A Cross-linguistic Survey of Vowel Nasalisation in Non-nasal Environments: An Augmented Taxonomy(*

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Abstract:

A centuries-old, seemingly counterintuitive observation made in the study of speech sounds is that a vowel can be nasalised in an environment that lacks an etymological nasal consonant. This phenomenon is known as spontaneous nasalisation, and it has been reported in typologically diverse languages across the world. This study uses data drawn from published sources of 30 languages to build a taxonomy of the non-nasal environments that have been shown to condition vowel nasalisation. Five major types of spontaneous nasalisation have been identified. The study reveals that the non-nasal consonants that have the capacity to induce vowel nasalisation are mostly glottals, pharyngeals, sibilants, and aspirates. The study also reveals that approximant-induced nasalisation is typologically rare; only one out of the 30 languages investigated here is found to exhibit this pattern. Low vowels are found to be particularly susceptible to nasalisation in non-nasal environments. In several languages, vowel nasalisation is found to be prosodically circumscribed. This finding lends support to the proposition that spontaneous nasalisation can be analysed as an edge-effect phenomenon serving to augment prosodic prominence word-initially and improve perceptibility word-finally. Phonetic and phonological explanations for spontaneous nasalisation are also provided.

Keywords: Spontaneous nasalisation, nasalised vowels, taxonomy, phonetics, phonology

دراسة استقصائية عبر اللغات حول تأنيف الصوائت في غياب الأصوات الأنفية: تصنيف تاكسونومي موسع

المستخلص

لاحظ علماء الأصوات منذ قرون قابلية الصوائت للتأنيف مع عدم وجود صوت أنفي أصلي بالكلمة، في ظاهرة تبدو معاكسة لما هو بديهي فيما يخص التأنيف، وقد اصطُلح على تسميتها ظاهرة التأنيف التلقائي، وتم رصدها في عدة لغات متنوعة نمطيّا حول العالم، وقد استَخدمت الدراسة الحالية بيانات تم استخلاصها من مصادر منشورة توثق ٣٠ لغة وذلك لبناء تصنيف تاكسونومي للحالات التي سُجّلت فيها هذه الظاهرة، وقد تم تحديد خمسة أنماط رئيسية للتأنيف التلقائي، وكشفت الدراسة أن الأصوات غير الأنفية التي لديها القدرة على تحفيز تأنيف الصوائت هي في الغالب الأصوات الحنجرية والحلقية وأصوات الصفير والأصوات الهائية، كما أظهرت الدراسة أن التأنيف التلقائي الذي يحصل استجابة لأشباه الصوائت هو نمط نادر؛ حيث رُصد في لغة واحدة فقط من مجموع ٣٠ لغة تم دراستها في هذا البحث، كما وجدت الدراسة أن الصوائت المنخفضة معرضة بشكل خاص للتأنيف التلقائي في غياب الأصوات الأنفية، وكشفت الدراسة كذلك أن تأنيف الصوائت يخضع لقيود فوقطبقية في عدة لغات، وهو مايدعم المقترح القائل أنّ التأنيف التلقائي يمكن تحليله كظاهرة أثر الحد التي من شأنها تعزيز البروز الفوقطبقي للأصوات في حد البداية للكلمة وتحسين الإدارك السمعي للأصوات في حد النهاية للكلمة، وقد قدّمت الدراسة شروحات لظاهرة التأنيف التلقائي مستقاة من علم الأصوات والصوتيات الوظيفية.

الكلمات المفتاحية: التأنيف التلقائي، الصوائت المؤنفة، تصنيف تاكسونومي، علم الأصوات، الصوتيات الوظيفية

1 Introduction

Vowel nasalisation is a widespread phenomenon that is characterised by a coupling (i.e., pairing) of the oral and nasal cavities causing the airflow to escape simultaneously through the oral and nasal tracts (Prasad & Yegnanarayana, 2021). In its most common instantiation, vowel nasalisation is an assimilatory or co-articulatory process whereby a vowel takes on the nasal quality of an adjacent nasal consonant (e.g., /m/, /n/, /ŋ/, /ɲ/). This is known as contextual nasalisation. For example, the vowel in the English word 'ban' [bæ̃n] is nasalised in anticipation of the upcoming articulation of the following nasal consonant. In contrast, the vowel in the English word 'bad' [bæd], which is neither preceded nor followed by a nasal consonant, is not nasalised.

Typologically, contextual nasalisation is extremely common across the languages of the world (Maddieson, 1984). It has even been described as a universal phonological process by Foley (1973). Posner (1973), who rejects Foley's universal claim, nevertheless agrees with him that vowel nasalisation is "so widespread" that "we can take it for granted" (p. 105). More recently, Meftah and Alotaibi (2020, p. 24.1) note that "[m]ore than 99% of languages contain nasalized vowels or consonants".

Contextual nasalisation is postulated to be behind the genesis of contrastively nasal vowels in languages where the presence and absence of nasality on a vowel distinguish meaning (Lightner, 1970). Languages like French, Lakhota, and Yoruba fall into this category. For example, the French minimal pair /pɛ/ 'peace' – /pɛ̃/ 'bread' is defined over the presence versus absence of nasality (Hajek, 2013).

Intriguingly, vowel nasalisation can also occur in the absence of an etymological nasal consonant in the vicinity of the nasalised vowel. This phenomenon is attested cross-linguistically in genetically diverse languages. This type of vowel nasalisation in the absence of a

neighbouring nasal consonant is called ‘spontaneous nasalisation’ (Diels, 1912, 1913; Grierson, 1922; Turner, 1921). The term emphasises the apparently untriggered occurrence of this type of nasalisation.

This study aims to identify and classify the non-nasal environments that have been shown in the literature to condition spontaneous nasalisation. The main question the study attempts is stated in (1).

(1) Which non-nasal environments should a taxonomy of spontaneous nasalisation include?

The study investigates this question from segmental and prosodic viewpoints. Segmentally, the study asks the following sub-questions.

(1-a) Which consonant classes induce spontaneous nasalisation?

(1-b) Which vowels are most susceptible to spontaneous nasalisation?

(1-c) Can semi-vowels (i.e., glides/approximants) induce spontaneous nasalisation?

Prosodically, the study asks this sub-question.

(1-d) Can the prosodic position of a segment condition vowel nasalisation in non-nasal environments?

