

A survey of the phonology of the feature [±nasal]*

Abigail C. Cohn

In recent years, nasalization has been a topic of interest in both phonetics and phonology. Within phonetics, there has been work on the acoustics of nasalization, including the acoustic effects of vowel nasalization (Beddor (1983), Hawkins and Stevens (1985) among others). Work in phonology has included consideration of rules of nasal spreading (Anderson (1972), Hyman (1972; 1982) Poser (1981; 1982) among others) and of typologies of nasal segment inventories (Ferguson (1963; 1974), Ruhlen (1978), Maddieson (1984)). Despite this interest, there is no single source in the literature that provides an overview of the co-occurrence of inventories and rules. The database presented in this report was compiled to provide such information. The focus is on languages with inventories or rules deemed unusual.

Issues addressed in this report include the status of the feature [nasal], i.e. the types of inventories of sounds that have [nasal] as a distinctive feature; the behavior of rules involving the feature [nasal] and their interaction with different kinds of nasal inventories; and general issues that cut across both of the above topics.

In order to consider these issues, I have compiled a corpus of 165 languages. Information about the patterning of the feature [nasal] in each of these languages was entered into a database. This information was gathered through a computerized search and from several major sources about nasals and nasalization.

In Section 1 of this paper, I discuss the questions that I sought to address through this database. This is followed, in Section 2, by a brief description of the major secondary sources consulted. This includes a description of the kinds of theoretical questions addressed by each author, and the sorts of language information presented. In Section 3, I give a brief description of the construction of the database, including the type of language data used. In Section 4, I present results and discussion. This is followed by an appendix

* This paper, originally written in 1987, has been referred to in my work and that of others as Cohn, A. (1987) "A survey of the phonology of the feature [±Nasal]." UCLA ms. It appears here in its original form, with some minor errors and inaccuracies corrected. Since this paper was written, much attention has been paid to the representation of the feature [nasal] and formulation of processes of nasalization in both the phonological and phonetic literature which sheds further light on the issues discussed here. An excellent survey of more recent work in both phonology and phonetics is the volume edited by M. Huffman and R. Krakow (1993) *Nasals, Nasalization, and the Velum*. San Diego: Academic Press.

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with a description of the format of the database and a database entry for each language and a bibliography of both theoretical works and the language references cited in the database.

1. Terminology and Issues

Much of the consideration of the cross-linguistic patterning of the feature [nasal] is due to work by Ferguson (1963, 1974) and subsequent work stimulated by these articles (most notably the 1975 conference on nasals and nasalization and the volume of papers from that conference: Ferguson, Hyman and Ohala eds. (1975) *Nasálfest*). Ferguson (1963) defines six kinds of nasal "segments."

<u>Ferguson's Terminology</u>	<u>Terminology in this Paper</u>
1. <i>Primary nasal consonants</i> (PNC) (voiced nasal stops)	Nasals
2. <i>Secondary nasal consonants</i> (nasals with a secondary articulation)	—
3. <i>Nasal vowels</i>	Distinctively nasalized vowels
4. <i>Nasal syllabics</i>	—
5. <i>Nasal or nasalized allophones or phonemes the most characteristic of which are non-nasal</i>	Contextually nasalized segments (most commonly vowels and sonorants)
6. <i>Prosodic features of nasality</i> (alternately analyzable in terms of segmental phonology)	[+nasal] as a feature of something larger than the segment

Ferguson considers 5. and 6. to be less central. In this survey, I am interested in the possible patterning of the feature [nasal] with respect to 1, 3, 5, and 6 and their interaction.

I use *nasal* to refer to segments that are [+nasal, -continuant, (+voice)]-segments in which there is nasal airflow, but no oral airflow. *Nasalized* is used to refer to segments with both oral and nasal airflow (and the rather anomalous case of nasalized glottal stops in

which there is only potential nasal airflow), i.e. [+nasal] on anything but a [-continuant] segment. This is an articulatory definition, but it parallels, in some sense, the markedness of the feature [nasal]. [+nasal] in consonants is expected cross-linguistically and assumed to be unmarked, whereas [-nasal] in vowels (and sonorants) is rarer and assumed to be marked (Ferguson (1963), Maddieson (1984)).

The questions I consider here are on three difference levels. The first issue is possible contrasts in consonants and vowels based on the feature [nasal].¹ The second is, in cases where there is no contrast, whether physically there is no nasal airflow or whether there is allophonic (contextual) nasalization. Finally, in cases of allophonic nasalization, what type of patterns occur. More specific issues relating to each of these three levels are taken up in turn in sections 1.1, 1.2, 1.3, respectively.

1.1. The status of [nasal] as a distinctive feature

The first set of issues is concerned with the patterns of occurrence of the feature [nasal] in vowels and consonants. For the moment, considering only the role of the feature [nasal] as a distinctive feature, it may be present or absent in both vowels and consonants in any given language. Four possible patterns emerge:

	<u>Distinctive in Vowels</u>	<u>Distinctive in Consonants</u>
#1	No	No
#2	Yes	No
#3	No	Yes
#4	Yes	Yes

A basic question to ask is how common these four patterns are across languages. Of the implicational universal tendencies put forth by Ferguson (1963, 1974), there are four which make predictions about relative markedness of these four patterns:

- A. "All languages have at least one PNC [primary nasal consonant]." (Ferguson (1963, p.44, I.)).

¹ The status of the feature [nasal] was also considered by Hockett (1955, p.119-20).

- B. "No language has NV's [nasal vowels] unless it also has one or more PNCs." (Ferguson (1963, p. 46, X.)).
- C. . . . "languages normally don't have nasal vowel phonemes." (Ferguson (1976, p. 5)).
- D. "A certain type of nasal assimilation seems to be 'normal', i.e. vowels next to nasal consonants tend to become nasalized." (Ferguson (1976, p. 7)).

These assumptions, taken together, predict the relative markedness for the four different combinations of distinctiveness of [nasal] in consonants and vowels: The least marked patterning of [nasal] is for it to be distinctive in consonants, and allophonic in vowels (following A, C, D); a more marked pattern is [nasal] being distinctive in both consonants and vowels (based on A, C); and two highly marked patterns are [nasal] being distinctive in vowels but not consonants (following B) and [nasal] being distinctive in neither consonants nor vowels (following A, B).

There are exceptions to A. and B. Ferguson, himself, cites the exception of three Salishan languages which are described as having no nasals (and no nasalized vowels, i.e. [nasal] is not a distinctive feature in these languages). As discussed below, there are other exceptions as well. Although B. holds true of most languages and is certainly the unmarked case, there are some languages described as having nasalized vowels without nasals. Such cases will be considered below. Thus both A. and B. are generalizations, but they are not exceptionless universals.

A related question is what kinds of sounds can be distinctively nasalized. It has been argued that [nasal] plays a distinctive role only in [-continuant] and [+syllabic] segments (see Ladefoged and Maddieson (1986, chapter 4) for discussion of this point). Thus, it is assumed that glides, non-syllabic liquids, and fricatives are never distinctively nasalized. Why should this be the case? There are a few exceptions to this claim noted in the literature some of which appear in this database. What is the nature of these exceptions?

1.2. Non-contrast as absence of nasalization or as allophonic nasalization

In cases where there is not a distinctive use of the feature [nasal], it can be asked whether there is physically nasal airflow or not. D. claims that the 'normal' state for

languages with nasals is for the neighboring vowels to become nasalized. Is this equally true of languages with both nasals and distinctively nasalized vowels? For each of the four patterns we can consider the presence or absence of nasal airflow; in the cases where non-distinctive nasalization is present, we can consider its behavior. These issues are schematized in the following table, divided into the four patterns as defined above. Within each configuration further distinctions are drawn. The patterns under a. refer to the absence of non-contrastive nasal airflow and b. to its presence. Finally, i, ii, and iii identify issues which will be considered in 1.3 below.

Table 1

Contrastive in Vowels

		<u>No</u>	<u>Yes</u>
Contrastive in Consonants	<u>No</u>	1. a. non-existent, all segments oral on the surface b. non-distinctive, [+nasal] on the surface, but not contrastively, e.g. to facilitate a voicing distinction in stops c. prosodic system, [nasal] independent of C's or V's	2. a. non-existent in C's b. non-distinctive in C's (coarticulation, assimilation)
	<u>Yes</u>	3. a. non-existent in V's (no coarticulation) b. non-distinctive in V's i. direction: anticipatory, progressive, or both ii. domain: bound by syllable, foot, etc. iii. stress: does/not play a role iv. transparency of segments	4. a. no coarticulation or assimilation b. coarticulation or assim. i. neutralization of dist. and contextual nasalization ii. phonetic distinction between distinctive and contextual nasalization

Consider questions raised by these possibilities within the four configurations.

1.2.1. [nasal] contrastive for neither vowels nor consonants

As implied above, this pattern is assumed to be quite rare, although examples have been cited. How many cases have been cited in the literature and is there anything common to these languages? In these languages, what non-distinctive role, if any, does [nasal] play? Is there no nasal airflow (1a) or is there nasal airflow which is either random or which correlates with a distinctive feature in the language (1b)? 1c, systems of prosodic nasalization, count as [nasal] not being contrastive, because the categorization is in terms of consonants and vowels. In these languages, [nasal] does play a distinctive role, only not on the level of the segment.

1.2.2. [nasal] contrastive in vowels but not consonants

A few examples of this pattern have been cited in the literature, although in some cases it appears that there may be alternative analyses. How many cases are there and are these incontestable? In these languages, is there contextual "nasalization" of consonants, i.e. are there predictable alternations of consonants with respect to the feature [nasal]?

