

# Trade-offs in the contrastive hierarchy: Voicing *versus* continuancy in Slavic

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## 1 Our approach to phonological representations

Two components of a theory of phonemic contrast (Dresher 2009, 2015; Hall 2007, forthcoming):

1. **The Contrastivist Hypothesis:** Only contrastive features are phonologically active.
2. **The Successive Division Algorithm:** Contrastive features are assigned by recursively dividing the underlying inventory.

### 1.1 The Successive Division Algorithm

- (1) The Successive Division Algorithm (SDA; Dresher 2009: 16)
  - a. Begin with *no* feature specifications: assume all sounds are allophones of a single undifferentiated phoneme.
  - b. If the set is found to consist of more than one contrasting member, select a feature and divide the set into as many subsets as the feature allows for.
  - c. Repeat step (1b) in each subset: keep dividing up the inventory into sets, applying successive features in turn, until every set has only one member.

### 1.2 Specifications depend on hierarchical order

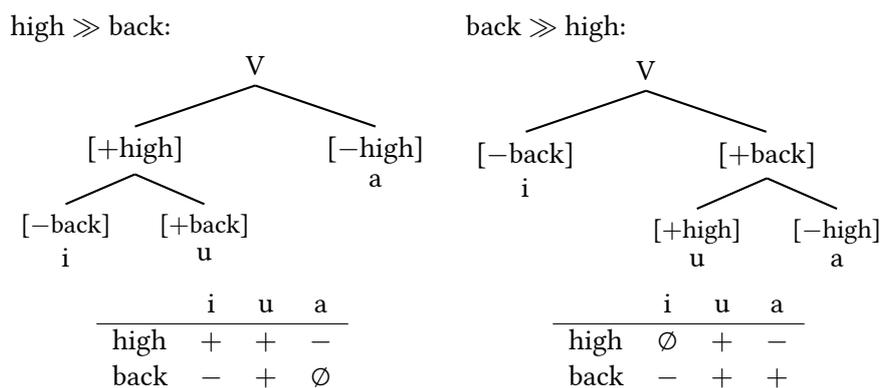


Figure 1: Two possible ways of dividing the vowel inventory /i u a/ using [ $\pm$ high] and [ $\pm$ back]

### 1.3 Contrast and phonological activity

- **The Contrastivist Hypothesis:** Only contrastive features are active in the phonology.
- How do we know which features are contrastive? The SDA.

- But if the order of features can vary, how do we know what the right hierarchy is for any given language?
  - If we observe that a feature is active, then by hypothesis it must be contrastive.
  - So every active feature must be high enough in the hierarchy to be specified on the relevant segments.
- **Is this circular?** (various reviewers, *passim*; see also Blaho 2008, de Lacy 2010)  
No. The SDA and the Contrastivist Hypothesis make testable predictions.
- Given just a phonological inventory...
  - We **can't** predict exactly what the feature specifications are. The SDA is not deterministic.
  - We **can** make predictions about how many features can be specified/active.
  - We **can** make predictions about trade-offs between potentially contrastive features.
- Back to our three-vowel example:
  - We can't use more than two features to specify three vowels.
  - We can have [+high] on /i/, or [+back] on /a/, but not both.
  - Our predictions are not **[F] will be active and [G] will not**, but rather **if [F] is active then [G] cannot be**.

## 2 A trade-off in Russian

- Russian offers an exemplary case of a trade-off in the contrastive hierarchy.
- Our starting point is Halle (1959).
- In SPR, Halle uses a contrastive hierarchy, but does not adopt the Contrastivist Hypothesis.

“The hierarchy of features seems to provide an explanation for the intuition that not all features are equally central to a given phonological system” (Halle 1959: 34).

“[P rules] specify all features which play no distinctive role in the language but are not randomly distributed” (Halle 1959: 63).

- For Halle, the hierarchy primarily serves to simplify underlying representations.
- Redundant features are filled in during the derivation, allowing them to be phonologically active.

