Sonority Profiles, Gestural Coordination and Phonological Licensing: Obstruent-Sonorant Clusters in Polish

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Research Questions

- Plosive-sonorant clusters
  - Does violation of syllable contact constraint mean that cluster such as /kr/ is tautosyllabic?
  - Uniform analysis of these clusters word initially and finally?
  - Is there evidence for a different coordination in these positions?
  - Is there evidence for onsethood word initially?
- Sonorant voicing / devoicing
  - To what extent are sonorants devoiced in plosive-sonorant clusters word finally?*
  - Are they phonologically [-voice] or simply unspecified for voicing?

*Rubach (2008); Sieczkowska et al. (2009); Gussmann (2007)

Coupling hypothesis*

in-phase 0°

anti-phase 180°

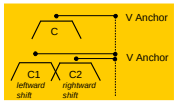
CCV

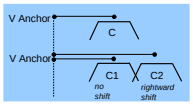
Competitive coupling structure in complex onsets; strong bonding

VCC

Weaker strength of sequential coupling (allows for more variation)

Measures





* Browman & Goldstein (1988), Byrd (1995); Nam (2007); Goldstein, Nam, Saltzman & Chitoran (2009); Marin & Pouplier (in press); Bombien et al. (in press); Hermes et al. (2008); Shaw et al. (2009).

Speech materials

- obstruent-sonorant clusters /kr, pr, kl, pl/
- single counterparts /k, p, r, l/

• word initial	/**kr**/asić	/**r**/abin	/**k**/adisz
• word final	WI/**kr**/	ti/**r**/	ti/**k**/

"Niech ona mówi krasić płynnie." *(Übersetzung)*

Recordings

- Acoustic & kinematic (EMMA) data
- Sensors placed on upper and lower lip, tongue tip, blade and dorsum
- 3 native speakers (Polish, standard variety)
- 672 tokens (3 speakers x 16 target words x 7 repetitions x 2 accent conditions)

Discussion

Gestural coordination

- Polish allows for complex onsets (c-center type coordination)
- Weaker coupling strength in word final position

Voicing of sonorants and obstruents

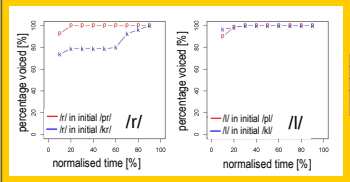
- Final devoicing can be accounted for by delinking of voicing feature (for Polish obstruents and sonorants)
- *Partial* devoicing of sonorant in word final position points to a lack of specification for voicing
  - Not [-voice]
- Evidence for privative feature [voice]
- Domain for final devoicing must include sonorant

Voicing Profiles

Percentage of voicing during sonorant production (normalised time)

word initial

CCV

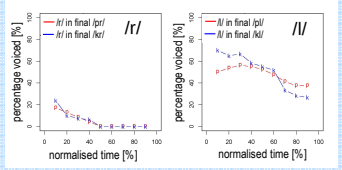


%	/kr/	/pr/	/kl/	/pl/
JSf	84	99	99	**99**
JSm	91	96	98	**80**
NL	100	98	98	**92**
mean	**92**	**98**	**98**	**90**

No devoicing of sonorant word initially.
(Partial) devoicing of sonorant in word final position.
Stronger devoicing in /r/-clusters than /l/-clusters, possibly due to aerodynamic factors (/r/ involves some friction)

word final

VCC



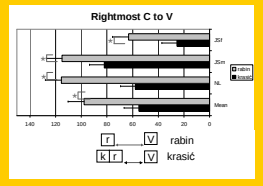
%	/kr/	/pr/	/kl/	/pl/
JSf	4	5	51	49
JSm	15	3	43	60
NL	22	22	29	43
mean	14	10	41	51

Gestural coordinaton C2

Does the consonant (adjacent to the vowel) shift towards that vowel to make room for the added C?

word initial

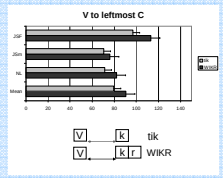
(C)**C**→**V**



Different timing patterns for C2:
Rightward shift in word initial position in all conditions, but *not* in word final position.
Evidence for onsethood.

word final

V←**C**(C)