The study takes a qualitative approach to the issue of spontaneous nasalisation and proceeds within a taxonomy framework where an extensive survey of the literature is undertaken for the purposes of the identification, comparison, and classification of the relevant datasets which are dispersed in the literature. To build a taxonomy of the non-nasal environments where spontaneous nasalisation has been reported in the literature, datasets have been collated from 30 languages that belong to 13 distinct language families.

The paper also presents a detailed discussion of the phonetic and phonological explanations that have been proposed so far in the literature. The rest of the paper is structured as follows. In section 2, I review the available literature on spontaneous nasalisation. In section 3, I describe in detail the taxonomy proposed. In section 4, I provide a detailed overview of the phonetic and phonological explanations proposed in the literature. In section 5, I summarise the main findings and conclude the paper.

2 Literature Review

The term 'spontaneous nasalisation' has often been associated with Sir George Grierson (1851–1944), who published an article entitled *Spontaneous nasalisation in the Indo-Aryan languages* in 1922. However, older records show that the term was already in circulation before Grierson's publication. For example, Sir Ralph Turner (1888–1983) discussed the phenomenon in a section headed 'Spontaneous nasalisation' in an article on Gujarati phonology that was published in 1921. Almost a decade earlier, Paul Diels (1882–1963) published two articles in German in the years 1912 and 1913 about spontaneous nasalisation. The titles of his papers contain the phrase *Spontanen nasalierung*.

Even though existing records indicate that the term spontaneous nasalisation was coined in the early twentieth century, the phenomenon it names has been observed by philologists at least since the fifth century BCE (Butkauskaitė, 2010). The oldest record of nasalised vowels in non-nasal contexts is said to belong to Pānini (520BCE – 460BCE). According to Bloch (1965, p. 45), "Pānini himself authorises the nasalisation of [Sanskrit] a, i, u, whether short or long, at the end of a sentence".

With such a long history behind it, one would expect to find a considerable amount of research devoted to the issue of spontaneous

nasalisation. However, the reality is that the issue of spontaneous nasalisation has only received comparatively little attention, with sporadic reports commenting on it or documenting its existence in individual languages (cf. Khattab, Al-Tamimi, & Alsiraih, 2018). In this regard, Johnson (2019, p. ii) rightly notes that spontaneous nasalisation has always been a "historically difficult topic of study". One reason she gave involves the need to analyse "a combination of articulatory data that measures both nasalization and phonation quality" (Johnson, 2019, p. iii).

Over the past decades, researchers have investigated the issue of spontaneous nasalisation from descriptive and empirical perspectives. Two lines of research dominate the descriptive approach to spontaneous nasalisation: one is synchronic while the other is couched in diachrony. Studies adopting a synchronic stance are fundamentally concerned with (1) documenting spontaneous nasalisation in the synchronic phonologies of individual languages or language families (e.g., Boivin, 1996; Grierson, 1922); (2) constructing a typology of the phenomenon (e.g., Blevins & Garrett, 1992; Reina, 2019); and (3) accounting for the phonological facts within a theory-informed framework (e.g., Botma, 2004). In a similar vein, studies that examine the diachrony of spontaneous nasalisation typically approach spontaneous nasalisation from the perspective of language change. The issues that this line of research attempts to elucidate bear on the genesis, historical development, spread, phonetic grounding, and phonological motivation of the reported cases of spontaneous nasalisation. The studies by Igartua (2008) and Ahland (2005) fall into this category.

The publication of Matisoff's (1975) classic paper entitled *Rhinoglottophilia: The mysterious connection between nasality and glottality* marked an important milestone in the chronology of spontaneous nasalisation. More specifically, Matisoff's (1975) study has made a massive contribution to the progress of the research

agenda of spontaneous nasalisation, as it has drawn attention to the link between nasalisation and laryngealization, which Matisoff describes as 'mysterious'. Examining data from genetically unrelated languages, including Thai, Semitic Gurage, and English (among others), the study has proved the viability of spontaneous nasalisation as a serious research enterprise (see section 3 for details). It should also be remembered that it was in this publication that this particular type of spontaneous nasalisation had been given a name—*rhinoglottophilia*. Moreover, Matisoff has made several thought-provoking speculations on its possible origins, phonetic basis, phonological motivations, and theoretical implications. Expectedly, subsequent attempts to address spontaneous nasalisation never fail to cite Matisoff (1975) and use the term he has coined. Examples of published articles with the word 'rhinoglottophilia' in their titles include Johnson, Sutton, and Liang (2017), Igartua (2008), and Ahland (2005).

Another influential study is that by Blevins and Garrett (1992), who have identified two additional types of spontaneous nasalisation: (1) rhinochthamalophilia, which pertains to spontaneous nasalisation on low vowels in particular, and (2) rhinosyrigmatophilia, whereby spontaneous nasalisation is induced by sibilant consonants. See the next section for details.

The phonetics of spontaneous nasalisation has also been examined instrumentally from the perspectives of articulation, acoustics, and perception. For example, several studies have looked into the articulatory configuration and concomitant aerodynamics of spontaneous nasalisation. Examples of this category include Elgendy (1991, 2001) and Zellou (2012). Likewise, the acoustic aspects of spontaneous nasalisation have been a subject of inquiry in several studies, including, for example, Khattab et al. (2018) and Zellou (2012). Perception-based investigations have also been undertaken in combination with acoustic and/or articulatory experiments, typically

for the expressed purpose of calibrating acoustic and/or articulatory findings. More recently, magnetic resonance imaging (MRI) techniques have been incorporated into the study of spontaneous nasalisation, as in Johnson et al. (2017) and Johnson (2019). Section 4 gives more details about the findings of the studies enumerated here.

3 Taxonomy of Non-nasal Environments

Reports in the literature show that the context where spontaneous nasalisation of vowels emerges is not uniform; a variety of non-nasal environments have been reported to trigger vowel nasalisation in typologically diverse languages around the world. These environments can be collated in a taxonomy of non-nasal contexts that condition vowel nasalisation cross-linguistically. These contexts can be defined segmentally or prosodically. Based on an extensive survey of the literature, five major types have been identified: four segmental and one prosodic. The taxonomy presented here is based on Blevins and Garrett's (1992) trichotomous classification of spontaneous nasalisation and the recent modifications proposed by Johnson (2019). The classification is further augmented by incorporating a fourth category based on Nevins and Costa's (2019) account of spontaneous nasalisation in Brazilian Portuguese, and a fifth, rather typologically rare category, inspired by the datasets reported in Schadeberg (1982). In what follows, I describe and illustrate each of these types. For consistency, I use the International Phonetic Alphabet (IPA) (The International Phonetic Association, 1999) throughout the paper for data transcription. Table A1 in the appendix lists the 30 languages surveyed in this study.