### 2.1 Voicing assimilation

- Obstruents in clusters undergo regressive assimilation.
- Assimilation involves both voicing and devoicing.

(2) examples from Padgett (2002)

/__ SON.:	s-jexat <sup>j</sup>	‘move out’	iz-lagat <sup>j</sup>	‘set out’
/__ VLS.:	s-prosit <sup>j</sup>	‘ask (for)’	is-kl <sup>j</sup> ufat <sup>j</sup>	‘exclude’
/__ VD.:	z-d <sup>j</sup> elat <sup>j</sup>	‘do’	iz-gnat <sup>j</sup>	‘drive out’

- So [±voice] is phonologically active on obstruents. (And it's not active on sonorants.)

- Most Russian obstruents come in voiced/voiceless pairs, and sonorants are all voiced.
- So if  $[\pm\text{sonorant}]$  (or the equivalent<sup>1</sup>) takes scope over  $[\pm\text{voice}]$ , voicing will be specified on obstruents but not on sonorants.

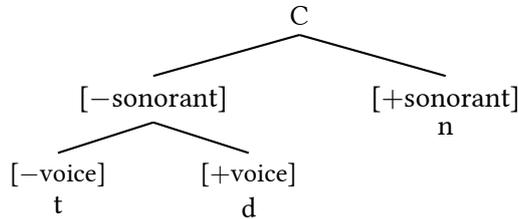


Figure 2: Schematic representation of separation between sonorants and obstruents

- For pairs like /t/ and /d/,  $[\pm\text{voice}]$  **must** be contrastive.
- No matter how low  $[\pm\text{voice}]$  is in the hierarchy, there's no other feature that could distinguish them.
- But Russian also has three unpaired voiceless obstruents /ts tʃ x/.<sup>2</sup>

	LABIAL	DENTAL	(PRE)PALATAL	VELAR
STOP	p p <sup>j</sup>	t t <sup>j</sup>		k k <sup>j</sup>
	b b <sup>j</sup>	d d <sup>j</sup>		g
AFFRICATE		ts	tʃ	
FRICATIVE	f f <sup>j</sup>	s s <sup>j</sup>	ʃ	x
	v v <sup>j</sup>	z z <sup>j</sup>	ʒ	

Table 1: Obstruent inventory of Russian

- These unpaired obstruents were key to Halle's (1957; 1959) argument against the structuralist separation of morphophonemic and allophonic patterns (see also Drescher 2011).
- Unpaired /ts tʃ x/ undergo regressive assimilatory voicing:

(3) examples from Halle (1959), Timberlake (2002)

- |                            |                    |            |            |
|----------------------------|--------------------|------------|------------|
| a. ot <sup>j</sup> ets     | 'father'           | c. mox     | 'moss'     |
| b. ot <sup>j</sup> edz bil | 'father was'       | d. moy bil | 'moss was' |
| e. zeʃ l'i                 | 'should one burn?' |            |            |
| f. zedʒ bi                 | 'were one to burn' |            |            |

(Thus Halle's argument: If processes that produce alternations between phonemes are strictly separate from allophony, then there is no unified account of voicing assimilation.)

1. For Halle (1959), sonorants are distinguished by  $[\pm\text{vocalic}]$ ,  $[\pm\text{consonantal}]$ , or  $[\pm\text{nasal}]$ .

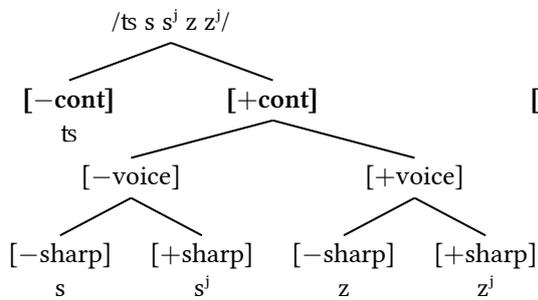
2. The phonemic status of  $[k^j g^j ʃ^j]$  in Russian has been the subject of some dispute; here, we follow Halle's (1959) inventory, but use IPA symbols. In this inventory, /k<sup>j</sup>/ also lacks a minimal voiced counterpart, but Halle's hierarchy gives it an underlying specification for  $[\pm\text{voiced}]$  anyway; see below.

