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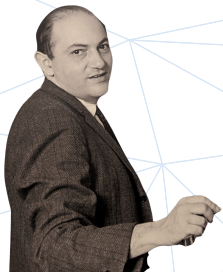
Formal Approaches to Slavic Linguistics 33
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Voicing assimilation & featural contrasts



Outline

- 1** Halle's argument
- 2** The road not taken
- 3** Optimality and its discontents



1. Halle's argument

- 1** Halle's argument
- 2** The road not taken
- 3** Optimality and its discontents

A pattern in many Slavic languages: obstruents assimilate in voicing to immediately following obstruents.

(1) *In SPE notation*

$$[-\text{sonorant}] \rightarrow [\alpha \text{ voice}] / \text{ — } \begin{bmatrix} -\text{sonorant} \\ \alpha \text{ voice} \end{bmatrix}$$

Setting aside for now:

- assimilation to sonorants, within words as in Nadiža/Natisone Slovenian (Frasson this conference), or across word boundaries as in Slovak (Short 1993)
- non-participation or partial participation by obstruents that were historically sonorants (see, e.g., Hall 2004 and Iosad 2018 on /v/ in Czech and Russian)

Regressive voicing assimilation

(2) *Some Russian examples*

		/s-/		/iz-/	
a.	/__SON.: contrast	s-jexat ^j	'move out'	iz-lagat ^j	'expound'
b.	/__VLS.: voiceless	s-p ^r osit ^j	'ask (for)'	is-kl ^j ut ^j fat ^j	'exclude'
c.	/__VD.: voiced	z-d ^j elat ^j	'do'/'make'	iz-gnat ^j	'expel'

data from Padgett (2002)

The unpaired obstruents

	LABIAL		DENTAL		PALATAL	VELAR	
STOP	p	p ^j	t	t ^j		k	k ^j
	b	b ^j	d	d ^j		g	
AFFRICATE			ts		tʃ		
FRICATIVE	f	f ^j	s	s ^j	ʃ	x	
	v	v ^j	z	z ^j	ʒ		
NASAL	m	m ^j	n	n ^j			
LATERAL			l	l ^j			
TRILL			r	r ^j			
GLIDE					j		

Table: Russian consonant inventory (based on Halle 1959)

The unpaired obstruents

(3) Unpaired obstruents *undergo* assimilation

- | | | | | | |
|----|--------------------------------------|--------------------|----|----------------------|------------|
| a. | ot ^j et ^s | ‘father’ | e. | mox | ‘moss’ |
| b. | ot ^j edz b ^ɪ l | ‘father was’ | f. | moy b ^ɪ l | ‘moss was’ |
| c. | zet ^f l ⁱ | ‘should one burn?’ | | | |
| d. | zedz b ^ɪ | ‘were one to burn’ | | | |

(4) Unpaired obstruents *trigger* assimilation

- | | | | | | |
|----|---------------------------------------|------------------|----|---|------------------|
| a. | b ^j ez oz ^j era | ‘without a lake’ | c. | b ^j es t ^s en ^ɪ | ‘without price’ |
| b. | b ^j es x ^l eba | ‘without bread’ | d. | b ^j es t ^f est ^j i | ‘without honour’ |

data from Halle (1959); Timberlake (2002); Calabrese (1995)

- Phonemic contrast is evaluated purely at the surface.
- The sequence of phonemes must be recoverable from the phonetics. Phonemes cannot overlap.



Against the taxonomic phoneme

Halle (1957, 1959): This condition would require assimilation to be two separate rules.

	'were (he) getting wet'	'was (he) getting wet?'	'were one to burn'	'should one burn?'
Morphophonemic:	//mok bi//	//mok l'i//	//ʒetʃ bi//	//ʒetʃ l'i//
Assimilation 1:	mo g bi	—	—	—
Phonemic:	/mog bi/	/mok l'i/	/ʒetʃ bi/	/ʒetʃ l'i/
Assimilation 2:	—	—	ʒe dʒ bi	—
Phonetic:	[mog bɪ]	[mok l'i]	[ʒedʒ bɪ]	[ʒetʃ l'i]

Towards the systematic phoneme

Theoretical constructs are never introduced because of considerations that have to do with analytic procedures. Thus, for instance, it is inconceivable that chemistry would establish substances that can be identified by visual inspection as a category distinct from substances that require more elaborate techniques for their identification.