3.1 Rhinoglottophilia: The link between nasality and glottality

A survey of the literature on spontaneous nasalisation reveals that adjacency to glottal consonants (i.e., /ʔ/, /h/) is involved in the majority of the cases exhibiting spontaneous nasalisation of vowels. This type of nasalisation is dubbed 'rhinoglottophilia' by Matisoff (1975). In technical terms, rhinoglottophilia refers to a phonetically grounded affinity between the velum (hence, nasality) and the larynx (i.e., glottality). Several instrumental studies have provided evidence that the velum is, more or less, in its natural resting position (i.e. lowered) during the production of glottal consonants. The findings of these studies will be discussed in the next section, as the current section surveys the cross-linguistic data that illustrate this phenomenon.

Rhinoglottophilia has been documented in a variety of languages, many of which are genetically unrelated. For example, in Bangkok Thai, a Tai-Kadai language spoken in the capital city of Thailand, the low vowels [a], [æ], and [ɔ] are allophonically nasalised when they follow a glottal consonant, be it /ʔ/ or /h/, syllable-initially, as evident from the examples in (2), which appear in Matisoff (1975, p. 266). Tone diacritics, which are not relevant here, are omitted for clarity.

(2) Bangkok Thai

/hɛɛ/	[hæ̃æ̃]	'parade'
/ʔɔɔk/	[ʔɔ̃ɔ̃k]	'leave, depart'
/hɔɔ/	[hɔ̃ɔ̃]	'package'
/haa/	[hãã]	'five'
/ʔaw/	[ʔãw]	'take'

In Arabela, a Zaparoan language of the Peruvian Amazonian family spoken in Peru, post-[h] vowels are nasalised, as shown in the

examples in (3), which are based on Rich (1963, pp. 195–199). The same pattern is also reported for Wichi′, a Matacoan language spoken in Argentina, and for Cèmuhî, an Austronesian language that belongs to the Oceanic New Caledonian branch. Wichi′ words illustrating spontaneous nasalisation are given in (4). They appear in Rogers (2011, p. 1). Cèmuhî forms, which are taken from Blevins and Garrett (1993, p. 223) are listed in (5).

(3) Arabela

/karak kohwa/	[karʌk: kohw̃ãʔ]	‘type of owl’
/huwa/	[h̃ũw̃ãʔ]	‘a yellow bird’
/hijani/	[h̃ĩj̃ænĩʔ]	‘old woman’
/hija/	[hĩj̃æ]	‘where’
/heeke/	[h̃ẽẽgɪʔ]	‘termites’

(4) Wichi′

/ha-/	[hã-]	‘2SG.POSS’
/hiʔaʔ/	[-hĩʔaʔ]	‘Verbal Negation’
/hiʔnoʔ/	[hĩʔnõʔ	‘man’
/halaʔ/	[hãlaʔ]	‘tree’
/o-hux/	[o-hũx]	‘my finger’
/o-pohiʔ/	[o-pohĩʔ]	‘I closed (it)’

(5) Cèmuhî

hũ	‘bean’
hãã	‘to shout’
hĩũũt	‘wealth’

Another Peruvian Amazonian language, this time from the Jivaroan sub-group, in which vowels are nasalised in pre-[h] as well as post-[h] positions is Aguaruna. The examples in (6) are based on Botma (2004, p. 286). A similar pattern is found in Souletin Basque, as illustrated in (7) below. The Souletin Basque forms are taken from Igartu (2008, p. 175).

(6) Aguaruna

ãh̃ũm	'later'
ʦũh̃ĩ	'fish'
sũh̃ĩk	'beads'
kũh̃ũ	'porcupine'
sakãh̃ũ	'skeleton'

(7) Souletin Basque

ãhãte	'duck'
mẽhẽ	'thin'
mĩhĩ	'tongue'
ũhũre	'honour'
zũhũr	'prudent'

In Seimat, an Austronesian language spoken in Western Admiralty Islands, vowels following nasalising /h/ are nasalised, as shown in the examples in (8), which appear in Botma (2004, p. 284). The same pattern is found in a totally unrelated language, Kwangali, a Southern Bantu language spoken in Namibia, which belongs to the Atlantic-Congo family. Illustrative examples are given in (9). They are based on Ladefoged and Maddieson (1996, p. 132).

(8) Seimat

hõŋ	‘to hear’
hũhũa	‘two’
matihũ-	‘to sleep’
wahã	‘root’

(9) Kwangali

h̃õh̃õ	‘devil’s thorn’
h̃ũh̃w̃ã	‘fowl’
mũh̃õ	‘kind of spear’
koh̃ĩ	‘beneath, under’

There are also languages where both non-nasal segmental and prosodic environments trigger vowel nasalisation. For example, in Lahu, a Sino-Tibetan language belonging to the Lolo–Burmese branch, vowel nasalisation optionally occurs following a syllable-initial /h/ or in onsetless initial vowels. The examples in (10), which are taken form Matisoff (1975, p. 267), illustrate both types of spontaneous nasalisation. Tone marks, which are not relevant here, are left out for clarity.

(10) Lahu

/ɔ/	[ɔ]~[ɔ̃]	‘four’
/ɔ-hɔ/	[ɔ-hɔ]~[ɔ̃-hɔ̃]	‘underpart’
/hɔ/	[hɔ]~[hɔ̃]	‘elephant’
/ɔ-qa/	[ɔ-qa]~[ɔ̃-qa]	‘water buffalo’
/ɔ-ha/	[ɔ-ha]~[ɔ̃-hã]	‘spirit’
/ɔ-hɔ-ɛ/	[ɔ-hɔ-ɛ]~[ɔ̃-hɔ̃-ɛ̃]	‘grandchild’

This pattern is actually reminiscent of the phonetic vowel nasalisation in the British English dialects that Matisoff (1970) illustrates. According to Matisoff (1975, p. 269), vowel nasalisation is "rampant, especially in words with syllable-initial vowels or h- and the low central vowel /ɑ/". The examples in (11) are reproduced from Matisoff (1975, p. 269).