1.2.3. [nasal] contrastive in consonants but not vowels

As stated above, this pattern is the most common pattern across languages. Since nasalization is not used distinctively in vowels, it is expected that coarticulation will occur (and it is assumed by many that it does, even if it is not described (see Beddor (1983))). Are there cases in which there is no contextual nasalization? In the cases with contextual nasalization, four considerations present themselves: direction of nasalization, domain of nasalization, the role of stress, and transparency of segments with respect to spreading. These are taken up below (see 1.3).

1.2.4. [nasal] contrastive in both consonants and vowels

This is the next most common pattern, where, in addition to being distinctive in consonants, [nasal] is also distinctive in vowels. A basic question is whether contextual nasalization co-occurs with distinctive nasalization (4b). If it does, what is the interaction between the two? In what instances is there neutralization (4bi)? In what ways are distinctive nasalization and contextual nasalization differentiated (4bii)? Are there any generalizations regarding this pattern and direction of nasalization?

1.3. Patterns of allophonic nasalization

If non-contrast means allophonic, what kinds of allophonic effects are found:

1.3.1. Direction of nasalization

How does contextual nasalization pattern with respect to direction; is it anticipatory, progressive, or both? Does direction correlate with other characteristics (e.g. domain of nasalization, distinctive nasalization, etc.)?²

1.3.2. Domain of nasalization

If nasalization affects more than one immediately neighboring segment, what is the relevant domain? Do these correlate with possible prosodic/morphological domains: syllable rhyme (R), syllable (S), foot (F), morpheme (M), word (W) and so forth. Are there generalizations regarding domain of application and direction of application?

1.3.3. Role of stress

Related to the domain of application is the question of the role of stress as a conditioning factor. Schourup (1973) observes that stress and nasalization are often correlated. What kind of role does stress play?

1.3.4. Transparency of segments with respect to spreading of nasalization

It has often been observed that, in addition to vowels, sonorants may be contextually nasalized. Which segments, in particular, are most prone to nasalization: only vowels, laryngeal segments ([h, ʔ]), glides ([w, y]), liquids ([r, l]), or obstruents? This question was addressed by Schourup (1972). Here, additional data will be considered.

Related to this is the question of the physical feasibility of nasalization. It has been argued that phonetically spreading nasalization, initiated by a nasal segment, may never spread through an obstruent (Schourup (1973)) and that, further, there are no nasalized fricatives (see Ladefoged and Maddieson (1986)). Are there exceptions?

Finally, there are two considerations that cut across the distinctions drawn above.

1.4. The morphological role of nasalization

In addition to playing a phonological and a phonetic role, [nasal] may play a morphological or grammatical role in languages. Are there any generalizations about the kind of systems in which [nasal] plays such a role?

² The role of syllable boundaries in rules is not considered here. Although it is an important question, this information was not available in the secondary sources consulted with the exception of Schourup (1972; 1973).

1.5. Genetic and areal relationships

Is the distribution of nasalization cross-linguistically tied to genetic or areal relationships? This question was considered by Ruhlen with respect to languages with distinctive nasalization. The question will be considered here with regard to the range of observed patterns, issue by issue, where relevant.

2. Sources

In previous studies of the cross-linguistic patterning of nasals and nasalization, three general questions have been the main focus of attention: 1) the patterning of typical systems of nasals (consonants)—Ferguson (1963, 1974), Crothers (1975), Maddieson (1984); 2) the patterning of nasalized vowels (both distinctively and contextually nasalized), i.e. the number and height of nasalized vowels compared to oral vowels in the same language—Schourup (1973), Bhat (1975), Ruhlen (1978), Beddor (1983); and 3) the historical development of nasalized vowels—Lightner (1970), J. Foley (1975), Ruhlen (1978). Material was drawn from several of these sources, although these three questions are only tangentially related to the questions being addressed here. Additionally, several other sources, which discuss only one or a few languages, but focus on theoretical issues, were consulted in this study: Anderson (1976), Hyman (1972; 1982), Poser (1981, 1982), Hart (1981), van der Hulst and Smith (1982).

Below, I briefly summarize the sources used for this study in which descriptions from several languages were presented and an attempt was made to draw cross-linguistic generalizations.

Ferguson 1963 "Assumptions about Nasals; A Sample Study in Phonological Universals"

Ferguson defines and discusses 15 non-definitional assumptions (universal tendencies) regarding nasals, with language examples for many of the assumptions. He focuses mainly on the patterning and distribution of nasal consonants (nasals and nasals with secondary articulations).

Ferguson 1974 (see also 1975) "Universals of Nasality"

This article is part of the work of the Stanford Universals Project and draws on the Stanford Phonology Archives. Ferguson discusses the patterning of nasality and defines "normal" synchronic patterns and "normal" phonological processes, including types of nasal segments, possible nasal inventories and processes of vowel nasalization. Based on

this, some hypotheses are made about how these systems/patterns develop. Numerous language examples are cited.

Schourup 1973 (written before Schourup (1972)) "A Cross-language Study of Vowel Nasalization"

In this study, five aspects of nasalization are examined in order to determine their cross-linguistic characteristics: 1. and 2. the environment for regressive and progressive nasalization respectively (i.e. consonant environments and vowel quality); 3. the patterns of long distance spreading effects; 4. the patterns of vowel shifts (vowel quality changes) due to nasalization; and 5. the process of nasalization with concomitant nasal loss (nasal effacement). For each of these five points, numerous language examples are cited. The information for each language is limited to the specific point at hand, but throughout the article, reference is made to approximately 75 languages.

Schourup 1972 "Characteristics of Vowel Nasalization"

This is a reworking of the language data presented in Schourup (1973), focusing particularly on the cases where nasalization of not only vowels, but also sonorants, occurs. He discusses these patterns and groups them with respect to direction of spreading and transparency of segments to spreading. Based on this, he proposes a hierarchy of opacity. There is also discussion of the issue of nasal effacement.

Ferguson, Hyman, Ohala, eds. 1975 *Nasálfest*

This volume includes several important articles regarding cross-linguistic patterning of nasalization. In addition to different versions of some of the articles mentioned above (Ferguson (1974), Ruhlen (1978), Anderson (1976)), there are three articles which present data from a wide range of languages: Bhat "Two Studies of Nasalization," Crothers "Nasal consonant systems," and Foley "Nasalization as a universal phonological process."

Ruhlen 1978 (see also 1975) "Nasal Vowels"

Drawing on language data from the Stanford Language Archives, Ruhlen discusses "typical" patterns of nasal vowels cross-linguistically. Of the roughly 700 languages in the Archives, 150 are described as having nasal vowels (i.e. distinctively nasalized vowels). He considers the patterning of these with respect to geographical and genetic distribution and then considers both the synchronic and diachronic patterning of these systems. Numerous examples are cited for each issue discussed.

Beddor 1983 *Phonological and Phonetic Effects of Nasalization on Vowel Height*

The results of previous work on the effects of nasalization on vowel height have been contradictory. Beddor reconsiders the previous work and considers the range of possible patterns based on a language sample of 75 languages. In addition to specific information about vowel height and the inventory of both oral and nasalized vowels for each of these languages, Beddor presents basic information about the phonological patterning of nasalization, which made this source particularly useful for the present study.

Maddieson 1984 *Patterns of Sounds*, Chapter 4 Nasals

Maddieson discusses patterns of phonological inventories, using a database constructed from a sample of 317 languages (UPSID). Based on UPSID, Maddieson considers patterns of nasals including primary and secondary articulations. He also reconsiders Ferguson's (1963) assumptions. He cites all examples of very marked systems found in the sample, notably those with no nasals and those in which [nasal] is distinctive in vowels but not consonants.

Kawasaki 1986 "Phonetic explanations for phonological universals: The case of distinctive vowel nasalization"

Kawasaki hypothesizes that listeners' expectations in perceiving speech play a crucial role in giving rise to sound patterns of language. She tests this hypothesis with two experiments concerning the perception of nasality. In her introduction, Kawasaki draws on the languages in the Stanford Phonology Archives and cites extensive examples of a) non-distinctive nasalization, b) nasal loss, c) diachronic development of nasalized vowels, and d) position of maximal contrast for distinctive nasal vowels. Unfortunately, for the present study, although Kawasaki refers to dozens of languages, the actual information for each language is extremely limited.

LLBA—Linguistics and Language Behavior Abstracts

A computerized reference search was done, using *nasalization* and *nasality* as the descriptors. The resulting 76 references with abstracts were both phonetic and phonological in nature. The sources that focused on phonological nasalization in one or more languages have been incorporated into this study.

3. Database

In this section, the construction of the database, including the kind of language information used, will be described. A description of the format of the database as well as entries for each language is presented in the Appendix.

The languages collected for this sample all come from sources where the author was interested in some aspect of nasals or nasalization and attempted to look at cross-linguistic generalizations. From these secondary sources (see 2. Sources), there was discussion of approximately 200 languages. For 165 of these 200 languages, information relevant to at least one of the questions posed in this study was available. This information was the basis of the database presented and analyzed in this study. I am indebted to all of the sources consulted.

The default case across languages is assumed to be that there is a distinction in consonants based solely on the feature [nasal] (e.g. [m] ~ [b], [n] ~ [d], [ŋ] ~ [g]). Additionally, it is assumed that in such languages contextual nasalization of vowels occurs. Languages which fit this default pattern, where additional information about rules of nasalization was not available have been excluded from this study. In this survey, I have not considered the role of partially nasal segments, e.g. prenasalized or postnasalized stops (see Ladefoged and Maddieson (1986), Anderson (1976)). This involves the additional dimension of timing, which is an interesting matter and deserves further attention.