Halle (1959: 23–24)

See also: Chomsky, Halle & Lukoff (1956); Chomsky & Halle (1965); Dresher & Hall (2022)

	'were (he) getting wet'	'was (he) getting wet?'	'were one to burn'	'should one burn?'
Morphonemic:	{{mok bi}}	{{mok l'i}}	{{ʒetʃ bi}}	{{ʒetʃ l'i}}
Assimilation:	mog bi	—	ʒedʒ bi	—
Phonetic:	[mog bɪ]	[mok l'i]	[ʒedʒ bɪ]	[ʒetʃ l'i]



2. The road not taken

- 1 Halle's argument
- 2 **The road not taken**
- 3 Optimality and its discontents

Some generic statements:

- › Sonorants...
 - ›› ...don't contrast for voicing
 - ›› ...don't participate in voicing assimilation

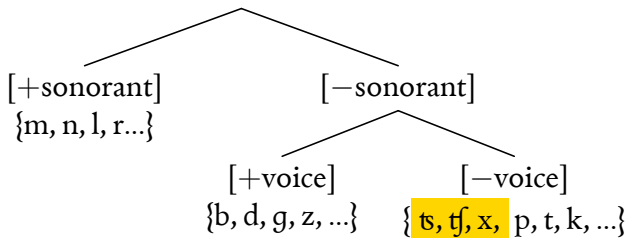
- › Obstruents...
 - ›› ...do contrast for voicing
 - ›› ...do participate in voicing assimilation

But even the unpaired obstruents participate in assimilation.
Can we say the generalization applies to them?

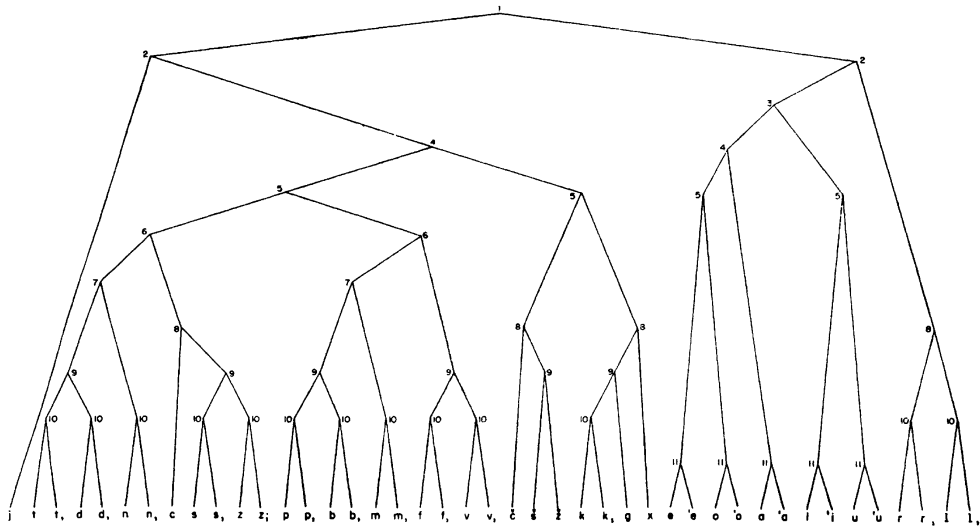
The contrastive hierarchy

Organizing features into a contrastive hierarchy (Dresher 2009) gives us a way of talking about the **scope** of contrasts, and avoids the pitfalls of equating contrasts with minimal pairs (Archangeli 1988).

(6)



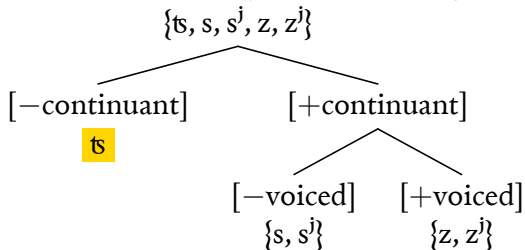
Halle (1959: 46) uses a contrastive hierarchy:



...but he doesn't order the features in such a way as to assign $[-\text{voiced}]$ to $/\text{t}/$:

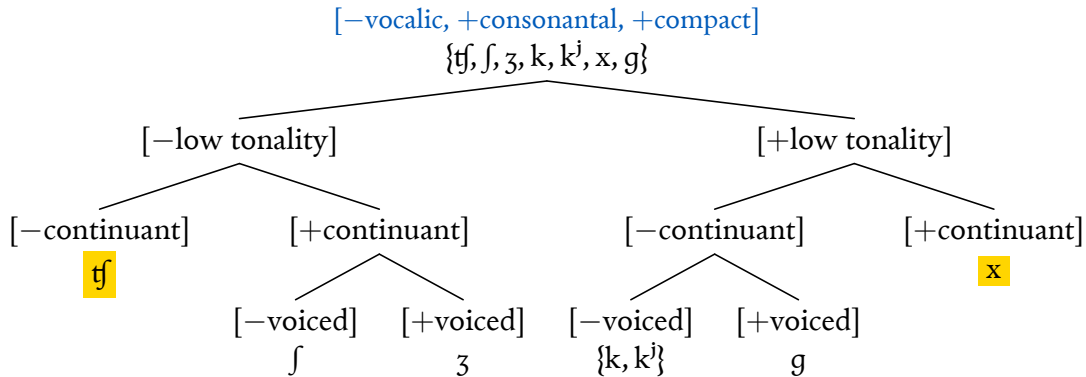
(7) *Subtree from Halle (1959: 46): the strident dentals*

$[-\text{vocalic}, +\text{consonantal}, -\text{compact}, -\text{low tonality}, +\text{strident}]$



...nor to /tʃ/ or /x/:

(8) *Subtree from Halle (1959: 46): the palatals and velars*



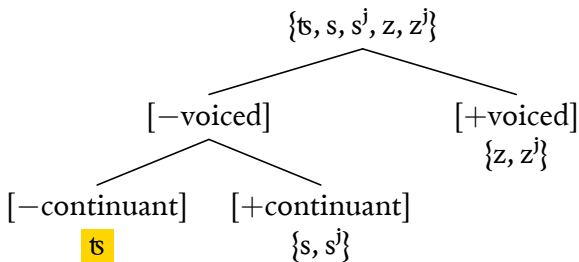
- Halle's tree is about information (Cherry *et al.* 1953), not phonological activity.
- Predictable values of $[\pm\text{voiced}]$ are filled in before assimilation applies:
 - Rule P 1b:** Unless followed by an obstruent, /t̪/, /tʃ/, and /x/ are voiceless.
 - Rule P 3a:** If an obstruent cluster is followed [...] by a sonorant, then with regard to voicing the cluster conforms to the last segment.

(9) *без хлеба* /bʲez xɫʲeba/ [bʲes xɫʲeba] 'without bread':

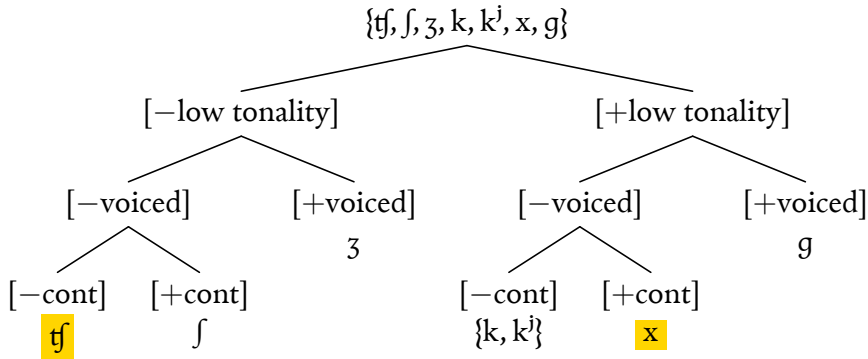
	UNDERLYING		RULE P 1B		RULE P 3A
	bʲe z x ɫʲeba	→	bʲe z x ɫʲeba	→	bʲe s x ɫʲeba
$[\pm\text{voiced}]$:	+ ∅		+ −		− −

- Dresher & Hall (2021): What happens if we reorder the features to specify [−voiced] on /ʈ/, /tʃ/, and /x/?
- The simplest change to Halle's tree is to move [±voiced] above [±continuant].

