



Towards a sociophonetic explanation of progressive and regressive assimilation in NC clusters

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1. BACKGROUND

NC clusters tend to be homorganic, with the nasal stop fully assimilated for place to the following oral stop. However, nasals are also able to alter the articulation of the post-nasals in different ways, as documented e.g. in many varieties of the Italo-Romance area [2,5,7].

1) As for **place of articulation**, nasals are notoriously the target of **regressive** assimilation: It. /'banka/ 'bank': [ˈbaŋka] and not *[ˈbanta].

The constraint of homorganicity in NC clusters reflects a fundamental tendency of coarticulation, anticipatory assimilations being more frequent than perseverative ones [1,3,4].

2) As for **laryngeal assimilation**, voiceless post-nasals **voice** in some central and southern Italian dialects: *dende* 'tooth' (It. *dente*), *cambo* 'field' (It. *campo*), *biango* 'white' (It. *bianco*) [7].

3) **Complete assimilations** of homorganic clusters are also **left-to-right**: in some southern dialects, voiced post-nasals totally assimilate to nasals, resulting in geminates: *munno* 'world' (It. *mondo*), *piommo* 'lead' (It. *piombo*), *liŋŋa* 'tongue' (It. *lingua*) [7].

Both laryngeal and complete assimilations are generally believed to function as **sociolinguistic variables** in conveying the speaker's socio-cultural and geographical identity.

2. ALTERNATIONS IN LARYNGEALITY

It has been suggested that the crucial element favoring either perseverative, or anticipatory assimilation seems to be the laryngeal status of the post-nasals :

post-nasals totally assimilate to nasals when voiced; in clusters with voiceless post-nasals, complete right-to-left assimilations are frequently observed (e.g. Old Norse *munn* 'mounth' <*munða vs. *bekkr* 'bank' [8]).

nasal "dominance" before voiced C
vs.
nasal "lenition" before voiceless C

Why?

The reason lies in the **durational differences** related to the laryngeal specification of the post-nasal, **being nasals longer before voiced C and shorter before voiceless C** [8].

The Cluster Internal Balance Hypothesis:

The different temporal behaviour of nasals according to the nature of the following consonant should be reflected in the **relative timing of segments within the cluster**, and specifically:

in order for a N to 'dominate' before voiced C and to be 'lenited' before voiceless C, the N-to-C duration ratio should be higher in voiced clusters than in voiceless clusters

3. ALTERNATIONS IN PLACE

N-to-Alveolar and N-to-Velar clusters differ inasmuch assimilations triggered by the former cluster type are geographically more widespread than the latter, at least in the Italo-Romance domain.

• In southern Italy, only limited areas of Sicily, Calabria, Lucania, Puglia, and the Salentine peninsula show /ng/ > [ŋŋ]

• According to linguistic atlases (e.g. AIS), nasals are usually geminate in the *munno* (< *munno*) type, while they are often short in the *liŋŋa* (< *lingua*) type.

Though usually neglected in sociophonetic research, **speech rate** enters into the picture because of its intrinsic complexity as an explicative parameter of both change initiation and transmission.

Increased rates of speaking have demonstrable effects on the mechanics of articulators and on the relative organization of speech gestures (i.e., on change initiation), but on the other hand these effects "could be voluntarily overridden by the speaker, who could increase his articulatory explicitness" [6], thus influencing the transmission of change in a non-deterministic manner.

→ Speech rate variations must be included as a crucial factor in the investigation of the (socio)phonetic bases of NC progressive and regressive assimilations, in order to explore the degree of gestural reorganization due to temporal compressions.

AIMS

The experiment aims at replicating in an experimental setting the conditions for a sound change which has clear socio-phonetic implications in some Italo-Romance areas (i.e., *nt* > *nd*, *nd* > *nn*, *nk* > *ŋŋ*).

(i) We expect that different types of assimilation originate from different conditions in the **relative timing** among sounds in sequences varying for voicing of the postnasal consonant;

(ii) Given the external evidence sketched above, we hypothesize that Alveolar clusters undergo temporal reductions in pre-voiceless nasals more consistently than Velar ones;

(iii) We wanted to verify whether the temporal relationship among sounds in /nC/ clusters is consistent across different rates of speech, or rather, varies in accordance with some articulatory constraints which can be used as a potential for the explanation of attested sound changes.

