

SYLLABIFICATION, VARIATION AND PERCEPTION

Marie-Hélène Côté, Université d'Ottawa

Syllabification is usually taken to be a categorical process in phonology. This is, however, in contradiction with a variety of experimental results, which suggest a more fluid syllabification, with consonants being variably associated with the preceding segment (coda), the following one (onset) or both (ambisyllabicity). The phonetic literature also stresses the difficulty in finding stable phonetic correlates for syllable boundaries or constituents; recent work (e.g. Krakow 1999) rather suggests the existence of cues to the syllabic affiliation of consonants. These gaps between theory and experimental data may be interpreted in at least three ways: (1) the syllable is not a relevant theoretical concept (Kohler 1966; Angoujard 1997); (2) the gaps reflect a distinction between different levels of syllabification (phonetic and phonological) (Selkirk 1982; Itô 1986); (3) the experimental results do not reflect the subjects' syllabification rules.

I would like to explore a more direct approach to syllabification that bridges the gaps between the phonological, phonetic and psycholinguistic results. I consider that syllabification is a gradient surface process and that the (intra- and inter-speaker) variation observed is real and linguistically relevant. Syllabification does not consist in localizing syllable boundaries, which have no phonological status, but in identifying syllable peaks (sonority maxima) and determining to what extent each surrounding consonant associates with the preceding and following segments. More specifically, I suggest that the syllabic affiliation of consonants depends in large part on a principle of perceptual dependency, according to which the syllabic affiliation of a consonant is a function of the degree of perceptual dependency between it and each of its adjacent segments. This perceptual principle interacts with other known factors related to word margins (Steriade 1999; Berg & Niemi 2000; Martens et al. 2002), morpheme structure and rhythm (tendency to equalize syllable duration; Maddieson 1985). This principle also accounts for and unifies a number of tendencies observed in syllabification:

- Consonants tend to associate with the following segment more than the preceding one, as a consequence of a perceptual asymmetry between onsets and offsets of acoustic signals (Bladon 1986; Delgutte 1997; Wright 2004). The onset maximization principle, including the unmarked status of CV, and the syllable contact law (Vennemann 1988) may be interpreted as following from this tendency. Interestingly, Tabain & al. (2004) observe that the CV-VC asymmetry is more pronounced in English than in Arrernte, a language exceptionally analyzed as VC (Breen & Pensalfini 1999).
- Consonants are attracted to more salient segments, which provide stronger perceptual cues: vowels more than other consonants, stressed vowels more than unstressed ones, phonetically longer vowels more than shorter ones (Treiman & Danis 1988 ; Ishikawa 2002 ; Redford & Randall 2005).
- Sonorants appear more easily than obstruents in coda position (Clements 1990 ; Barry et al. 1999 ; Zamuner & Ohala 1999 ; Content et al. 2001 ; Ishikawa 2002), as a result of coarticulation between a sonorant and a preceding vowel being more salient than coarticulation between an obstruent and a preceding vowel. Among obstruents, stops associate with the preceding vowel more than fricatives, due to their weaker internal cues that make them more dependent upon contextual cues. Among stops, Delattre (1940) further notices a contrast between intervocalic [pt] (*reptile*) and [kt] (*recteur*) in French, [p] appearing more readily than [k] in the following onset, possibly for reasons related to the perceptibility of stop release.

It remains to be seen to what extent this approach to syllabification is compatible with the phonological processes that have been claimed to depend on syllable constituents or boundaries. The role of the syllable in phonotactic processes has already been questioned (Steriade 1999 ; Côté 2000 ; Blevins 2003 ; McCrary 2004). Otherwise, the approach outlined here is compatible with processes that depend on the number of syllables (or peaks), as well as the distinction between closed and open syllables and heavy and light syllables.

