

# Rules and constraints



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# Preview. A rule is...

⌘ structural description + structural change

⌘ Polish devoicing: /zvug/ -> [zvuk]

⌘ SD [-sonorant, +voice]#

⌘ SC  -voice

⌘ Today: reasons to separate SD from SC and let them function independently in grammars

# What speakers know



⌘ **Which** sounds:

∅ in English? In French? ø?

⌘ **Where**:

**blog** in English? Polish? Korean?

⌘ **Organizing principles**:

a. **al-geb-ra**

b. **al-ge-bra**

c. **a-lge-bra**

# Alternations



⌘ *bags, vibes, sides, loves, means*

⌘ [gz], [bz], [dz], [vz], [nz]

⌘ *fakes, cups, cites, laughs*

⌘ [ks], [ps], [ts], [fs]

⌘ *misses, buzzes, brushes, garages*

⌘ [s´z], [z´z], [S´z], [Z´z]

⌘ [+strident]: s, z, S, Z, <sup>t</sup>S, <sup>d</sup>Z



⌘ **z/[+voice]\_**

⌘ **s/[-voice]\_**

⌘ **'z/[+strident]\_**

# Analysis 1



⌘ Suffix is /z/

⌘ /pœk-z/ [pœks]

⌘ Devoicing:

z -> s/ [-voice]\_

⌘ /brøS-z/ [brøS´z]

⌘ Epenthesis:

∅ -> ´/ [+strident]\_z

⌘ Order?

⌘ [brøS´z] vs. \*[brøS´s]

# How Analysis 1 works

UR	<b>bœg-z</b>	<b>pœk-z</b>	<b>brøS-z</b>
Epenthesis			<b>brøS'z</b>
Devoicing		<b>pœks</b>	
Outcome	<b>bœgz</b>	<b>pœks</b>	<b>brøS'z</b>

# Analysis 2



⌘ Suffix is /s/

⌘ Voicing:

**s -> z/ [+voice]\_\_**

⌘ Epenthesis:

**∅ -> ʻ/ [+strident]\_s**

⌘ Order?



# How Analysis 2 works

UR	<b>bæg-s</b>	<b>pæk-s</b>	<b>brøS-s</b>
Epenthesis			<b>brøS's</b>
Voicing	<b>bægz</b>		<b>brøS'z</b>
Outcome	<b>bægz</b>	<b>pæks</b>	<b>brøS'z</b>

# Analysis 3



⌘ Suffix is /'z/

⌘ Schwa deletion

´ -> Ø/ [-strident]\_z

⌘ Devoicing:

z -> s/ [-voice]\_\_\_

⌘ Order?

# How Analysis 3 works

UR	<b>bœg-´z</b>	<b>pœk-´z</b>	<b>brøS-´z</b>
´-Deletion	<b>bœgz</b>	<b>pœkz</b>	
Devoicing		<b>pœks</b>	
Outcome	<b>bœgz</b>	<b>pœks</b>	<b>brøS´z</b>



**There is also analysis 4  
but life is short**

# How would learners choose?

⌘ **bækd, klæsb, æsg, flfD**

⌘ Devoicing rule (A1, A3) is general:

⌘ **[-son] -> [-voice]/[-voice]\_#**

⌘ Voicing rule (A2) is not:

⌘ **[-son] -> [+voice]/[+voice]\_#**

⌘ **mlnt, kArt, sikr´t**

# How would learners choose?

⌘ **bUSsi, bEdZzo...**

⌘ Epenthesis rule (A1, A2) is general:

⌘  $\emptyset \rightarrow \acute{\_} / [+strident]\_ [+strident]$

⌘ Is Deletion rule (A3)?

⌘  $\acute{\_} \rightarrow \emptyset / [-strident]\_ [+strident]$

⌘ **IE|´s, mEn´s, kAm´z...**

# If the choice



⌘ is based on the comparative generality of the competing analyses

⌘ then A1 would be selected.

