NASALIZATION AS UNIVERSAL PHONOLOGICAL PROCESS

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0. Nasalization is a universal phonological process applicable to all languages, though it need not appear in all languages. We are concerned not with writing a rule as part of the description of any particular language, but rather with understanding the phenomenon of nasalization. Nevertheless, the description of nasalization in any particular language must be in terms of the universal process.

In our study of nasalization we are concerned with the following illustrative questions:

1. Why is nasalization generally tautosyllabic rather than heterosyllabic? (Latin centum > French cent, but Lat. amat > Fr. aime.)
2. Why are vowels often lowered if nasal effacement occurs (Fr. cent) but raised if effacement does not occur (English wind, cf. Lat. ventus)?
3. Why does German nasalization occur only before x (denken : dachte) and not before s, f, θ (Gans, fünf, Mund)?
4. Why does English nasalization occur before continuants (thought, goose, five, mouth) but not before stops?
5. Why does Portuguese allow intervocalic nasal effacement (bona > boa) but not preocclusive effacement (cento)?
6. Why does Latin manus give a nasal reflex in Portuguese (mão) but bona give a nonnasal reflex (boa)?
7. Why does nasal effacement occur in Sanskrit second person plural hathá (< *hanthá) but not first person singular hánmi ?
8. Why does nasal effacement occur in Latin homo (hominis) but not in Latin nomen (nominis) ?
9. Why is Polish final ę denasalized, but not final ǫ ?

Perhaps the obvious approach to nasalization is that it occurs when the nasal is followed by a consonant or word boundary, but not if followed by a vowel, as in French chantons [šãtõ], bon [bõ], but bonne [bɔn]. However, the rule

$$Vn \longrightarrow \tilde{V} \quad /\_\_ \; C, \#$$

which effaces the nasal with simultaneous nasalization of the vowel is not part of a universal process but, rather, only an abbreviation applicable in special cases. For nasalization can apply without effacement (Fr. [mõnami] mon ami) and effacement can occur without nasalization (Greek kestos for *kenstos). Nasalization is a complex process which cannot be adequately understood as the operation of a single rule. (Cf. Lightner, 1970.)

The next three sections of this paper deal with (1) operations on vowels before nasal effacement, (2) nasal effacement, (3) operations on vowels after nasal effacement. Section 4 then considers denasalization; section 5 presents detailed exemplification from French, Polish, and Old Norse, and section 6 summarizes the paper and its conclusions.

1. Operations on vowels before nasal effacement. Before nasal effacement vowels may become nasalized or raised subsequent to vocalization of the nasal.

1.1 Nasal assimilation is the acquisition of nasality by a segment followed by a nasal segment:

$$\epsilon \longrightarrow \tilde{\epsilon} \quad /\_\_ N$$

where ϵ may be either a consonant (Lat somnus from *sopnos, cf. sopor or a vowel (Med. Fr. fẽme). Often there is no phonetic reflex of nasalization, as in Lat. ferimus and Fr. aime, though nasalization must have occurred, for otherwise syncope would have deleted the thematic vowel in ferimus (as in *ferit > fert) and ame would not have diphthongized.

1.2 Nasal vocalization and vowel raising. When nasals are not effaced, the vowel is often raised (Lat. ventus, Eng. wind; Lat. pontem, Med. Fr. punt) by assimilation to a high glide which arises from vocalization of the nasal:

i.	n	$\longrightarrow$	n^y /__C	(vocalization)
ii.	e	$\longrightarrow$	i /__C^y	(assimilation)

The glide need not appear phonetically:

iii.	n^y	$\longrightarrow$	n	(phonetic manifestation)

Nasal vocalization parallels liquid vocalization, as illustrated by Latin vult < volt (cf. volimus) and English wind < wend (Lat. ventus):

volt	went	
vol^wt	wen^yd	(vocalization)
vul^wt	win^yd	(assimilation)
vult	wind	(phonetic manifestation)

Notice also Lat. quinque (Gk. pente), Lat. simplex (cf. semel), Ger. binden (IE*bhendh-), etc.

