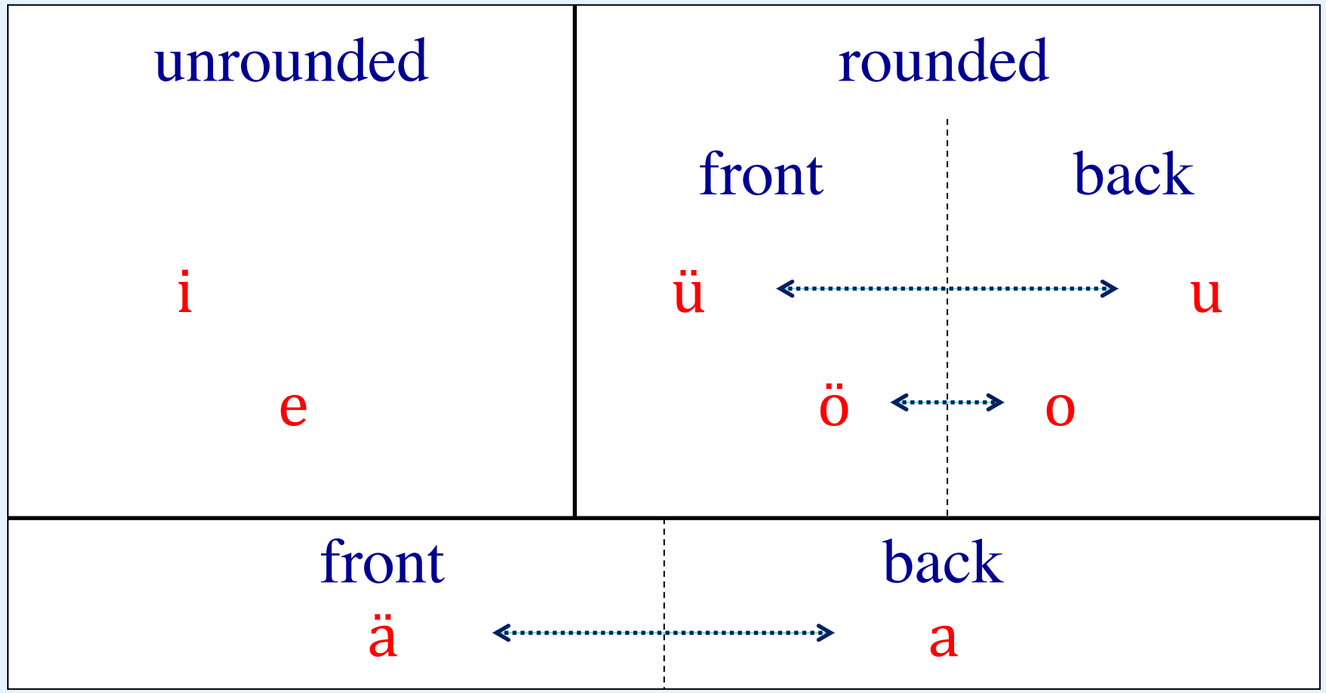
Trubetzkoy presents Finnish as exemplifying a different type of language with three classes of timbre /i, ü, u/ (and /e, ö, o/).

In Finnish, front-back vowel harmony relates ü ~ u, ö ~ o, and ä ~ a, whereas /i/ and /e/ are not involved.



The Finnish vowel system

In Finnish the front-back contrast is under the rounded-unrounded one in the non-low vowels; this is the opposite of the feature ordering in Polabian.



Contrast depends on point of view

The difference between Polabian and Finnish exemplifies another important insight, contained in a 1936 article addressed to psychologists and philosophers (Trubetzkoy 2001 [1936]: 20):

> The correct classification of an opposition "depends on one's point of view"; but "it is neither subjective nor arbitrary, for the point of view is implied by the system."

What does this mean? To say that the correct classification depends on one's point of view means that phonological contrasts can vary from language to language, and cannot be determined simply by inspecting an inventory.

‘Point of view’ means contrast is variable

We have seen that in Latin the low vowel /a/ is set apart from the other vowels, in Trubetzkoy’s analysis.

But this is not the only way to draw the contrasts in a five-vowel system.

Latin

	/i/	/u/
[–low]		
	/e/	/o/
[+low]	/a/	

‘Point of view’ means contrast is variable

It is possible, for example, to group the low vowel /a/ with the other [–round] vowels.

Troubetzkoy proposes that Archi (East Caucasian, in Central Daghestan) has a vowel system that is divided in this manner.

Archi

[–round]	[+round]
/i/	/u/
/e/	/o/
/a/	

He says this because of the way the sounds behave.

‘Point of view’ means contrast is variable

Trubetzkoy observes that a consonantal rounding contrast is neutralized before and after the rounded vowels /u/ and /o/, contrasting these vowels with unrounded /i/, /e/, and /a/.

Archi

[–round]	[+round]
/i/	/u/
/e/	/o/
/a/	

“This means that all vowels are divided into rounded and unrounded vowels, while the back or front position of the tongue proves irrelevant…” (Trubetzkoy 1969: 100–1).

‘Point of view’ means contrast is variable

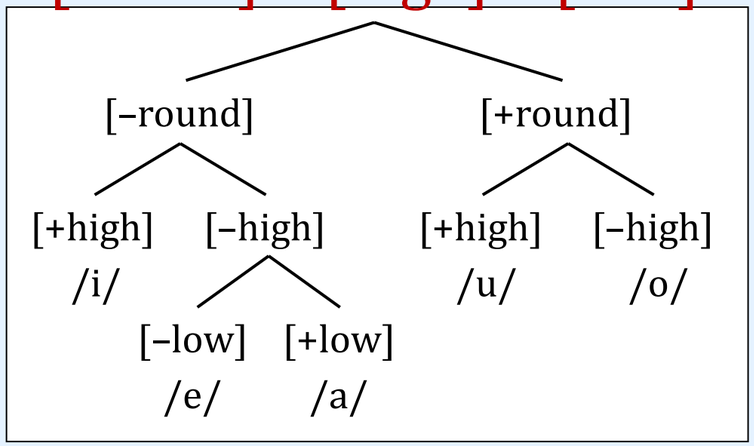
This analysis corresponds to ordering [±round] first, dividing the vowels into two groups: /i, e, a/ and /u, o/.

Further distinctions within these groups are made by other features; the tree below shows one possible feature hierarchy.

Archi

[–round]	[+round]
/i/	/u/
/e/	/o/
/a/	

[round] > [high] > [low]



Five-vowel systems: Japanese

In Japanese, Trubetzkoy argues that neutralization of the opposition between palatalized and non-palatalized consonants before /i/ and /e/ shows that these vowels are put into opposition with the other vowels /a, o, u/.

Japanese

[+front]	[–front]
/i/	/u/
/e/	/o/
	/a/

The governing opposition is that between front and back vowels, “lip rounding being irrelevant” (Trubetzkoy 1969: 101).

Five-vowel systems: Japanese

This analysis corresponds to ordering [front] first.