EXPERIMENTAL DESIGN

➤ *Speakers*: Four native Italian speakers, aged 30-35, speaking a Tuscan variety of Italian

➤ *Corpus*: 8 meaningful Italian words containing the following sequences:
/anta/, /anda/, /anka/, /anga/

embedded in short isosyllabic frame sentences.

Participants were asked to produce 30 repetitions of each sentence (random order), at a normal (N), slow (S) and fast (F) rate of speaking.

➤ *Dependent variables*:

1) Duration (in msec) of (i) whole sentence, (ii) /anCa/ sequence, (iii) /nC/ cluster
2) n-to-C duration ratio within the cluster

➤ *Factors*:

SPEAKING RATE (N, S, F)

PLACE OF ARTICULATION (PoA) of the post-nasal C (Alveolar, Velar)

VOICING of the post-nasal C (Voiceless, Voiced)

RESULTS

1. Speech rate variations

The three elicited styles (F, N, S) were significantly different in sentence duration ($p < .0001$), /anCa/ duration ($p < .0001$), and /nC/ cluster duration ($p < .0001$), thus confirming that the three elicited 'styles' were significantly different as for duration of different-size units

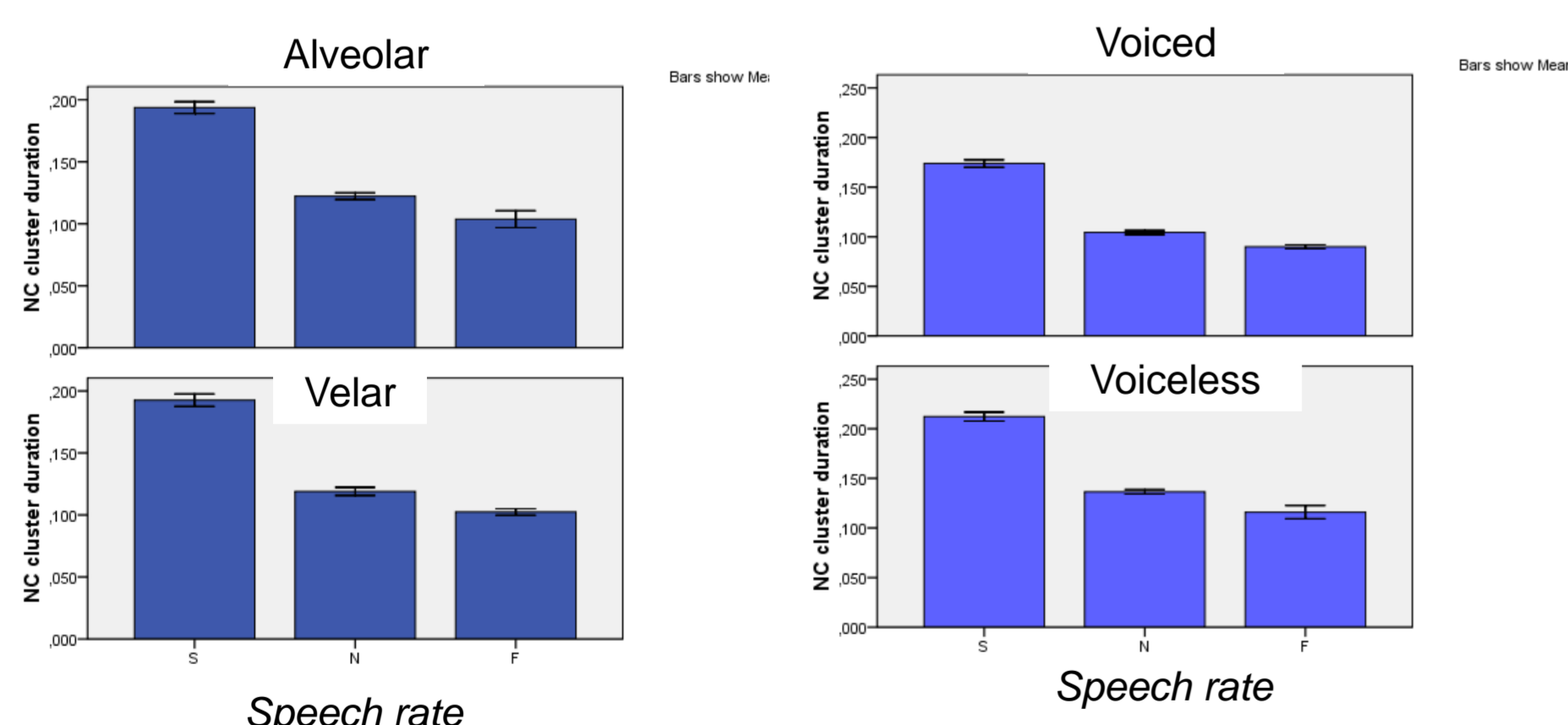


Fig. 1

2. Analysis of N/C duration ratio

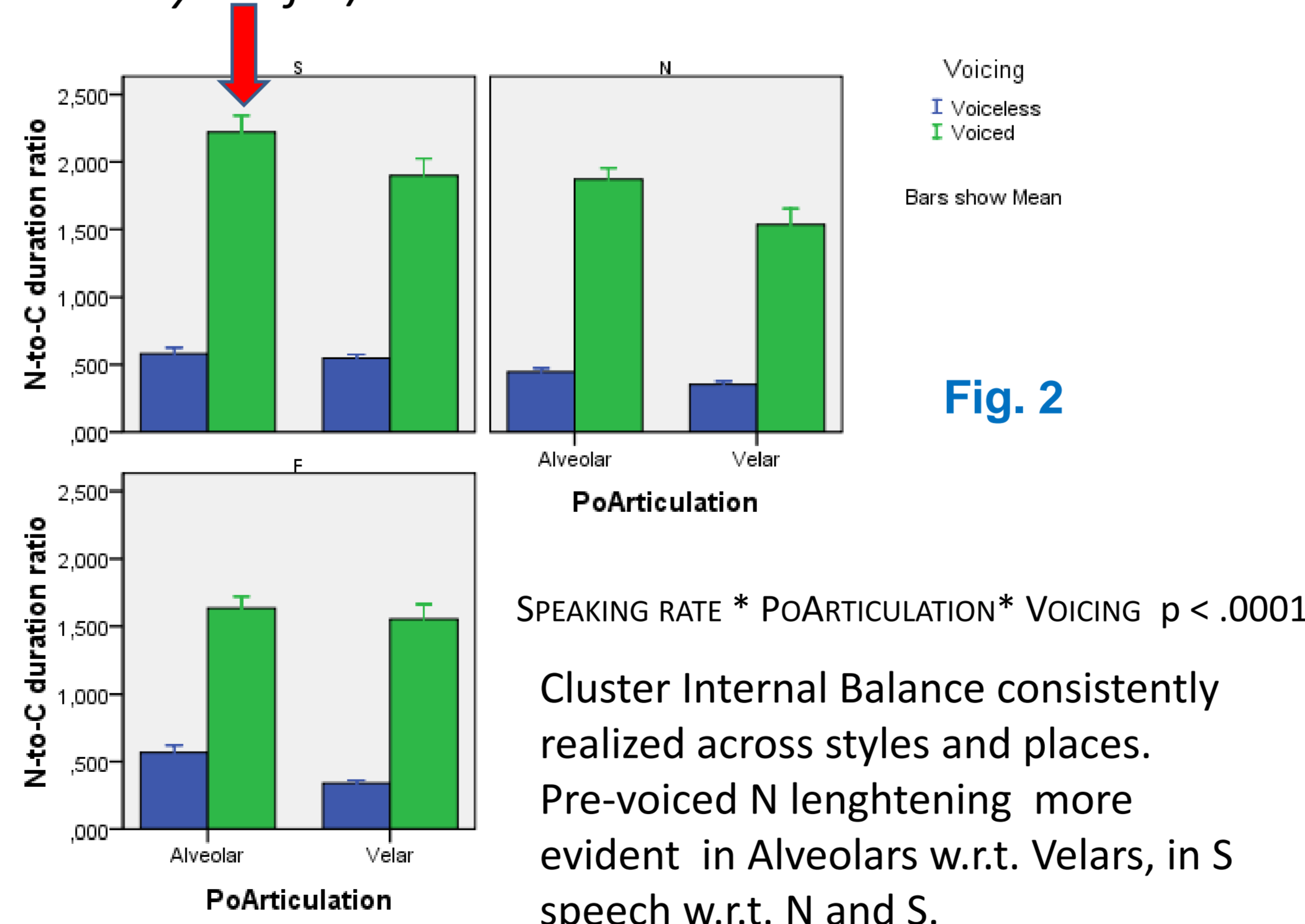


Fig. 2

SPEAKING RATE * POARTICULATION * VOICING $p < .0001$

Cluster Internal Balance consistently realized across styles and places. Pre-voiced N lengthening more evident in Alveolars w.r.t. Velars, in S speech w.r.t. N and S.

