For the importance of fine-grained phonetic detail in phonology

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Phonology can be defined as the cognitive ability to organize the sounds of a language into abstract categories, where phonemes are ideal concepts clearly separated from their phonetic realizations. However, if recent studies have tried to re-consider the relationship between phonetics and phonology (i.e. Kingston, 2007), little has been said about fine-grained phonetic detail, viz. the articulatory and/or acoustic, non-phonemic information that is to be found in phonetic inputs.

In this abstract, we would like to make a case for the importance of what has been commonly called "fine-grained phonetic detail", asserting that it is in fact no detail. It can be of paramount importance to model data in phonology or to explain phonological processes. Two arguments shall be presented to enlighten how phonetics informs phonology: one from data in first language acquisition and one in loanword phonology. In both cases, an external input is treated by a specific matrix to create a licit output. Our claim is that this matrix draws its content from low-level information.

In the acquisition of French 'liaison', a phonetic detail as the length of the vowel and the consonant involved in this phonological process is a cue to determine their phonological status. The Liaison consists in the surfacing of a latent segment – liaison consonant (LC) – that is resyllabified in the following noun starting with a vowel (e.g. *les* [le], en. *the* + *ours* [uʁs], en. *bears* → *les[z]ours* [le.zuʁs], en. *the bears*). The phonological-autosegmental model uses a LC which is a floating segment, with respect of both the segmental and syllabic tiers (Fig. 1., Encrevé, 1988). Nonetheless liaison causes many infant difficulties in French speech segmentation that seem vanished at 6 years of age, when children acquire this double-floating nature of the LC autosegment (Wauquier, 2009). To find out some evidences of this underlying representation, we analyze 43 French children's productions (M 6; 3) in a picture naming task. In the task, we propose 18 couples of cards depicting the same animal or object but differing in number (one vs. many). The interviewer names the first card producing an elision (e.g. *l'ours* [luʁs], en. *the bear*) then asks the child to name the second card in order to produce the plural and so the liaison (e.g. *les[z]ours* [le.zuʁs], en. *the bears*) and vice-versa (interviewer's input: liaison *les[z]oreillers*, [le.zɔ.ʁɛ.je], en. the pillows → child's production: elision *l'oreiller* [lɔ.ʁɛ.je], en. *the pillow*). The test items alternate at random with fillers that don't require productions of liaison or elision (e.g. interviewer's input: *les gateaux* [le gɑ.to], en. *the cakes* → child's production: *le gateau* [lə gɑ.to], en. the cake). The results show that when it's asked to produce an elision [lɔ.ʁɛ.je] (en. the pillow) from a liaison [le.zo.ʁɛ.je] (en. *the pillows*), children product the same percentage of (1) good answers as [lo.ʁɛ.je] (32%) and of (2) sequences that preserve the LC at the beginning of the noun as [lə-zo.ʁɛ.je] (33%). We analyze these children's productions through the software PRAAT and we discover:

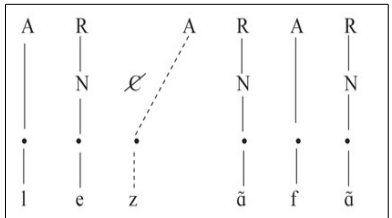

Fig. 1. Autosegmental representation of French liaison in *les enfants*, en. *the children* (Encrevé, 1988)

- in (2), the LC [z] doesn't make any difference in length from the LC in the correct production of liaison as *les ours* [le.zuʁs], en. *the bears*.
- However, the vowel [ə] is in average longer (198ms and 178ms) in (2) than in non-liaison sequences as in the filler *le gateau,* [lə gɑ.to], en. *the cake* (150ms).

The length of the vowel in wrong elision productions is evidence of the underlying phonological representation of liaison at 6 years of age, where LC is a floating segment. The skeletal position and the segmental content of LC are preserved and the LC itself is floating from the segmental and the syllabic tiers: in the segmental tier it causes the lengthening of the

previous vowel, as it happens for the vowel in liaison (Nguyen et al. 2007) and doesn't happen between separated words where the consonant is the lexical onset of the noun (e.g. *le gateau* [lə gɑ.to], en. *the cake*); in the syllabic tier it fills the onsetless syllable and avoid hiatus, preventing the elision process.

