Phonology without markedness constraints

Paul Boersma
ICLaVE 3, Amsterdam, 25 June 2005
Fugitive /g/ (Boersma 1989) in the presence of unaspirated /k/

- $g \rightarrow \phi$ (Czech, Slovak, Ukranian)
- $g \rightarrow \gamma$ (Dutch vs. other Germanic)
- $g \rightarrow d\zeta$ (Arabic)
- $g \rightarrow \eta$ (Japanese)
- counterexamples to Ohala/Blevins’ ‘innocent misapprehension’ theory?
On the observational level: enhancement of /g/-/k/ contrast

• $g \rightarrow \{ h, \gamma, d\zeta, \eta \}$ increases voicing.
• Teleology, observationally.

• This talk will show, however, that an underlying blind mechanism could handle these facts.
Grammar: markedness is implicit

UF  lexical constraints
    faithfulness constraints
    structural constraints
    cue constraints
SF  structural constraints
    auditory constraints?
    sensorimotor constraints
AudF auditory constraints?
    sensorimotor constraints
ArtF articulatory constraints
Processes: parallel phonology & phonetics

comprehension

production

UF

SF

AudF

ArtF

UF

SF

AudF

ArtF
Faithfulness constraints

- ID-voice:
  *−voi|/+voi/
  *|+voi|−voi/
Cue constraints (e.g. Escudero & Boersma 2004)

- */+voi/[[0voi]]
- */+voi/[[1voi]]
- ...
- */+voi/[[9voi]]

- */−voi/[[0voi]] ... */−voi/[[9voi]]
Example cue ranking

* /+voi/[3voi]  
  
* /+voi/[5voi]  
  
* /+voi/[7voi]  
  
* /+voi/[9voi]  

* /−voi/[9voi]  
  
* /−voi/[7voi]  
  
* /−voi/[5voi]  
  
* /−voi/[3voi]
Perception: modular

comprehension

UF
SF
AudF
ArtF

production

UF
SF
AudF
ArtF
Perception

- [[3voi]] $\rightarrow /-\text{voi}/$ nearly always
- [[9voi]] $\rightarrow /+\text{voi}/$ nearly always
- [[5voi]] $\rightarrow /-\text{voi}/$ most of the time
- [[7voi]] $\rightarrow /-\text{voi}/$ most of the time
Sensorimotor constraints

- ... reflect knowledge of relation between sound and articulation.
- Their ranking is acquired by practice (speaking, vocal play).
- For simplification, I assume that the s.m. constraints are ranked ‘perfectly’.
Perfect sensorimotor rankings

• Possible combinations are low-ranked:
  *[[9voi]] [dorvel, plosvoieffort=22]
  *[[7voi]] [dorvel, plosvoieffort=18]
  *[[5voi]] [dorvel, plosvoieffort=14]

• Impossible combinations are high-ranked:
  *[[7voi]] [dorvel, plosvoieffort=22]
  *[[9voi]] [dorvel, plosvoieffort=18]
Low sensorimotor constraints

*[[9voi]] [dorvel, plosvoieffort=22]
*[[9voi]] [coralv, plosvoieffort=18]
*[[9voi]] [bilab, plosvoieffort=14]
*[[7voi]] [dorvel, plosvoieffort=18]
*[[5voi]] [dorvel, plosvoieffort=14]
*[[3voi]] [dorvel, plosvoieffort=10]
Simplify GEN because of perfect s.m. ranking

Allow only perfect candidates in tableaus, i.e. those containing the following phonetic parts:

[9dorplos22],
[7dorplos18], [9corplos18],
[5dorplos14], [7corplos14], [9labplos14],
[3dorplos10], [5corplos10], [7labplos10]
Fixed articulatory ranking

* [plosvoieffort=22] >>
* [plosvoieffort=18] >>
* [plosvoieffort=14] >>
* [plosvoieffort=10]
Production: parallel

comprehension

UF

SF

AudF

ArtF

production

UF

SF

AudF

ArtF
Production

• There is a ranking of ID-voice, cue and *ART constraints that leads to

|dorplos,+voi| → /+voi/[7dorplos18]
|corplos,+voi| → /+voi/[8corplos16]
|labplos,+voi| → /+voi/[9labplos14]

• The dorsal is both less voiced than the labial, and more effortful.
Spirantization facilitates voicing

(spirant = fricative or approximant)
Remaining s.m.-perfect phonetic candidates:

[9dorspir18],
[7dorplos14], [9corplos14],
[5dorplos10], [7corplos10], [9labplos10]

An additional faithfulness constraint:

ID-manner, i.e. *|plos|/spir/
There exists a ranking of ID-voice, ID-manner, cue and *ART constraints that leads to

\[
\begin{align*}
|\text{dorplos, +voi}| &\rightarrow /+\text{voi}/[8\text{dorspir16}] = [\gamma] \\
|\text{corplos, +voi}| &\rightarrow /+\text{voi}/[8\text{corplos16}] = [d] \\
|\text{labplos, +voi}| &\rightarrow /+\text{voi}/[9\text{labplos14}] = [b]
\end{align*}
\]
With evaluation noise

Labials: voiceless 0.1%, spirantized 4.6%
Coronals: voiceless 3.9%, spirantized 24.5%
Dorsals: voiceless 15.2%, spirantized 49.0%

Naive ‘innocent misapprehension’ theory only predicts devoicing: the merger /g/ → /k/.
The current equally non-teleological ‘bidirectional constraint use’ theory also
predicts fugitive /g/ → /ɣ/. 
Where are crazy rules?

• For some speakers, /g/ (i.e. /+voi, +dor, +plos/) at SF is pronounced as [ɣ] at ArtF.

• Some learners interpret the AudF [ɣ] as the SF /+voi, +dor, −plos/.

• These learners may introduce a language-specific structural constraint */+voi, +dor, +plos/ at SF.

• Such a constraint is not less natural than, say, */−voi, +dor, +plos/.
Conclusion

• This is how phonologization works in parallel bidirectional phonology & phonetics.
• We find natural rules only at ArtF and AudF, and rules at SF are arbitrary.
• Because of phonologization, the structure /g/ is uncommon at SF, but there is no markedness constraint */g/ at SF.
So?

• So you have ‘crazy’ reconstructed proto-Indo-European with /g/ but not /b/ at SF, against the markedness correlation, because of a change like /t’, c’, k’/ → /d, ŋ, g/ that is unrelated to the high ranking of the articulatory constraint against implementing a very voiced [g].

• No markedness constraints, no teleology.
Parallel bidirectional phonology and phonetics

UF —— lexical constraints
    |  faithfulness constraints
SF —— structural constraints
    |  cue constraints
AudF —— auditory constraints?
    |  sensorimotor constraints
ArtF —— articulatory constraints