Sometimes the nasal is effaced, leaving the glide to form a diphthong with the preceding vowel: Polish koński [kõyski]; Lesbian Greek pheroisi (Doric pheronti); Portuguese falam [fálɐ̃w], tens [tɐ̃yš]. Once again nasal vocalization parallels liquid vocalization:

vels	tens	
vel^ys	ten^ys	(vocalization)
veys	teys	(effacement before continuant)
vīs	"	(contraction)

Vocalization raises the prenasal vowel. The nasal may remain (Eng. wind) or may be deleted (Pol. [kõyski]), in which case effacement of the nasal often lowers the vowel (Fr. ponte > punt > pont) while otherwise the high vowel remains.

2. Nasal effacement. The most salient feature of nasal effacement is that nasals are effaced under the same conditions that govern effacement of other elements, viz., effacement occurs preferentially to weak elements. This preferential effacement explains many otherwise inexplicable phenomena of nasalization.

2.1 The inherently weak nasal. Weakening applies preferentially to weak elements. Thus since g is weaker than d or b (see Foley, 1970), g weakens before d or b. Similarly, e drops before o does, t drops before s does, etc.

The effacement of the German nasal before x follows the same principle:

Gothic	German	Old English
uns	uns	ūs
fimf	fünf	fīf
munþs	Mund	mūþ
þāhte	dachte	þōhte

Though it seems that German nasal effacement depends on the following continuant:

$$n \longrightarrow \emptyset \quad /\_\_x$$

there are no theoretical reasons for effacing n before x but not before s, f, θ. We therefore conclude that the velar x causes effacement not directly but rather indirectly by converting n to velar ŋ:

Assimilation

$$n \longrightarrow m \quad /\_\_f$$
$$n \longrightarrow ŋ \quad /\_\_x$$

followed by

Preferential Effacement

$$ŋ \longrightarrow \emptyset$$

which deletes the weakest element of a series.

Old English nasal effacement before any continuant is a generalization of this rule. Similarly Portuguese intervocalic n is effaced (manus > mão) while intervocalic m remains (fumare > fumar) since n is phonologically weaker than m.

Referring to the α phonological parameter (Foley, 1970):

g	d	b
ŋ	n	m
---------- →		
1	2	3

nasal effacement occurs preferentially to sufficiently weak nasals.

The precise conditions are:

$$N_p \longrightarrow \emptyset \qquad \text{where } 1 \leqslant p \leqslant q$$

and $q = 1$ for German
$q = 2$ for Portuguese
$q = 3$ for Old English

2.2 The tautosyllabic nasal. Nasal effacement often occurs before a consonant (Fr. cent) or in final position (Fr. bon) but not if followed by a vowel (Fr. ami). However, the observation

$$N \longrightarrow \emptyset \quad /V\_\_C,\#$$

misses the generalization that the feature uniting the environments is tautosyllabicity, reflected in the higher order rule

$$N \longrightarrow \emptyset \quad /V\_\_. \quad \text{(where . is a syllable boundary)}$$

which effaces the nasal in

.chan.tons.

.bon.

but not in

.a.mi.

Though the concept of tautosyllabicity is an improvement over listing environments, it is unsatisfactory, for why are tautosyllabic nasals effaced in preference to heterosyllabic ones?

Tautosyllabicity is the accidental property. The essential property is that syllable-final nasals are weaker than syllable-initial nasals, in consonance with the general condition that final elements are phonologically weaker than initial elements. Weak (tautosyllabic) nasals are effaced in preference to strong (heterosyllabic) nasals. Thus chantons [šãtõ], but ami [ami]. Effacement of comparatively strong (syllable-initial) nasals does occur (Port. manus > mão) but only if comparatively weak (syllable-final) nasals have already been effaced (Port. ganso [gõsu]). The effacement of strong nasals is a generalization on the effacement of weak nasals.