(11) British English

[hɑ̃ɑ̃f]	'half'
[ɑ̃ɑ̃ə]	'hour'
[hɑ̃ɑ̃t]	'heart'
[hɑ̃ɑ̃fən ɑ̃ɑ̃ə]	'half an hour'
[ɑ̃ɑ̃t]	'art'

The glottal stop [ʔ] is also reported to trigger vowel nasalisation, but in a much limited set of languages. One language where the presence of a nasalising glottal stop leads to nasalisation on the flanking vowels is Ganza, a Blue Nile Mao language in the Omotic sub-group. In this language, /ʔ/ conditions vowel nasalisation, as evident from the forms in (12), which are based on Smolders (2016, p. 103).

(12) Ganza. Tone marks are omitted.

sãʔĩ	'bead jewellery'
hãʔã	'water'
k'jãʔã	'egg'
dãʔĩ	'hammer'
p′õʔõ	'Chelada baboon'
zĩʔĩ	'green'
sẽʔẽ	'to not comply'

Other languages that exhibit a similar pattern are Ennemor and Endengy, two Semitic languages that belong to the Peripheral West Gurage of the Outer South Ethiopic branch documented by Hetzron (1969, 1972, 1977). In these languages, a glottal stop, which is originally a debuccalised stop that is still retained in neighbouring sister languages, triggers vowel nasalisation. The dataset in (13) is drawn from Ahland (2005, pp. 21–22).

(13) Ennemor and Endegeny. Undebucclised forms from Gyeto are provided for comparison.

Gyeto	Ennemor	Endegeny	English Gloss
t′ɨfɨr	ʔɪ̃fɨr	ʔɪ̃fɨr	‘claw’
ɛsk′ur beet	ɛsũʔũr biid	ɛsũʔũn biid	‘ceiling’
t′ɛk′ɛrɛ	dɛʔɛ̃rɛ	dɛʔɛ̃nɛ	‘conceal’
afɛt′ɛrɛ	afɛ̃ʔɛ̃r	affɛ̃ʔɛ̃nɛ	‘be fast’
araak′ɛ	arããʔɛ	anããʔɛ	‘remove’
at′m	aʔɪ̃m	aʔɪ̃w	‘bone’

3.2 Rhinochthamalophilia: The link between nasality and the feature [+low]

Another, less well-documented, form of spontaneous nasalisation that is segmentally conditioned involves pharyngeal consonants (i.e., /ħ/, /ʕ/) and low vowels (e.g., /a/, /ɑ/). Extending Matisoff’s (1975) rhino-affixed coinage, Blevins and Garrett (1992) came up with the term ‘rhinochthamalophilia’ to describe the association between nasality and [+low] specification. Technically, rhinochthamalophilia refers to a phonetically motivated and physiologically demonstrable affinity between velum lowering and the low-jaw configuration that is required for the articulation of low vowels and pharyngeals (see e.g., Elgendy, 2001; Hajek & Maeda,

2000). Pharyngeal-conditioned rhinochthamalophilia has been observed in several Semitic languages. For example, in Moroccan Arabic, pharyngeals are shown to trigger vowel nasalisation. Zellou (2012) presented acoustic and articulatory evidence to this effect (see section 4 for details). The dataset in (14) is based on the stimuli and the findings of Zellou's study (2012, p. 183).

(14) Moroccan Arabic

/baʕ/	[bãʕ]	'he sold'
/baħ/	[bãħ]	'it disappeared'
/ʕud/	[ʕũd]	'wood'
/ħut/	[ħũt]	'fish'
/biʕ/	[bĩʕ]	'selling'
/ʃiħ/	[ʃĩħ]	'type of plant'

Another Semitic subgroup displaying pharyngeal-induced vowel nasalisation includes Eastern and West Gurage languages which are spoken in Ethiopia. For example, Eastern Gurage Zway and Silte-Wolane forms of the corresponding Semitic pharyngeal-initial roots are all realised with initial nasalised vowels. The examples in (15) are reproduced form Botma (2004, p. 292)

(15) Zway and Silte-Wolane Gurage varieties of Eastern Gurage

Semitic root	Eastern Gurage	English Gloss
*ʕtr	ãntärä	'pea'
*ħjk	ẽnke	'to chew'
*ħqf	ẽnqäfä	'embrace'
*ʕwf	ũf	'bird'

Similarly, several West Gurage varieties including Cheha, Ennemor, Endegeny, and Gyeto have also been shown to display vowel nasalisation in forms that historically had a pharyngeal consonant preceding the vowel in question, as evident from Tigre and Geʿez. The forms in (16) of the word for bird appear in Ahland (2005, pp. 18, 20). The Tigre and Geʿez form for bird is *ʕof*, which still retains the word-initial pharyngeal consonant from the proto-language.

(16) Peripheral West Gurage varieties

Cheha	ãf^{w}
Ennemor	ã:f^{w}
Endegeny	ã:f^{w}
Gyeto	ã:f^{w}

Recall from section 3.1 that Ennemor and Endegeny also have spontaneous nasalisation induced by glottal consonants, as exemplified in (13) further above. In fact, the pattern where glottal and pharyngeal consonants trigger vowel nasalisation is also found in Inor, another Peripheral West Gurage of the Outer South Eithopic-Semitic branch. The dataset in (17) comes from Boivin (1996, p. 23). Geʿez forms which show the presence of a pharyngeal or glottal consonant are also provided for comparison.

(17) Inor

Inor	Geʿez	English Gloss
ãã^{n}f^{w}	ʕof	‘bird’
ã^{n}ʃəʃə	ħəsajə	‘to rub’
gããr̃ə	g^{w}əħələ	‘to be red hot’
ɨ̃^{n}ʃuwa	ʕasɨb	‘bribe’
ɨ̃^{m}f^{w}aad	ħəq^{w}əfə	‘armful’

ɨ̃^{m}f^{w}yə	ħifn	‘handful’
ã^{m}f^{w}	ʔəf	‘nose’

A language where spontaneous nasalisation is induced by a low vowel is Western Abenaki, an Eastern Algonquian language that belongs to the Algic family. In Western Abenaki, the Proto-Algonquian long low vowel [aː] has acquired lip-rounding and nasality and become [ɔ̃], irrespective of the segmental makeup of its environment. The forms in (18) are based on Whalen and Beddor (1989, p. 459), Costa (2007, p. 94), and Goddard (1971, p. 140).