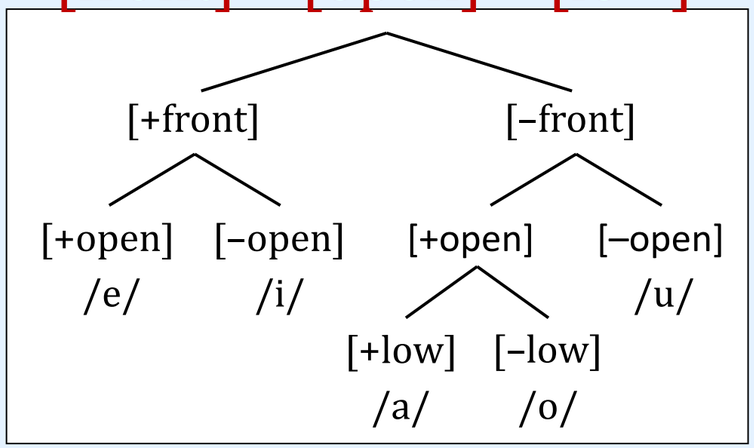
The rest of the tree is adapted from Hirayama (2003).

These feature trees are implicit in Trubetzkoy, but they become explicit in the work of Roman Jakobson and his collaborators.

Japanese

[+front]	[–front]
/i/	/u/
/e/	/o/
	/a/

[front] > [open] > [low]



References and further reading

For further reading, see Dresher (2007; 2009: 42–59; 2016: 60–63):

Dresher, B. Elan. 2007. Variability in Trubetzkoy's Classification of Phonological Oppositions. *The LACUS Forum* 33, 133–142.

Dresher, B. Elan. 2009. *The contrastive hierarchy in phonology*. Cambridge: CUP.

Dresher, B. Elan. 2016. Contrast in phonology 1867–1967: History and development. *Annual Review of Linguistics* 2: 53–73.

Eastern Generative Grammar (EGG)

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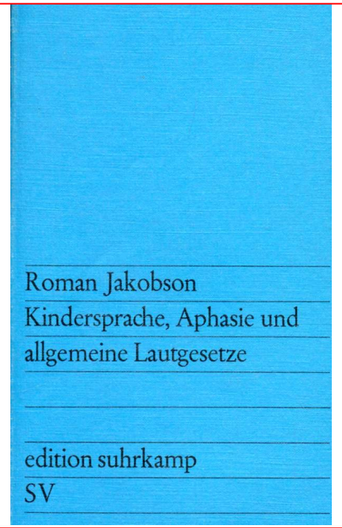
4. Jakobson 1941
The Acquisition of Phonological Contrasts

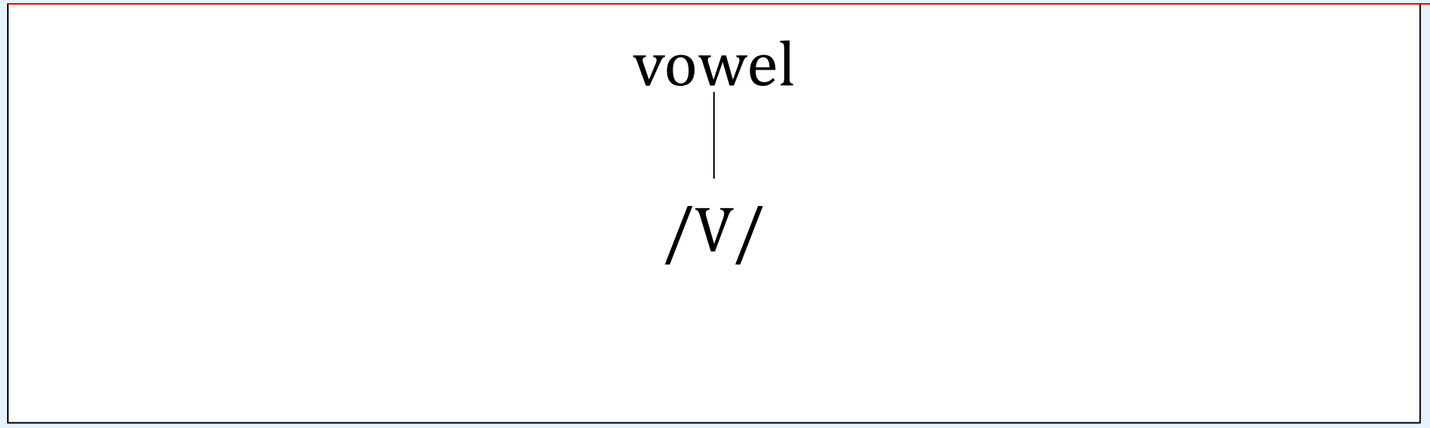
Jakobson's *Kindersprache*



Jakobson's *Kindersprache* (1941; English trans. 1968, Spanish 1974), advances the notion that contrasts are crucial in phonological acquisition and that they develop in a hierarchical order.

In particular, he proposes that learners begin with broad contrasts that are split by stages into progressively finer ones.

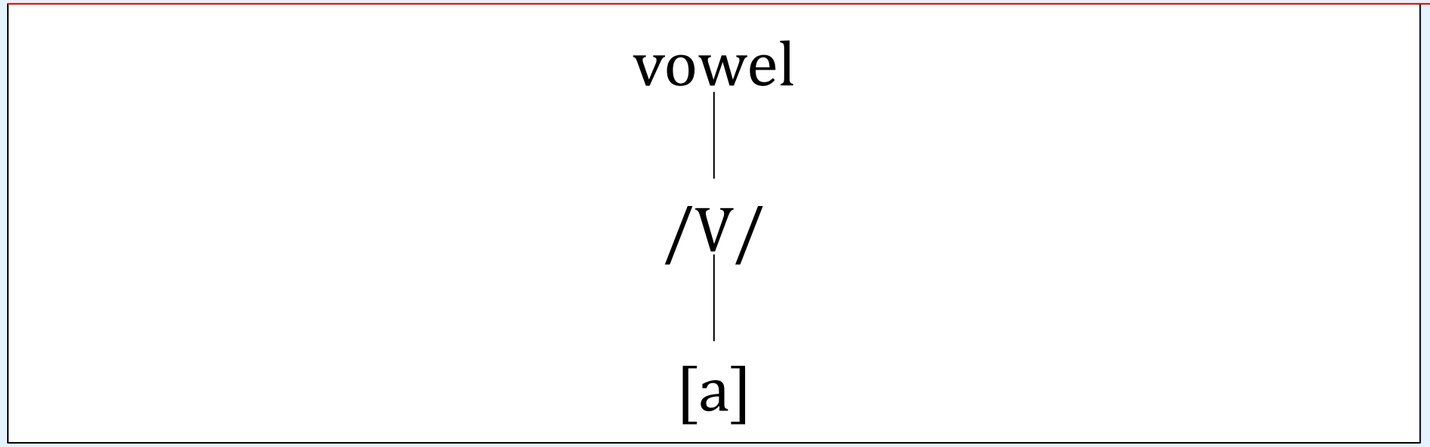
Acquisition sequences (vowels)



The acquisition of vowel systems set out in Jakobson (1941) and Jakobson & Halle (1956) follows this schema.

At the first stage, there is only a single vowel. As there are no contrasts, we can simply designate it /V/.

