

# Patterns of Vowel Nasalisation in Northern Italy: Articulatory versus Perceptual

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## ABSTRACT

Developments in the Romance-speaking area provide an extremely useful testing ground for phonetic hypotheses regarding sound change. Detailed investigation of nasalisation-related sound changes (e.g.  $a > \tilde{a}n > \tilde{a}$ ) in the Romance dialects of Northern Italy has uncovered a range of pervasive suprasegmental effects. In the long tradition of research on the development of distinctive nasalisation, attempts at phonetic explanation have focussed largely on articulatory causation. However, most recent evidence suggests that many of the sound changes observed in Northern Italy and elsewhere have a substantial perceptual basis.

## 1. INTRODUCTION

Distinctive nasalisation is a well-known characteristic of much of the Romance-speaking area, with French and Portuguese the best known examples. It is not surprising therefore that a longstanding tradition of investigation of the historical development of the phenomenon exists in Romance linguistics (see Hajek [1] for references). In the later universalist literature on distinctive nasalisation, which first developed in the 1970s, scholars have tended to adopt the same phonetic explanations first formulated by Romance linguists such as Straka [6] and others. All of these attempts at phonetic explanation have focussed squarely on articulatory causation, in particular on purportedly universal patterns of relative velopharyngeal opening (VPO) to account for observed patterns of development. However, after extensive reviews of all experimental articulatory evidence, Hajek [1] and Hajek & Maeda [2] conclude that VPO is in itself not an unproblematic measure of relative nasalisation. Instead, more recent cross-linguistic and experimental evidence suggests that many of the sound changes associated with the development of distinctive nasalisation are appropriately treated as more perceptual than articulatory in nature.

The Romance languages provide perhaps the best laboratory for the investigation of sound change over long periods of time in that the usual historical starting point, Latin, is well understood and copiously documented over a period of more than 2,000 years. Moreover, we also have for much of the Romance-speaking world extensive

medieval documentation that allows us to shed light on intermediate steps in change up until the modern day. All of this knowledge provides investigators with very reliable means to track sound change across more than two millennia. One of the greatest (and underestimated) problems in establishing the course and plausibility of sound change is the frequent reliance by linguists on reconstructed proto-languages. As Hajek [1] points out, the use of proto-languages in diachronic typology runs the strong risk of circularity: assumptions are made about the plausibility of sound changes in order to establish the proto-language, and claims are then made about sound changes as they progress from the proto-language forward in time to the modern day.

## 2. SUPRASEGMENTAL CONDITIONING OF NASALISATION IN NORTHERN ITALY

In a detailed investigation of the development of distinctive nasalisation in a sample of Northern Italian dialects (eg Bolognese, Milanese, Romagnol, and Ligurian), Hajek [1] uncovers extensive prosodic conditioning of the spread of vowel nasalisation and nasal consonant deletion. Primary factors include: (1) vowel length, (2) presence and degree of stress, and (3) location of the stressed syllable within the word (foot type).

The most important of all suprasegmental factors is undoubtedly the predictable effect of vowel length. In all Northern Italian dialects, the historical sequence /V:N/ is always the preferred locus over /VN/ for any or all parts of the process of distinctive nasalisation. Where nasalisation and/or N-deletion is reported in the context of short vowel + N, then the same is also found in the context of long vowels. The reverse case of short nasal vowel (with or without N-deletion), but long vowel remaining oral before N is not found anywhere. In Northern Italy we find examples such as:

- (1) [vẽ:na] </ve:na/ 'vein' but [pena] </pena/ 'feather'  
[kẽ:] </ka:n/ 'dog' but [a:n] </an/ 'year'

The degree of patterning uncovered by Hajek [1] is so regular that the so-called Vowel Length Parameter (VLP) can be formulated: over time distinctive nasalisation will occur preferentially in the context of long vowels before

spreading to short vowels:

(2) V:N >> VN (VLP)

Further investigation confirms an identical pattern of interaction with length in other languages, eg Veracruz Nahuatl, German dialects, Irish and Kire. In Northern Italian, operation of the VLP is so constrained that short vowels must be lengthened before they can undergo nasalisation, ie an > a:n > ã:n, and never \*an > ãn. The reasons for this particular phenomenon are unknown.