A second argument can be found in Korean loanword phonology, where phonetic detail such as a release burst can be held responsible for a phonological process, i.e. epenthesis. It has been commonly assumed that the release burst which is sometimes realized after the coda in English should be responsible for the insertion of a final vowel in Korean, as follows:

English		Korean	vs.	English		Korean
ˌækəˈdɛmɪkˀ	>	akʰademikˀ		ˈplɑːkˠ	>	pʰɨʟʟɑkʰɨ
ˈnɪpˀ	>	nipˀ		ˈpaɪpˠ	>	pʰaipʰɨ
ˈfætˀ	>	pʰætˀ		ˈfruːtˠ	>	pʰɨʟutʰɨ

Among some others, Kang (2003) and Boersma & Hamann (2009) give interesting analyses of that fact. But none of the authors cared to *prove* that release burst was actually the reason for epenthesis. Indeed, several exceptions are to be found: Some English items which would be expected to release their final codas do not undergo final epenthesis in Korean (en. *hotcake* [ˈhɑtˌkeɪkˠ] > ko. [hɑtˀkʰeikˀ]) and, conversely, English items which would be expected not to release their final codas do undergo epenthesis in Korean (en. *audit* [ˈɔdɪtˀ] > ko. [oditʰɨ]). That variation is problematic because it means that there is no strict causality between release burst in English and epenthesis in Korean. However, in a more recent 2000-item database, we used other cues (tenseness of the preceding vowel, point of articulation of the coda and stress pattern) to calculate the probability of the release burst for each item, assigning them a "Release Burst Index" (RBI). We showed that release burst after post-vocalic codas in English was indeed *statistically correlated* with final vowel insertion in Korean (r^2=0.9441).

As a conclusion, one has to grant fine-grained phonetic detail the importance it has. Taking it into consideration allows us to support otherwise acceptable phonological models with more accuracy by giving concrete evidence through phonetic data. Given the important effects it can have, low-level information should be modelled into phonology since we believe it can provide interesting feedback to Strict-CV Phonology (Lowenstamm, 1996) and especially the way it deals with timing.

References

BOERSMA, P. & HAMANN, S., 2009. "Loanword adaptation as first-language phonological perception", in Andrea Calabrese & W. Leo Wetzels (eds.), *Loanword phonology*, 11-58. Amsterdam: John Benjamins

ENCREVÉ, P., 1988. La Liaison avec et sans enchaînement, Phonologie tridimensionnelle et usage du français, Paris: Éditions du Seuil

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

KIM, H., 1998. "A phonetic Characteristics of Release and Nonrelease: The Case of Korean and English", in *Language Research* Vol. 34, n° 2

KINGSTON, J., 2007. "The phonetics-phonology Interface" in Paul de Lacy (ed.) *The Cambridge Handbook of Phonology*. Cambridge University Press, pp. 435-456

LOWENSTAMM, J., 1996. `CV as the Only Syllable Type', in *Current Trends in Phonology Models and Methods*, Jacques Durand & Bernard Laks (eds.), European Studies Research Institute, University of Salford, pp. 419-442.

WAUQUIER, S., 2009. Acquisition de la liaison en L1 et L2 : stratégies phonologiques ou lexicales?, Aile, Lia 2, 93-130

NGUYEN, N., WAUQUIER-GRAVELINES, S., LANCIA, L., TULLER, B., 2007. Detection of liaison consonants in speech processing in French: Experimental data and theoretical implications. In Pilar Prieto; Joan Mascaró; Maria-Josep Solé (eds.) Segmental and Prosodic Issues in Romance Phonology. (Current Issues in Linguistic Theory; 282). Amsterdam: John Benjamins. 2007, p. 3-23