- They also trigger regressive assimilatory devoicing:

- (4) examples from Calabrese (1995)
- b<sup>h</sup>ez oz<sup>h</sup>era ‘without a lake’
  - b<sup>h</sup>es x<sup>h</sup>l<sup>h</sup>eba ‘without bread’
  - b<sup>h</sup>es t<sup>h</sup>seni ‘without price’
  - b<sup>h</sup>es t<sup>h</sup>fest<sup>h</sup>i ‘without honour’

- Since /ts tʃ x/ act like other [–voice] obstruents, it would make sense for them to be specified as [–voice].
- But this is not what Halle does.

Strident dentals:



Palatals and velars:

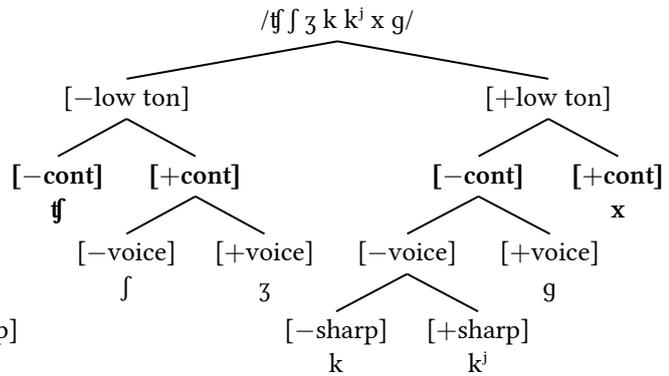


Figure 3: Halle’s hierarchy: [±low tonality] ≫ [±continuant] ≫ [±voiced] ≫ [±sharped]

- In the hierarchy in Figure 3, [±continuant] cuts off /ts/, /tʃ/, and /x/ before [–voiced] can be assigned to them.
- For Halle, this is not a problem.
- The underlying representations of /ts tʃ x/ are kept simple, and redundant values for [±voiced] can be filled in by rule.

(5) Rules (Halle 1959: 63–64)

**Rule P 1b:** Unless followed by an obstruent, /ts/, /tʃ/, and /x/ are voiceless.

**Rule P 3a:** If an obstruent cluster is followed [...] by a sonorant, then with regard to voicing the cluster conforms to the last segment.

(6) без хлеба /b<sup>h</sup>ez x<sup>h</sup>l<sup>h</sup>eba/ [b<sup>h</sup>es x<sup>h</sup>l<sup>h</sup>eba] ‘without bread’

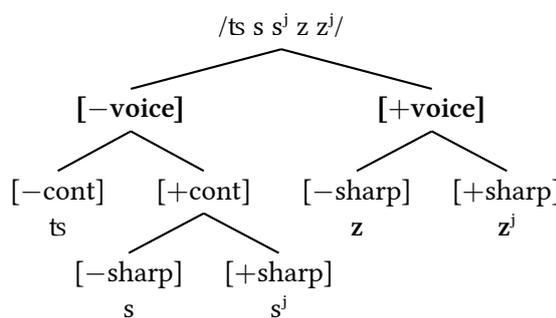
	UNDERLYING		RULE P 1B		RULE P 3A
	b <sup>h</sup> e z x <sup>h</sup> l <sup>h</sup> eba	→	b <sup>h</sup> e z x <sup>h</sup> l <sup>h</sup> eba	→	b <sup>h</sup> e s x <sup>h</sup> l <sup>h</sup> eba
[±voiced]:	+ ∅		+ –		– –

- If we adopt the Contrastivist Hypothesis, then [±voiced] must be contrastive on /ts tʃ x/ in order to be active.
- /ts tʃ x/ don’t have minimally different voiced counterparts \*/dz dʒ ɣ/ in the underlying inventory, but they contrast with voiced obstruents in general.