The presence or absence of stress also has a predictable effect on the development of distinctive nasalisation in Northern Italian: the phenomenon is always found to occur preferentially in stressed position, as the following examples demonstrate: ['kã:] < ['ka:n] 'dog', ['ã:n] < ['an] 'year', but ['stevan] < ['stefan] 'Stephen'. More subtle effects can be discerned in unstressed position: nasalisation occurs preferentially in pretonic position, as opposed to post-tonic position, eg [fün'tã:na] 'fountain' but ['stevan] 'Stephen'. Once again the suprasegmental effect is exceptionless in Northern Italian and Hajek [1] is able to formulate the so-called Extended Stress Parameter (ESP):

(3) 'VN >> 'VN >> 'VN (ESP)

An identical interaction between (un)stressed syllable type and the spread of distinctive nasalisation is found in many other Romance varieties, eg Portuguese, Galician, Sardinian and Gascon.

Finally, foot structure is also found to have a predictable effect over time in the development of distinctive nasalisation in stressed syllables in Northern Italian. Distinctive nasalisation develops preferentially in word-final stressed position, before spreading to stressed penults and then to stressed antepenults. The correlation is once again so strong in Northern Italian that Hajek [1] is able to propose the Foot Parameter:

(4) 'σ >> 'σσ >> 'σσσ (FP)

Similar foot-related effects are reported elsewhere, as in Corsican ['no] < [nõ:] < Lat. NON 'no', ['lã:(n)a] < LANA 'wool' but ['an(n)ema] < ANIMA 'soul'.

### 3. PHONETIC BASIS

#### 3.1 THE VOWEL LENGTH HYPOTHESIS

Hajek [1] suggests that the phonetic basis of all three suprasegmental parameters (VLP, ESP and FP) is associated with vowel length (at the phonological level) and duration (at the phonetic level) and is primarily perceptual in nature. He notes on the basis of cross-linguistic evidence that phonologization of distinctive

nasalisation on a vowel is possible in the absence of an adjacent nasal consonant, and that such spontaneous nasalisation is typically associated with long vowels, eg. Hindi [sã:p] < Sanskrit *sarpa*. In Western Algonquian, long \*/a:/ is regularly nasalized in historically oral contexts, whilst short \*/a/ remains oral. In all of these examples the absence of an adjacent nasal consonant and its associated velopharyngeal opening (VPO) has not prevented the complete phonologization of nasalisation. These and other facts indicate that vowel length strongly facilitates the perception of vowel nasalisation.

Preferential nasalisation of long vowels, seen to be extremely robust across languages, is not however predicted by the available articulatory evidence which suggests that nasalisation on short vowels should be favoured. Experimental results indicate that across languages the duration of VPO may be no less or even relatively greater in short vowels than in long vowels (see Hajek & Maeda [2]).

With respect to the ESP, experimental data indicate that vowel duration correlates strongly with the degree of stressedness: vowels are markedly longer in stressed position across languages than in pretonic syllables. Pretonic vowels are in themselves longer in duration than post-tonic vowels. Available vowel duration figures for Brazilian Portuguese are indicative: 243 ms (tonic) >> 160 ms (pretonic) >> 112 ms (post-tonic) [1].

A similar duration/length effect is also found with respect to the Foot Parameter. Cross-linguistic evidence indicates that word-final stressed vowels are significantly longer in duration than penults, which are longer than antepenults. Experimental data confirms this observation across a range of languages, including Spanish, Hungarian, Polish, Swedish, and Dutch. One study for instance reports for Italian the following: 274 ms (final) >> 236 ms (penult) >> 196 ms. (antepenult) [1]. From a phonological perspective, vowel length correlates strongly with foot structure in Northern Italy: stressed vowels in final and penultimate position behave as if historically long whilst antepenults, even when long in Latin, were subject to regular shortening very early on. As already reported above, the development of distinctive nasalisation is strongly disfavoured in antepenultimate position in Northern Italian. Indeed it is found only rarely and only after secondary vowel lengthening has occurred.

