Auditory cues determine allomorphy
Vocalized and non-vocalized prepositions in Czech

Katerina Chladikova
Phonetic Sciences, University of Amsterdam

I. Non-syllabic prepositions

<table>
<thead>
<tr>
<th>always vocalized</th>
<th>always non-vocalized</th>
<th>both vocalized and non-vocalized</th>
</tr>
</thead>
<tbody>
<tr>
<td>ke kolu ‘to a bike’</td>
<td>k tomu ‘to that’</td>
<td>ke psovi 30 % — k psovi 70 % ‘to a dog’</td>
</tr>
<tr>
<td>k autu ‘to a car’</td>
<td>ke skvitr 90 % — k skvitr 10 % ‘to a chink’</td>
<td></td>
</tr>
<tr>
<td>ke plotu 10 % — k plotu 90 % ‘to a fence’</td>
<td>ke psu 90 % — k psu 10 % ‘to a dog’</td>
<td></td>
</tr>
</tbody>
</table>

Articulatory ease
* BUT: no problem with producing complex clusters such as /ks/, /sk/, /pst/; why not /ks/; then?

II. The explanation I propose: prepositional vocalization is listener-oriented

Perceptual ease
the /e/ is inserted so that the listener can recover the preposition
auditory cues almost exclusively determine the choice between the vocalized and non-vocalized prepositional forms
the speaker has no articulatory difficulty with e.g. [k:] but the listener would not be able to recover the preposition
structural constraints against what can be a word contribute as well (cf. ke psu BUT k psovi)
/e/ inserted in SF (because if present it is stressed)
UF prefers |k| (k is much more frequent)
simulations show that such a grammar is learnable

III. The analysis
modeled in Bidirectional Phonetics and Phonology in parallel BiPhon (Boersma 2007, 2008)
5 levels of representations used in the present analysis (the Tableaus below collapse the Aud.F. and the Art.F.)
constraints that operate at a level of representation and constraints evaluating the mapping between levels
Stochastic Optimality Theory as the evaluation strategy

IV.a Simple onsets

*[GC]Art → do not produce two adjacent identical separate consonantal articulatory gestures
*[CC] / [C] → an auditorily prolonged single consonant that follows a pause does not correspond to two consonantal segments in the SF
*/ [x] → the presence of auditory events does not correspond to the absence of a segment in the SF

Production of <to + a bike>

<table>
<thead>
<tr>
<th>ranking value</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>80</th>
<th>60</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>[k + kolu] / kko lu / [k kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
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</tr>
<tr>
<td>[k + kolu] / kko lu / [k kolu]</td>
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<td>[k + kolu]</td>
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<tr>
<td>[k + kolu] / kko lu / [k kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
<td>[k + kolu]</td>
</tr>
<tr>
<td>failed comprehension of [k kolu] when &lt;to + a bike&gt; intended</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cue constraints interact with DEP:

<table>
<thead>
<tr>
<th>cue</th>
</tr>
</thead>
</table>
| 78%
| 23%
| 49%
| 56%
| 19%
| 81% |

IV.b Cue constraints: Complex onsets

Dissimilar consonantal cues auditorily = different segments in the SF
C = /place/ [formant] /manner/ [noise, silence] /voicing/ [periodicity]

<table>
<thead>
<tr>
<th>cue constraints with DEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>ranking value</td>
</tr>
</tbody>
</table>
| ke psovi / ke psu | 1 * 77%
| ke plotu / ke plotu | 1 * 23%
| ke psomi / ke pso / ke psu | 1 * 49%
| ke psomi / ke pso / ke psu | 1 * 56%
| ke psomi / ke pso / ke psu | 1 * 19%
| ke psomi / ke pso / ke psu | 1 * 81% |

V. When the cue constraints are not enough

Both ke psovi and k psovi are attested, and we also observe ke psu (but NOT k psu). (all are <to + a dog>)
This cannot be handled by the cue constraints introduced above.
There are three structural constraints:
* FEETUN → feet are not monosyllabic
* MINWORD → a light monosyllabic is not a prosodic word
* ONSETCC – onsets are not composed of 3 or more segments
* these constraints work both in HG (see Tableau on the right),
* as well as in OT under the local conjuction approach (Smolensky 1997).