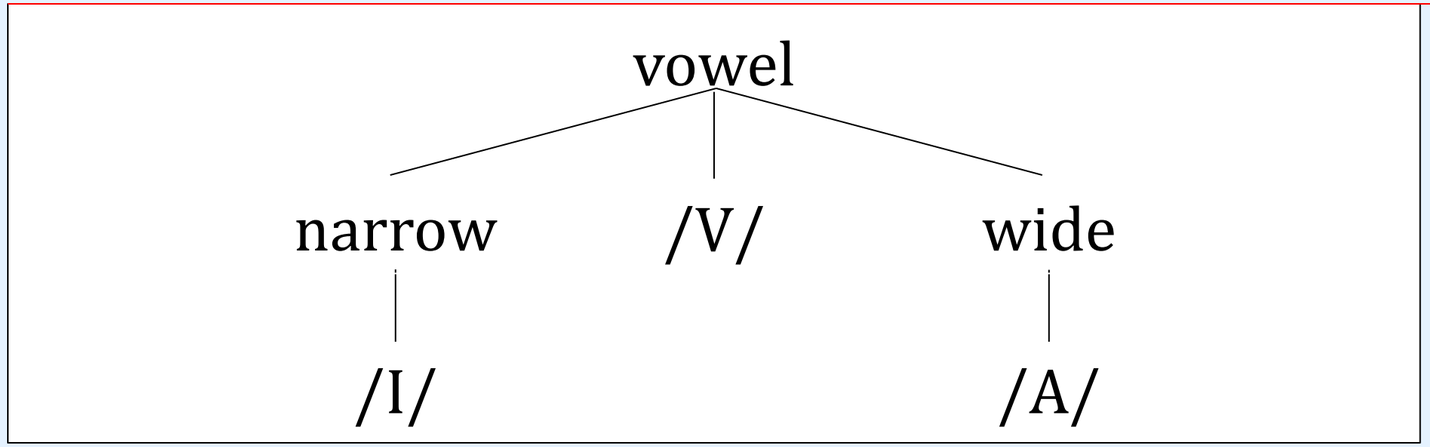
Acquisition sequences (vowels)



Jakobson & Halle write that this lone vowel is the maximally open vowel [a], the ‘optimal vowel’.

But we don’t need to be that specific: we can understand this to be a default value, or a typical but not obligatory instantiation.

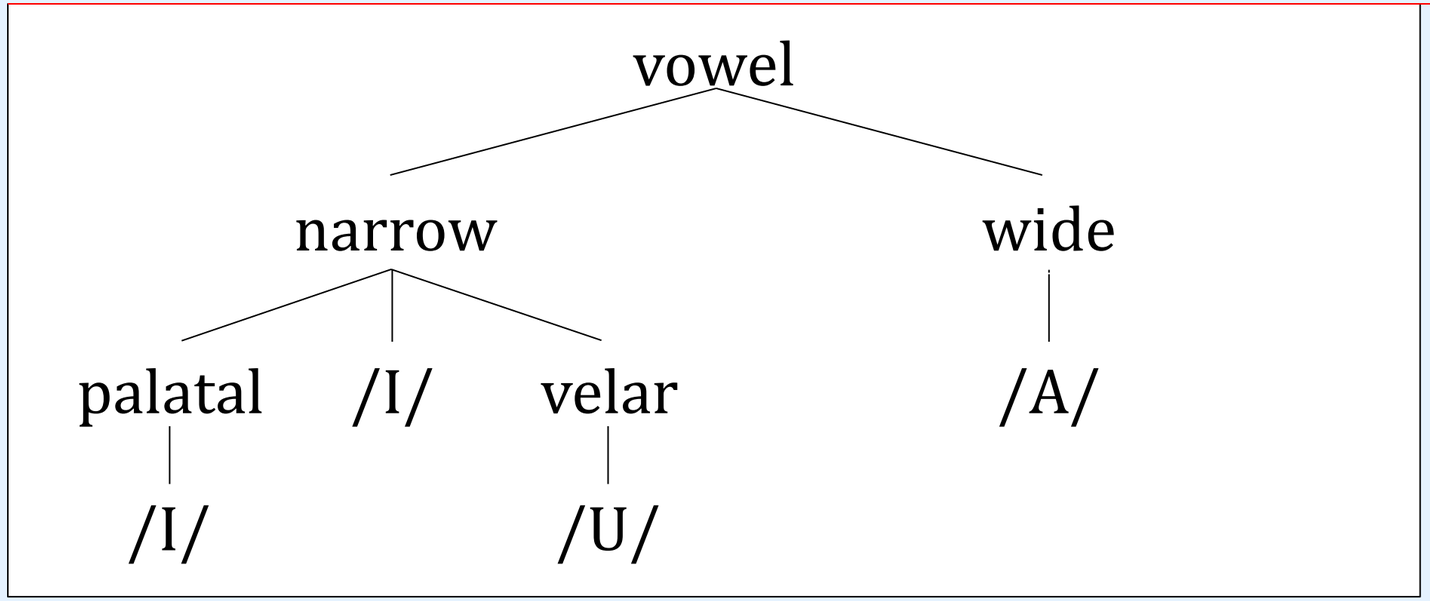
Acquisition sequences (vowels)



In the next stage it is proposed that the single vowel splits into a narrow (high) vowel /I/, which is typically [i], and a wide (low) vowel, /A/, typically [a].

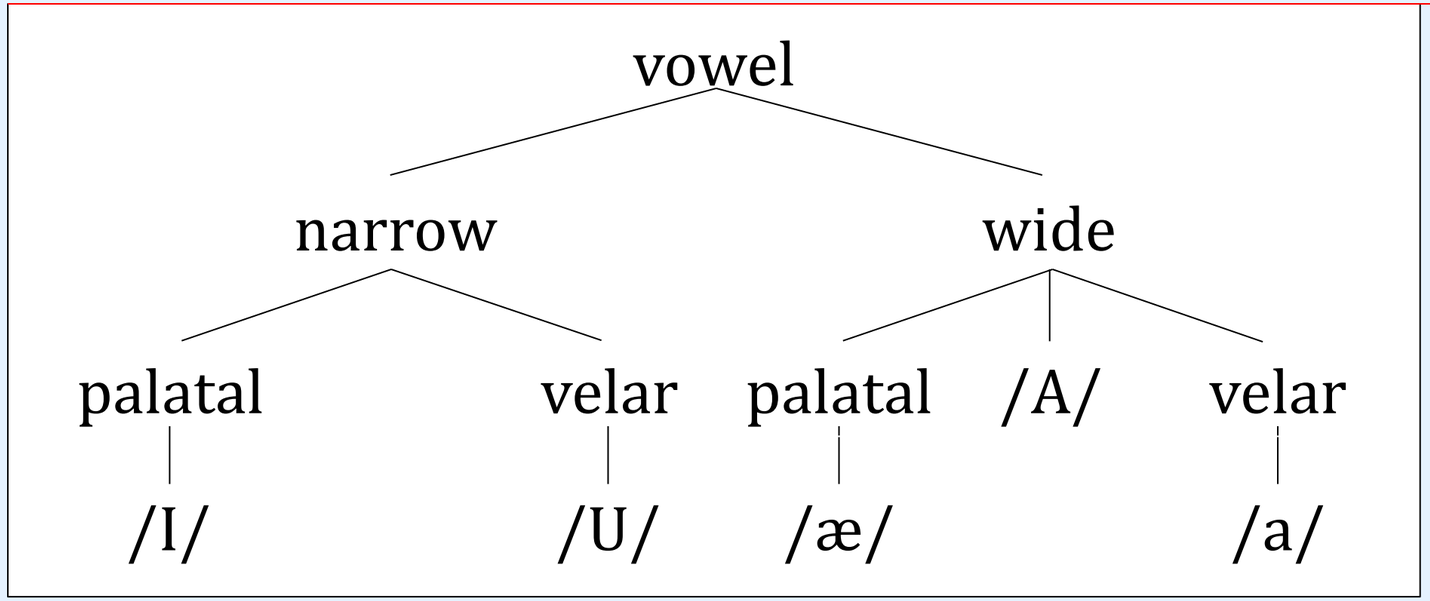
I will continue to understand these values as defaults.