(18) Western Abenaki

Proto-Algonquian	Western Abenaki	English Gloss
*ʃekaːkwa	səkɔ̃kw	‘skunk’
*aθaːm	atɔ̃m	‘underneath’
*waːp	wɔ̃bigo	‘he is white’
*waːpanwi	bádɔ̃bán	‘dawn is coming’
*kaːwija	gɔ̃wi	‘porcupine quill’

The British English pronunciations of the words ‘hour’ and ‘art’ in (11) as [ɑ̃ɑ̃ə] and [ɑ̃ɑ̃t], respectively, actually exemplify rhinochthamalophilia. In fact, Johnson (2019) classifies British English as dually affiliated with rhinoglottophilia and rhinochthamalophilia. It is not uncommon in the literature to find a language exhibiting more than one form of spontaneous nasalisation. Recall that spontaneous nasalisation in the Gurage varieties of Ennemor and Endegeny is induced by glottal as well as pharyngeal consonants. The different categories of spontaneous nasalisation are not mutually exclusive. Each has its own acoustic, articulatory, perceptual, and/or phonological explanations, which I take up in section 4.

3.3 Rhinosyrigmatophilia: The link between nasality and noise

Rhinosyrigmatophilia is a term that Blevins and Garrett (1992) have coined to describe a type of vowel nasalisation that occurs in the vicinity of consonants whose production involves noise: breathiness and high airflow (Ohala & Ohala, 1993). This category includes voiceless fricatives and aspirates. Several phonetic explanations for this seemingly unlikely connection between nasality and noise have been offered in the literature. Section 4.3 discusses these explanations.

Rhinosyrigmatophilia has been reported for several languages in the descriptive literature of spontaneous nasalisation. Perhaps the most well-known examples of this phenomenon come from Hindi, an Indic language of the Indo-European family. In Hindi, a vowel is nasalised when it is immediately adjacent to a voiceless fricative, as exemplified by the forms in (19), which are reproduced from Ohala (1983, p. 78). Corresponding Sanskrit forms are provided for comparison.

(19) Hindi

Hindi	Sanskrit	English Gloss
pəhũʧ	praːghuːrɳan	‘attain’
sãp	sarpa	‘snake’
hə̃si	haːsja	‘laughter’
ãsu	aʃru	‘tear (noun)’
sãs	ʃvaːsa	‘breath’

Another language with vowel nasalisation induced by voiceless sibilant fricatives is Bzhedugh, a West Circassian language that belongs to the Caucasian family. The forms in (20) are taken from Blevins and Garrett (1993, p. 222) and Arkadiev and Lander (2021, p. 8).

(20) Bzhedugh

/ʃʰaʃʰ/	[ʃʰ̃ĩʃʰⁿ]	‘horse’s milk’
/psə/	[psə̃]	‘water’

In Swabian, a Western Germanic Indo-European language, the diphthong /əi/ is nasalised when the following consonant is /s/ or /ʃ/, which are voiceless sibilant fricatives. Corresponding forms from Middle High German are provided for comparison. The Swabian data in (21) come from Griffen (1994, p. 36).

(21) Swabian

Middle High German	Swabian	English Gloss
geist	gə̃iʃt	‘spirit’
diːhsel	də̃isl̩	‘beam’
iːs	ə̃is	‘ice’
liːs(e)	lə̃is	‘quiet’
riuse	rə̃is	‘wicker-trap’
ziːse	ʦə̃isə	‘greenfinch’

Importantly, Rhinosyrigmatophilia is not only limited to sibilant fricatives. In Fwâi and Pije, which are Oceanic New Caledonian languages in the Austronesian family, non-sibilant fricatives and aspirated stops can condition vowel nasalisation. The dataset in (22) appears in Blevins and Garrett (1993, p. 223).

(22) Fwâi and Pije

Fwâi	Pije	English Gloss
fũ	pʰũ	‘bean’

tʰẽ-	tʰã-	‘mother’
kʰããk	kʰããk	‘to shout’
tʰõõt	tʰõõt	‘wealth’

Likewise, in Kaimganj Pathan Urdu (KPU), a Western Hindi Indo-Aryan language spoken in Uttar Pradesh in India, vowel nasalisation is observed in the immediate environment of a fricative or a plosive. The forms in (23) are taken from Masood (1986, p. 41). Modern Standard Urdu (MSU) forms are also provided for comparison.

(23) Kaimganj Pathan Urdu (KPU)

KPU	MSU	English Gloss
gʰãs	gʰas	‘grass’
ãʈa	aʈa	‘flour’
sõc	soc	‘thinking’
ɖãk	ɖak	‘post’
ɻʰũʈ	ɻʰuʈ	‘lie’

3.4 Edge nasalisation: The link between nasality and prosodic enhancement

A fourth category of spontaneous nasalisation, which is not found in Blevins and Garrett’s (1992) classification, is defined over prosodic positions of the vowel undergoing nasalisation in non-nasal contexts. This type of spontaneous nasalisation occurs independently of the consonantal composition of the neighbouring segments. In the relatively few cases where this phenomenon is attested, the nasalised vowels are typically unstressed and located at the right or left edge of the phonological domain, suggesting that nasalisation is an edge effect that is meant to achieve prominence. The notion that nasalisation can

boost prosodic prominence is backed up with instrumental evidence. I discuss this in section 4.4. But here, I only survey the attested cases of edge nasalisation.

Nevins and Costa's (2019) account of spontaneous nasalisation in Brazilian Portuguese, an Indo-European Romance language, offers a compelling illustration of edge nasalisation. They show that unstressed or secondarily-stressed vowels in word-initial positions are nasalised regardless of the consonantal makeup of their environments. Nevins and Costa argue that nasalisation in this left-edge context serves to enhance the prosodic prominence of initial onsetless syllables in Brazilian Portuguese. The data items in (24) are from Nevins and Costa (2019, pp. 172–173).