Since almost all of this information is taken from secondary sources, several caveats need to be made:

1) Primary references are cited for each language, but only in a few cases were they consulted. Almost all information presented here was taken directly from the secondary sources.

2) In most cases, the questions that I am addressing through this database are different from those posed by the authors themselves. Thus, the type of information available for each language is limited by the goals of the authors, and in most cases information for any particular language is available for only a few of the fields in the database. In addition, it is possible that I have misinterpreted the brief descriptions in these sources.

3) Since languages were chosen because they differed from the expected default pattern, this is neither a systematic nor a random language sample with respect to genetic affiliation or geographical distribution. As quite a lot is known about expected patterns of the feature [nasal] (Ferguson (1963, 1974), Crothers (1975), Ruhlen (1978), Maddieson (1984)), it is, rather, observing as much as possible about the less typical patterns that is the goal here.

The results of this study are preliminary in nature. The generalizations that emerge are suggestive for further research, but are not in themselves firm conclusions. The database, thus, serves as a guide to interesting cases.

4. Results

In this section, results and discussion are presented point by point. This discussion parallels the presentation of issues and questions in Section 1: the issues in 1.1, and 1.2, that is, the status of the feature [nasal] as a distinctive feature and the presence or absence of nasalization in non-distinctive situations, are taken up together in Section 4.2 (4.1 has been skipped in order to maintain a closer parallelism in the numbering of sections.); the patterning of allophonic nasalization is discussed in Section 4.3; the questions of the morphological role of nasalization is discussed in 4.4; a summary of the discussion of areal and genetic generalizations from the preceding sections is given in 4.5.

[4.1.]

4.2. The status of [nasal] as a distinctive feature and the presence or absence of nasalization in non-contrastive environments

For 76 of the languages, there was no information regarding the status of [nasal], which can be assumed to indicate that most of these are cases in which [nasal] is distinctive in consonants and not in vowels. As described above, these languages were included in the database because information regarding the patterning of allophonic nasalization was given in the description.

4.2.1. [nasal] contrastive for neither consonants nor vowels

There are nine languages where [nasal] plays no distinctive role in either consonants or vowels. These are presented in Table 2.

Table 2 Languages with no distinctive nasalization

<u>language</u>	<u>language family</u>	<u>location</u>
Chinese, Hakka	Chinese	China
Mura	Chibchan ³	Brazil
Pawnee	Caddoan	USA
Quileute	Chimakuan	USA
Rotokas	Bougainville, Western	Papua New Guinea
Salish, Duwamish	Salishan	USA
Salish, Puget Sound	Salishan	USA
Salish, Snoqualmie	Salishan	USA
Wichita	Caddoan	USA

Of these nine languages, three of them are Salishan languages all spoken on the Northwest Coast, two are Caddoan, and a total of six are Native American languages spoken in the USA. It is difficult to know, based on the brief descriptions, but it appears that in both Wichita and Hakka nasalization does play a non-distinctive role. Thus, these are languages that could be considered to fall under the pattern of 1.b in Table 1. In the case of Wichita, there is an alternation between [r] ~ [n], both described as allophones of /r/. Hakka is described as having prenasalized stops, but there are no voiced stops in the language. The prenasalized stops alternate with voiceless stops. It is reasonable to hypothesize that this is a case where [nasal] functions as an "enhancement feature" for [voice]⁴ (Stevens, Keyser, Kawasaki (1986)). Mura and Rotokas are both interesting in that they have extremely small phoneme inventories (see Maddieson (1984)). They are the two languages in UPSID that have the smallest phoneme inventories—only 11 phonemes. Perhaps in such systems, [nasal] is not as basic as place of articulation or other manner features. In Puget Sound Salish, [nasal] is described in one source (Thompson (1972)) as playing a minor morphological role, where nasalization marks the diminutive.

Besides for Wichita, Hakka, and Puget Sound Salish, the descriptions of these languages do not give enough information to determine whether nasalization is physically

³ This is listed by Grimes (1984) as being a language isolate, but is categorized by Maddieson (1984) as Chibchan.

⁴ The primary sources need to be consulted to verify this hypothesis. This is one of three languages in UPSID (Maddieson (1984)) that has no primary nasal consonants, but has prenasalized stops (see also Siriono and Apinaye). However, this is the only case where [nasal] does not appear to play a distinctive role elsewhere in the phonology.

present. It would be interesting to examine phonetic data from one or more of these languages to see how [nasal] behaves when it is not phonologically distinctive. Are these languages where the velum actually remains up at all times (pattern 1.a of Table 1) or is there nasal airflow which is random or which correlates with other features (pattern 1.b hypothesized for Hakka and Wichita)? A parallel case might be [voice]; often in languages which do not use voicing distinctively, phonetically there is extensive contextually determined use of the feature [voice] (e.g. Creek (Cohn (1986))).

There are 17 languages in the sample which are described as having prosodic nasalization: that is, where [nasal] is described as applying to something larger than the segment (1.c in Table 1). There are also 22 languages in the sample which are not specifically described as having prosodic nasalization, but where the domain of nasalization appears to be larger than the segment. It is difficult to separate languages described as having long distance spreading of [nasal] and those which have prosodic nasalization. To a large degree, this difference depends on the theoretical orientation of the description. As noted by Ferguson (1963), prosodic systems can always be analyzed in segmental terms.

The large number of examples of prosodic and long-distance spreading systems supports the idea proposed by Anderson (1976), Hyman (1972; 1982), Poser (1981), and others that [nasal] is often suprasegmental in nature. Questions of the characteristics of these languages will be considered below in Section 4.3.2. Domain of nasalization.

4.2.2. [nasal] contrastive in vowels but not consonants

There are 10 languages in the sample in which [nasal] is distinctive in vowels, but not in consonants. A list of these languages is presented in Table 3.

Table 3 Languages where [nasal] is distinctive in vowels but not consonants

<u>language</u>	<u>language family</u>	<u>location</u>
Akan	Kwa	Ghana
Apinaye	Ge	Brazil
Barasano	Tucanoan	Columbia, Brazil
Ewe	Kwa	Ghana, Togo
Hidatsa, Missouri R.	Siouan	USA
Kpelle	Mande	Liberia
Parintintin	Tupí	Brazil
Senadi/Senoufo	Gur	Ivory Coast
Siriono	Tupí	Bolivia
Tucano	Tucanoan	Columbia, Brazil

The description of four of these cases is rather ambiguous. Kpelle is described very differently in three separate sources. In one description of Barasano, it is described as having nasalization as a property of syllables, rather than vowels. Siriono is described as having no principle nasal consonants, but it is not clear whether the use of prenasalized stops in contrast to voiced stops is predictable from distinctively nasalized vowels. It is not clear whether nasality in consonants in Akan is fully predictable.

Considering the possible difference between patterns 2.a. and 2.b. (as described in Table 1), the latter seems much more common. Of the six languages not yet discussed, in all but one instance, there is predictable nasalization of neighboring consonants, either stops (e.g. Apinaye, Parintintin), or sonorants (e.g. Hidatsa, and maybe Ewe). This includes some of the complex timing relations of partially nasalized segments described by Anderson (1976) in which prenasalized and postnasalized segments are predictable from the nasalization of neighboring vowels. There is only one example in which it appears that nasalization does not play even a non-distinctive role in consonants—Tucano—but this impression may be due to lack of information.

This pattern is not as unusual as is often assumed. But it is true that the analysis of these languages is less clear cut than most of the other groups, as some of these languages have been alternatively analyzed as having distinctive nasalization in consonants and not vowels or as being systems with prosodic nasalization. Geographically, the languages in Table 3 are grouped quite closely. Five of them are spoken in South America and four of them are spoken in West Africa. These are both geographic areas that are often described

as having various nasal spreading processes, which does make one wonder if these cases are prosodic in nature, but were described or interpreted by someone who did not consider the possibility of [nasal] playing a role in a domain larger than the segment. I do not know what an appropriate diagnostic would be to determine whether a language does indeed fit this pattern. Certainly, closer examination of these cases would be useful.

4.2.3. [nasal] contrastive in consonants but not vowels

This group, the largest, will be considered in the more general discussion of the direction and domain of nasalization (4.3.1 and 4.3.2 respectively).

4.2.4. [nasal] contrastive in both consonants and vowels

There are 60 languages described as having distinctive nasalization in both vowels and consonants. For identification of specific languages that fit this pattern, the reader is referred to the status field in the Appendix. It is often assumed that nasalization plays a contextual role as well in languages of this pattern. One interesting question concerning languages with both distinctive and contextual nasalization of vowels is whether there is a phonetic distinction between nasalization from these two different sources, i.e. whether either distinctive or contextual nasalization is stronger or longer in duration. For 31 of the languages, no information was presented regarding the behavior of contextual nasalization.

Of the remaining 29 languages, 25 are described as having neutralization of distinctively nasalized vowels in the environment of a nasal consonant. Except for the case of Bengali, where contextual nasalization is described as being stronger than distinctive nasalization, no information is provided in these cases about the possible distinction of contextual and distinctive nasalization. It is certainly possible that there is a physical difference, but in these cases, since there is neutralization, it is assumed that such a distinction would be phonologically irrelevant. In the remaining four cases, where there is no neutralization, distinctive nasalization is described as being stronger than contextual nasalization in three cases: Nama, Kannada, and Picurus. Contextual nasalization is described as stronger in one case: Albanian. In addition, in two of the cases of pattern 2, in which [nasal] is distinctive in vowels but not in consonants, relevant information is cited. In Ewe, there is no neutralization between distinctive and contextual nasalization and distinctive nasalization is stronger. In Senadi, there is neutralization.