Acquisition sequences (vowels)



In the next stage the narrow vowel splits into a palatal (front) vowel /I/ and a velar (back or round) vowel /U/, typically [u].

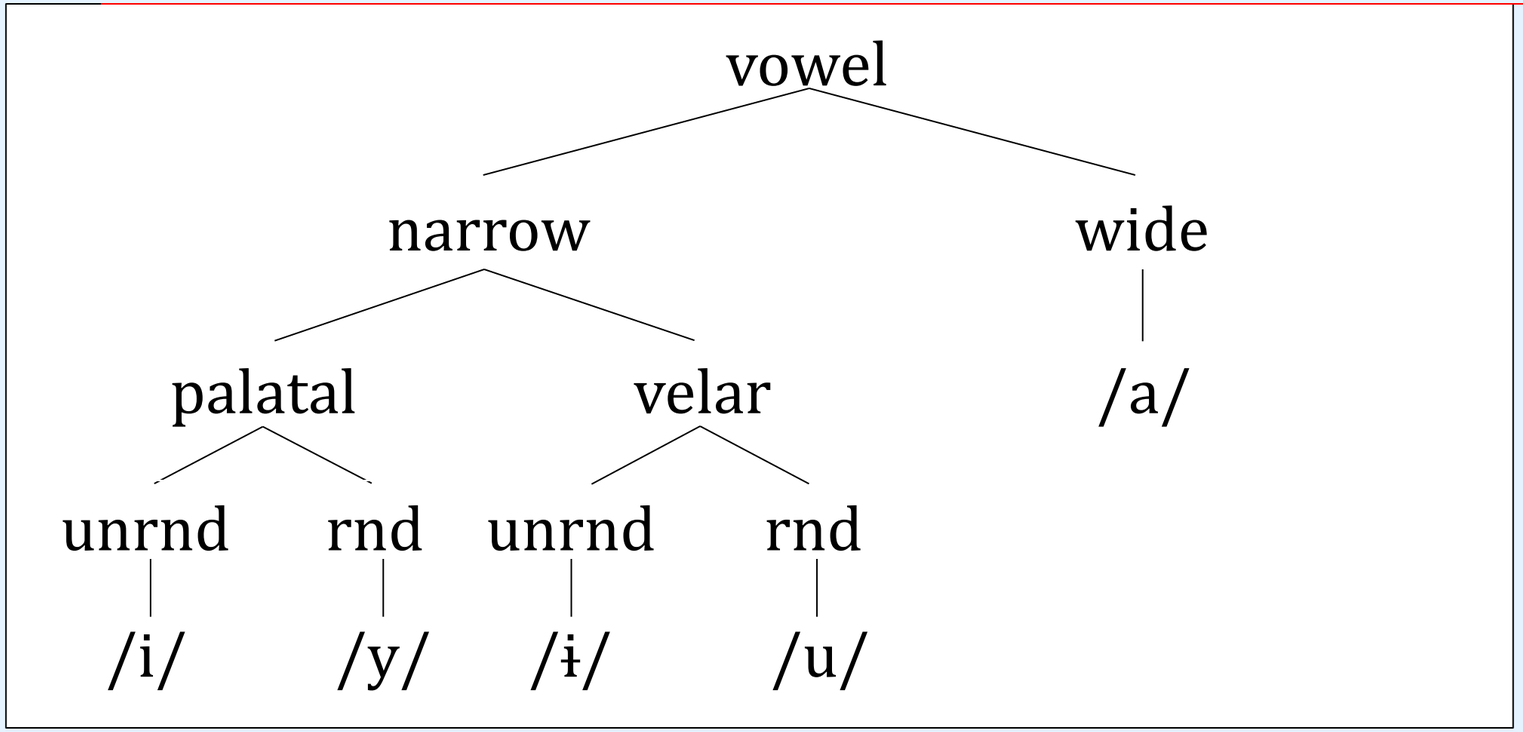
Acquisition sequences (vowels)



After the first two stages, Jakobson & Halle allow variation in the order of acquisition of vowel contrasts.

The wide branch can be expanded to parallel the narrow one.

Acquisition sequences (vowels)



Or the narrow vowels can develop a rounding contrast in one or both branches.

Contrastive features assigned hierarchically

Continuing in this fashion we will arrive at a complete inventory of the phonemes in a language, with each phoneme assigned a set of contrastive properties that distinguish it from every other one.

This approach has two notable characteristics:

- Only contrastive features are assigned to each phoneme.
- Contrastive features are assigned hierarchically, in a way that can be represented by a branching tree.

Contrastive hierarchies in child phonology

The branching trees of Jakobson (1941) remained influential in child language studies, for they are a natural way to describe developing phonological inventories (Pye, Ingram, & List 1987; Ingram 1988,1989; Levelt 1989; Dinnsen et al. 1990; Dinnsen 1992, 1996; see Dresher 1998 for a review).

Fikkert (1994) presents observed acquisition sequences in the development of Dutch onsets that follows this general scheme, and Bohn (2015, 2017) shows the routes that three children take in acquiring the vowel system of Brazilian Portuguese (see also Bohn & Santos 2018).

References and further reading

For further reading, see Dresher (1998; 2019):

Dresher, B. Elan. 1998. Child phonology, learnability, and phonological theory. In Tej Bhatia & William C. Ritchie (eds.), *Handbook of language acquisition*, 299–346. New York: Academic Press.

Dresher, B. Elan. 2019. Contrastive feature hierarchies in phonology: Variation and universality. In David W. Lightfoot & Jonathan Havenhill (eds.), *Variable properties in language: Their nature and acquisition*, 13–25. Washington, DC: Georgetown University Press.