(24) Brazilian Portuguese

idiota	[ĩdʒiɔtɐ]	'idiot'
igreja	[ĩgreʒɐ]	'church'
ironia	[ĩɾoniɐ]	'irony'
usufruir	[ũzufɾuih]	'to make use of'
ebulição	[ĩbulisɐ̃w̃]	'boiling'
ocorrer	[õkoɦeh]	'occur'
abacaxi	[ãbakaʃi]	'pineapple'

Word-final nasalisation is also reported for unstressed vowels in several Swabian dialects, as can be seen from the forms in (25). These examples appear in Reina (2019, p. 308).

(25) Swabian. Devoicing Diacritics have been omitted for simplicity.

kitzl-e	[k^{h}idzlẽ]	'tickle-1SG]
härte	[hɛɾdẽ]	'harness'

höhle	[heːlẽ]	‘cave’
kirchweih	[k^hɪrbẽ]	‘parish fair’
freilich	[vɾœilẽ]	‘of course’
höhe	[hɛɐɣẽ]	‘height’

This pattern is also repeated in an unrelated language, Umbundu, a Bantu language spoken in Angola. In this language, word-final vowels are nasalised in monosyllabic stems. The forms in (26) appear in Schadeberg (1982, p. 114).

(26) Umbundu. Tones are not marked for clarity.

oʊa.lã	‘intestines’
o.fĩ	‘indigestion’
oʊa.sũ	‘urine’
e.kwĩ	‘ten’
-ʊĩ	‘bad’
-ĩ	‘to know’
pũ	‘extremely cold’
fĩ	‘extremely hot’

In Solsona Catalan, an Indo-European Romance language, word-final unstressed /a/, which is reduced to /ə/, is optionally nasalised, as evident from the examples in (27). These forms appear in Reina (2019, p. 162).

(27) Solsona Catalan

casa	[kasə]~[kasə̃]	‘house’
llengua	[ʎɛŋgə]~[ʎɛŋgə̃]	‘tongue’
porta	[pɔɾtə]~[pɔɾtə̃]	‘door’

dentist-a	[dəntistə]~[dəntistə̃]	‘dentist-F’

Finally, another rare case exemplifying edge nasalisation comes from Haitian Creole, an Circum-Caribbean language. In Haitian Creole, the definite article has two allomorphs: /-a/ and /-la/. These forms are optionally nasalised. The data items in (28) are taken from Tẽzil (2019, pp. v, 12, 67–68).

(28) Haitian Creole

/ʃat + la/	[ʃatla]~[ʃatlã]	‘the cat’
/paji + a/	[pejija]~[pejijã]	‘the country’
/tab + la/	[tabla]~[tablã]	‘the table’
/diri + a/	[dirija]~[dirijã]	‘the rice’
/pate +a/	[pateja]~[patejã]	‘the patty’
/patat +la/	[patatla]~[patatlã]	‘the sweet potato’

3.5 Glidal nasalisation: The link between nasality and approximants

Glidal nasalisation is the rarest of all known types of spontaneous nasalisation. The only language in our language pool that exemplifies glidal nasalisation is Umbundu. Recall that this language has edge nasalisation as well, as illustrated in section 3.4. In Umbundu, the approximant sounds (/ʊ/, /l/, /j/, /w/, and /ɦ/) induce spontaneous nasalisation on the preceding and following vowels. This is illustrated in (29). The forms are based on Schadeberg (1982, pp. 117–123).

(29) Umbundu. Tone marks are omitted.

o-hũʊĩ	‘kind of bird (vulture)’
oku-tjãʊã	‘to cut firewood’

oku-tãlã	‘to look’
oc-ẽlũ	‘kind of groundnut’
pwãjĩ	‘but’
u-tõjĩ	‘courage’
oku-tãhã	‘to divine’
okw-ĩhã	‘to give (someone)’
e-twĩ	‘ear’
o-hwãsi	‘rich person’

It is worth noting that, despite the typological rarity and peculiarity of this type of spontaneous nasalisation, it is actually not a recent innovation. Nearly a century ago, Sardesai (1930, p. 538) reminded us that in Indic scripts, the approximants /j/, /ʋ/, /l/, /r/, and /ɦ/ together with voiceless sibilants were typically accompanied with an anusvāra, a symbol indicating nasalisation. In synchronic phonologies, there are cases of nasalised approximants which acquire nasality from an adjacent contrastively nasal vowel, as in Yoruba (Ladefoged & Maddieson, 1996). What is curious about the nasalisation pattern in Umbundu, however, is that there are no contrastively nasal vowels to spread nasality to these approximants. Consequently, the source of nasalisation on the approximants and the vowels is still obscure. See section 4.5 for details.

4 Discussion

Despite the fact that laboratory-based research on the phonetics of nasalisation has been ongoing for decades, “still not much is known about the articulatory and perceptual factors that are crucial for the initiation of this specific sound change” (Kunay, 2022, p. 2). In fact, the phonetic factors that shape the dynamics of spontaneous nasalisation remain largely under-researched. So far, only

a few hypotheses have been posited to explain this phenomenon. In what follows, I present these hypotheses and discuss the supporting evidence that has been drawn from the phonetics and phonology of nasalisation.

4.1 Rhinoglottophilia

The search for an explanation for rhinoglottophilia has always been guided by linguists' contemporary knowledge about the physiology of the vocal apparatus, especially in terms of what Matisoff (1970, p. 42) call "universal articulatory fact[s]". It has long been acknowledged that the configurations required for the production of nasalisation and glottalisation are not incompatible. In fact, the production of glottal consonants is only negligibly affected by the posture of the velum. Ohala (1972, p. 1168) contends that "it is possible to produce acoustically acceptable versions of these consonants regardless of the state of the soft palate". This observation underlies the velopharyngeal underspecification hypothesis that Ohala (1971, 1974) has proposed as a plausible explanation of this phenomenon. According to this hypothesis, glottal consonants are characterised as lacking any specification for velopharyngeal opening. In languages with spontaneous nasalisation induced by glottal consonants, the articulation of these consonants is thought to be accompanied by a larger velic opening, causing neighbouring vowels to nasalise via coarticulation. Aerodynamically, air pressure build-up, which is required for the production of these consonants, is not impeded by velic lowering since the location of their construction is posterior to the velum.