# SD vs. SC



⌘ Consider English Devoicing

⌘ Its SD: **[-voice][+voice,-son]#**

⌘ Its SC: [-voice]





# SD vs. SC



⌘ Consider Epenthesis

⌘ Its SD: **[+strident] [+strident]**



⌘ Its SC:

# So far we thought that



- ⌘ Systematic absence of a string of sounds shows that a rule has applied.
- ⌘ Knowledge of the systematic gap is knowledge of a rule.

# Wug test (Berko 1957)



Image removed for copyright reasons.

This is a wug [**wøg**]

# Wug test



Images removed for copyright reasons.

**These are two \_\_\_**

# Three subject groups

⌘ Children: 5 and 7 (pre and post-literate)

⌘ Adults: BU undergrads

⌘ Stimuli:

CVC: CV {**p, t, k, b, d, g**}

CV {**m, n, l, r**}

CV {**f, s, S, v, z, Z**}

# Children's mistake types



⌘ hif, hif'z

⌘ Epenthesis rule overapplied

⌘ fœs, fœs

⌘ møz, møz

⌘ Epenthesis rule underapplied and  
suffix dropped

# Non-mistakes



⌘ Epenthesis never fails when suffix is there:

**\*fœsz**

⌘ Devoicing never over/under/misapplies:

**\*wukz, \*wøgs,**

⌘ Knowledge of **phonotactic wellformedness**

⌘ **(i.e. SD)**

⌘ arises earlier than knowledge of **rules.**

⌘ **(i.e. SD+SC)**

# A small follow-up on Berko

⌘ 5 children, 8-10 years.

⌘ -k 'tiny'

⌘ **tiny flower:** *flowerk*

⌘ **tiny boy:** *boyk*

⌘ **tiny country:** *countryk*

⌘ **tiny sock?** **sAk, sAk´k, not sAkk**

⌘ **tiny rug?** **røg, røg´k, not røgk**

⌘ **tiny cat?** **kœtk, kœt´k**



# The next point previewed



- ⌘ SD of English epenthesis is independent of the rule of epenthesis
- ⌘ It's known even to speakers of languages lacking alternations
- ⌘ It functions even in English independently of the rule of epenthesis,
- ⌘ as a constraint on surface strings of segments.

# No relevant alternations

⌘ French, Romanian, Hungarian (+ others)

⌘ **s, S, z, Z** at end of syllables:

**muS, ruZ, rys, ryz, kaz-ba, aS-te**

⌘ **s, S, z, Z** at beginning of syllables:

**lap-sys, eg-zakt, ar-Se**

⌘ No adjacent members of the set {**s, S, z, Z**}

⌘ \***laSsys, \*aZze, \* azSe**

⌘ Unlike English, no alternations. No rule?

# Back to English

⌘ [+strident] [+strident]

⌘ *rebel, rebellion*: suffix -j'n

⌘ *confess, confession; use, usual*

**Palatalization** s->S/ \_j,      z -> Z/ \_j

⌘ *permit, permission; divide, division*:

1. **Assibilation** t->s/ \_j,      d -> z/ \_j

2. **Palatalization** s->S/ \_j      z -> Z/ \_j

⌘ More assibilation:

*vacant, vacancy; pirate, piracy; private, privacy*

# How this works

	permit
Add -j´n	<b>p´rmlt-j´n</b>
Assibilate	<b>p´rmls-j´n</b>
Palatalize	<b>p´rmlS-j´n</b>
(drop j)	<b>p´rmlS´n</b>

# How this doesn't work

	permit	digest
Add -j´n	<b>p´rmlt-j´n</b>	<b>daldZEst-j´n</b>
Assibilate	<b>p´rmls-j´n</b>	<b>daldZEss-j´n</b>
Palatalize	<b>p´rmlS-j´n</b>	<b>daldZEsS-j´n</b>
(drop j)	<b>p´rmlS´n</b>	<b>daldZEsS´n</b>