2.3 The unstressed nasal. Unstressed elements are prone to weaken, as in Germanic where continuants voice after unstressed vowels (Verner's Law). Similarly nasals are effaced preferentially after unstressed vowels, as in Sanskrit second person plural hathá from *hanthá but first person singular hánmi. Other examples of effacement of unstressed nasals are: Skt. 3rd pers. pl. júhvati for *júhvanti (cf. dviṣánti); Gk. épathon (cf. péntho); Gk. autómatos (cf. ménos); and the Sanskrit passive participles aktá (√añj), baddhá (√bandh), çrabdhá (√çrambh), dastá (√dańç), srastá (√sraṅs), bāḍhá (√baṅh), and gatá (√gam) etc. (see Whitney, 1889: 341, para. 954).

Nasal effacement does occur after stressed vowels (Fr. chantons), but only if effacement has already occurred after unstressed vowels.

2.4 Effacement after a strong element: the alternation principle. A nasal after a strong element is in a weak position in consequence of the alternation principle which accounts for stress alternation, historical alternation of Romance velar vocalization reflexes (nokte > noche, placitu > plazdo > plazo), historical alternation of Germanic strengthening reflexes (Lat. tres, Eng. three; Eng. tooth, Ger. Zahn;

Eng. top, Ger. Topf), Sievers' syncope (Goth. sōkida, OE sohte; Goth. nasida, OE nerede), and other phenomena.

Nasals are effaced after quantitatively strong vowels and after qualitatively strong vowels.

2.4.1 Effacement after quantitatively strong vowels (before continuants). Nasalization is more likely to occur before continuants than before stops: OE gōs, Ger. Gans, but OE hund, Ger. Hund; Port. ganso [gɐ̃su], but cento [sẽntu]; Lat. dēns [dēs], but dĕntis. Notice also Eastern Ojibwa kookkooššˇ 'pig', nenkookkooššim 'my pig', but šekaak 'skunk', nešikaakom 'my skunk' (Harms, 1968: 108).

Although there are also numerous examples of nasal effacement before both continuants and stops (Fr. chantons) there are no examples of nasal effacement before stops unless also before continuants. This in itself is a significant observation:

$$N \longrightarrow \emptyset \quad /\_\_C$$ where C is preferentially a continuant

but theoretically unsatisfactory. What property of continuants is conducive to nasal effacement?

If the question is posed in this direct fashion, there is no solution, for there is no theoretical reason for preferential nasal effacement before continuants. Indirectly, however, there is a solution in terms of vowel lengthening. Vowels are lengthened preferentially before a voiced segment followed by a continuant (Lat. dēns, dĕntis). Furthermore, an element after a long vowel is in weak position (recall Sievers' syncope in sōkida but not in nasida).

The preferential effacement of nasals before continuants thus results from (1) the lengthening of vowels followed by the features voiced and continuant, (2) the weakening of an element after a strong element sufficiently dissimilar, and (3) the preferential effacement of weak elements. Thus, for example:

Germanic	gans	hund	
	gāns	"	(1)
	gān^{-}s	"	(2)
	gās	"	(3)
Old English	gōs	hund	

Nasal effacement before continuants is not a direct property of the continuant, but rather a result of vowel strengthening under the influence of the continuant. This insight allows us to relate precontinuant effacement to effacement after inherently strong vowels.

2.4.2 Effacement after qualitatively strong vowels. Nasal effacement occurs preferentially after strong vowels (where the nasal is weak) as in homō, hominis; virgō, virginis; sermō, sermonis; nomen, nominis, with nasal effacement in homō, virgō, sermō, but not in nomen. The nominative ending is -n, the genitive is -is. The etyma are:

homŏn	homŏnis
virgŏn	virgŏnis
sermōn	sermōnis
nomĕn	nomĕnis

In the genitive the medial short vowels ŏ and ĕ reduce to ĭ. In the nominative, final n is effaced after a strong vowel (homo, virgo,

sermo), but not after a weak vowel (nomen).