- The flexibility of the SDA allows us to give  $[\pm\text{voiced}]$  wider scope, so that it is specified on all Russian obstruents.
- **But this doesn't come for free.**
- If  $[\pm\text{voiced}]$  is promoted in the contrastive hierarchy, something else must be demoted.
- **We predict a trade-off.**

## 2.2 Specifying the unpaired obstruents

Strident dentals:



Palatals and velars:

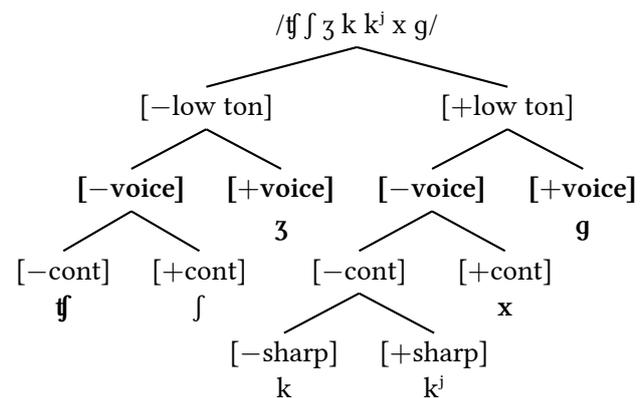


Figure 4: Revised hierarchy:  $[\pm\text{low tonality}] \gg [\pm\text{voiced}] \gg [\pm\text{continuant}] \gg [\pm\text{sharped}]$

Revising Halle's hierarchy...

- ...gives us  $[-\text{voiced}]$  on  $/ts tʃ x/$  but removes  $[\pm\text{continuant}]$  from  $/z z^j ʒ g/$ .

## 2.3 The other unpaired obstruents

- The revised hierarchy shows the gaps in the underlying inventory— $^*/dz dʒ ɣ/$ —in a new light.
- What's missing from the inventory are not the voiced counterparts to  $/ts tʃ x/$ , but the  $[-\alpha\text{continuant}]$  counterparts to  $/z z^j ʒ g/$ .
- We predict that  $[\pm\text{continuant}]$  is not phonologically active on  $/z z^j ʒ g/$ .
- Minimally, we predict that omitting  $[\pm\text{continuant}]$  from these segments will not lead to what Nevins (2015) calls an 'Oops, I Need That' problem.
- More than this, though, there seems to be positive evidence for underspecification of  $[\pm\text{continuant}]$ .

### 2.3.1 Variation

- Circumstantially, we note that Russian  $/g/$  can be realized as  $[\gamma]$  or  $[\hbar]$  as well as  $[g]$ .
- This is dialect variation, so it doesn't necessarily show that the same U.R. surfaces as both stop and continuant in a single grammar.
- However, to the extent that different dialects of Russian show similar phonological patterns, we expect their inventories to have the same specifications.
- If this segment variously shows up as  $[g]$  and  $[\gamma]/[\hbar]$ , this is consistent with—but does not entail—the idea that it is unspecified for continuancy.

### 2.3.2 Alternations

Some (morpho)phonological evidence:

#### Alternations resulting from the First Velar Palatalization

(7) The pattern arising from the First Velar Palatalization

		[+low tonality] → [−low tonality]		
[−voiced]	[+continuant]	x	→	ʃ
[−voiced]	[−continuant]	k	→	tʃ
[+voiced]	∅	g	→	ʒ

(8) examples from Lightner (1965)

a. Adjectives:

	POSITIVE	COMPARATIVE	GLOSS
i.	tʃixij	tʃife	‘quiet(er)’
ii.	zarkij	zarʃe	‘hot(ter)’
iii.	dorogoj	doroʒe	‘dear(er)’

b. Verbs:

	3RD PLURAL	3RD SINGULAR	GLOSS
i.	maxut	maʃet	‘wave(s), wag(s)’
ii.	pekut	peʃet	‘bake(s)’
iii.	strigut	striʒet	‘shear(s)’

c. Denominal adjectives:

	NOUN	ADJECTIVE	GLOSS
i.	ʃerepaxa	ʃerepaʃij	‘turtle’ / ‘testudinian’
ii.	volk	volʃij	‘wolf’ / ‘lupine’
iii.	vrag	vraʒij	‘enemy’ / ‘hostile’

The hierarchy that assigns [−voiced] to /ts tʃ x/ also correctly identifies /g/ and /ʒ/ as counterparts.