Evidence supporting Ohala's velopharyngeal underspecification hypothesis comes from physiological, phonetic, and phonological facts. Physiologically, velar lowering represents the natural resting position of the velum, and, it goes without saying, it is

the posture that the velum maintains during normal nasal breathing (Siddiqui, 2022). Even during speech, as Bloch (1965) observes, the velum has a tendency to relax. Matisoff (1975) calls this tendency 'velic lassitude'. In light of these physiological facts, the velopharyngeal underspecification hypothesis offers the following explanation for rhinoglottophilia. Glottal-induced nasalisation represents a 'least effort' configuration during the production of vowels in the proximity of glottal consonants.

Importantly, instrumental evidence in support of the velopharyngeal underspecification hypothesis has been reported in Ohala (1971). Using a nasograph to examine velar configuration during the articulation of glottal consonants in American English, Ohala (1971) observed a similar degree of velar lowering in the production of glottal and nasal consonants in one of his participants. More recently, Johnson and Shosted (2019) measure nasal airflow during the production of glottal consonants and nasalised vowels by six native speakers of Thai. Their findings confirm that velopharyngeal underspecification is the source of nasalisation in Thai, with nasalisation starting in the glottal consonant itself and then spreading to the following vowel. An MRI-based investigation of rhinoglottophilia in Thai (Johnson et al., 2017) shows a lowered velum during the production of vowels in the context of glottal consonants.

The phonological behaviour of glottal consonants lends further support to the velopharyngeal underspecification hypothesis. Fundamentally, treating glottals as underspecified segments is widely accepted in the phonological literature (e.g., Stemberger, 1993). Importantly, in languages with nasal harmony, glottal consonants are shown to be characteristically transparent. Having examined nasal harmony systems in a wide array of languages, Walker (2011, p. 1844) noted that glottals "rarely—perhaps never—block nasal harmony". See also Rose and Walker (2011).

4.2 Rhinochthamalophilia

Velum lowering is also invoked as a possible articulatory basis for rhinochthamalophilia—the affinity between nasality, on the one hand, and low vowels and pharyngeal consonants, on the other. Low vowels are characteristically produced with a lowered velum, a configuration not found in other vowels. For example, Clumeck (1976) analysed nasographic data from 14 speakers of American English, French, Hindi, Swedish, and Brazilian Portuguese and reported a tendency for low vowels to nasalise. Importantly, reviewing electromyographic and nasographic data published in Bell-Berti (1973) and Clumeck (1975), Ohala (1975) reaches the conclusion that the velum is actively lowered during the production of low vowels even in non-nasal contexts for many native speakers of American English. He even went on to speculate that "a little bit of nasalization" seems to be required for the production of low vowels in American English (p. 299).

In fact, the observation that low vowels have greater velopharyngeal opening is backed up with data-based evidence from several studies employing a variety of instruments, including x-ray (Fant, 1960), cineradiography (Hiroto, Hirano, & Umeno, 1962), a nasograph (Clumeck, 1976; Ohala, 1971), an endoscope (e.g., Bell-Berti, Baer, Harris, & Niimi, 1979), electromyography (Clumeck, 1975), and magnetic resonance imaging (Whalen, 1990). This accumulating evidence has led Johnson (2019, p. 13) to suggest that low vowels are, in effect, "already somewhat nasalized". Johnson's description actually resonates with Bloch's (1965) remark regarding the cross-linguistic tendency of low vowels to nasalise. Bloch (1965, p. 45) attributes this tendency to "the fact that the nasal resonance innate in vowels asserts itself […] in connection with long vowels and a".

Reflecting on what this configuration means perceptually, Ohala (1974) reasons that this nasal coupling is recurrent during the production of low vowels, in particular, because the acoustic consequences of greater velopharyngeal opening as a result of velar lowering are perceptually negligible in the case of low vowels. Nasal coupling during the production of a vowel introduces nasal resonances, which affect the frequency and width of the vowel formants, especially the first formant (F1) (Johnson, 2012; see also Styler, 2015, 2017 and references therein). Since the general frequency range of F1 in low vowels lies above the frequency range of the first nasal resonance (Fujimura, 1961; Johnson, 2019), the formant-shifting effect caused by nasalisation on the vowel's first formant will be weak. By way of contrast, the frequency range of F1 in non-low vowels falls below the frequency range of the first nasal resonance (Fujimura, 1961; Johnson, 2019). Therefore, a dramatic formant-shifting effect will occur, causing affected vowels to be perceived as lower than their oral counterparts. Based on phonetic evidence, Ohala (1975) succinctly summarises the impact of nasalisation on F1 as follows: "the lower is the F1 of a segment, the less will it tolerate nasalization" (p. 301). Interestingly, nasalisation has long been shown to affect the perception of vowel height, such that nasalised mid vowels are perceived as low vowels (Wright, 1975).

Diachronically, these phonetic facts are thought to be responsible for the cross-linguistic preference for nasalised low vowels over nasalised high or mid vowels. Matisoff (1975, p. 272) contends that "[i]f vowel nasalization invades a language, it is the low vowels that are affected first". Typological data seem to support this claim (e.g., Chen, 1972; Hess, 1990; Schourup, 1973, but see Hajek & Maeda, 2000, for a different view).

The lower-velum configuration that is associated with nasalisation has also been reported for pharyngeal consonants. For example, a fiberscopic study by Elgendy (1991) reveals that

pharyngeals in Egyptian Arabic are articulated with velic opening even in non-nasal environments. More recently, however, Khattab et al. (2018) conclude, based on acoustic evidence, that Iraqi Arabic pharyngeal consonants contribute to "the presence of nasalization" in their environments" (p. 310).

Another important phonetic study in this regard is Zellou (2012). Zellou argues that pharyngeal consonants should be treated as non-buccal consonants since their place of articulation is posterior to the velum. She conducted aerodynamic, acoustic, and perceptual studies investigating nasalisation in Moroccan Arabic. Airflow data show that vowels in the vicinity of pharyngeal consonants have "reliably more nasal airflow than vowels adjacent to both oral and nasal consonants" (p. 42). Zellou suggests that an explanation for this intriguing finding should take into consideration jaw positions in the production of pharyngeals in Arabic. According to Elgendy (2001, p. 91), the production of pharyngeal consonants is marked with "an extreme degree of jaw opening", which is even "greater than for vowels". The acoustic data analysed in Zellou's (2012) study are consistent with the findings of her aerodynamic study, with pharyngeal-adjacent vowels displaying a great amount of nasalisation. Finally, Zellou's perceptual study also reveals that listeners tap into the nasalisation effect that is caused by pharyngeal adjacency. Zellou (2012, p. iii) reaches the conclusion that nasality in Moroccan Arabic is "perceptually associated with pharyngeal, as well as nasal consonants".