# Epenthesis doesn't help

	permit	digest
Add -j´n	<b>p´rmlt-j´n</b>	<b>daldZESt-j´n</b>
Assibilate	<b>p´rmls-j´n</b>	<b>daldZEss-j´n</b>
Palatalize	<b>p´rmlS-j´n</b>	<b>daldZEsS-j´n</b>
Epenthesis.		<b>daldZEs´Sj´n</b>

# \*[+strident][+strident] used to block assibilation

	permit	digest
Add -j´n	<b>p´rmlt-j´n</b>	<b>daldZEst-j´n</b>
Assibilate	<b>p´rmls-j´n</b>	<del><b>daldZEss-j´n</b></del> <b>daldZEst-j´n</b>
Palatalize	<b>p´rmlS-j´n</b>	<b>daldZEstS-j´n</b>

# A different view of rules

- ⌘ Grammar records which sounds, sound sequences are impossible in the language.
- ⌘ These statements correspond to SD's.
- ⌘ **“Phonotactic constraints”**
- ⌘ If an UR violates one of them, a SC may be launched: the result may be alternations.
- ⌘ Or the UR may be discarded: no alternations.
- ⌘ If a SC results in violation of a phonotactic constraint: it may be blocked.



# Effect of \*+strident-+strident

	<i>/...s+z/</i>	<i>/...sz.../</i>	<i>/...st-j.../</i>
<b>English</b>	∅->ʰ	<b>Blocked from surfacing</b>	<b>Blocked from assibilating</b>
<b>French</b>	---	<b>Blocked from surfacing</b>	

# Loanwords: English -> Korean

⌘ film	pÓillÈm
⌘ victory	piktÓori
⌘ graph	kÈrœphÈ
⌘ olive	olibÈ
⌘ after	œpÓÈtÓO
⌘ bus	pOsÈ
⌘ bush	puSi

# Korean vs. English

E	v	b	f	p	CC#	#CC	l	r	b, d, g#
K	b/p	pÓ	C#	#C	ll/r		p, t, k#		

# No native alternations

⌘ tell Korean speakers how to fix

⌘ /v/, /f/, #CC, Im#, short l.

⌘ Ollv orip, ollip, onip, odip

ollip, ollibÈ, olliw

ollibÈ, ollibO, ollibi, olliba

# No native alternations

⌘ tell Korean speakers how to fix

/v/, /f/, #CC, Im#, VIV

⌘ Ollv orip, ollip, onip, odip, oip

ollip, **ollibÈ**, olliw, olli

ollibO, ollibi, olliba

# Nonetheless

- ⌘ They all know a set of strategies
- ⌘  $\emptyset$  ->  $\text{È}$ , the shortest vowel of Korean
- ⌘ CC#: *film* ->  $\text{pÓillÈm}$
- ⌘ #CC: *club* ->  $\text{kÓÈllOp}$
- ⌘ *f* ->  $\text{pÓ}$ .
- ⌘  $\text{pÓ}$  followed by *V*: *graph* ->  $\text{kÈrœpÓÈ}$
- ⌘ *s*, *S* followed by *V*: *bus* ->  $\text{pOsÈ}$ , *bush* ->  $\text{puSi}$

# ∅ -> È is not exactly a rule

⌘ It corresponds to many SD's:

⌘ #CC, CC#, pÓ#, s#

⌘ Nor is È the only vowel Koreans insert:

⌘ Cf. *bush* -> **puSi** vs. *bus* -> **pOsÈ**

⌘ Korean **S** can't occur before È. But s can.

# A hierarchy of preferences

⌘ **\*#CC, \*CC#, s, S/\_V, \*SÈ**

⌘ Do not insert long V's ( $\neq i$ , È)

⌘ Do not remove sounds

⌘ Do not change **S** to s ([±anterior])



⌘ Do not insert i



⌘ Do not insert any sound, incl. È



# Perhaps English too



⌘ \*strident-strident

⌘ \*voiceless-voiced#

⌘ Don't insert any V other than ´

⌘ Don't remove sounds; or change strident

⌘ Don't add any V to the UR

⌘ Don't modify [ $\pm$ voice] feature in UR