In cases with both distinctive and contextual nasalization, by far the most common pattern is for there to be neutralization in potentially ambiguous contexts. But in many of these cases, 12 languages, it is not clear from the description which context neutralization

occurs in. For the remaining 13 languages the patterning of neutralization with respect to direction of contextual nasalization is as follows:

Table 4 Patterning of neutralization with respect to direction of contextual nasalization

Direction of: nasalization	→	anticipatory	progressive	both
neutralization				
↓	/_N	4	0	1
	/N_	1	2	4
	//N	1	0	0

Six of the cases for which there is information about neutralization are cases with anticipatory nasalization. Of the anticipatory cases, four—Chinese, Goajiro, Grand Couli, and Kashmiri—pattern as one would expect; neutralization occurs before a nasal, precisely the context of contextual nasalization. It is odd that in one case, Nupe, neutralization is said to be in the opposite context of the contextual nasalization. This should be verified. Also in one case, Bengali, neutralization occurs both before and after a nasal, although contextual nasalization only occurs before a nasal. This might relate to the fact that, in addition to having distinctively nasalized vowels, [nasal] also plays a morphological role in Bengali. The two cases with progressive nasalization, Bariba and Mazatec, pattern as one would expect with neutralization following a nasal. The cases with nasalization in both directions neutralize in only one direction, most often after a nasal. In four languages, Ayulta Mixtec, Ijo, Navaho, and Yoruba, neutralization occurs after a nasal; in one language, Hindi-Urdu, it occurs before a nasal. In many of the languages with nasalization in both directions, the character of the nasalization in each of the two directions is different and this may determine the context of neutralization.

If there is no neutralization, it appears to be more common for a difference to be made by distinctive nasalization being stronger than contextual nasalization. There are no languages in the sample which are described as having both distinctive and contextual nasalization, without either neutralization or some phonetic distinction occurring between the two types of nasalization. It would be interesting to have more phonetic data to know

whether, in the cases with neutralization, there is also a phonetic distinction made and whether it is perceptible.

Ruhlen (1978) observes that distinctively nasalized vowels are both areal and genetic features of languages. The patterns in this study follow Ruhlen's observations fairly closely. Distinctively nasalized vowels occur in 33 of the 70 language families represented in this study. In most of these cases (23 out of 33), at least two thirds of the languages in the family have distinctively nasalized vowels. Geographically, there is a concentration of languages with distinctively nasalized vowels in South America, Mexico, India, West Africa and to a lesser degree, USA.

4.2.5. [nasal] as distinctive in segments which are neither [-continuant] nor [+syllabic]

Is it possible for anything besides a [-continuant] or a vowel to be distinctively nasalized? In the database, there are nine examples of sonorants or fricatives which are claimed to be distinctively nasalized. A list of these languages appears in Table 5.

Table 5 Languages with distinctively nasalized sonorants and fricatives

<u>nasalized</u>	<u>language</u>	<u>lang family</u>
ṽ	Lua	Kwa
ṽ	Marathi	Indo-Iranian
β	Waffa	E. New Guinea Highlands
ÿ, ħ	Umbundu	Benue-Congo
ṽ	Breton	Celtic
ÿ	Japanese	Japanese
ÿ	Yakut	Turkic
ṽ	Sinhalese	Indo-Iranian

Several of these examples are cited in Maddieson (1984). In the instances in which it is claimed that there is a distinctively nasalized fricative, I do not know what the actual articulatory facts are. In any case, these all appear to be clearly documented cases of distinctively nasalized non-vowel continuants. Thus, it can be said that such segments are highly marked, but not that they never occur.

4.3. Patterning of allophonic nasalization

4.3.1. Direction of nasalization

There are three possibilities for direction of nasalization: anticipatory, progressive, or both anticipatory and progressive. No information regarding direction of nasalization was presented for 48 of the languages in this study. The direction of nasalization for all other languages, including both those with and without distinctive nasalization of vowels, is as follows: anticipatory - 61; progressive - 30; both - 26. Anticipatory nasalization is often assumed to be much more common than progressive nasalization (Barrett (1982)). While it is true that anticipatory nasalization is more common, the number of cases of progressive nasalization and nasalization in both directions is also considerable.

What is interesting is that the characteristic patterns of anticipatory and progressive nasalization are somewhat different. Looking first at the cases with nasalization only in one direction, it is less common for long distance spreading to occur with anticipatory than progressive nasalization. Only four cases out of the 61 cases of anticipatory nasalization involve spreading in a domain larger than the segment; whereas 11 of the 30 cases of progressive nasalization involve such spreading. Long distance spreading in languages with nasalization in both directions is considered below.

Concomitant with anticipatory nasalization is nasal loss (or effacement). Nineteen of the 61 anticipatory cases are described as having a rule of nasal loss. This is obligatory in some cases and optional in others. Such a rule is described as well for six of the languages with nasalization in both directions, but in all cases it is anticipatory nasalization that triggers the loss. One case, Capanahua, is particularly interesting in this regard. There is anticipatory nasalization, which may spread through vowels, glides, [ʔ], and [h]; if a subsequent optional rule of nasal deletion applies, progressive nasalization occurs as well, spreading through vowels and glides.

In Table 6, the patterning of the distinctive use of the feature [nasal] in vowels with respect to direction of contextual nasalization is considered. In each case, the number of languages for each group in which long distance spreading is involved is put in parenthesis (i.e. a subset of each group).

Table 6 Patterning of distinctively nasalized vowels with respect to direction

Distinctive in vowels —>		No	Yes	Total
Direction ↓	Anticipatory	38	23(4)	61(4)
	Progressive	15(5)	15(6)	30(11)
	Both	16(8)	10(7)	26(15)
	Total	69	48	117

The distribution of direction of nasalization within languages with a distinctive use of [nasal] in vowels is not too different from the overall distribution. The number of cases of progressive nasalization is proportionally higher, and anticipatory nasalization lower, for languages with distinctively nasalized vowels than for ones without, but no particularly interesting patterns emerge.

The most interesting cases are those with nasalization in both directions (26 languages). In the Table 7, I list all languages in the sample with nasalization in both directions. In the first column, languages with no additional information have been identified. Next, it is indicated whether long distance spreading is involved (L = yes). In the next two columns, it is noted for each anticipatory and progressive nasalization whether long distance spreading is involved and whether anticipatory or progressive is dominant (+ = more dominant). (By dominant, I mean more regular and applies in most contexts.) In the last column, it is noted whether it is a language with distinctively nasalized vowels (V = yes).

Table 7 Languages with both anticipatory and progressive nasalization

<u>language</u>	<u>No Info</u>	<u>LongDist</u>	<u>Antic.</u>	<u>Prog.</u>	<u>Dist. V</u>
Armenian, Eastern	NI				-
Bagheli		L		+	
Basque	NI				-
Breton, Plouyescant	NI				V
Capanahua		L	L+	L	-
Eskimo, Greenlandic		L	L+		-
Fanti/e		-		+	-
Gaelic, Applecross		L	L	L+	V
Gokana		L	?	?	-
Guaraní		L	=	=	V
Hindi-Urdu		-	+		V
Ijo, Kolokuma		L	L+		V
Irish	NI				V
Island Carib		-	+		V
Konkani		L?	L?+		V
Maidu		-		+	-
Maxakali		L	L+		-
Mixtec, Ayutla		L?		L?+	V
Mundari	NI				
Navaho				+	V
Seneca		L	?	?	-
Somali	NI				
Spanish, Panama		-	+		-
Spanish, S. Castilian		L	=	=	
Sundanese		L		L+	-
Urdu		L	=	=	-

Looking at Table 7, it is clear that a wide range of patterns occur with nasalization in both directions. Overall, anticipatory nasalization is dominant in eight cases, progressive in seven and they are equal in three cases. There is long distance spreading involved in fourteen cases. This is proportionally a much higher incidence than in the sample as a whole. Of these fourteen cases, there is no additional information in two cases,

anticipatory nasalization is dominant in five cases, progressive in four and equal in three. In all cases, if there is long distance spreading and it is only in one direction, this is the dominant direction. There is distinctive nasalization in ten of these cases. These are cases of extremely complex patterning of nasalization and it would be interesting to know more about their phonetics.

4.3.2. Domain of nasalization

There are 39 cases in which the domain of nasalization is larger than the segment. In segmental terms, these are cases where contextual nasalization applies iteratively. Assuming an autosegmental representation of the [nasal], these are cases where the domain of application is larger than the segment. I have interpreted the descriptions of the relevant domains in terms of prosodic/morphological constituents where possible (i.e., syllable rhyme (R), syllable (S), metrical foot (F), word (W), and so forth). In Table 8, these 39 cases are presented, organized by domain, with language family and location information provided for each language.