#### Relics of the Second Palatalization

(9) The pattern arising from the Second Palatalization:

		$\left[ \begin{array}{l} +compact \\ +low\ tonality \end{array} \right] \sim \left[ \begin{array}{l} -compact \\ -low\ tonality \end{array} \right]$		
[−voiced]	[−continuant]	k	~	ts
[+voiced]	∅	g, gʲ	~	z, zʲ

(10) examples from Lightner (1965)

a.	brjakatʲ	‘to let fall w/ a clang’	brjatsatʲ	‘to clang’
b.	voskliknutʲ	‘to exclaim’ (pf.)	vosklitsatʲ	‘to exclaim’ (impf.)
c.	tʃagatʲsja	‘to sue’	sostʃizatʲsja	‘to contend with’
d.	knjaʒʲinja	‘princess’	knjazʲ	‘prince’

These alternations are not productive in Modern Russian, but they are consistent with the prediction that /z zʲ/ are also unspecified for continuancy.

### 3 Elsewhere in Slavic

Other Slavic languages show similarly asymmetrical inventories, and similar phonological patterns.

#### 3.1 Serbian

Serbian /g/ has no continuant counterpart, and alternates with /z/ and with /z/. Radišić (2009) argues for a contrastive hierarchy that leaves /g/ unspecified for continuancy.

#### 3.2 Lower Sorbian

Lower Sorbian /g/ has no continuant counterpart. Where /k/ alternates with /ts/ and /x/ with /ʃ/, /g/ becomes either /z/ or /dz/, whichever is phonotactically less marked (/dz/ after /z/; /z/ elsewhere).

(11) examples from Schaarschmidt (1998)

	NOMINATIVE	DATIVE	GLOSS
a.	ruk-a	ruts-e	'hand'
b.	mux-a	muf-e	'fly'
c.	nog-a	noz-e	'leg'
d.	rozg-a	rozdz-e	'twig'

#### 3.3 Ukrainian

In Ukrainian, historical \*/g/ has become /ɦ/, making its alternations with coronal continuants more transparent phonetically. A new, marginally contrastive stop /g/ is emerging through borrowings (Shevelov 1977).

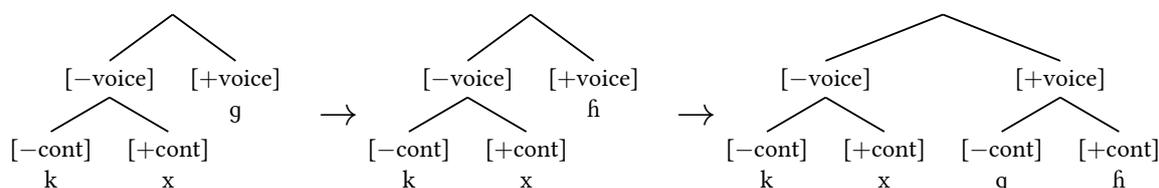


Figure 5: Diachronic changes in the Ukrainian consonant inventory

## 4 Conclusions

- The Successive Division Algorithm is not deterministic.
- It does not stipulate the order of features, and so it cannot predict exactly which features will be active based on the inventory alone.
- This makes it compatible with the proposition that features themselves are emergent (Mielke 2008), as discussed by Dresher (2014) and Cowper & Hall (2014).
- But it does make predictions about **how many** features can be specified, and about **trade-offs** between potential specifications.
- These predictions are, in principle, falsifiable.
- As regards voicing and continuancy in Slavic, though, it appears that they are not actually false.

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