Table 1

Speech rate	Voicing	Mean N-to-C ratio	Std deviation
F	Voiced	1,596	0,51
	Voiceless	0,454	0,24
N	Voiced	1,704	0,58
	Voiceless	0,399	0,14
S	Voiced	2,057	0,70
	Voiceless	0,565	0,20

SPEAKING RATE * VOICING $p < .0001$

S speech presents the highest values for N-to-C ratio in voiced clusters (compared to N and F speech)

CONCLUSIONS

(i) *Cluster Internal Balance Hypothesis* strongly supported, across speech rates and places:

There is a clear tendency for nasals to be longer before voiced plosives, shorter before voiceless ones, w.r.t. the post-nasal C.

Such difference in *cluster intrinsic timing* depending on the laryngeal specification of the post-nasal C is likely to be a universal of speech production.

(ii) Place alternations play a role in this effect:

Pre-voiced N lengthening more evident in Alveolar than Velar clusters (see Fig. 2)

The preference for progressive assimilations in Alveolar clusters (w.r.t. Velars), as attested in diachronic, areal and sociolinguistic variation of southern Italian dialects, seems to have some grounding in the durational properties of the clusters.

(iii) Speech rate also plays a role:

Cluster Internal Balance gets looser in Fast speech, w.r.t. N and S (see Table 1).

Temporal compressions imply gestural **restructuring**, besides gestural shortening.

