# A THEORY OF SUBFEATURAL REPRESENTATIONS IN PHONOLOGY

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## 1. INTRODUCTION

❖ **"Phonological teamwork"** (Lionnet in prep.): two segments aspiring to trigger the same phonological process (here assimilation), but too weak to trigger it on their own, may "join forces" and together pass the threshold necessary for that process to occur.

❖ Two logical ways of dealing with such phenomena:

- **Grammatically derived**: ganging up of weak grammatical constraints, each of which wants a categorical assimilation
  - Local Constraint Conjunction, e.g. Suzuki (1997)
  - Harmonic Grammar, e.g. Lionnet (2015)
  - ➢ PROBLEM: do not account for phonetic effects to be shown here → overprediction
- **Phonetically grounded**: ganging up of weak phonetic effects to make a single strong influence (e.g. Flemming 1997, 2002)
  - ➢ "Stabilization problem" (Hayes and Steriade 2004:7)

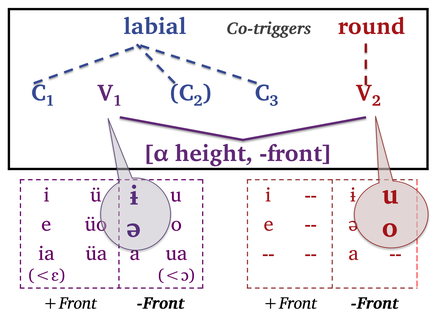
❖ Here: second option explored

- Data: Laal doubly triggered rounding harmony
- Coarticulatory effects are relevant to phonology
- Coarticulatory effects are entirely phonologized
  → Strict separation between phonetics & phonology
- SUBFEATURAL level of representation: captures distinctive but featurally identical categories that are visible to the phonological grammar.

## 2. DATA: LAAL

❖ **Laal:** isolate, ca. 750 speakers, two villages, southern Chad

❖ Doubly triggered rounding harmony:




**(1) $V_2$ [rd] , Lab, Height, -Front > Rounding:**

a. /ɓɨr + -ú/ > **ɓùr-ú** 'hook-pl'
b. /təb + -ó/ > **tòb-ó** 'fish(sp.)-pl'
c. /cîrm- + -ú/ > **cúrm-ú** 'tree(sp.)-pl'
d. /páb + -ó/ > **pób-ó** 'cobra-pl'

**(2) No Rounding:**

| | | | | |
|---|---|---|---|---|
| a. | /gōbōr/ | > gōbōr | 'cloud' | $V_1$ [rd] , *$V_2$ [rd] |
| b. | /pîrmîn/ | > pîrmîn | 'dust' | *$V_2$ [rd] |
| c. | /gîn + -ù/ | > gîn-ù | 'net-pl' | *Lab |
| d. | /ɓər + -ú/ | > ɓər-ú | 'plant.sp-pl' | *Height |
| e. | /bìrú / | > bìrú | 'burn' | *-Front |

## 3. A PHONOLOGICAL ALTERNATION

❖ Opacity of intervening /w/:

**(3)**

| | *Sg.* | | *Pl. suffix = -o* |
|---|---|---|---|
| a. | wàár | 'genet' | wòòr-ó |
| b. | gâw | 'hunter' | gə́w-ó |
| | gàw | 'elephant trap' | gə̄w-ō |
| | jàw | 'cheetah' | jə̀w-ó |
| | māw | 'scorpion' | mə́w-ó |
| | sàw | 'fish sp.' | sə̄w-ō |
| | sə́w | 'warthog' | sə́w-ò |
| | táw-ál | 'shield' | tə́w-ò |
| | jāgw-ā | 'hat' | jə́gw-ó |

❖ Morphologically conditioned (affix-type specific):

- Number-marking affixes: Doubly triggered rounding harmony
- Other affixes: systematic and unconditional Rounding harm.

