Gradient Representations: a new insight into Tuscan Gorgia and Raddoppiamento

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In a nutshell I propose a new analysis of *Raddoppiamento fonosintattico* (RF) and *Gorgia* by considering them as, respectively, strengthening and undershoot. I aim at a unified explanation for the different phonetic realizations of a single underlying phoneme in different contexts:

(1) a. /in/ /ˈ**k**asa/ 'in (the) house' → [iŋˈ**k**a:za] *"default" realization*
b. /la/ /ˈ**k**asa/ 'the house' → [laˈ**x**a:za] *Gorgia*
c. /a/ /ˈ**k**asa/ 'at home' → [aˈ**k:**a:za] *Raddoppiamento Fonosintattico*

This approach has a higher empirical adequacy than previous accounts, since it considers the length distinction between these derived segments and the corresponding default realization of the underlying segment. RF-segments are not geminates, lenited allophones are not underlyingly fricatives: they are segments equipped with different degrees of phonological strength. Data comes from Florentine and the analysis is couched in the framework of *Gradient Symbolic Representations*.

Raddoppiamento fonosintattico RF (Loporcaro 1997) is a word-boundary gemination process of Standard Italian. The initial consonant of WORD_2 in the string WORD_1-WORD_2 is lengthened if:

(2) WORD_1 is an item of a closed lexical set:
/ˈkome/ /ˈva/ → [ˈkoːmeˈ**v:**a] 'how are you?'

(3) WORD_1 is stressed on the final syllable:
/ʧiˈt:a/ /ˈ**k**ara/ → [ʧiˈt:aˈ**k:**a:ra] 'dear town'

Lexical RF (2) is due to a final consonant in the historically earlier form of WORD_1(Lat. *ad* > It. *a*, Lat. *quomodoet* > It. *come*). Stress-driven RF (3) is a phonologically predictable stress-triggered gemination. Crucially, RF-segments ("geminates" across word-boundary) are only 50% longer than singletons in the same position, in contrast to inherent geminates (geminates in word-internal position), which are 200% longer than singletons (as in [ˈpa**s:**i] 'steps' vs. [ˈba**ː**z**i**] 'bases'; Campos-Astorkiza 2014: 101). In general, RF-segments are always shorter than inherent geminates (Payne 2005: 159). Furthermore, the gesture profile of RF-geminates resembles singletons, while inherent geminates involve a higher degree of articulatory fortition (Payne 2005: 177).

Gorgia (Marotta 2008) is a process of postvocalic consonant lenition, which targets all consonants, but primarily stops. It applies word-internally and across word boundaries:

(4) a. /la/ /ˈ**k**o:sa/ 'the thing' → [laˈ**h**ɔ:sa]
b. /la/ /ˈ**k**re:ma/ 'the cream' → [laˈ**x**rɛ:ma]

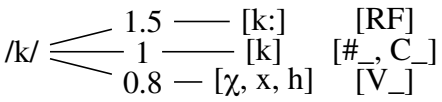
Importantly, phonematic fricatives are longer than the allophonic fricatives (Sorianello 2002: 34). Moreover, non-lenited stops are longer than the lenited allophones (Sorianello et al. 2003).

➳ Gorgia and RF are in complementary distribution, but there are contexts where both processes should be possible, as in (3), where Gorgia could apply, but it does not. Why?

Theoretical Background In *Gradient Symbolic Representations* (Smolensky & Goldrick 2016; Faust & Smolensky 2017; Zimmermann 2018), strength is a property of linguistic symbols. Numerical gradience expresses the degree of activity, or presence, of a linguistic item. I also adopt *undershoot* as the trigger for lenition, which is a process of promotion on a scale of consonant strength, corresponding to a reduction of constriction degree or duration (Kirchner 2000).

Proposal I claim that (i) *Phonetic length* is a correlate of *phonological strength*. (ii) The gradient activity of output segments can be different from 1. (iii) Phonological strength affects the phonetic length of segments. If a segment is associated to a strength value greater than 1, then it is interpreted as long by the phonetics. Therefore, RF-geminates are non-moraic consonants associated to a strength value greater than 1. Consequently, they only differ from singletons in terms of strength. Lexical geminates, on the contrary, are represented as moraic consonants. On the other hand,

lenited segments are associated to a strength value smaller than 1; they are defective segments due to undershoot, which results in a reduction of closure and the duration.

(5)


(iv) Stress (the strong position in a foot) brings in phonologically derived extra activity. In open non-final syllables, this results in vowel lenghthening: /ˈka.za/ → [ˈkaː.za]. In final syllables, this activity associates to the following consonant, resulting in stress-driven RF (3). (v) Triggers of lexical RF (2) end in a weak root node, which can fuse with the following consonant.

Analysis Constraints: MAX[STR]: Assign z reward for every activity (x) that is present in the input and is associated to a segment in the output (y) (z = y). DEP[STR]: Assign z violation for every output segment that is associated with y strength and a corresponding input segment that is associated with x strength (z = y-x). REALIZE[STR]: assign z violation for every activity (y) that is present in the output but has no phonetic realization on an output segment (z = y). ONE!: Assign z violation for every segment that has strength y > 1 in the output (z = y-1). FULL!: Assign z violation for every segment that has strength y < 1 in the output (z = 1-y). ONE!-V#: Assign z violation for every final vowel that has strength y > 1 in the output (z = y-1). WEAK!-C-V_: Assign z violation for every post-vocalic consonant with strength y in the output (z = y).

Gorgia: the markedness constraint WEAK!-C-V_ favors an output gradient segment /$k_{0.8}$/. This is then realized by the phonetics as a lenited variant of /k/ ([χ, x, h], depending on speed and variety).

/laˈ$k_1$asa/	MAX[STR]	DEP[STR]	REALIZE[STR]	FULL!	ONE!	ONE!-V#	WEAK!-C-V_	H
weight	w=+20	w=-8	w=-30	w=-3	w=-2	w=-50	w=-30	
a. lak$_1$asa	1						1	-10
☞ b. lak$_{0.7}$asa	0.7			0.3			0.7	-7.9

Stress-triggered RF: the extra-strength brought by the stress is associated to the initial consonant of WORD_2. The final stressed vowel cannot be stronger than 1, as in (c), because of ONE-V#, therefore the RF candidate (b) is preferred. Even though the context for Gorgia is actually met (d, e), the segmental realization of strength overcomes the need for weak consonants, bleeding Gorgia.

/ʧiˈta $^{0.5}$ kara/	MAX[STR]	DEP[STR]	REALIZE[STR]	FULL!	ONE!	ONE!-V#	WEAK!-C-V_	H
weight	w=+20	w=-8	w=-30	w=-3	w=-2	w=-50	w=-30	
a. ʧiˈtːa $^{0.5}$ kara	2		0.5				1	-5
☞ b. ʧiˈtːa k$_{1.5}$ara	2.5	0.5			0.5		1.5	0
c. ʧiˈtːa$_{1.5}$ kara	2.5	0.5			0.5	0.5	1	-10
d. ʧiˈtːa$_{1.5}$ k$_{0.7}$ara	2.2	0.5		0.3	0.5	0.5	0.7	-7.9
e. ʧiˈtːa $^{0.5}$ k$_{0.7}$ara	1.7		0.5	0.3			0.7	-2.9

Conclusion RF and Gorgia are related to the phonological representation of linguistic elements. This account can explain the complementary distribution of these processes, the difference between phonematic and derived segments, has the potential for further implementations (synchronic and diachronic variation, phrase-initial strengthening, backward gemination, vowel deletion, epenthesis) and contributes to the debate on the division between phonetics and phonology.

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