French nasalization also applies preferentially to strong vowels. Referring to the Romance strength scale (Foley, n.d.: 31):

u	o	ɑ
i	e	a
----------→		
1	2	3

let us consider the remarks of Pope (1952: 168-9):

> Low vowels nasalize more readily than high ones because it is not quite easy to combine the lowering of the soft palate that is required to open the nose passage with the raising of the back or front of the tongue...
>
> The complete nasalization of the vowels and diphthongs appears to have been a slow process, occupying close on four centuries, from the tenth to the end of the thirteenth or later. The audible nasalization of the low vowels began in Early Old French, first with a and ai (in the tenth century), then with e and ei: the other vowels and diphthongs were gradually nasalized completely in the order of their heights, i and u last...

Low vowels nasalize more readily than high vowels not because they are phonetically lower but because they are phonologically stronger. Nasal effacement applies preferentially in weak position, that is, after a strong vowel.

3. Operations on vowels after nasal effacement. The most obvious operation after nasal effacement is nasalization of the preceding vowel. When the nasal is effaced, it leaves behind a unit of nasalization:

$$n \longrightarrow \emptyset + \sim$$

which combines with the preceding vowel:

$$V + \sim \longrightarrow \tilde{V}$$

There are thus two sources of vowel nasalization: one from nasal assimilation (before nasal effacement), the other from combination with free nasalization (after nasal effacement). A vowel with nasalization from both sources is more likely to appear phonetically nasalized than a vowel with nasalization from only one source, as in French:

bon	bona	
bõn	bõna	nasal assimilation
bõ	"	nasal effacement
[bõ]	[bɔn]	phonetic manifestation

The vowel with two units of nasalization appears phonetically nasalized, while the vowel with only one unit does not; i.e. $V + 2\sim \longrightarrow \tilde{V}$; $V + 1\sim \longrightarrow V$.

In Medieval French the requirements were less strict, with vowels having only one unit of phonological nasalization also appearing phonetically nasalized ([fẽme]).

Other posteffacement operations, aside from vowel nasalization, are lengthening, lowering, and diphthongization (with raising).

Nasalized vowels are often lengthened. Lengthening may be a direct phonetic manifestation of nasalization ($\tilde{V} \longrightarrow \tilde{\tilde{V}}$) or may arise through other processes such as lengthening in an open syllable.

Nasalized vowels often lower (Fr. cinq, cent, un) though phonetic lowering ($\tilde{i} \longrightarrow \tilde{e}$, $\tilde{e} \longrightarrow \tilde{a}$) is epiphenomenal to the strengthening of the vowel. Nasalization increases the strength of an element ($\tilde{I} \longrightarrow \tilde{I}^{+}$) followed by manifestation of strengthened $\tilde{I}^{+}$ as [ẽ] ($\kappa 1^{+} \longrightarrow \kappa 2$).

Other examples of lowering are: ON rētta, OE rihta; Old Church Slavonic klętĭ from *klinti, cf. klinǫ̃ 'curse'; Gk. ménos, autómatos <*autómentos.

Nasalized vowels often diphthongize. When the phonologically strongest vowels are strengthened by nasalization, depotentiation occurs by means other than simple promotion. For example, since ã cannot strengthen to an articulatorily lower vowel, it diphthongizes (as in Norman French õ from ã in enchauntement). Although the vowel is apparently raised, the mechanism is diphthongization (a manifestation of strengthening):

$$\tilde{a}^{+} \longrightarrow \tilde{a}w$$

$$\tilde{a}w \longrightarrow \tilde{o}$$

Sometimes instead of a back glide a front glide appears (Fr. faim, aime, main).

Other examples of vowel depotentiation by diphthongization are: Icelandic sál [sawl]; Russian čitayu > *čitayou > čitayǭ; OE þōhte <*þāhte (cf. Goth. þāhte).

4. Denasalization. The following sections will deal with four types of denasalization: (1) epenthetic denasalization, (2) syneric denasalization, (3) corriptive denasalization, and (4) spontaneous denasalization.

4.1 Nasalized vowels followed by an oral occlusive are often denasalized by the insertion of a nasal stop, as in Polish rąb [rõb] → romb. Nasal epenthesis also occurs in Portuguese, though the vowel retains its nasalization: [sẽtu] → [sẽntu] (cento). That the nasal is epenthetic rather than original is indicated by mão for Lat. manus. Since the nasal in manus is in a stronger position than the nasal in centum, it can be deleted only if the other is also deleted. The phonetic appearance of a nasal in cento [sẽntu] results from epenthesis:

$$\text{sentu} > \text{sẽtu} > \text{sẽntu}$$

Nasal epenthesis does not occur before continuants; cf. Pol. mąz [mõš], Port. ganso [gẽsu].

