Conflicting forces of place and manner of articulation:
A reaction times study on Polish phonotactics

Paula Orzechowska
[1]*Adam Mickiewicz University, Poznań*

This paper discusses online processing of word-initial phonotactics in Polish. Cross-linguistic research on consonant clusters has demonstrated that online processing is largely sensitive to sonority violations (e.g. Pitt 1998, Moreton 2002, Berent et al. 2007) and place constraints (e.g. Frisch & Zawaydeh 2001). With these views in mind, words differing in terms of the place of articulation and manner of articulation properties are expected to be processed differently. In Polish, the processing of sonority was investigated in terms of ERPs (Wagner et al. 2012, Wiese et al. 2017). However, no studies we are aware of have tested the online processing of consonant clusters in Polish explicitly in terms of reaction times (RTs), and – what os more – using constraints related to the place of articulation.

The experiment explores the psycholinguistic reality of three factors which can be potentially relevant in the processing of word-initial consonant clusters: (1) *cluster existence*, (2) *phonological well-formedness* and (3) *phonetic distance*. Existence distinguishes between clusters that are found in real (existent) or hypothetical words (non-existent). Well-formendness specifies whether CCs follow the *Sonority Sequencing Generalization* (well-formed) or violate it (ill-formed). Examples of clusters used as stimuli are presented below.

	Existent	Non-existent
Well-formed	tr lj gm	nr dʒm tsx
Ill-formed	ɕtɕ lv sk	mz lk jm

Additionally, for each of the conditions, target CCs were further subcategorized depending on the distances in place of articulation between constituent consonant along the following 7-point scale: bilabial–labio-dental–dental–alveolar–alveolo-palatal–palatal–velar. The distance of 0 holds between consonants sharing the place features (e.g. /dl ɕtɕ/), while the distance of 6 specifies extreme articulations (e.g. /gm kp/). Target clusters were embedded in monosyllabic nonce words of the structure CCVC, where VC suffixes involved /es/, /ot/, /um/. The total of 252 nonce stimuli were presented to subjects auditorily. 38 native speakers of Polish (average age: 21, 33 women) took part in the experiment. The subjects were requested to indicate whether the words they heard sounded as if they could exist in Polish by pressing a 'yes' or 'no' keyboard button. The data was recorded with the *E-Prime* software.

The statistical analysis involved running the quantile regression (Fasiolo et al. 2017). Two types of data were analysed. First, response latencies are affected by the place of articulation distances. The processing of clusters with medial distances (2–4) is cognitively most costly (the longest reaction times). Larger distances (5-6) entail shorter RTs, and therefore facilitate processing. Interestingly, no statistically significant results were obtained existence and sonority. The study demonstrates that speakers are sensitive neither to the distinction between words with real and hypothetical consonant sequences nor to sonority violations. However, the findings lend support to the principle of the clarity of perception according to which contrast facilitates perception. As regards behavioural data, accuracy rates are affected by the interaction between sonority and existence. This result suggests that sonority is consulted when intuitive judgements is made on new words.

Overall, the results show that although sonority is evoked by native speakers of Polish in the decision making process, the processing of phonotactics is governed by principles other than sonority, i.e. related to the place of articulation. Generally, we conclude that sonority (based on the manner features) does not suffice as a generalizing principle in a phonotactically elaborate language such as Polish.

[1] Berent, I., D. Steriade, T. Lennertz, and V.Vaknin. 2007. What we know about what we have never heard: Evidence for perceptual illusions. *Cognition* 104 (3): 591-630.

[2] Fasiolo, M., Y. Goude, R. Nedellec, and S. N. Wood. 2017. Fast calibrated additive quantile regression . Manuscript. Bristol: University of Bristol.

[3] Moreton, E. 2002. Structural constraints in the perception of English stop-sonorant clusters. *Cognition* 84 (1): 55-71.

[4] Pitt, M. 1998. Phonological processes and the perception of phonotactically illegal consonant clusters. *Perception and Psychophysics* 60 (6): 941-951.

[5] Wagner, M., M. Brett, V. L. Shafer, and M. Steinschneider. 2012. The phonotactic influence on the perception of a consonant cluster /pt/ by native English and native Polish listeners: A behavioral and event related potential (ERP) study. *Brain and Language* 123: 30-41.

[6] Wiese, R., P. Orzechowska, P. Alday, and C. Ulbrich. 2017. Structural principles or frequency of use? An ERP experiment on the learnability of Polish consonant clusters. *Frontiers in Psychology – Auditory Cognitive Neuroscience* 7: 2005.