# Phonetic detail needs phonological representations: Why phonology is not all computation.

**Problem**

Most current phonological accounts couched in Optimality Theory (Prince & Smolensky 1993) derive outputs from letter-like inputs thanks to a matrix of ordered/weighted constraints. I contend here that even the best computational models, such as Bi-Phon (Boersma & Hamann 2009), need more complex phonological representations.

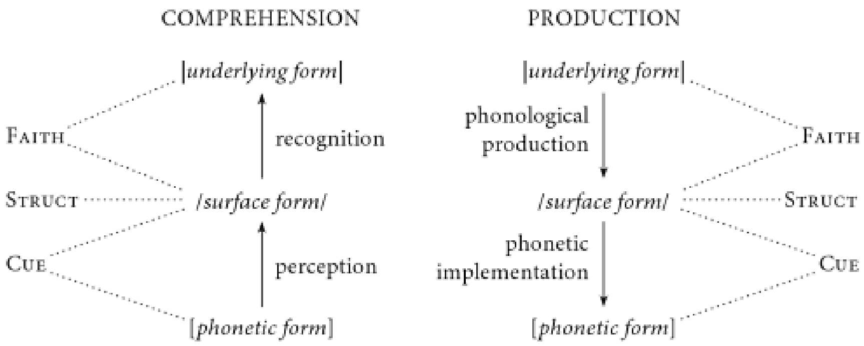



**Figure 1.** A single model for L1 processing as well as loanword adaptation

In this model, the same three types of constraints are used to account for comprehension and production. Among them, CUE handle the computation of phonetic forms into surface forms and vice-versa. They are especially useful to account for possible effects of "phonetic detail" in perception: phonetic forms are represented through very fine-grained transcriptions; one only needs to include the appropriate CUE constraint in the model to capture specific phonetic, non-phonemic, characteristics.

Boersma & Hamann (2009) show how such details – in their study, the release burst – can thus be accounted for (on the necessity to include the burst in the phonology, see Kang 2003, Hutin 2018): They include a symbol for the burst in the phonetic form and a constraint in the phonology of Korean: *[burst]/C./ ("released consonants cannot be perceived as codas").

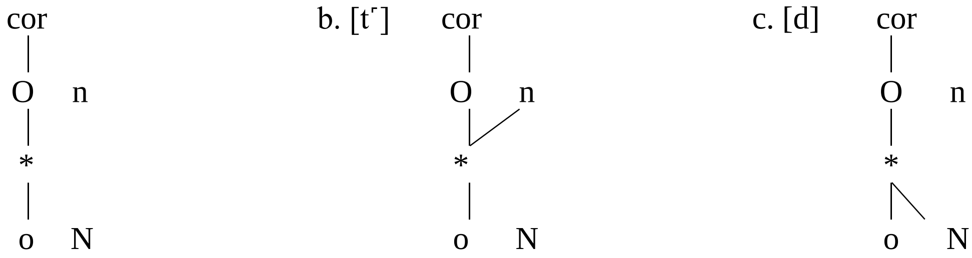
In this proposal, albeit embedded in the model, bursts remain phonetic detail. However, adult perception is known to be based on the phonological categories speakers are used to, i.e. on their representations (on *Phonological Deafness*, see Polivanov 1931, Liberman et al. 1957, Werker & Tees 1984, Rivera-Gaxiola et al. 2005, etc.). It is therefore arbitrary to postulate a constraint in perception against released codas if released codas do not rely on any kind of underlying representation. I contend that the constraint proposed by the authors can be motivated by a specific representation of bursts, that also makes predictions on independent facts.

**Proposal**

Boersma & Hamann (2009) build their demonstration on the fact English CVC˺ and CVCʳ are differentially adapted in Korean as CVC and CVCɨ respectively. The adequation between burst and epenthetic vowel suggests bursts will be best modelled as properties of the syllable.

In this regard, the contour-based version of Strict-CV theory (Carvalho 2014, 2017) seems interesting. It uses coplanar structures involving strictly alternating O and N positions, with timing slots at the interface of the C- and V-planes. ON transitions formalize syllabic effects such as length and VOT. In this model, the burst can be described as a minimal transition between O and n, the mirror-image of N on the consonantal tier (2b).

(2) a. [t˺] b. [t˹] c. [d]




With this model, the ban on released codas simply requires a constraint preventing an empty nucleus from sharing a slot with its onset. Interestingly, this also accounts for the facts that voiced codas in English (2c) also trigger epenthesis in Korean, and that, in Korean, there are no tautosyllabic clusters and laryngeal features in coda position are neutralized. Also, this can explain why, in English, released codas are more marked after lax vowels (Lisker 1999).

In conclusion, adding representations to a computational model is useful to: motivate the CUE constraints, and formulate more general constraints that make the model more economical.

[497 words]

**References**


Boersma, P. & Hamann, S. 2009. Loanword adaptation as first-language phonological perception. Andrea Calabrese & W. Leo Wetzels (eds.), *Loanword phonology*, 11-58

Carvalho, J. Brandão de. 2014, C/V interactions in Strict CV. S. Bendjaballah, N. Faust, M. Lahrouchi & N. Lampitelli (eds.), *The form of structure, the structure of form. Essays in honor of Jean Lowenstamm*. Amsterdam: John Benjamins, 123-138

Carvalho, J. Brandão de. 2017. Deriving sonority from the structure, not the other way round: A Strict CV approach to consonant clusters. *The Linguistic Review* 34, 589-614

Hutin, M. 2018. *La détente syllabique et ses implications phonologiques*. Ph.D. dissertation, Université Paris 8

Kang, Y. 2003. Perceptual similarity in loanword adaptation: English post-vocalic final stops in Korean, *Phonology* 20, 219-273. Cambridge University Press

Liberman AM, Harris KS, Hoffman HS, Griffith BC. 1957. The Discrimination of Speech Sounds within and across Phoneme Boundaries. Journal of Experimental Psychology 54 (5): 358-368

Lisker, L. 1999. Perceiving final voiceless stops without release: effects of preceding monophthongs versus nonmonophthongs. *Phonetica* 56, (1-2), 44–55

Polivanov, E. 1931. La perception des sons d’une langue étrangère. TCLP 4:79–96

Prince, A., and Smolensky, P. 1993. *Optimality Theory: Constraint interaction in generative grammar*. Technical Report CU-CS-696-93, Department of Computer Science, University of Colorado at Boulder.

Rivera-Gaxiola, M., Silva-Pereyra, J., Kuhl, P. K. 2005. Brain potentials to native and non-native speech contrasts in 7- and 11-month-old American infants. *Developmental Science* 8 (2): 162-172

Werker, J. F. & Tees, R. C. 1984. Cross-language speech perception: Evidence for perceptual reorganization during the first year of life. *Infant Behavior & Development 7*(1), 49-63