(10) *The strident dentals revisited*



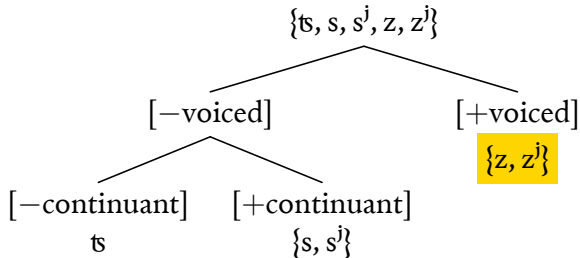
(11) *The palatals and velars revisited*



The other unpaired obstruents

This reordering has other consequences, though. We're no longer specifying $[\pm\text{continuant}]$ on $/z, z^j/...$

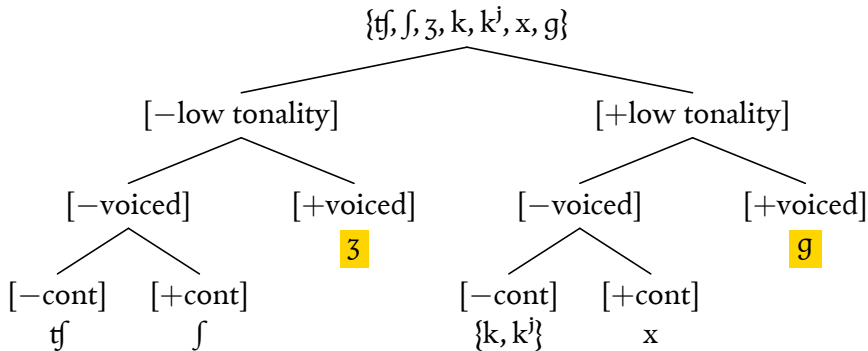
(10) *The strident dentals revisited*



The other unpaired obstruents

...nor on /ʒ/ and /g/:

(11) *The palatals and velars revisited*



Viewed this way, the gaps in the inventory aren't the [+voice] counterparts of /tʃ, x/, but the [-α continuant] counterparts of /z, zʲ, ʒ, g/.

The other unpaired obstruents

(12) *Alternations arising from the First Velar Palatalization*

[+low tonality] → [−low tonality]

[−voiced]	[+continuant]	x	→	ɟ
[−voiced]	[−continuant]	k	→	tʃ
[+voiced]	∅	g	→	ʒ

(13) *Degree on adjectives*

	POSITIVE	COMPARATIVE	GLOSS
a.	tʰixij	tʰiʃe	‘quiet(er)’
b.	ʒarkij	ʒartʃe	‘hot(ter)’
c.	dorogoj	doroʒe	‘dear(er)’

data from Lightner (1965)

The other unpaired obstruents

(14) *Number on verbs*

	3RD PLUR.	3RD SING.	GLOSS
a.	maxut	maʃet	'wave(s), wag(s)'
b.	pekut	petʃet	'bake(s)'
c.	strigut	striʒet	'shear(s)'

(15) *Denominal adjectives*

	NOUN	ADJECTIVE	GLOSS
a.	tʃerepaxa	tʃerepaʃij	'turtle' / 'testudinian'
b.	volk	volʃij	'wolf' / 'lupine'
c.	vraǵ	vraʒij	'enemy' / 'hostile'

data from Lightner (1965)

The other unpaired obstruents

(16) *Relics of the Second Velar Palatalization*

		$\begin{bmatrix} +\text{compact} \\ +\text{low tonality} \end{bmatrix} \sim \begin{bmatrix} -\text{compact} \\ -\text{low tonality} \end{bmatrix}$	
[−voiced]	[−continuant]	k	~
[+voiced]	∅	g, g ^j	~
			ts, z ^j

- (17)
- | | | | | |
|----|-------------------------|-------------------------|---------------------------------------|-------------------|
| a. | brjakat ^j | ‘let fall with a clang’ | brjat ^{ts} at ^j | ‘clang’ |
| b. | voskliknut ^j | ‘exclaim’ (PF.) | vosklic ^{ts} at ^j | ‘exclaim’ (IMPF.) |
| c. | tjagat ^j sja | ‘sue’ | sostjazat ^j sja | ‘contend with’ |
| d. | knjag ^j inja | ‘princess’ | knjaz ^{z^j} | ‘prince’ |

data from Lightner (1965)

- /t͡s, t͡ʃ, x/ pattern phonologically as if they're specified with [−voiced].
- We can make that happen if we leave /g, ʒ, z, zʲ/ with no specifications for [±continuant].
- And /g, ʒ, z, zʲ/ don't particularly act as if they're specified for [±continuant].
- In addition to phonological behaviour, we could also look at phonetic realizations—/g/ in some varieties of Russian can be [ɣ] or [ɦ] (like its cognates in Ukrainian and Czech; see Ćavar & Czaplicki (this conference) on the realizations of Ukrainian /ɣ/).
- Similar patterns apply in other Slavic languages—see, e.g., Radišić (2009) on Serbian.