(4)

| | | | | |
|---|---|---|---|---|
| a. | /tír + -ùn/ | túr-ùn | 'put her across' | *Lab |
| b. | /dəg + -òn/ | dòg-òn | 'drag her' | *Lab |
| c. | /dəg + -nŭ/ | dòg-nŭ | 'drag us (ex.)' | *Lab, *Height |
| d. | /léér + -nŭ/ | lùóór-nŭ | 'wrap us' | *Lab, *Height, *-Front |

## 4. SUBFEATURES

❖ Featural level: binary contrast

- [+round] /ü, üo, üa, u, o, ua/
- [-round] /i, e, ia, ɨ, ə, a/

❖ Subfeatural level: multi-level scale

- ⟦0 round⟧ [i, e, ia, ɨ, ə, a]
- ⟦.5 round⟧ [ɨᵇ, əᵇ]
- ⟦1 round⟧ [ü, üo, üa, u, o, ua]

❖ Subfeatural distinction without featural contrast:

- [ɨ, ə]: [-round] ⟦0 round⟧
- [ɨᵇ, əᵇ]: [-round] ⟦.5 round⟧

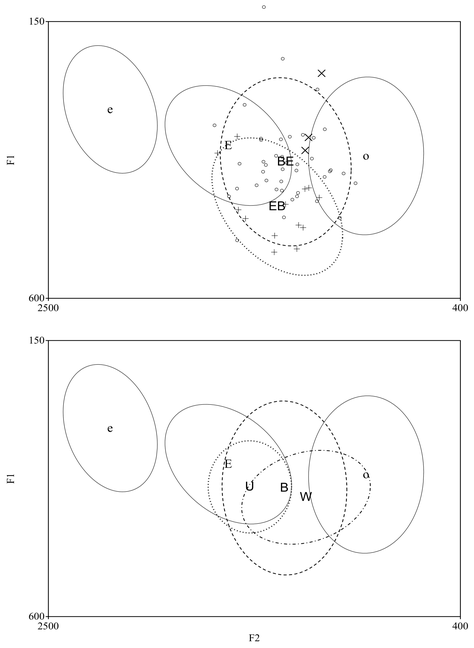
❖ Word-level rounding harmony targets all [-round] vowels, no reference to subfeatural level

❖ Stem-level rounding harmony

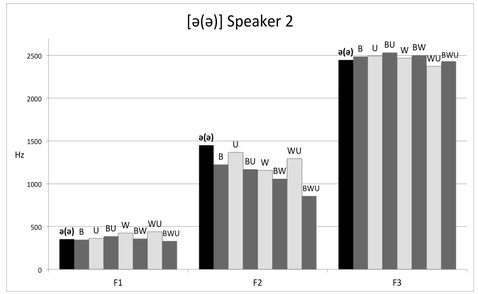
- targets only ⟦.5 round⟧ vowels
- parasitic on height and backness

❖ Any theory of parasitic vowel harmony can account for the Laal doubly triggered rounding harmony, if it is allowed to refer to subfeatural representations.

## 5a. PHONETIC UNDERPINNINGS




## 5b. PHONETIC UNDERPINNINGS




| | *Average* $\Delta_{F2}$ | *Significance* |
|---|---|---|
| $\Delta_{F2}$(ɨ, ɨᵇ) | 399 Hz | $p < 2.2 \times 10^{-16}$ |
| $\Delta_{F2}$(ə, əᵇ) | 286 Hz | $p < 4.3 \times 10^{-5}$ |
| $\Delta_{F2}$(ə, ə-o/u) | 110 Hz | $p = 0.11$ |

❖ Labial consonant = significant lowering of F2

❖ No effect on F3

❖ No effect of following round vowel

❖ Conclusion Specific realzation of /ɨ, ə/ = [ɨᵇ, əᵇ] next to labial C:

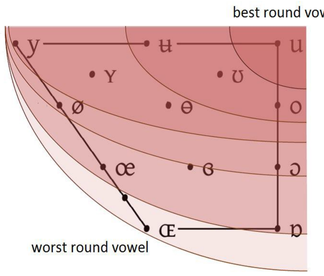
- [ɨ, ə] and [ɨᵇ, əᵇ] are perceptually distinctive
- Not pure coarticulation (F2 ≠ F3)