Table 8 Domain of nasalization

<u>domain</u>	<u>language</u>	<u>lang family</u>	<u>location</u>
F	Mixtec, Jicaltepec	Mixtecan	Mexico
F	Mixtec, Molinos	Mixtecan	Mexico
F	Shiriana	Yanomán	Brazil, Venezuela
F?	English, midw.,east	Germanic	USA
F? M?	Guaraní	Tupí	Bolivia, Argentina
S	Apache, Chiricahua	Athapaskan	USA
S	Barasano	Tucanoan	Columbia, Brazil
S?	Mazatec	Popolocan	Mexico
S	Tiwa, Taos/Northern	Kiowa-Tanoan	USA
W	Acehnese	Hesperonesian	Indonesia
W	Capanahua	Panoan	Peru
W	Gaelic, Applecross	Celtic	England
W	Gbeya	Adamawa-Eastern	Central African Rep.
W	Gokana	Benue-Congo	Nigeria
W	Ijo, Kolokuma	Kwa	Nigeria
W	Indonesian	West Indonesian	Indonesia
W	Malay	West Indonesian	Indonesia, Malaysia

W	Maxakali	isolate	Brazil
W	Otomi, Pame	Otopamean	Mexico
W	Parintintin	Tupí	Brazil
W	Sundanese	Hesperonesian	Indonesia
W	Terena	Arawakan	Brazil
W	Warao	isolate	Venez., Guyana, Surin.
?	Arabela	Zaparoan	Peru
?	Breton	Celtic	France
?	Bribri	Chibchan	Central Am., Costa R.
?	Chinantec, Tepetot.	Chinantecan	Mexico
?	Desano	Tucanoan	Columbia, Brazil
?	Eskimo, Greenlandic	Eskimo-Aleut	Greenland
?	Hindi-Urdu	Indo-Iranian	India, Pakistan
?	Igbo	Kwa	Nigeria
?	Konkani	Indo-Iranian	India
?	Land Dayak	Hesperonesian	Indonesia
?	Mandan	Siouan	USA
?	Mixtec, Ayutla	Mixtecan	Mexico
?	Senadi/Senoufo	Gur	Ivory Coast
?	Umbundu/Mbundu	Benue-Congo	Angola
?	Urdu	Indo-Iranian	Pakistan, India
? str	Cashibo	Panoan	Peru

The languages preceded by a ? are ones in which it is clear from the description that the domain of nasalization is indeed larger than the segment, but there is no specific information about the domain. In many of the cases, the domain is probably the word, but without consulting the primary sources, this is only a guess. The cases where the domain is the metrical foot (F) are of two types. There are cases, Midwestern English and Molinos Mixtec, where spreading is bound by the foot; there are cases, Jicaltepec Mixtec and Shiriana, where all relevant segments must be either [+nasal] or [-nasal] within the foot. The descriptions of Guarani are rather contradictory and it is not clear whether the domain is the foot or the morpheme. The cases preceded by S are ones in which nasalization is said to be a property of the syllable or the syllable rhyme. Unfortunately, more explicit information is not given for any of these four cases. The cases preceded by W are ones in which the domain is the word or is bound by the word in at least one direction. One

particularly interesting case is Applecross Gaelic, which is described as being bound by the word in progressive spreading, but bound by the foot in anticipatory spreading. Finally, Cashibo is a case in which spreading of nasalization beyond the segment is triggered by the presence of stress. In cases where the morpheme (M) is defined as relevant, it acts as a trigger for nasalization and not as domain in which nasalization spreads. Thus, in this sample, it appears that all examples of domains larger than the segment appear to correlate with prosodic domains. There is no description of anything larger than the word being a domain relevant to nasalization.

Twenty five language families in the sample have examples of nasalization spreading beyond a single segment. Unlike cases with distinctive nasalized vowels, here only a minority of the languages in any given family exhibit long distance nasalization. (This is excluding families with only one language in the sample.) Mixtecan and West Indonesian are exceptions to this generalization, but in both of these cases, the languages representing these families within this study are very closely related or are only different dialects. It seems that it is not uncommon for individual languages to develop long distance spreading. There do seem to be particular areas which are particularly prone to long distance spreading of nasalization: South America, Mexico, Indonesia, and West Africa, but closer examination would be needed of the precise speaking areas of these languages to draw a firm conclusion about areal influence.

4.3.3. The role of stress

In some cases, stress is related to the domain of nasalization, but it can also be considered independently. There are twelve languages in the sample which are explicitly described as having stress play a role. Stress plays two general types of roles: 1) As described above, stress may define the domain of application, e.g. Molinos Mixtec, Midwestern English, Applecross Gaelic. 2) Stress may play a restricting role in the application of a rule or the distribution of nasal segments, i.e. some type of correlation between stress and nasalization. In Acehnese, there is a contrastive nasal/oral distinction in vowels only in stressed syllables. In Diola Fogny, Upper Austrian German, and Panama Spanish, allophonic rules of nasalization apply only if the vowel in question is stressed. In Guaraní, only stressed segments are specified for [nasal]. In Goajiro, Island Carib, and Jicaltepec Mixtec there is a link between stress and nasalization. In the case of Cashibo, only in the presence of stress is contextual nasalization iterative.

4.3.4. Transparency of segments

Schourup (1972) discusses the transparency of segments with respect to nasalization. He presents data from thirteen languages. Here data from 37 languages are presented. Schourup proposes a hierarchy of sorts (my formulation of his generalization):

Most likely to nasalize

Least likely to nasalize

V > h, ? > w, y > r, l > obstruents

He explains this on the basis of the oral-nasal coupling requirements of these segments (Schourup (1972, p. 533)). For vowels and glides, lowering of the velum will have less effect on the signal than for sounds, particularly fricatives, which have higher oral airflow requirements. It is predicted that fricatives cannot be nasalized, although Schourup cites the exception of Guaraní. The patterns found in the present sample are presented in Table 9. The results are generally consistent with Schourup's observations.

Table 9 Transparency of segments

<u>segs spread thru</u>	<u>language</u>	<u>lang family</u>	<u>domain</u>
V	Cashibo	Panoan	? str
V	Island Carib	Arawakan	str
V	Senadi	Gur	?
V w	Breton	Celtic	? str
V w y	Chinantec, Tepetot.	Chinantecan	?
V glides	Konkani	Indo-Iranian	?
V glides	Arabela	Zaparoan	?
V glides	Maxakali	isolate	W
V glides	Urdu	Indo-Iranian	?
V h ?	Mixtec, Molinos	Mixtecan	F
V h ?	Otomi, Pame	Otopamean	W
V h ?	Sundanese	Hesperonesian	W
V ?	Mixtec, Ayutla	Mixtecan	?
V w y h	Warao	isolate	W
V w y h	Yoruba	Kwa	W
V w y h	Land Dayak	Hesperonesian	?
V w y ?	Seneca	Iroquoian	?
V w y h ?	Malay	West Indonesian	W?
V w y h ?	Terena/Tereno	Arawakan	W?
V w y h ?	Acehnese	Hesperonesian	str
V w y h ?	Capanahua	Panoan	?
V w y h ? ?	Indonesian	West Indonesian	W?
V w y r	Ijo, Kolokuma	Kwa	W
V w h r	Mandan	Siouan	?
V w y h r	Hindi-Urdu	Indo-Iranian	?
V w y h r l	English, midw., east	Germanic	F?
V [+sons]	Spanish, S. Castilian	Romance	?

Table 9 continued

<u>segs spread thru</u>	<u>language</u>	<u>lang family</u>	<u>domain</u>
V y w obsts	Gbeya	Adamawa, Eastern	W
V h frics	Igbo	Igbo	?
V r [uv. fric]	Eskimo,Greenlandic	Eskimo-Aleut	?
w frics	Umbundu/Mbundu	Benue-Congo	?
V [+sons] frics	Guaraní	Tupí	F? M?
V [+sons] ʃ f	Gaelic, Applecross	Celtic	W
all - incl obst	Desano	Tucanoan	??
[+voice]	Gokana	Benue-Congo	W
frics [+voice]	Kpelle	Mande	?
y, ɔ	Cubeo	Tucanoan	?

The languages above the line are easily discussed in the terms used by Schourup. There are languages where iterative spreading is only through vowels (3). There are cases where spreading involves vowels and glides (6). It is not possible to know, without consulting the primary sources, whether "glide" includes only *w* and *y* or whether it is intended to include *h* or glottal stop as well. There are cases where spreading is through vowels and laryngeal segments (4). There are nine cases where spreading is through vowels, glides, and laryngeal segments. There are five cases in which a range of sonorants is included. Without consulting the primary sources, I do not know whether in these cases this is all of the sonorants or only a subset in a particular language. This is all in fitting with Schourup's hierarchy, except for the cases with spreading through vowels and glides, but not laryngeal segments. Contrary to Schourup's observation, it does appear that nasalized glides may occur without nasalized laryngeal segments. I would propose a slight modification to the hierarchy, whereby spreading through laryngeal segments is independent of spreading through supraglottal segments:

Most likely to nasalize		Least likely to nasalize
	> h, ?	
V	> w, y	> r, l > obstruents

Separating out the laryngeal segments, this hierarchy looks like a sonority hierarchy (as proposed by Hankamer and Aissen (1974), Zwicky (1972)) In his description, Schourup

implies this kind of gradient applicability of the feature [nasal], in this case across languages not within particular languages. It is hypothesized that the gradient behavior of the feature is due to the balancing of the kind of articulatory facts outlined by Schourup and the general applicability of the feature.

Below the line are ten cases where nasalization is said to affect fricatives, among other things. These cases are of particular interest as it is often assumed that fricatives cannot be nasalized. It has been hypothesized that in such cases the nasalized sounds are not actually fricatives, but rather approximants (Ladefoged and Maddieson (1986)). All of these cases merit further attention to address questions regarding both phonetic behavior and phonological patterning of these segments. A language which has nasalization of what are phonemically fricatives and also has phonemic approximants at the same place of articulation (e.g. w and β) would be useful for testing this hypothesis. Would there be phonetic differences between the two (i.e. between \tilde{w} and β)?

4.4. The Morphological Role of Nasalization

There are 14 languages in the sample where [nasal] plays some kind of morphological role, i.e. a morphological contrast is signaled solely by the presence or absence of [+nasal] on one or more consonants or vowels. A list of these languages is presented in Table 10.