Increased rates of speaking do **not** create conditions that favor assimilations. The complexity of nasal cluster assimilation cannot be reduced to aspects of connected speech processes.

[1] Bybee & Easterday 2010 "Gestures in sound change: anticipatory vs. perseverative assimilation". Poster presented at 12th International Conference on Laboratory Phonology, Albuquerque, 8-10 July, 2010. [2] Celata, Calamai, Ricci & Bertini 2010 "Nasal place assimilation between phonetics and phonology: An articulatory study of Italian nasal-to-velar clusters", under review in *Journal of Phonetics*. [3] Ferguson 1975 "Universal tendencies and 'normal' nasality", in Ferguson, Hyman & Ohala (eds), *Nasalfest. Papers from a symposium on nasals and nasalization*. Stanford: 175-196. [4] Lass 1984 *Phonology. An introduction to basic concepts*. Cambridge. [5] Mioni 1993 "Fonetica e fonologia", in Sobrero (cur.) *Introduzione all'italiano contemporaneo. Le strutture*. Roma-Bari: 101-139. [6] Nolan & Kerswill 1990 "The description of connected speech processes", in Ramsaran (ed.), *Studies in the pronunciation of English. A commemorative volume in honour of A.C. Gimson*. London: 295-316. [7] Rohlfs 1966 *Grammatica storica della lingua italiana e dei suoi dialetti. Fonetica*. Torino. [8] Tuttle 1991 "Nasalization in Northern Italy: syllabic constraints and strength scales as developmental parameters", *Italian Journal of Linguistics* 3: 23-92.