## 6a. IMPLICATIONS AND CONCLUSION

❖ **Solving the "stabilization problem"** (Hayes & Steriade 2004:7)

- Subfeatures = purely phonological representations, phonologized phonetic information
- Reification of PHONETIC KNOWLEDGE (Kingston and Diehl 1994), at the basis of Markedness constraints according to Hayes and Steriade (2004:1)

❖ **Representing enhancement**




(cf. Kaun 2004, Terbeek 1977, Linker 1982, Stevens 1998)

| *Rounding continuum* | *Subfeatural scale* | *Featural scale* |
|---|---|---|
| u | ⟦3 round⟧ | [+round] |
| o | ⟦2 round⟧ | |
| ua | ⟦1 round⟧ | |
| ɨᵇ, əᵇ | ⟦.5 round⟧ | [-round] |
| ɨ, ə, a | ⟦0 round⟧ | |

## 6b. IMPLICATIONS AND CONCLUSION

- No necessity for phonetically grounded abstract relations between redundant and distinctive features (Stevens *et al.* 1986).
- Subfeatural scale results from the phonologization of phonetic enhancement relations → does not refer to those relations anymore, and does not impose any reference to an abstract relation between phonological features.

❖ **Enriching phonology with subfeatural representations:**

- Quantal perceptual representations → fine-grained representation of coarticulatory effects in phonology
- In keeping with phonetically grounded approaches
  - ➢ without abandoning the separation of phonology and phonetics
- In keeping with proposals such as Inkelas and Shih's (2014) Q theory (also Steriade's (1993) Aperture Theory)
  - ➢ Q = three subsegments q1, q2, q3 (e.g. /t/ = t1, t2, t3)
- Subdividing features account for facts that question the validity of both
  - ➢ the binary *diktat* in feature theory (without abandoning binary features)
  - ➢ the very definitions of PHONEME that phonologists have been working with for decades.

**REFERENCES**


Flemming, Edward S. 1997. Phonetic Detail in Phonology: Towards a unified account of assimilation and coarticulation. In Suzuki, K. and D. Elzinga (eds.), *Southwest Workshop on Optimality Theory: Features in OT (SWOT),* Coyote Papers.

Flemming, Edward S. 2002. *Auditory Representations in Phonology*. New York & London: Routledge.

Hayes, Bruce and Donca Steriade. 2004. Introduction: the phonetic bases of phonological Markedness. In Hayes, Bruce et al. (eds.), Phonetically Based Phonology. Cambridge: CUP. 1-33.

Hayes, Bruce, Robert Kirchner and Donca Steriade. 2004. Phonetically Based Phonology. Cambridge: CUP

Kaun, Abigail. 2004. The typology of rounding harmony. In B. Hayes et al. (eds.), *Phonetically Based Phonology*. 2004. Cambridge: CUP.

Linker, Wendy. 1982. Articulatory and acoustic correlates of labial activity in vowels: A cross-linguistic study. Doctoral dissertation, UCLA. Published in *UCLA Working Papers in Phonetics* 56.

Lionnet, Florian. In preparation. *Phonological Teamwork: A Typology and Theory of Cumulative Effects in Phonology*. Ph.D. dissertation. University of California, Berkeley.

Lionnet, Florian. 2015. Phonological teamwork as cumulative markedness: a Harmonic Grammar account. Poster presented at WCCFL 33, Vancouver, Mar. 27 – 29, 2015.

Suzuki, Keiichiro. 1997. Double-sided Effects in OT: Sequential Grounding and Local Conjunction. In Suzuki, K. and D. Elzinga (eds.), *Proceedings of the 1995 Southwest Workshop on Optimality Theory: Features in OT* (SWOT), Coyote Papers.

Steriade, Donca. 1993. *Closure, release, and nasal contours*. San Diego: Acaemic Press.

Stevens, Kenneth. 1998. Acoustic Phonetics. Cambridge (Mass.): MIT Press.

Terbeek, Dale. 1977. A cross-language multidimensional scaling study of vowel perception. PhD dissertation, UCLA. Published in *UCLA Working Papers in Phonetics* 37.