Table 10 Languages where [nasal] plays a morphological role

<u>language</u>	<u>language family</u>	<u>location</u>
Apache, Kiowa	Athapaskan	USA
Bengali	Indo-Iranian	India, Bangladesh
Breton	Celtic	France
Chatino	Zapotecan	Mexico
Chipewyan	Athapaskan	Canada
Creek	Muskogean	USA
Hindi-Urdu	Indo-Iranian	India, Pakistan
Kannada, Havyeka	Dravidian, Southern	India
Karok	isolate	USA
Maithili	Indo-Iranian	India, Nepal
Otomi, Pame	Otopamean	Mexico
Salish, Puget Sound	Salishan	USA
Terena/Tereno	Arawakan	Brazil
Yuchi	isolate	USA

Three general questions are of interest. 1) What kind of morphological role does nasalization play? 2) What is the general patterning of [nasal] in these languages? 3) Are there genetic or areal connections between these languages?

1) No information about function is presented for three of the languages. Of the others, the function can be roughly characterized as inflectional in eight of the languages, and derivational in three. The three derivational cases include Creek, where nasalization of the verb stem final vowel indicates intensity, and Karok and Puget Sound Salish, where in both cases nasalization marks the diminutive. In five of the inflectional cases, Bengali, Chatino, Chipewyan, Hindu-Urdu, and Terena nasalization marks some kind of verbal person or number distinction. In two cases, Chipewyan and Yuchi, some kind of tense/aspect distinction is marked.

2) Most of these languages are described as having distinctive nasalization in vowels. In some of the cases, there is no information; the case of Puget Sound Salish was discussed above; and two cases, Terena and Pame Otomi, are described as having prosodic nasalization, where a morpheme [nasal] spreads within a particular domain.

3) There is an interesting concentration of geographic locations. Six of these languages are Native American languages spoken in the USA or Canada, four of the

languages are spoken in South Asia (three of these are Indo-Iranian) and two of these are spoken in Central America (Mexico).

Although there are generalizations that can be drawn, it is clear that nasalization may function morphologically in a number of different ways across languages.

4.5. Genetic and areal relationships

Genetic and areal relationships have been considered above, where relevant. Most notably, this study supports Ruhlen's earlier finding that distinctively nasalized vowels are both a genetic and an areal feature. It was observed that long distance spreading appears to have areal influences related to it, but for the most part not genetic ones.

4.6. Conclusions

The results presented above raise numerous questions and suggest directions for further research. The most interesting results are as follows: 1) There is a relatively high occurrence of certain patterns assumed to be highly marked: the cases of languages with no distinctive use of [nasal]; those with [nasal] distinctive in vowels, but not consonants; the number of cases of nasalized approximants and fricatives; and the number of cases of contextually nasalized fricatives. 2) The interaction of distinctive and contextual nasalization in languages with both is of interest. All languages, for which information is available, either have neutralization in the environment in which these two sources of nasalization would be ambiguous or there is a physical distinction between the two. 3) Progressive nasalization is more common than often assumed. 4) Long distance nasalization follows certain regular patterns. What can be spread through follows a sonority hierarchy and the domain in which spreading occurs is an independently defined prosodic domain.

The sorts of questions left unanswered require two additional kinds of information: 1) consultation of primary sources for a more detailed understanding of a particular phonological system, e.g. the full inventory of phonemes, additional information about certain phonological rules and so forth; and 2) instrumental work to allow a consideration of the phonetic facts in light of the phonological descriptions. This is particularly important as very little previous phonetic description has appeared in the literature. (With the exception of a few isolated studies (notably Clumeck (1976), Robins (1957), J. Ohala (1971), and M. Ohala (1976)), little instrumental work on the description of nasalization in languages other than English has been undertaken.) Most lacking is work comparing the physical realization of distinctive and contextual nasalization in languages with both and

information about the presence or absence of nasal airflow in languages with no distinctive nasalization.

Appendix

A. Database format

In Figure 1, a copy of the database format is presented.

language	lang family	location	refs	status	direction	domain	segs spread thru
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Figure 1. Format of the database

The database is indexed by **language** with entries for different dialects only in cases where dialects differed in significant ways. Specific dialect names, alternate spellings and so forth are included where appropriate.

The **language family** field contains information about genetic affiliation. The **location** field lists the country/countries where a language is spoken. If a language is spoken in several countries, the ones with the most significant populations of speakers have been listed. Both the **language family** and **location** fields were completed by consulting Grimes (1984) *Index to the Tenth Edition of Ethnologue*. Some of the sources presented information about genetic affiliation as well, but for consistency I used the information from Grimes throughout. In general, her genetic affiliations refer to smaller grouping and no attempt is made to group language families into stocks.

In the **references** field, both secondary sources and primary sources are listed, including page numbers when they were cited in the secondary sources. Sources which I have not consulted have secondary source information in brackets, listing the source or sources from which the reference was taken. The abbreviations referring to secondary sources are as follows:

- A76 - Anderson 1976
- Ba82 - Barrett 1982
- Be83 - Beddor 1983
- F1 - Ferguson 1963
- F2 - Ferguson 1974

H82	-	Hyman 1982
L86	-	Ladefoged & Maddieson 1986
LLBA	-	Linguistics & Language Behavior Abstracts
M84	-	Maddieson 1984
R78	-	Ruhlen 1978
S1	-	Schourup 1972
S2	-	Schourup 1973
VdH	-	van der Hulst & Smith 1982

In the **status** field, information was coded regarding the distinctive role of the feature [nasal]. The following abbreviations were used:

∅	[nasal] not distinctive in either C's or V's
V	[nasal] distinctive in V's
	y neutralization of distinctively and contextually nasalized V's /N
	n no neutralization
	c contextual nasalization is stronger than distinctive nasalization
	d distinctive nasalization is stronger than contextual nasalization
X	[nasal] <i>not</i> distinctive in C's
P	nasalization prosodic in nature
M	[nasal] plays a morphological/grammatical role

Both the **direction** and **domain** fields were used to code information concerning behavior of rules involving the spreading of nasalization.

In the **direction** field, where information about direction of nasal spreading and the possibility of concomitant nasal loss were encoded, the following abbreviations were used:

?	contextual nasalization, direction unknown
A	anticipatory nasalization /_N
P	progressive nasalization /N_
B	nasalization in both directions
∅	deletion of a nasal in the environment of a contextually nasalized vowel
x	direction information refers to spreading to a consonant

If the spreading of nasalization affected more than just an immediately neighboring vowel, information as to the domain of spreading was listed in the **domain** field. This field was also used to indicate if stress played a role in defining either the domain or applicability of a rule. The following abbreviations were used:

- R rhyme
- S syllable (also in non-iterative cases if the trigger must be in the same syllable)
- F foot
- M morpheme
- W word
- str stress plays a role

The field **segs spread thru** was used to encode information about the transparency of segments with respect to nasalization. Thus any segments which could become nasalized by spreading were listed in this field. Most of the segments listed in this field are sonorants. Also distinctively nasalized segments besides vowels and non-continuants are listed in this field separated from contextually nasalized segments by a semicolon and followed by an exclamation point.

There are four additional fields in the database which are not directly relevant to this report. **Blocked by** was used to list segments which block the spread of nasalization. For the most part, this was in complementary distribution with segments spread thru. There are clearly cases when these two would not be in complementary distribution, but the available descriptions did not allow this distinction to be drawn. In the **oral vowels** and **nasal vowels** fields, vowel inventories were listed when described in the secondary sources. Vowel inventory information was only available for a small subset of languages in the sample, thus this information has not been used in the present analysis. Finally the **comments** field was used for additional information which did not fit into one of the above fields.

B. Database entries, alphabetically by language

language	lang family	location	refs	stat	dir	dom	thru
Acehnese	Hesperone- sian	Indonesia	Durie (1984)	V	P	str	V w y h ?
Akan	Kwa	Ghana	Schachter & Fromkin (1968)[Ba82], Welmers (1946)[K86], Crothers (1975)	V X	A Px		
Alabama	Muskogean	USA	Rand (1968)[K86, Be83]		A	R	
Albanian	Albanian	Albania	Lowman (1932)[Be83], Cimochowski (1951)[Be83]	V c	A		
Amahuaca	Panoan	Peru, Brazil	Osborn (1948)[K86]				
Apache, Chiricahua	Athapaskan	USA	Hoijer (1946)[Hockett (1955:119)]			R	
Apache, Kiowa	Athapaskan	USA	Bittle (1963)[Be83]	VM	?		
Apinaye	Ge	Brazil	Burgess & Ham (1968)[K86, M84], Callow (1962)[A76:13]	V X			
Arabela	Zaparoan	Peru	Rich (1963)[Be83]	P	P	?	V, glides
Armenian, Eastern	Armenian	USSR, Middle East	Allen (1950: 197)[Be83, K86]		B? Ø		
Azerbaijani	Turkic	Middle East, Iran	Householder (1965)[K86]		A Ø		
Bagheli	Indo- Iranian	India	Pathak (1976)[LLBA#44]		B?		