Eastern Generative Grammar (EGG)

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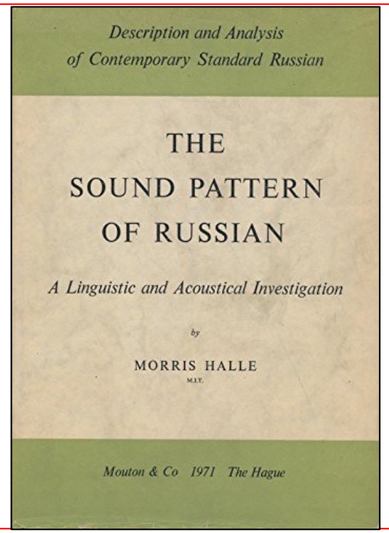
5. Halle 1959

An argument for specification by branching trees

An argument for branching trees



In *The Sound Pattern of Russian* (1959; *SPR*), Halle makes an argument on behalf of branching trees; this is the first such argument I have found in the literature.

He argues that feature specification by a branching tree is the only way to ensure that segments are kept properly distinct.

Figure I-1 in *The Sound Pattern of Russian,* p. 46

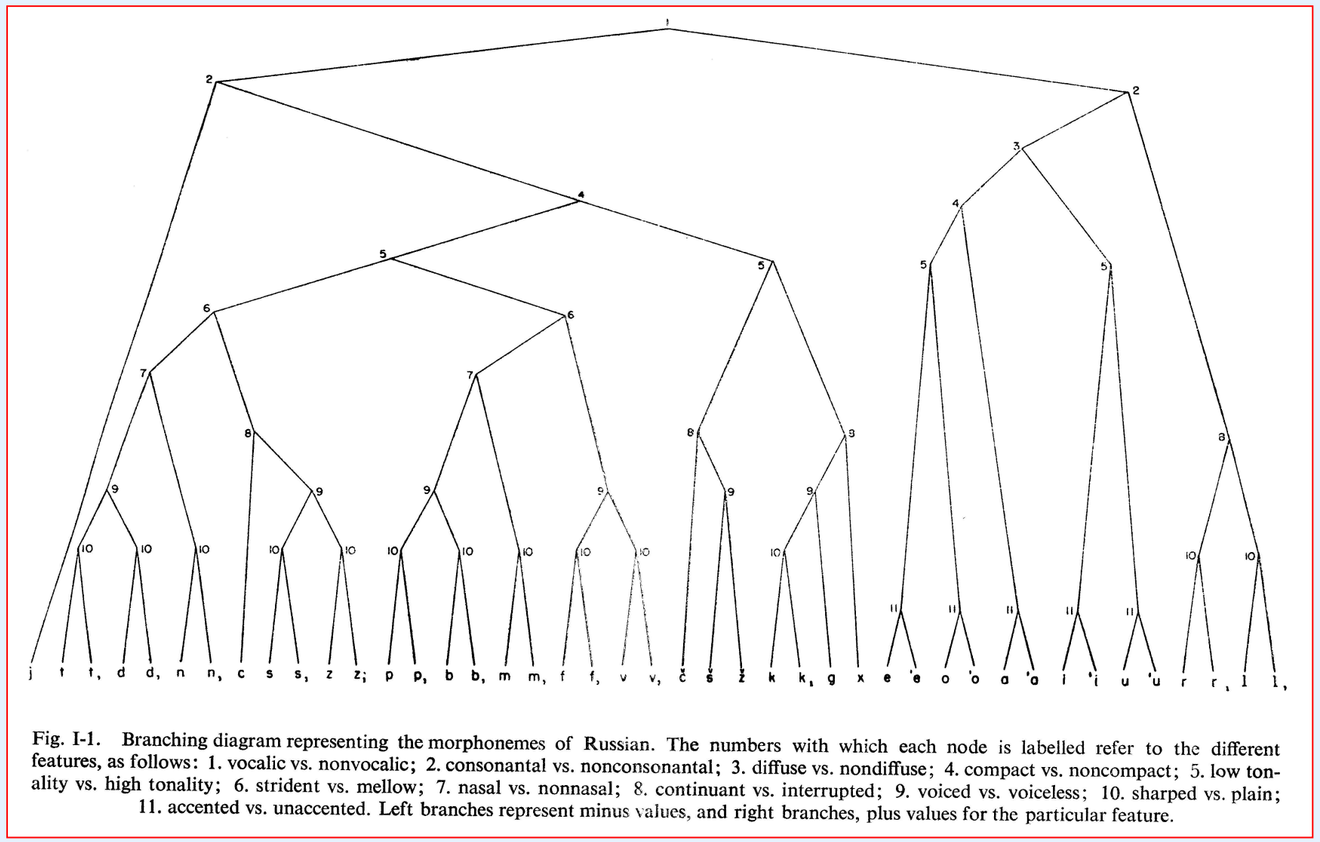


Fig. I-1. Branching diagram representing the morphonemes of Russian. The numbers with which each node is labelled refer to the different features, as follows: 1. vocalic vs. nonvocalic; 2. consonantal vs. nonconsonantal; 3. diffuse vs. nondiffuse; 4. compact vs. noncompact; 5. low tonality vs. high tonality; 6. strident vs. mellow; 7. nasal vs. nonnasal; 8. continuant vs. interrupted; 9. voiced vs. voiceless; 10. sharped vs. plain; 11. accented vs. unaccented. Left branches represent minus values, and right branches, plus values for the particular feature.

(*This is his tree for Russian.*)

The Distinctness Condition

Specifically, Halle proposed (1959: 32) that phonemes must meet the Distinctness Condition:

The Distinctness Condition

> Segment-type /A/ will be said to be different from segment-type /B/, if and only if at least one feature which is phonemic in both, has a different value in /A/ than in /B/; i.e., plus in the former and minus in the latter, or vice versa.

This formulation is designed to disallow contrasts involving a zero value of a feature.

How do we establish contrasts?

Consider the typical sub-inventory /p, b, m/ shown below, and suppose we characterize it in terms of two binary features, [±voiced] and [±nasal].

In terms of full specifications, /p/ is [–voiced, –nasal], /b/ is [+voiced, –nasal], and /m/ is [+voiced, +nasal].

Which of these features is contrastive? Many people reason as follows:

	/p/	/b/	/m/
[voiced]	–	+	+
[nasal]	–	–	+

How do we establish contrasts?

We observe that/p/ and /b/ are distinguished only by [voiced]; so these specifications must be contrastive.

Similarly, /b/ and /m/ are distinguished only by [nasal]; these specifications must also be contrastive.

What about the uncircled specifications? These are predictable from the circled ones:

	/p/	/b/	/m/
[voiced]	(–)	(+)	+
[nasal]	–	(–)	(+)

How do we establish contrasts?

Since/p/ is the only [–voiced] phoneme in this inventory, its specification for [nasal] is predictable, hence redundant. We can write a rule or constraint:

Similarly, /m/ is the only [+nasal] phoneme, so its specification for [voiced] is redundant:

This is a still-popular way of thinking about contrastive specifications; we can call it the ‘Minimal Difference’ approach (e.g. Padgett 2003, Calabrese 2005, Campos-Astorkiza 2009, Nevins 2010).

	/p/	/b/	/m/
[voiced]	–	+	
[nasal]		–	+

If [–voiced], then [–nasal]

If [+nasal], then [+voiced]

How do we establish contrasts?

According to Minimal Difference, a feature is only contrastive in a segment if it is the only feature that distinguishes that segment from another one.