#### 3.2 EXPERIMENTAL EVIDENCE IN FAVOUR OF VOWEL LENGTH AS THE CRITICAL PERCEPTUAL FACTOR

Lintz & Sherman [5], using unedited hypernasal and normal speech, found that in phonologically oral contexts contextually determined vowel duration differences correlated directly with the perception of nasality by

American listeners. As vowel duration increased according to context, e.g. before fricatives and voiced consonants, so did perceived vowel nasality.

In a series of experiments using synthesized tokens, Whalen & Beddor (1989) examined the effects of relative VPO and duration (50, 100, 150, 200 and 250 ms) on the perception of vowel nasalisation on the vowels /a i u/. As expected, the average nasality rating by twelve speakers of American English increased with greater velar port opening for all vowels, as shown for /a/ in Figure 1. However, more significant is the finding that the nasality rating also rose with an increase in vowel duration for all vowels at all levels of VPO. This and other experiments also established that the link between perceived nasality and duration was not dependent on other factors such as vowel height.

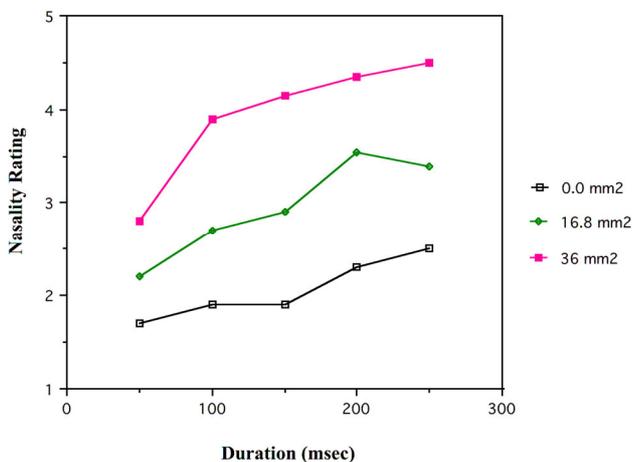


Figure 1: Nasality ratings by 12 speakers with three degrees of VPO at five durations. The midpoint ‘3’ is the suggested boundary between oral and nasal vowel. Source: Whalen & Beddor [9].

### 3.3 MORE RECENT EXPERIMENTAL EVIDENCE: VOWEL LENGTH IS NOT THE ONLY FACTOR

While we have little evidence that VPO does not appear to be very different in short and long vowels, Krakow [4] reports articulatory evidence that VPO is greater in stressed syllables than in unstressed position. We have no experimental data on relative VPO across foot types.

In a recent series of perceptual tests using synthesized speech, Hajek & Watson [3] and Watson & Hajek [7] have examined the effects of duration, stress and foot structure on the perception of vowel nasality in disyllables. Results drawn from a sample of ten speakers of British English confirm Whalen & Beddor’s earlier findings that increased VPO ( $0 < 16.8 < 36 \text{ mm}^2$ ) and increased vowel duration

( $150 < 250 \text{ ms}$ ) both result in greater perception of vowel nasalisation. Both effects were significant across stressed v. unstressed vowels and foot types.

In testing the stressed v. unstressed condition, prominence effects on stressed vowels were achieved by synthesis of greater duration (100 ms longer than adjacent unstressed vowel), greater intensity and with a marked F0 drop. The Foot Parameter was tested by varying the location of the stressed vowel from penultimate (paroxytonic) to final (oxytonic) position. In addition to the already cited VPO and vowel duration effects, independent effects of relative prominence and foot structure were also uncovered.

At all levels of VPO, the difference between stressed v. unstressed vowels was always significant. Where VPO was present, stressed vowels were perceived as more nasal, although the order was reversed when VPO was set at  $0 \text{ mm}^2$ .