In Portuguese, nasal epenthesis also occurs between vowels; thus nidum > nĩo > ninho (cf. Williams, 1962: 62).

4.2 Syneric denasalization is a combination of the nasal element of the vowel with the following nasal consonant:

$$\tilde{V}n \longrightarrow V\tilde{n}$$

In this manner Medieval French nasalized vowels lose their nasalization:

feme	
fẽme	(nasal assimilation)
fãme	(vowel strengthening - lowering)
faṁe	(syneric denasalization)
femme	

Similarly in Latin sum the nasalization on the vowel (which strengthens it sufficiently to prevent elision — cf. est from *sət) does not appear phonetically, but rather combines with the following nasal:

sum > sũm > sum̃ > sum

This is the historical precursor to French syneric denasalization.

4.3 Corriptive denasalization denasalizes Portuguese vowels when followed by another vowel (bona > bõa > boa) by the same mechanism that shortens Latin long vowels before other vowels (*monēō > monĕō, cf. monēre).

(i) Vocalis ante vocalem corripitur

$$V \longrightarrow V^{-} \quad / \_\_ V$$

(ii) Phonetic manifestation

$$\tilde{V}^{-} \longrightarrow \breve{V}$$

$$\tilde{\breve{V}}^{-} \longrightarrow V$$

Denasalization does not occur in Portuguese mão since o does not weaken a but rather strengthens it through diphthongization:

$$\tilde{a}o \longrightarrow \tilde{a}^{w}$$

4.4 Spontaneous denasalization is part of the general weakening that applies to linguistic elements in the absence of a countervailing strengthening. Long vowels shorten, unstressed vowels drop, vowels lose their nasalization. For example, Greek hekaton is from *hekenton by the following sequence of operations:

hekẽton	(nasal effacement)
hekãton	(strengthening — lowering)
hekaton	(denasalization)

The same process gives French cent, though Greek has progressed further to include denasalization of the vowel.

Denasalization as a spontaneous weakening adheres to the condition that weakening applies preferentially to weak elements. For example, Polish ę denasalizes in final position in preference to ǫ: idę — ide, but idǫ — idǫ, since ę is phonologically weaker than ǫ.

The preferential denasalization of weak elements is also illustrated in Old Norse, where it explains the failure of fracture before nasal a. According to Gordon (1957: 274):

> The only vowel affected by fracture was e. When followed in the next syllable by a (other than nasalized a), e became ea, which appears as ja in the literary period (see §46): e.g. gjalda (cf. OE. geldan); jafn (cf. OE. efen), from PrN. *efnaR. Fracture was usual in verbs of the type gjalda in the third

strong conj., but the e of verbs of the fourth and fifth conjs. remained unfractured because after a short syllable the a of the ending was still nasalized during the period of fracture (c. 750 - 950), e.g. geta, from earlier *getan.

Thus although gelda > gjalda, we find geta, not *gjata. From geldan and getan both words nasalize to gelda and geta. But then gelda denasalizes, allowing vowel fracture, but geta does not until too late for vowel fracture:

geldą	getą	
gelda	"	(preferential denasalization)
gjalda	"	(fracture before nonnasalized a)
"	geta	(generalized denasalization)

The denasalization in gelda but not in geta is another manifestation of the general principle that weakening occurs after strong elements (alternation of strong and weak elements). For example, in Sievers' syncope an Old English (positionally weak) vowel is effaced after a strong syllable, but a (positionally strong) vowel remains after a weak syllable: Gothic sōkida, OE sōhte, but Gothic nasida, OE nerede.

After a strong syllable a vowel is weakened. A weakened nasal vowel loses its nasalization, and a weakened oral vowel loses itself.