But according to the Distinctness Condition, /p/ is not ‘different from’ /m/: where one has a feature, the other has none.

Therefore, these specifications are not properly contrastive.

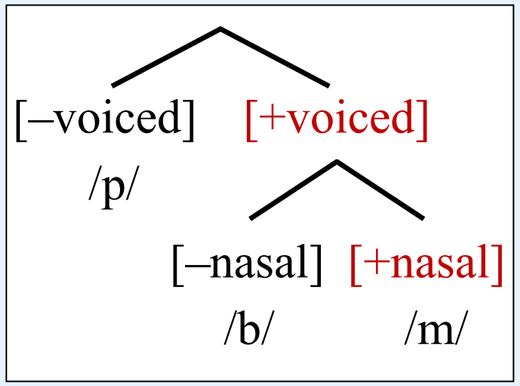
	/p/	/b/	/m/
[voiced]	–	+	
[nasal]		–	+

The Distinctness Condition

They violate the Distinctness Condition because no feature hierarchy yields this result.

If we order [voiced] > [nasal], we generate an ‘extra’ specification on /m/.

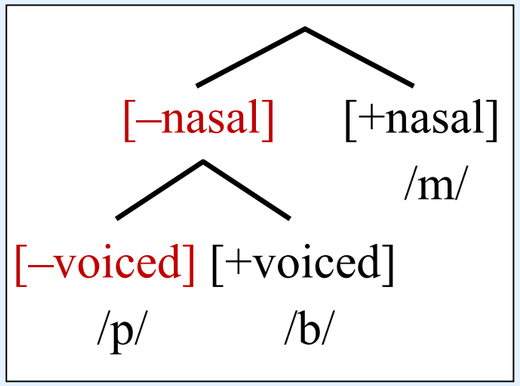
	/p/	/b/	/m/
[voiced]	–	+	⊕
[nasal]		–	+



The Distinctness Condition

If we order [nasal] > [voiced], we generate an ‘extra’ specification on /p/.

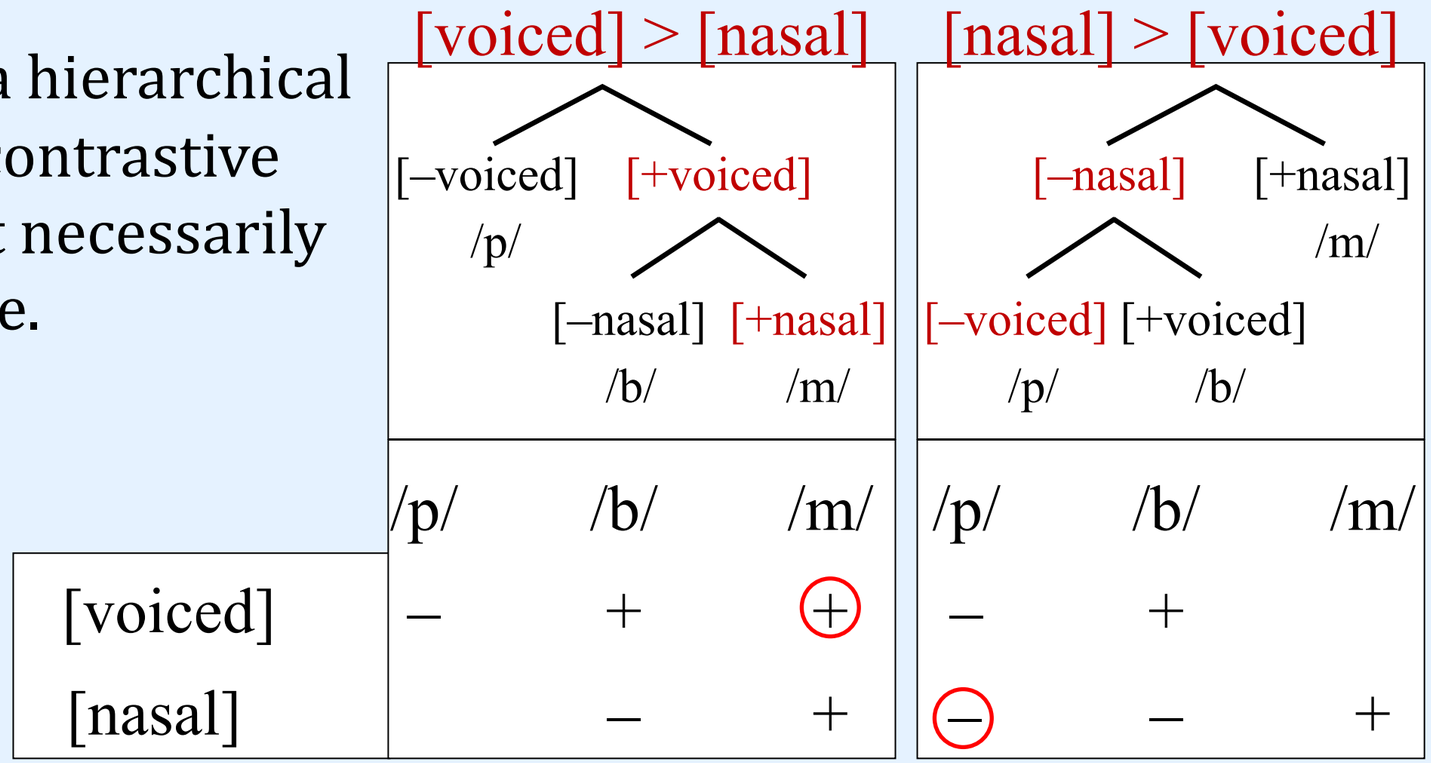
	/p/	/b/	/m/
[voiced]	–	+	
[nasal]	–	–	+



Contrastive ≠ unpredictable

Either of the specifications below is properly contrastive.

Note that in a hierarchical approach, a contrastive feature is not necessarily unpredictable.



Therefore, according to *SPR*, to ensure that all the phonemes of a language are distinct from one another, it is necessary that their feature specifications must be generable by a branching tree.