language	lang family	location	refs	stat	dir	dom	thru
Barasano	Tucanoan	Columbia, Brazil	Stolte & Stolte (1971)[M84], Crothers (1975)	V X P?		S	
Bariba	Gur	Nigeria	Welmers (1952)[Be83]	V y	P		
Basque	isolate	Spain, France	Lochak (1960: 29)[Be83]		B		
Beembe	Benue-Congo	Congo	Jacquot (1962)[K86]	V y	A		
Bengali	Indo-Iranian	India, Bangladesh	Chatterji (1926: 725-6, 936-7)[F2], Chatterji (1970)[R78], Ferguson & Chowdhury (1960)[K86, Be83, R78], Kostic & Das (1972)[Be83]	V y cM	A \emptyset		
Breton	Celtic	France	Ternes (1970)[K86, M84], Dressler (1972: 21)[S2], Anderson (1976)	VM	A	? str	V w; w̃(!)
Breton, Plouynescant	Celtic	France	Jackson (1961: 339)[Be83]	V y	B		
Bribri	Chibchan	Central Am., Costa Rica	Constenla (1985)[LLBA#3]	P		?	
Bulgarian	Slavic	Bulgaria, Greece	Nikolov (1982)[LLBA#15]	V			
Burmese	Tibeto-Burman	Burma, Bangladesh	Matisoff (1975)[K86], Haas (1949: 28-9)[S2]	V			

language	lang family	location	refs	stat	dir	dom	thru
Capanahua	Panoan	Peru	Safir (1982)[LLBA#18], Loos (1969)[VdH, K86]	P	B Ø	?	[-cons] V w y ? h
Cashibo	Panoan	Peru	Shell (1950: 199)[S2]	V P?	P	? str	V
Cayapa	Chibchan	Ecuador	Lindskoog & Brend (1962)[K86]		A		
Chatino	Zapotecan	Mexico	McKaughan (1954)[Be83]	V? M			
Chinantec, Palantla	Chinante- can	Mexico	Merryfield (1963)[Ladefoged (1972: 34-35)]	V			
Chinantec, Quiotepec	Chinante- can	Mexico	Robbins (1961)[K86]	V y	P		
Chinantec, Tepetot.	Chinante- can	Mexico	Westley (1971: 160- 63)[S1]	P	?	?	V,w,y
Chinese, Amoy	Chinese	China	Chu (1970: 144)[S2], Yen (1968)[Bhat (1975)]		A?		
Chinese, Hakka	Chinese	China	Hashimoto (1973)[M84]	Ø			
Chinese, dialects	Chinese	China	Chen (1973)[K86], Chen (1975)[LLBA#48], Dong (1968)[K86], Cheng (1973)[K86]	V y	A		
Chipewyan	Athapaskan	Canada	Li (1946)[K86, Be83], Li (1932)[Be83], Richardson (1963)[Be83]	VM	A		
Chontal	Tequistlate- can	Mexico	Keller (1959)[K86]		A Ø		

language	lang family	location	refs	stat	dir	dom	thru
Cora	Uto-Aztec	Mexico	McMahon (1967: 133)[S2]		P		
Creek	Muskogean	USA	Haas (1977), UCLA field methods class notes	M	A		
Creole, Surinam	?	Surinam	Smith (1980)[LLBA#26]		?		
Cubeo	Tucanoan	Columbia, Brazil	Salzer (1971)[A76]				ʧ, ʤ
Cuicateco	Mixtecan	Mexico	Needham & Davis (1946)[Be83]	V?			
Danish	Germanic	Denmark	Basbøll (1968: 53)[Be83]		A		
Delaware	Algonkian	Canada, USA	Voegelin (1946)[K86]		A		
Desano	Tucanoan	Columbia, Brazil	Kaye (1971)[S2, Hyman (1982)], Bohrer (1986)	P		?	all incl obst?
Diola Fogy (Dyola)	West-Atlantic	Senegal	Sapir (1965)[Be83]		A Ø	str	
Dutch	Germanic	Holland	Moulton (1962)[Be83]		A		
English	Germanic	England, USA	Ladefoged (1975: 81)[Ba82], Malécot (1960)[K86]		A Ø?		
English, midw.,east	Germanic	USA	Stampe (p.c.)[S2], Kahn (1976)[Be83], Strauss (1981)[Be83]	P		str F?	V, r, l, w, y, h
Eskimo, Greenlandic	Eskimo-Aleut	Greenland	Thalibitzer (1904: 153)[K86, S2]		B	?	V, r, uvular fric

language	lang family	location	refs	stat	dir	dom	thru
Ewe	Kwa	Ghana, Togo	Berry (1951)[Ba82, K86, Be83], Stahlke (1971)[Ba82], Capo (1981)[LLBA#17]	V n d X	A		
Ewe, Central	Kwa	Nigeria?	Stahlke (1970: 51)[S2]		P		
Fanti/e, (Akan)	Kwa	Ghana	Welmers (1946:16)[S2]		B		
Finnish	Finno- Ugric	Finland	Lehiste (1964: 177)[S2]		P		
French	Romance	France	Jensen (1967)[Be83], Delattre (1951)[Be83], Morin (1972:102)[S2], Schane (1968: 48)[S2], Lightner (1970:182)[S2], Posner (1971)[K86]	V	A	R	
Gaelic, Applecross	Celtic	England	Ternes (1973)[VdH]	V	B	str S F	f!, f!
Gbeya	Adamawa- Eastern	Central African Rep.	Samarin (1966:29)[K86, Be83, S2, A76]	V? P	P	W	y, w, obst!
Georgian	Caucasian	USSR	Robins & Waterson (1952)[K86]		A Ø		
German, Upper Austr.	Germanic	German Austria	Keller (1961: 207)[S2]		A	str	
Goajiro/ Guajiro	Arawakan	Colombi- a, Vene- zuela	Holmer (1949: 50)[K86, S2]	V y	A Ø	str	
Gokana	Benue- Congo	Nigeria	Hyman (1982)		B	M W?	[+voi]

language	lang family	location	refs	stat	dir	dom	thru
Grand Couli	Oceanic	N. Caledonia	Grace (1976)[Be83]	V y	A		
Greek	Greek	Greece	Drachman & Drachman (1971)[S2], Householder, Kazazis & Koutsudas (1964)[K86]		A \emptyset		
Guaraní	Tupí	Bolivia, Argentina	Lunt (1973)[F2], Poser (1981,1982)[VdH], Gregores & Suárez (1967)[K86], Rivas (1974)[A76]	V P	B	F? M? str	V, sons, frics!
Gujarati	Indo-Iranian	India	Pandit (1961)[K86]	V			
Hausa	Chadic	Nigeria	Hodge (1947:10-1)[S2]		A		
Hidatsa, Missouri R.	Siouan	USA	Lowie (1939)[Hockett (1955:122)]	V X	Ax for sons		
Hindi-Urdu	Indo-Iranian	India, Pakistan	Ohala, M. (1976)[LLBA#40], (1975)[K86], Narang & Becker (1971)[S2], D'souza (1985) [LLBA#2], Fairbanks & Misra (1966)[S2, Be83]	V y M	B	?	A: V, r, w, y, h
Hupa	Athapaskan	USA	Golla (1970)[K86]		A		
Icelandic	Germanic	Iceland	Gordon (1957: 267)[S2]		P	str (hist)	
Igbo	Igbo	Nigeria	Ladefoged (1964)[Ba82], Green & Igwe (1963)[Hyman (1982)] Carnochan (1948)[L86], Williamson (1969)[L86]	V?	A	?	h, frics!

language	lang family	location	refs	stat	dir	dom	thru
Ijo, Kolokuma	Kwa	Nigeria	Williamson (1965: 16-17)[K86, S2]	V y	B	W	A: V, w, y,r
Ila	Benue- Congo	Zambia	K86, Doke (1928)[K86]		A Ø		
Indonesian	West Indonesian	Indonesia	Lapoliwa (1981)		P	W?	V, w, y, h?, ??
Irish/Irish Gaelic	Celtic	Ireland	Mhac an Fhailigh (1968)[K86, Be83], O'Rahilly (1932: 194)[Be83, S2]	V	B	str	
Island Carib	Arawakan	Dominica	Taylor (1951: 231)[S2], (1955)[K86, S2]	V y	B Ø	str	V
Japanese	Japanese	Japan	Bloch (1950)[M84], Martin (1952)[M84], Jorden (1963)[M84]				ɥ
Jukun, Wukari & Takum	Benue- Congo	Nigeria	Welmers (1968)[K86]	V y			
Kannada, Havyeka	Dravidian, Southern	India	Pandey (1977)[Be83], Bhat (1971)[Be83]	V n d M	P		
Karok	isolate	USA	Nichols (1971)[F2]	M			
Kashmiri	Indo- Iranian	India	Kelkar & Trisal (1964)[K86]	V y	A		
Keresan	Keresan	USA	Spencer (1946: 235)[S2]		A Ø		
Kharia	Munda	India	Pinnow (1959)[Be83]	V	?		
Konkani	Indo- Iranian	India	Fellbaum, (1981)[LLBA#24], Ghatage (1963)[Be83], Pandey (1977)[Be83]	V	B	?	A: V, glide

language	lang family	location	refs	stat	dir	dom	thru
Korean	Korean	Korea	Jung (1962:13-20)[S2], Chen & Clumeck (1975)[K86], Kim- Renaud (1974)[Ba82]		A		
Kpelle	Mande	Liberia	Welmers (1962: 84)[K86, M84, S1], Hyman (1973)[M84]	V X	A		voiced frics?
Kunjen	Pama- Nyungan	Australia	Sommer (1969)[K86]		P		
Kurux	Dravidian, Northern	India	Pfeiffer (1972)[K86]	V	P		
Kwa	Adamawa, Eastern	Nigeria?	Hyman (1972)[K86, F2], Williamson, (1973)[LLBA#60]	V			
Land Dayak	Hesperone- sian	Indonesia	Scott (1964: 432)[K86, S2, A76]		P	?	V, h, w, y, ?
Lithuanian	Baltic	USSR	Kenstowicz (1969)[S2]		A		
Loma	Mande	Liberia	Sadler (1951)[K86]		P		
Lua	Kwa	Ivory Coast	Boyeldieu (1985)[L86]				w!
Maidu	Maidu	USA	Uldall (1954: 10)[Be83]		B		
Maithili	Indo- Iranian	India, Nepal	Yadav (1982)[LLBA#12], Yadav (1979)[Be83]	VM			
Malay	West Indonesian	Malaysia, Indonesia	Verguin (1967)[K86], Onn (1976)[Kenstowicz &Kisseberth (1979)]		P	W?	V, w, y, h, ?
Mandan	Siouan	USA	Hollow (1970)[S1]		?	?	V, h, w, r