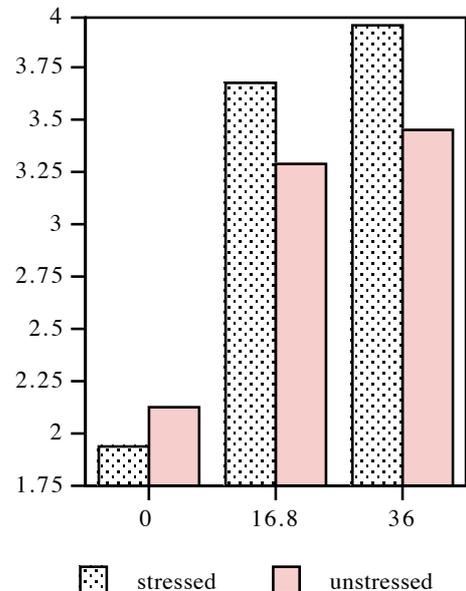


Figure 2. Comparison of nasality ratings for stressed and unstressed vowels at various degrees of VPO. Source: Watson & Hajek [7].

With respect to the ESP and the relative ordering of pretonic and posttonic vowels, no statistically significant difference in nasality ratings was found, although at all levels of VPO nasality judgments were always slightly higher in favour of pretonic position.

Foot structure was also found to have a significant effect on the perception of vowel nasalisation, in the direction predicted by the Foot Parameter: nasality ratings for word-final stressed vowels (oxytones) were at all VPO levels always higher than for penults (paroxytones). The difference can be seen in Figure 3.

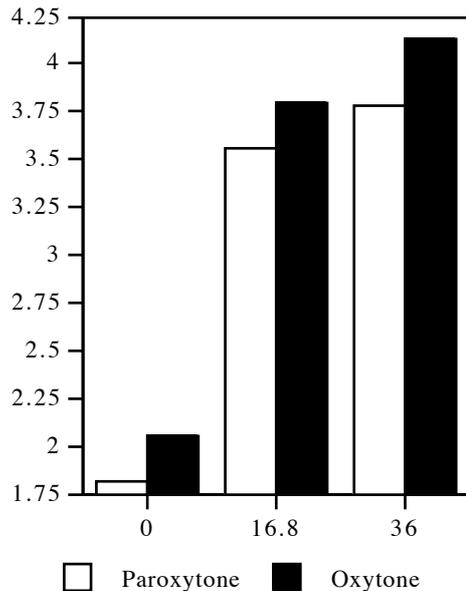


Figure 3. Comparison of nasality ratings for stressed syllables in two foot-structures at various degrees of VPO. Source: Watson & Hajek [7].

## 5. DISCUSSION AND CONCLUSION

Although Hajek [1] was able to identify vowel length, degree of stress and foot type as independent suprasegmental factors conditioning the development of distinctive nasalisation in Northern Italy and elsewhere, he suggested that predictable vowel duration differences (and the effects these had) might be the basis for all three suggested parameters (VLP, ESP, FP). Experimental evidence confirms that relative VPO and duration strongly condition the perception of nasality on vowels. The former effect is hardly surprising and has long been known to linguists. The second must now be accepted as reliable, although the reason for the observed perceptual effect is still unclear.

Hajek [1] did not propose that foot type or the degree of stress would in themselves directly effect the perception of nasality. But experimental results ([3], [10]) show that both of these factors have a significant conditioning effect. Although little difference was found between pretonic and posttonic vowels, the presence of primary stress was found to be important. The reasons for observed stress- and foot-related perceptual effects also remain to be understood.

## 6. CONCLUSION

Given the cross-linguistic evidence uncovered in Northern Italy and elsewhere, as well as available experimental results, there is no doubt that suprasegmental factors play an important conditioning role in the development of nasalisation-related processes over time. The articulatory factor of VPO is recognized as playing a vital role in

nasalisation-related sound change in Northern Italy (and elsewhere) since historical changes always occur adjacent to nasal consonants. But the presence of VPO is not in itself sufficient to account for the observed patterns of change. Perceptual factors are also seen to be critically important, although the phonetic basis for the observed cross-linguistic and experimental effects remains to be explained. Work continues on this front, and the Romance languages continue to provide a useful area of ongoing investigation (see Watson & Hajek [8] in this volume).

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