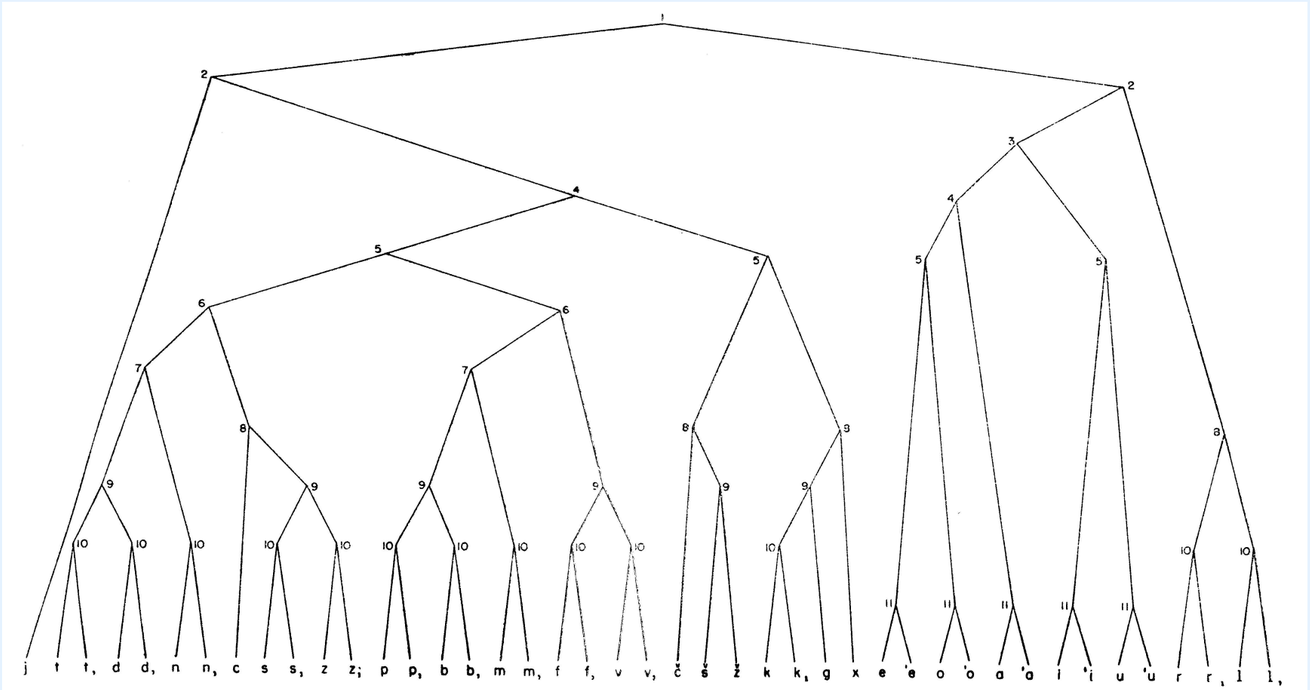


Fig. I-1. Branching diagram representing the morphonemes of Russian. The numbers with which each node is labelled refer to the different features, as follows: 1. vocalic vs. nonvocalic; 2. consonantal vs. nonconsonantal; 3. diffuse vs. nondiffuse; 4. compact vs. noncompact; 5. low tonality vs. high tonality; 6. strident vs. mellow; 7. nasal vs. nonnasal; 8. continuant vs. interrupted; 9. voiced vs. voiceless; 10. sharped vs. plain; 11. accented vs. unaccented. Left branches represent minus values, and right branches, plus values for the particular feature.

Contrast is hierarchical

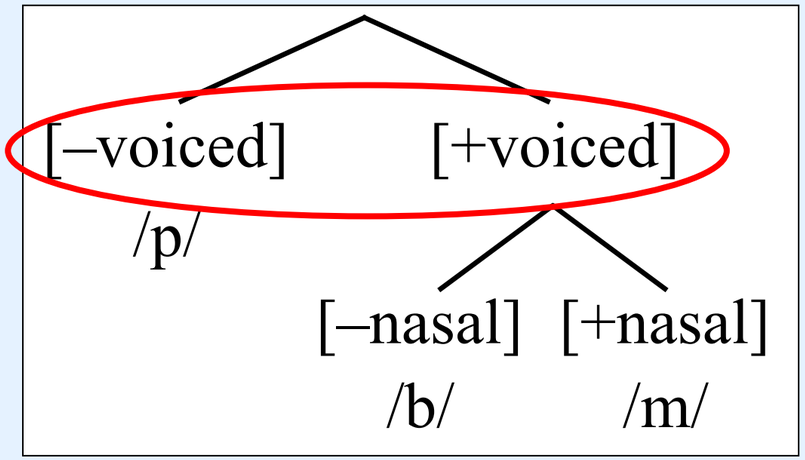
I believe that Halle's argument is correct: as demonstrated by Archangeli (1988) and in more detail by Dresher (2009), the Minimal Difference approach often fails to yield any intelligible set of specifications. It is the wrong theory of contrast.

Conceptually, the main flaw of Minimal Difference is its failure to recognize that contrastive relations in an inventory exist not just between pairs of segments, but also between groups of segments at different levels of the hierarchy.

Consider again the /p b m/ example where [±voiced] > [±nasal]:

Contrast is hierarchical: contrastive ≠ unpredictable

[voiced] > [nasal]



At the higher level, [±voiced] distinguishes between [–voiced /p/ and [+voiced] /b, m/.

The contrast is minimal at this level: at this point, [±voiced] is the only feature that distinguishes /p/ from /b, m/.

This does not change even though at the lower level /m/ receives [+nasal], which further distinguishes it from /p/.

Thus, there is a sense in which contrast is indeed minimal, almost by definition; but only when viewed in hierarchical layers, and not in pairwise comparisons.

Decline of the branching trees

It is ironic that while *The Sound Pattern of Russian* contains this original argument on behalf of branching trees, at the same time its analysis of Russian contributed to undermining the whole notion of contrastive specification (Dresher & Hall 2020).

Because of that, and due also to arguments by Lightner (1963) and Stanley (1967), underspecification was abandoned altogether in Chomsky & Halle's *The Sound Pattern of English* (*SPE*, 1968), along with the branching trees (for reasons, see Dresher 2009: 96–104).

The result was that language-particular feature contrasts did not play a role in the theory of generative grammar that developed from *SPE*.

References and further reading

For further reading, see Dresher (2009: 11–30; 96–104); Dresher & Hall (2020):

Dresher, B. Elan. 2009. *The contrastive hierarchy in phonology*. Cambridge: Cambridge University Press.

Dresher, B. Elan & 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. DOI: https://doi.org/10.1017/S0022226720000377.

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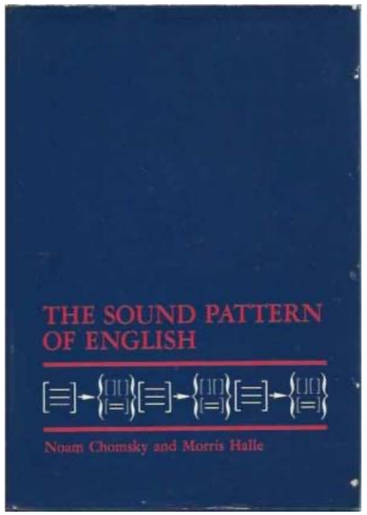
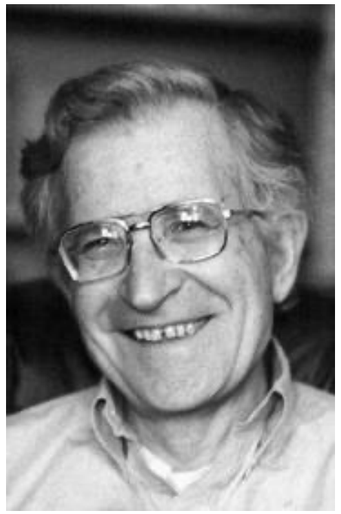
6. Chomsky & Halle 1968
The Generative Framework and Approach to Phonology