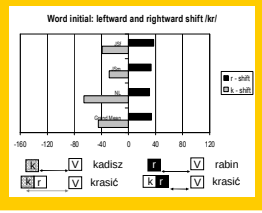


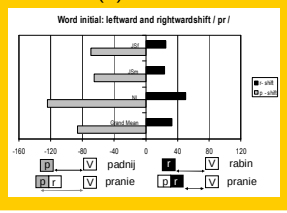
Gestural coordination C1 and C2

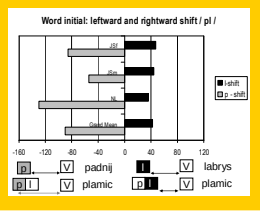
Is there a c-center-like coordination involving a rightward shift of C2 *and* a leftward shift of C1 in (C)CV and VC(C)?

word initial

←(C)**C**→**V**



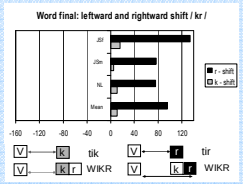


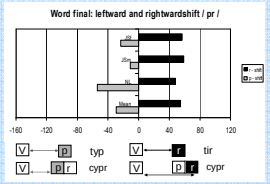


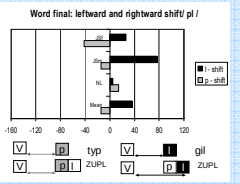
Word intially: c-center-like coordination for C1 (leftward shift) and C2 (rightward shift).
Word finally: Rightward shift for C2, no clear pattern for C1 (Honorof & Browman (1995); Nam, Goldstein & Saltzman (2009)).

word final

V←**C**(C)→







References: ✔ Bombien, L., Mooshammer, C., Hoole, P. & Kühnert, B. (in press). Prosodic and segmental effects on EPG contact patterns of word-initial German clusters. *Journal of Phonetics*. ✔ Browman, C.P. & L. Goldstein (1988). Some notes on Syllable Structure in Articulatory Phonology. *Phonetica* 45, 140-155. ✔ Byrd, D. (1995). C-centers revisited. *Phonetica* 52, 285-306. ✔ Goldstein, L., Nam, H., Saltzman E. & I. Chitoran (2009). Coupled oscillator planning model of speech timing and syllable structure. In: G. Fant et al. (eds). *Frontiers in Phonetics and Speech Science*, The Commercial Press. 239-250. ✔ Gussmann, E., 2007. *The Phonology of Polish.* Oxford University Press. ✔ Hermes, A., Grice, M., D. Mücke & H. Niemann (2008). Articulatory indicators of syllable affiliation in word initial consonant clusters in Italian. Proc. of the 8th *International Seminar on Speech Production*, Strasbourgh, France, 433-436. ✔ Honorof, D. & C. Browman (1995). The center or edge: How are consonant clusters organized with respect to the vowel? In: Elenius & Branderud (eds), Proc of the XIIIth ICPhS, Stockholm, 3, 552-555 ✔ Marin, S. & M. Pouplier (in press). Temporal organization of complex onsets and codas in American English: Testing the predictions of a gestural coupling model. *Journal of Motor Control*. ✔ Nam, H. (2007). Syllable-level intergestural timing model: Split-gesture dynamics focusing on positional asymmetry and moraic structure. In J. Cole & J. I. Hualde. *Laboratory Phonology* 9 (Phonology and Phonetics), 483-506. Berlin, New York: de Gruyter. ✔ Nam, H., Goldstein, L. & E. Saltzman (2009). Self-organization of syllable structure: a coupled oscillator model. In: F. Pellegrino et al, (eds). Approaches to phonological complexity, 299-328. ✔Rubach, J. (2008). Prevocalic faithfulness. *Phonology* 25(3), pp. 433-468. ✔Sieczkowska, J., Möbius, B., Schweitzer, A., Walsh, M. & G. Dogil (2009). Voicing profile of Polish sonorants: [r] in obstruent clusters. Proc. of *Interspeech*. Brighton, 2319-2322. ✔ Shaw. J., Gafos A., Hoole, P. & C. Zeroual (2009). Syllabification in Moroccan Arabic: evidence from patterns of temporal stability. Phonology 26, 187-215.