- Angoujard, J-P. (1997) *Théorie de la syllabe : rythme et qualité*, Paris : CNRS Éditions.
- Barry, W., C. Klein & S. Köser (1999) Speech production evidence for ambisyllabicity in German, *Phonus* 4 : 87-102 (Institute of Phonetics, University of the Saarland).
- Berg, T. (2001) An experimental study of syllabification in Icelandic, *Nordic journal of linguistics* 24 : 71-106.
- Berg, T. & J. Niemi (2000) Syllabification in Finnish and German: onset filling vs. onset maximization, *Journal of phonetics* 28 : 187-216.
- Bladon, A. 1986. Phonetics for hearers, in G. McGregor (eds.) *Language for hearers*, Oxford : Pergamon Press, 1-24.
- Blevins, J. (2003) The independent nature of phonotactic constraints : an alternative to syllable-based approaches, in C. Féry & R. Van de Vijver (eds.) *The syllable in Optimality Theory*, Cambridge : Cambridge University Press, 375-403.
- Breen, G. & R. Pensalfini (1999) Arrernte: a language with no syllable onsets, *LI* 30 : 1-25.
- Clements, G.N. (1990) The role of the sonority cycle in core syllabification, in J. Kingston and M.E. Beckman (éd.) *Between the grammar and physics of speech*, Cambridge : Cambridge University Press, 283-333.
- Content, A., R.K. Kearns & U.H. Frauenfelder (2001) Boundaries versus onsets in syllabic segmentation, *Journal of memory and language* 45 : 177-199.
- Côté, M.-H. (2000) *Consonant cluster phonotactics : a perceptual approach*, PhD thesis, MIT.
- Delattre, P. (1940) Tendances de coupe syllabique en français, *Publications of the Modern Language Association of America* 55 : 579-595.
- Delgutte, B. (1997) Auditory neural processing of speech, in W.J. Hardcastle & J. Laver (eds.) *The handbook of phonetic sciences*, Oxford : Blackwell, 507-538.
- Fallows, D. (1981) Experimental evidence for English syllabification and syllable structure, *Journal of linguistics* 17 : 309-317.
- Ishikawa, K. (2002) Syllabification of intervocalic consonants by English and Japanese speakers, *Language and speech* 45 : 355-385.
- Itô, J. (1986) *Syllable theory in prosodic phonology*, PhD thesis, UMass, Amherst.
- Kohler, K.J. (1966) Is the syllable a phonological universal ? *Journal of linguistics* 2 : 207-208.
- Krakov, R. (1999) Physiological organization of syllables : a review, *Journal of phonetics* 27 : 23-54.
- Maddieson, I. (1985) Phonetic cues to syllabification, in V.A. Fromkin (eds.) *Phonetic linguistics*, Orlando : Academic Press, 203-221.
- Martens, E., W. Daelemans, S. Gillis & H. Taelman (2002) Where do syllables come from ? In W. Gray & C. Schunn (eds.) *Proceedings of the Twenty-Fourth Annual Conference of the Cognitive Science Society*, Fairfax, VA : George Mason University, 657-664.
- McCrary, K.M. (2004) *Reassessing the role of the syllable in Italian phonology : an experimental study of consonant cluster syllabification, definite article allomorphy and segment duration*, PhD thesis, UCLA.
- Redford, M.A. & P. Randall (2005) The role of juncture cues and phonological knowledge in English syllabification judgments, *Journal of phonetics* 33 : 27-46.
- Steriade, D. (1999a) Alternatives to syllable-based accounts of consonantal phonotactics, in O. Fujimura, B.D. Joseph & B. Palek (eds.) *Proceedings of LP '98: Item order in language and speech*, Prague: Charles University in Prague - The Karolinum Press, vol. 1: 205-245.
- Steriade, D. (1999b) Phonetics in phonology: the case of laryngeal neutralization, in M.K. Gordon (éd.) *UCLA Working Papers in Linguistics* 2, *Papers in Phonology* 3, 25-246.
- Tabain, M., G. Breen & A. Butcher (2004) VC vs. CV syllables : a comparison of Aboriginal languages with English, *Journal of the International Phonetic Association* 34 : 175-200.
- Treiman, R. & C. Danis (1988) Syllabification of intervocalic consonants, *Journal of memory and language* 27 : 87-104.
- Vennemann, Theo (1988) *Preference laws for syllable structure and the explanation of sound change*, Berlin : Mouton de Gruyter.
- Wright, R.A. (2004) A review of perceptual cues and cue robustness, in B. Hayes, R. Kirchner & D. Steriade (éd.) *Phonetically based phonology*, Cambridge : Cambridge University Press, 34-57.
- Zamuner, T.S. & D.K. Ohala (1999) Preliterate children's syllabification of intervocalic consonants, in A. Greenhill et al. (éd.) *BUCLD 23 Proceedings*, Somerville, MA : Cascadilla Press, 753-763.