Rules and constraints

Donca Steriade,
Preview. A rule is...

- structural description + structural change
- Polish devoicing: /zvug/ \rightarrow \[zvuk\]
- SD \# [-sonorant, +voice]
- SC -voice

Today: reasons to separate SD from SC and let them function independently in grammars
What speakers know

- **Which** sounds:
  - ø 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, tS, dZ
z/ [+voice]_

s/ [-voice]_

´z/ [+strident]_
Analysis 1

- Suffix is /z/
- /pœk-z/ [pœks]
- Devoicing:
  - z -> s/ [-voice]_ 
- /brøS-z/ [brøS´z]
- Epenthesis:
  - Ø -> ´/ [+strident]_z
- Order?
- [brøS´z] vs. *[brøS´s]
How Analysis 1 works

<table>
<thead>
<tr>
<th>UR</th>
<th>bœeg-z</th>
<th>pœek-z</th>
<th>brøS-z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epenthesis</td>
<td></td>
<td></td>
<td>brøS´z</td>
</tr>
<tr>
<td>Devoicing</td>
<td></td>
<td>pœeks</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>bœegz</td>
<td>pœeks</td>
<td>brøS´z</td>
</tr>
</tbody>
</table>
Analysis 2

- Suffix is /s/
- Voicing:
  - s -> z/ [+voice]_
- Epenthesis:
  - Ø -> ˈ/ [+strident]_s
- Order?
# How Analysis 2 works

<table>
<thead>
<tr>
<th></th>
<th>bœg-s</th>
<th>pœk-s</th>
<th>brØS-s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Epenthesis</strong></td>
<td></td>
<td></td>
<td>brØS´s</td>
</tr>
<tr>
<td><strong>Voicing</strong></td>
<td>bœgز</td>
<td></td>
<td>brØS´ز</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>bœgز</td>
<td>pœks</td>
<td>brØS´ز</td>
</tr>
</tbody>
</table>
Analysis 3

- Suffix is /ˈz/ 
- Schwa deletion
  - ˈ -> Ø/ [-strident]_z
- Devoicing:
  - z -> s/ [-voice]__
- Order?
# How Analysis 3 works

<table>
<thead>
<tr>
<th>UR</th>
<th>bœeg-´z</th>
<th>pœek-´z</th>
<th>brøS-´z</th>
</tr>
</thead>
<tbody>
<tr>
<td>′-Deletion</td>
<td>bœegz</td>
<td>pœekz</td>
<td></td>
</tr>
<tr>
<td>Devoicing</td>
<td></td>
<td>pœeks</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>bœegz</td>
<td>pœeks</td>
<td>brøS´z</td>
</tr>
</tbody>
</table>
There is also analysis 4 but life is short
How would learners choose?

- bœkd, klœesb, œesg, flfD
- Devoicing rule (A1, A3) is general:
  - [-son] -> [-voice]/[-voice]_
- Voicing rule (A2) is not:
  - [-son] -> [+voice]/[+voice]_
- mInt, kArt, sikr´t
How would learners choose?

- bUSsi, bEdZzo...
- Epenthesis rule (A1, A2) is general:
  - \( \emptyset \rightarrow \text{́} / [+\text{strident}]_[-\text{strident}] / [+\text{strident}] \)
- Is Deletion rule (A3)?
  - \( \text{́} \rightarrow \emptyset / [-\text{strident}]_[-\text{strident}] \)
- IE|́s, mEńs, kAḿz...
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?: sAkk, sAkk´k, not sAkk
- tiny rug?: røg, røg´k, not røgk
- tiny cat?: køetk, køet´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 -jْn

*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

<table>
<thead>
<tr>
<th></th>
<th>permit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Add -j´n</strong></td>
<td>p´rmlt-j´n</td>
</tr>
<tr>
<td><strong>Assibilate</strong></td>
<td>p´rmls-j´n</td>
</tr>
<tr>
<td><strong>Palatalize</strong></td>
<td>p´rmls-`j´n</td>
</tr>
<tr>
<td><strong>(drop j)</strong></td>
<td>p´rmls-`n</td>
</tr>
</tbody>
</table>
How this doesn’t work