1. Weakening (alternation principle)

$$V \longrightarrow V^{-} \quad / [\text{strong syllable}]\_\_\_$$

2. Phonetic manifestation

Old Norse $\tilde{V}^{-} \longrightarrow V$ (denasalization)

Old English $\breve{V}^{-} \longrightarrow \emptyset$ (syncope)

5. Examples. Detailed exemplification from French, Polish, and Old Norse follows in this section.

5.1 French nasalization. The development of Latin pontem to French pont illustrates the three nasalization processes:

pont	
pon^{y}t	(vocalization)
pun^{y}t	(assimilation)
punt	(phonetic manifestation of n^{y} as [n])
pũnt	(nasal assimilation)
pũ̃t	(nasal effacement)
põ̃t	(strengthening)
põ	(phonetic manifestation of õ as [õ])

Denasalization is illustrated in aime and bonne:

ama	bona	
ãma	bõna	(nasal assimilation)
"	"	(nasal effacement fails)
ãima	"	(diphthongization of strong nasal vowel)
aime	bone	(denasalization)

Though French usually has either nasal vowels (chantons) or oral vowels followed by nasal consonants (bon ami), there is a group of words with nasal vowels followed by nasal consonants:

mon ami	[mõnami]
son oeuvre	[sõnœvr]
en avant	[ãnavã]
un enfant	[œ̃nafã]
en hiver	[ãniver]
en ete	[ãnete]

The sentence enclitic possessive pronouns (mon) and indefinite articles (un) have weaker sentence stress than adjectives (bon). The different sentence stress results in different nasalization reflexes. The weak n of mon is effaced, but not the strong n of bon. Thus monami → mõami but bonami → idem. Subsequently phonetic n is inserted in mõami (> mõnami) by nasal epenthesis.

5.2 Polish denasalization. Polish nasalized vowels remain before continuants (mąż) but denasalize before stops (ręka → renka) and before l (gineli — gineli). There are not two denasalization rules

ę → en / __oral stop

ę → e / __[l]

but rather one denasalization rule

(i) ę → en / __oral stop or [l]

followed by a rule which assimilates the n to the following l and then reduces the geminate cluster

(ii) nl → ll → l

Thus we have

ręka	gineli	
renka	ginenli	(denasalization by epenthesis)
"	ginelli	(assimilation)
"	gineli	(degemination)

Since Polish l is patterning as a stop (if it were patterning as a continuant the vowel would not denasalize before it) rule (i) should be:

ę → en / __stop

which is the same rule that occurs in Portuguese.

5.3 Old Norse nasalization. Old Norse shows the results of nasalization (vowel lowering) even though the nasalization itself has been lost: ON kappi (OE cempa), ON drekka (OE drincan).

The standard interpretation, as given by Gordon (1957: 275) is that

> When p, t, or k followed a nasal consonant, the nasal was assimilated to the following consonant (see 77); a preceding (nasalized) i was then lowered to e...

This may be formalized as follows:

(G1) $V \longrightarrow \tilde{V} \;/\; \_\_NC$

(G2) $NC \longrightarrow CC$

(G3) $\tilde{V}_1 \longrightarrow \tilde{V}_2$ (where V_2 lower than V_1)

The first (nasal assimilation) and third (vowel strengthening) rules are satisfactory, but the second is not. Following the general condition on assimilation that the weak element assimilates to the strong element (Lat. dictus > It. detto, not *decco), for a nasal to assimilate to a following consonant, that consonant must be stronger than the nasal. If the consonant is a liquid (ρ4; see Foley, n.d., p.117) the condition is met, but not if the consonant is an oral occlusive (ρ1). From NC we expect not CC but NN, as in Ger. Lamm (cf. Eng. lamb).

In place of the incorrect interpretation by Gordon, the following interpretation both conforms to the conditions on nasalization and avoids contradicting the conditions on assimilation.