language	lang family	location	refs	stat	dir	dom	thru
Marathi	Indo-Iranian	India	Ferguson (1974), Zuckerman (1975)				ʋ! ?
Maxakali	isolate	Brazil	Gudschinsky, Popovich, and Popovich (1970)[A76: 14]	P?	B	W	V, glides
Mazahua	Otopamean	Mexico	Bartholomew (1975)[Be83], Spotts (1953)[Be83]	V y	A		
Mazatec	Popolocan	Mexico	Pike & Pike (1947)[K86], Hockett (1955: 128)	V y	P	R? S?	
Mixtec, Ayutla	Mixtecan	Mexico	Pankratz & Pike (1967: 289)[S2]	V y	B	?	P: V, ?
Mixtec, Jicaltepec	Mixtecan	Mexico	Bradley (1970)[Be83]	V		str F	
Mixtec, Molinos	Mixtecan	Mexico	Hunter & Pike (1969)[Be83, K86]	V y	P	str F	V h ?
Mundari	Munda	India	Gumperz (1957)[K86], Schourup (1973)		B Ø		
Mura	Chibchan ?	Brazil	Sheldon (1974)[M84]	Ø			
Nahuatl(l)	Uto-Aztecan	Mexico	Wolgemuth (1969)[K86]		A Ø		
Nama	Khoisan, Central	South Africa	Beach (1938)[K86, Be83], Crothers et al (1979)[Be83]	V n d	P		
Navaho	Athapaskan	USA	Sapir & Hoijer (1967: 11)[K86, S2]	V y	B		
Nez Perce	Sahaptin	USA	Aoki (1970)[K86]		A		
Niaboua/ Nyabwa	Kru	Ivory Coast	Bentick (1975)[L86]	V			

language	lang family	location	refs	stat	dir	dom	thru
Nubian, Dongolese	Chari-Nile	Sudan	Armbruster (1960)[K86]		A Ø		
Nupe	Kwa	Nigeria	Hyman (1975)[K86], Smith (1967,1969)[Be83]	V y	A		
Ojibwa	Algonkian	Canada, USA	Bloomfield (1956)[K86]		A Ø		
Otomi, Pame/ Tenango	Otopamean	Mexico	Gibson (1956:258)[S2, Be83], Blight & Pike (1976)[K86]	V? P? M	P	W	V, ʔ, h
Paez	Inter- Andine	Colombia	Gerdel (1973)[K86]		P		
Pangasinan	Hesperone- sian	Philippi- nes	Benton (1971: 116- 21)[S1]		A		
Parachi	Indo- Iranian	Afghani- stan	Morgenstierne (1929)[Be83]		A Ø		
Parintintin	Tupí	Brazil	Hart (1981)[VdH], Pease & Belts (1971)[Hart (1981)]	V X P?	A?	W	
Pawnee	Caddoan	USA	Park (1976)	Ø			
Polish	Slavic	Poland	Lightner (1963: 225)[S2]	V	A		
Portuguese	Romance	Portugal	Saciuk (1970:198)[S2, R78], Strevens (1954), Morais Barbosa (1962)[R78, Be83], (1965)[Be83], Dunn (1970)[Be83]	V	P		
Portuguese Brazilian	Romance	Brazil	Dahl (1961: 315-7)[S2], Brito (1975)[K86]	V y	A		
Punjabi/ Panjabi	Indo- Iranian	India	Gill&Gleason (1963)[K86]	V y	A		

language	lang family	location	refs	stat	dir	dom	thru
Quileute	Chimakuan	USA	Andrade (1939)[Hockett (1955: 119)], Powell (1975)[M84]	Ø			
Rejang, (Cayon)	Hesperonesian	Indonesia	Coady & McGinn (1984)				
Rotokas	Bougainville, West.	Papua New Guinea	Firchow & Firchow (1969)[M84]	Ø			
Salish, Duwamish	Salishan	USA	Ransom (1945)[Hockett (1955: 119)]	Ø			
Salish, Puget Sound	Salishan	USA	Thompson (1972)[F2], Snyder (1968)[M84]	Ø M?			
Salish, Snoqualmie	Salishan	USA	Swadesh (1952)[Hockett (1955: 119)]	Ø			
Senadi/Senoufo	Gur	Ivory Coast	Welmers (1950)[Hockett (1955):119]	V y X? P?	P	?	V
Seneca	Iroquoian	USA, Canada	Holmer (1952: 220)[S2], Chafe (1967)[Be83]		B		V, w, y, ?
Sentani	Papuan, North	Indonesia	Cowan (1965)[K86]		A Ø		
Shiriana, (Ninam)	Yanomana	Brazil, Venezuela	Migliazza & Grimes (1961: 35)[Be83]	V P	?	F	
Sinhalese	Indo-Iranian	Sri Lanka	Coates and de Silva (1960)[K86], Crothers (1975)		A Ø		ǂ!
Siriono	Tupí	Bolivia	Priest (1968)[K86, M84]	V X			
Slave	Athapaskan	Canada	Howard (1963: 42-7)[Be83, S2]	V?			

language	lang family	location	refs	stat	dir	dom	thru
Somali	Cushitic	Somalia	Armstrong (1964)[K86, Ba82]		B \emptyset		
Sora, etc.	Munda	India	Stampe (p.c.)[S2]		P		
Spanish, Panama	Romance	Panama	Cedergren & Sankoff (1975)[K86], Robe (1960:36)[S2]		B	str	
Spanish, S.Castilian	Romance	Spain	Navarro Tomás (1961)[K86], Trager (1939)[Be83]		B \emptyset		V, r, [+son]
Sundanese	Hesperonesian	Indonesia	K86, S1, S2, Robins (1957:91)[S2, K86], Anderson (1972), Hart (1981)		B	W	V, h, ?
Swahili	Benue-Congo	Tanzania	Polomé (1967: 41-50)[Be83], Tucker & Ashton (1942)[K86]		A \emptyset		
Tagalog	Hesperonesian	Philippines	Schachter & Otones (1972)[K86]		A		
Telugu	Dravidian, Central	India	Lisker (1963)[K86]		A \emptyset		
Terena/o	Arawakan	Brazil	Bendor-Samuel (1966:350)[S2], (1960)[R78], Hart (1981)	PM		M W?	V, h, ?, w, y
Tewa	Kiowa-Tanoan	USA	Hojer & Dozier (1949)[K86, Be83]	V y	A		
Thai	Tai	Thailand	Noss (1964:15)[S2], (1954) [K86], Kruatrachue (1960) [K86], Abramson (1962) [K86], Ohala (1971)[F2]		P		

language	lang family	location	refs	stat	dir	dom	thru
Ticuna	Tucanoan	Peru, Brazil, Colombia	Anderson (1959)[K86]		P		
Tillamook	Salishan	USA	Thompson & Thompson (1972)[K86], Thompson & Thompson (1966: 314)[S2]		A Ø		
Tiwa, Taos/Nor.	Kiowa- Tanoan	USA	Trager (1946) [Be83, Hockett (1955: 128)], (1948) [Hockett (1955: 128)]	V y	A	S?	
Tiwa, Nor. Picuris	Kiowa- Tanoan	USA	Trager (1971: 32)[K86, S2]	V d	P		
Tolowa	Athapaskan	USA	Bright (1964)[K86]		A		
Tucano	Tucanoan	Brazil, Columbia	West & Welch (1967)[M84]	V X			
Tunica	Gulf	USA	K86, Haas (1941)[K86]		A		
Umbundu/ Mbundu	Benue- Congo	Angola	Schadeberg (1982)[LLBA#9, L86]	V	?	?	w, v, l; ŷ!, ñ!
Urdu	Indo- Iranian	Pakistan, India	Hoenigswald (1948)[Poser (1982)]		B	?	V semi- V's
Waffa	E. New Guinea Highlands	Papua New Guinea	Stringer and Hotz (1973)[L86]				β!
Warao	isolate	Venez.,G uyana,Su rin.	Osborn (1966: 111- 2)[S2]		P	W	V, h, w, y

language	lang family	location	refs	stat	dir	dom	thru
Washkuk/ Kwoma	Sepik	Papua New Guinea	Kooyers et al. (1971)[Be83]		A		
Wichita	Caddoan	USA	Garvin (1950)[Hockett (1955): 122]	∅			
Winnebago MS Valley	Siouan	USA	Susman (1943)[Hockett (1955: 119)]	P?			
Wolof	West- Atlantic	Senegal, Gambia	Sauvageot (1965)[K86]		A		
Yakut	Turkic	USSR	Krueger (1962)[M84], Böhtlingk (1964)[M84]				ÿ!
Yoruba	Kwa	Nigeria	Ward (1952: 13)[S2, Be83], Bamgbose (1966)[Be83], Ladefoged & Maddieson (1986)	V y	A?		A: w, y, h(?)
Yuchi	isolate	USA	Crawford (1973)[Be83, K86], Ballard (1975)[Be83]	V y M	P		
Zapotec, Guelavía	Zapotecan	Mexico	Jones & Knudsen (1977)[Be83]		A?		
Zulu	Benue- Congo	South Africa	Doke (1926:29)[Be83, K86]		A		

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