The generative framework

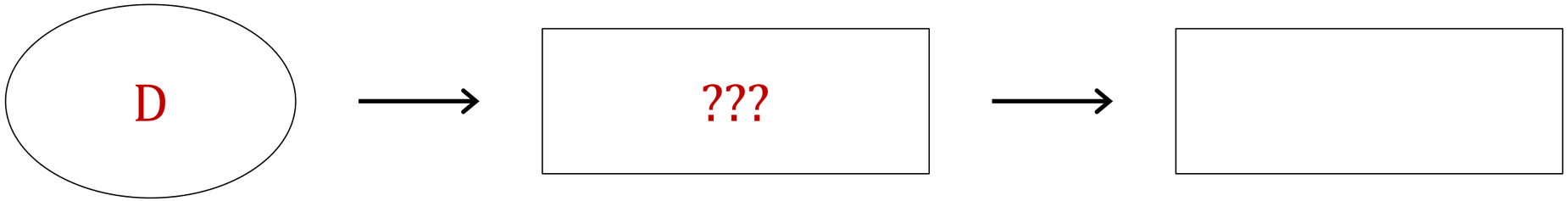




Though I depart from *SPE* with respect to contrast and the nature of features, Chomsky & Halle provide the broad generative framework and cognitive approach to phonology that I assume.

The goals of phonological theory

Generative phonology, as I understand it, is not a theory about everything to do with the sound side of language, but looks at the following schematic situation:

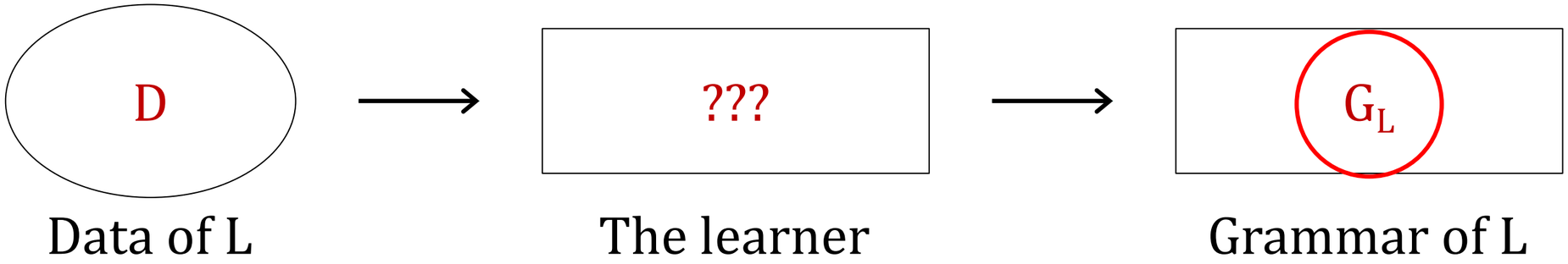


A learner born into a community that speaks a language, L, is exposed to data from L, and somehow arrives at a grammar of L.

Generative grammar aims to answer three questions:

The goals of phonological theory

1. What is the nature of the grammar of L, which we can call G_L?

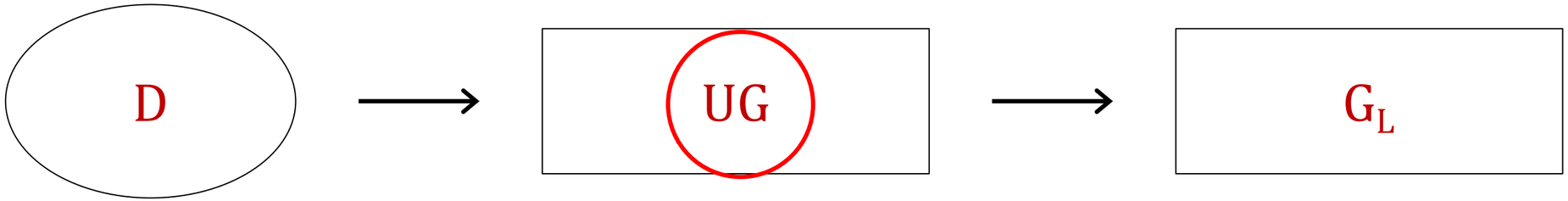


If we can correctly characterize G_L then we have a descriptively adequate theory.

The second question is more ambitious:

The goals of phonological theory

2. How, given D, does the learner arrive at G_L?



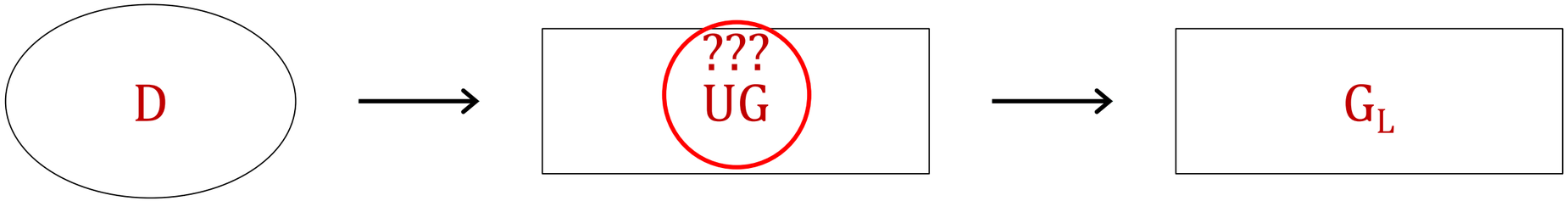
The learner must be equipped with a set of cognitive principles, called Universal Grammar (UG), that is able to convert D into G_L.

A theory that has a correct model of UG is said to achieve explanatory adequacy.

The goals of phonological theory

In the 21st century a third question has been asked:

3. Why does UG have the properties that it has?



Answering this question requires us to go beyond explanatory adequacy to look at biological and evolutionary factors that could have shaped UG.

More modestly, we should keep in mind that the UG we come up with should be plausible with respect to these considerations.

Phonological theory is empirical

Proposing a (partial) theory of UG amounts to characterizing what phonological grammars are possible; this entails that we also make hypotheses about what grammars are impossible.

Mielke (2008: 20) argues that phonological theory should not try to distinguish possible phonological phenomena from impossible ones, because we have no evidence that unattested = impossible. He goes on:

> "When there are so many linguistic phenomena found in only a handful of attested languages, how can we be certain that any phonological pattern never existed in the past, never will exist in the future, and doesn't exist currently in an understudied language?"

Of course, we can't be certain: phonology is not math, it's an empirical venture! Empirical fields have to make hypotheses that might be (probably are) wrong.

Universals and phonological theory

If we want to have an explanatorily adequate theory of UG, our model of UG has to have some content, which would necessarily be universal.

There is thus some motivation to try to make phonological notions, like features and markedness, as universal as possible.

The theory, however, has to allow for the cross-linguistic variation that we find.

Universals and variable properties in phonological theory

That is, we can ask what in phonology is universal and what can vary?

I think that efforts to make individual features universal work at a level that is too specific and does not account for the cross-linguistic variability that we find.

But there is something right about saying that features are universal—not at the level of individual features but at a conceptual level.

Contrastive Hierarchy Theory is a theory that allows us to have a universal feature theory without universal features.

And that is what we will talk about tomorrow.

References and further reading

For further reading, see Dresher (2014; 2019) :

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