The voiceless consonant is doubled after the nasal:

$$C \longrightarrow CC \;/\; N\_\_\_$$

this is a postnasal strengthening, as in Spanish β → b (hombre, but bibo [biβo]). After this initial step, nasalization proceeds normally:

$V \longrightarrow \tilde{V} \;/\; \_\_\_n$		(nasal assimilation)
$n \longrightarrow \emptyset + \sim \;/\; \_\_\_C$		(nasal effacement)
$\tilde{V} \longrightarrow \tilde{\tilde{V}}$		(strengthening of nasal vowel)
$\tilde{\tilde{V}}^n \longrightarrow V^{n+1}$		(denasalization)

For example: drinka > drinkka > drĩnkka > drĩ̃kka > drẽ̃kka > drekka.

Corroborative evidence comes from the cluster ht which gives tt plus lengthening of the preceding vowel (OE rihta, ON rētta). The standard interpretation parallels the standard interpretation of nasalization. First ht → tt, and then somehow the preceding vowel lengthens: $V \longrightarrow \bar{V} \;/\; \_\_tt$. But this rule is wrong, for vowels do not generally lengthen before geminate clusters, and in Old Norse they shorten.

The correct interpretation doubles t after h with subsequent combination of h with the preceding vowel:

$t \longrightarrow tt \;/h\_\_\_$		(postconsonantal strengthening)
$Vh \longrightarrow \bar{V}$		(combinatory lengthening)

Thus rihta > rihtta > rĩtta > rētta, paralleling exactly the nasalization process. Old Norse nasalization is the same as nasalization in other languages, though postconsonantal strengthening obscures the similarity.

6. Summary. Nasalization is a complex process comprising nasal assimilation and vocalization, nasal effacement, and vowel strengthening.

6.1 Before nasal effacement, vowels are nasalized by assimilation of nasality and vowels are raised by assimilation to a following high glide produced by vocalization of the nasal.

6.2 Nasal effacement applies preferentially to weak nasals, thus to velar nasals in preference to dental or labial nasals, to tautosyllabic nasals in preference to heterosyllabic nasals, to unstressed nasals in

preference to stressed nasals, to nasals after long vowels in preference to nasals after short vowels, to nasals after inherently strong vowels in preference to nasals after inherently weak vowels.

6.3 After nasal effacement, nasalized vowels may lengthen, lower, or diphthongize.

6.4 Denasalization may be epenthetic, syneric, corriptive, or spontaneous. Spontaneous denasalization occurs preferentially to weak vowels.

Our understanding of nasalization now allows us to answer the illustrative questions posed in section 0.

1. Nasalization is preferentially tautosyllabic rather than heterosyllabic because syllable-final nasals are weaker than syllable-initial nasals.
2. The lowering of vowels after nasal effacement reflects the extra strength acquired through nasalization. The raising of vowels before effacement reflects assimilation to a following high glide produced by vocalization of the nasal.
3. German nasalization occurs before x but not before s, f, or θ because n is the weakest nasal. Effacement occurs preferentially to weak elements.
4. English nasalization occurs before continuants but not before stops because vowels lengthen before voiced segments followed by continuants. The lengthened vowel weakens the following nasal.
5. Since intervocalic (heterosyllabic) nasal effacement implies preconsonantal (tautosyllabic) nasal effacement, if nasal effacement occurs in manus > mão, then it must also occur in centum (>*sẽtu). The phonetic nasal in cento ([sẽntu]) therefore cannot be original, but must represent a post-effacement epenthesis.
6. Denasalization applies preferentially to weak elements, thus to bõa (> boa) in preference to mão. In mão the nasal vowel is strengthened by combination with the following vowel to form a diphthong (aw). In bõa no diphthong is formed, rather o is weakened by the following vowel (vocalis ante vocalem corripitur). The weakening manifests itself as loss of nasalization.
7. Nasal effacement applies preferentially to unstressed nasals thus to Skt. hathá (*hanthá) but not to stressed hánmi.
8. Nasal effacement occurs preferentially after strong vowels, thus in Latin homo (*homon) but not in Latin nomen.
9. Denasalization applies preferentially to weak elements, thus to Polish idę (> ide) but not to Polish idą.

Footnote

[1] That Latin dẽns was phonetically [dẽs] is suggested by the loanword thensaurus for Greek thẽsauros. Cf. Foley (1971), paragraph E2, p.380.

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