<table>
<thead>
<tr>
<th></th>
<th>permit</th>
<th>digest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add -j’n</td>
<td>p´rmlt-j´n</td>
<td>daldZEst-j´n</td>
</tr>
<tr>
<td>Assibilate</td>
<td>p´rmIs-j´n</td>
<td>daldZEss-j´n</td>
</tr>
<tr>
<td>Palatalize</td>
<td>p´rmIS-j´n</td>
<td>daldZEsS-j´n</td>
</tr>
<tr>
<td>(drop j)</td>
<td>p´rmIS´n</td>
<td>daldZEsS´n</td>
</tr>
</tbody>
</table>
**Epenthesis doesn’t help**

<table>
<thead>
<tr>
<th></th>
<th>permit</th>
<th>digest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add -j´n</td>
<td>p´rmIt-j´n</td>
<td>daldZEst-j´n</td>
</tr>
<tr>
<td>Assibilate</td>
<td>p´rmIs-j´n</td>
<td>daldZEss-j´n</td>
</tr>
<tr>
<td>Palatalize</td>
<td>p´rmIsS-j´n</td>
<td>daldZEsS-j´n</td>
</tr>
<tr>
<td>Epenth.</td>
<td></td>
<td>daldZEs´Sj´n</td>
</tr>
</tbody>
</table>
* [+strident][+strident] used to block assimilation

<table>
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</tr>
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<tr>
<td>Add -j´n</td>
<td>p´rmlt-j´n</td>
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<tr>
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<td>p´rmls-j´n</td>
<td>daldZEss-j´n</td>
</tr>
<tr>
<td>Palatalize</td>
<td>p´rmlS-j´n</td>
<td>daldZEstS-j´n</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th></th>
<th>/...s+z/</th>
<th>/...sz.../</th>
<th>/...st-j.../</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>ø -&gt; ſ</td>
<td>Blocked from surfacing</td>
<td>Blocked from assibilating</td>
</tr>
<tr>
<td>French</td>
<td>---</td>
<td>Blocked from surfacing</td>
<td></td>
</tr>
</tbody>
</table>
## Loanwords: English -> Korean

<table>
<thead>
<tr>
<th>English Word</th>
<th>Korean Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>film</td>
<td>pÓillÈm</td>
</tr>
<tr>
<td>victory</td>
<td>piktÓori</td>
</tr>
<tr>
<td>graph</td>
<td>kÈrœephÈ</td>
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<tr>
<td>olive</td>
<td>ollibÈ</td>
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<tr>
<td>after</td>
<td>œerpÓÈtÓO</td>
</tr>
<tr>
<td>bus</td>
<td>pOsÈ</td>
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<tr>
<td>bush</td>
<td>puSi</td>
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</tbody>
</table>
### Korean vs. English

<table>
<thead>
<tr>
<th></th>
<th>v</th>
<th>b</th>
<th>f</th>
<th>p</th>
<th>CC#</th>
<th>#CC</th>
<th>l</th>
<th>r</th>
<th>b, d, g#</th>
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</thead>
<tbody>
<tr>
<td>E</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>b/p</td>
<td>pÓ</td>
<td>C#</td>
<td>#C</td>
<td>ll/r</td>
<td></td>
<td></td>
<td></td>
<td>p, t, k#</td>
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</tbody>
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<p>| | | | | | | | | | |</p>
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</tbody>
</table>
No native alternations

- tell Korean speakers how to fix
- /v/, /f/, #CC, lm#, 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, lm#, VIV

- Ollv orip, ollip, onip, odip, oip
  ollip, ollibÈ, olliw, olli
  ollibO, ollibi, olliba
Nonetheless

- They all know a set of strategies
- Ø -> È, the shortest vowel of Korean
- CC#: film -> pÓillÈm
- #CC: club -> kÓÈllOp
- f -> pÓ.
- pÓ followed by V: graph -> kÈrœpÓÈ
- s, S followed by V: bus -> pOsÈ, bush -> puSi
Ø -> 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 (≠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 [±voice] feature in UR