3. Optimality and its discontents

- 1 Halle's argument
- 2 The road not taken
- 3 **Optimality and its discontents**

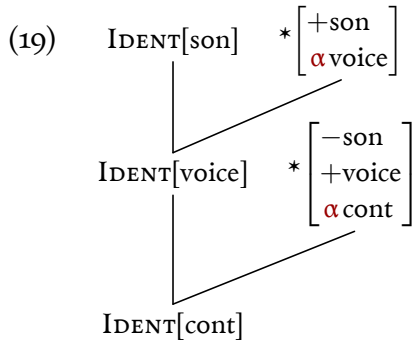
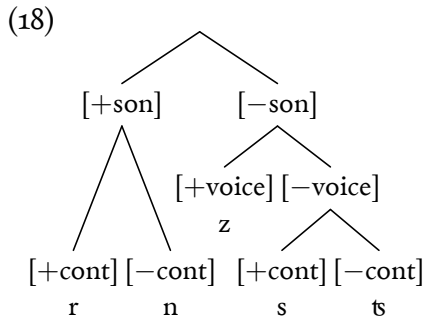
Contrastive specification in OT

- › Suppose we want to use Optimality Theory.
- › Mackenzie & Dresher (2003) and Mackenzie (2013, 2016) show how a contrastive hierarchy can be translated into a constraint ranking.
- › But at what level does this ranking apply?
- › Richness of the Base precludes restrictions on inputs.

All inputs are possible in all languages.

Prince & Smolensky (1993: §9.3)

From a contrastive hierarchy to a constraint ranking



(based on the procedure proposed by Mackenzie & Dresher 2003; Mackenzie 2013, 2016)

The ranking paradox

- The constraints that impose contrastive specifications also define the shape of the inventory.
- If we rank the feature coöccurrence constraints low enough to allow them to be violated, they can't determine the inventory or how it's specified.
- But if we don't, then they incorrectly predict that voicing assimilation will be structure-preserving—i.e., that it won't produce segments that aren't in the underlying inventory, like [ɖ, ɗ, ɣ] (Hall 2007; Mackenzie in press).

(20) *мох был* 'moss was'

мох бѣл	AGREE[voice]	IDENT _{PS} [voice]	IDENT[voice]	* _Y	IDENT[cont]
мох бѣл	*!				
мох рѣл		*!	*		
☹ мох бѣл			*	*!	
☞ мог бѣл			*		*

- Per Mackenzie (in press), assimilation is driven by AGREE[voice] (Baković 2000), with its direction determined by the positional faithfulness constraint IDENT_{PS}[voice] (Beckman 1998; Lombardi 1999; Steriade 1999; Padgett 2012).
- *_Y stands for the feature cooccurrence constraint *[-vocalic, +consonantal, +compact, +low tonality, +voiced, α continuant].

The ranking paradox


We could shove $*\gamma$ down below IDENT[cont] to get /x/ to stay [+continuant] when it becomes voiced...

(21) *мох был* 'moss was'

мох бѣл	AGREE[voice]	IDENT _{ps} [voice]	IDENT[voice]	IDENT[cont]	$*\gamma$
мох бѣл	*!				
мох рѣл		*!	*		
☞ моγ бѣл			*		*
мог бѣл			*	*!	

...but this ranking incorrectly predicts that input /ɣ/ will surface faithfully, and thus contrast with /g/ and /x/:

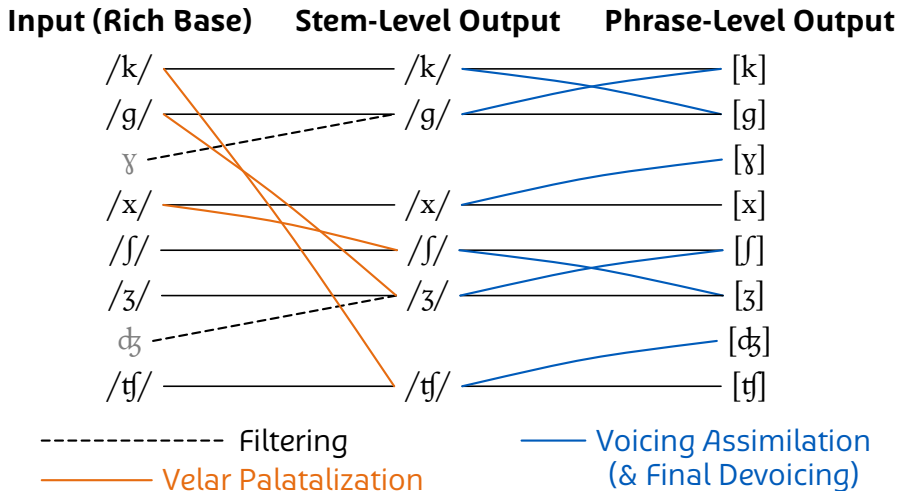
(22) *Hypothetical input*

agayaxa	IDENT[voice]	IDENT[cont]	*ɣ
 agayaxa			*
agagaxa		*!	
agaxaxa	*!		

Resolving the paradox

- Hall (2007) explores a complicated and tenuous *ad hoc* approach that uses anti-alignment constraints.
- Mackenzie (in press) proposes a much more principled solution in Stratal OT (Bermúdez-Otero 1999; Kiparsky 2000; Rubach 2003; Milenković this conference):
 - At the stem level, the constraint ranking enforces structure preservation and underspecification.
 - Voicing assimilation applies at the phrase level, where structure preservation is no longer in force.
- This is independently motivated—e.g., assimilation crosses syntactic word boundaries.

Mapping between levels



(see Blumenfeld 2003; Gribanova 2008)

What happened to contrast?

- Mackenzie's account makes it possible to account for voicing assimilation in OT while also excluding /dʒ, dʒ, ʒ/ from the underlying inventory.
- The contrastive hierarchy thrives in the stem-level constraint ranking... but does it have anything to say about assimilation, which applies at the phrase level?
- The constraints driving assimilation don't make use of contrastive specification:

(23) **AGREE**[voice]: Adjacent obstruents have identical specifications for [voice].
(Mackenzie in press, citing Baković 2000)

(24) **IDENT_{PS}**[voice]: An output obstruent in an environment that provides cues to voicing at least as good as those found in pre-sonorant contexts has the same value for [voice] as its input correspondent.

(Padgett 2012, cited in Mackenzie in press, adapting Steriade 1999)

Bringing contrast back into the picture


- What the contrastive hierarchy should do for us is make it unnecessary to stipulate that only obstruents participate in voicing assimilation.
- Let's try reformulating the constraints:
 - (25) **OCP[voice]**: Adjacent output segments must not be associated with separate instances of $[\pm\text{voice}]$.
 - (26) **IDENT_R[voice]**: For every instance of $[\pm\text{voice}]$ in the output, the **rightmost** segment associated with it must be associated with the same value of $[\pm\text{voice}]$ in the input.
 - (27) **MAXSPEC**: If a segment in the input has a specification for feature $[F]$, its output correspondent also has a value for $[F]$.

Bringing contrast back into the picture

- What about the sonorants? At the phrase level, won't they get their redundant [+voice] feature filled in?
- Not unless we require it.
 - If *[+sonorant, α voice] is still ranked high enough, they'll be required to be unspecified.
 - But faithfulness will also result in underspecification here: they're unspecified at the stem level, so DEP militates in favour of keeping them that way.
 - If we're okay with sending underspecified representations off to phonetic implementation, this should work.

Bringing contrast back into the picture

(28) *мох был* 'moss was' (phrase level)

<div style="text-align: center;"> m o x b ɪ l [-v] [+v] </div>	OCP[voice]	IDENT _R [voice]	IDENT[voice]	IDENT[cont]	*ɣ
<div style="text-align: center;"> m o x b ɪ l [-v] [+v] </div>	*!				
 <div style="text-align: center;"> m o ɣ b ɪ l [+v] </div>			*		*
<div style="text-align: center;"> m o g b ɪ l [+v] </div>			*	*!	
<div style="text-align: center;"> m o x p ɪ l / [-v] </div>		*!	*		

- 1 65 years after the publication of SPR, voicing assimilation is still telling us things about fundamental questions in phonology:
 - » How does the phonological computation work?
 - » How many levels of representation do we need?
 - » How are phonological contrasts represented?
- 2 Contrastive hierarchies are cool.
 - » They can do more explanatory work than Halle (1959) realized.
 - » They're useful even in a surface-oriented framework like OT.

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