4.3 Rhinosyrigmatophilia

The most plausible explanation for hinosyrigmatophilia—the affinity between nasality and breathiness, appeals to the perceptual similarity between the acoustic signature of nasalisation and of breathiness. Ohala (1974) and Ohala and Ohala (1991) proposed that fricatives and aspirates, which they grouped together as high-airflow

segments, are produced with a greater glottal opening that can spread to flanking vowels. This coupling between the subglottal and oral cavities creates acoustic effects that "mimic the effects of coupling of the oral and nasal cavities" (Ohala & Busà, 1995, pp. 132–133).

There is acoustic evidence supporting this perceptual similarity between the acoustic effects of nasalisation and breathiness. For example, Blankenship (2002) noted that vowels in the vicinity of glottal consonants or aspiration display increased breathy phonation. Both frication and nasalisation cause pronounced damping of the first formant and an increase in its bandwidth. These acoustic modifications are accompanied by increased spectral tilt in nasalised and glottalised vowels (Garellek, 2014; Stevens, 2000). Using electroglottographic and acoustic data from three Yi languages, Garellek, Ritchart, and Kuang (2016) reported that vowels following nasal consonants are breathier than vowels following non-nasal consonants.

The acoustic similarity between nasality and breathiness increases their perceptual confusability, with breathiness being misperceived as nasalisation and vice versa. In fact, the potential for misperception has been tested in a few perceptual studies. For example, Ohala and Amador (1981) ran a perceptual experiment where listeners had to judge stimuli of iterated vowels excised from VC syllables, where C is a voiceless fricative. Ohala and Amador reported that their participants rated these vowels as nasal even though there was no nasal consonant in their environments. These findings were replicated with English, Spanish, and Hindi native speakers (Ohala, 1993; Ohala & Ohala, 1993)

4.4 Edge nasalisation

Edge nasalisation has been approached in the literature as a prosodic enhancement effect. The notion of prosodic enhancement

relies on the logic that edge effects involving unstressed vowels mainly serve to augment the prosodic prominence of the syllable in question (Nevins & Costa, 2019; Smith, 2005). In the Brazilian Portuguese examples presented in 3.4, onsetless unstressed vowels are nasalised word-initially. It is a fact attested cross-linguistically that unstressed vowels are durationally shorter than their stressed counterparts, regardless of their quality (Fry, 1955). Expectedly, when an unstressed vowel occurs in an onsetless syllable, the vowel becomes even shorter than its counterpart in an onsetful syllable (Nevins & Costa, 2019). Importantly, nasalised vowels are known to be durationally longer than their oral counterparts (Akpanglo-Nartey, 2017). So, nasalising an onsetless unstressed vowel word-initially will increase its durational length, thus enhancing its prosodic prominence.

The same logic applies to right-edge nasalisation. Word-final positions are notoriously known to be prosodically weak. Coda consonants or unstressed word-final vowels are typically prone to neutralisation and reduction effects, including, of course, segment loss. Accordingly, as pointed out above, nasalisation increases the duration of the vowel word-finally, which will enhance the prosodic presence of the unstressed final vowel, shielding it, thus, from final erosion processes.

4.5 Glidal nasalisation

Glidal nasalisation has received the least attention, partly due to the typological rarity of this form of spontaneous nasalisation, and partly due to lack of instrumental data. In the languages surveyed in this study, only Umbundu was found to exhibit glidal nasalisation. It is to be noted, though, that approximants have been shown to act as a unitary class in Epena Pedee nasal harmony (Harms, 1985). In Epena Pedee, nasality spreads from a nasal vowel onto vowels and approximants, including glides, glottals, and liquids. It is blocked by

the trill /r/ and obstruents (Rose & Walker, 2011; Walker, 2011). The transparency-to-harmony argument, which has been abundantly illustrated and validated in the literature, adequately accounts for this behaviour of the approximants in Epena Pedee. However, glidal nasalisation as seen in Umbundu is different. There is still no agreement on the source of nasalisation (Schadeberg, 1982; Shosted, 2006). Do approximants initiate and spread nasality onto an adjacent vowel? Or do they just passively undergo nasalisation from a nearby nasalised vowel? Note that this latter scenario begs the question of how the vowel came to be nasalised in the absence of an etymological nasal consonant in its surroundings. Recall that Umbundu does not have contrastively nasalised vowels. How compatible is the articulation of approximants with that of nasality? Is the velum passively or actively lowered during the production of glides in this form of nasalisation? These are some of the fundamental questions that remain unanswered to date. The factors leading to glidal nasalisation are still largely unknown. Clearly, more research supported by instrumental data is needed to elucidate this rather curious type of nasalisation.

5 Conclusion

This study has described and illustrated five categories of spontaneous nasalisation in a taxonomy built using data from 30 languages. Glottals, pharyngeals, sibilants, and aspirants were found to be capable of triggering vowel nasalisation in non-nasal environments. Approximants, in contrast, were found to induce vowel nasalisation in only one out of 30 languages. This was interpreted as indicative of the typological rarity of glidal nasalisation. Low vowels were found to undergo nasalisation in several genetically unrelated languages. Some of these languages only allow low vowels to spontaneously nasalise. The study has also discussed and illustrated

prosodically conditioned nasalisation. Phonetic and phonological explanations for each of the five types of spontaneous nasalisation have been provided.

The study suggests two main directions for future research. Firstly, there is a need for more exploration into the phonetics and phonology of spontaneous nasalisation, particularly in languages where this issue has not been investigated. Secondly, it is hoped that more confirmatory studies will be conducted using instrumental data illustrating spontaneous nasalisation from a variety of languages. These two lines of research will hopefully sharpen our perspective on the phonetics and phonology of spontaneous nasalisation.

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Appendix

Table A1. List of languages surveyed. For each language, a unique identifier (the Glottocode, if available) and genealogical affiliation are given. These are drawn from Glottolog 4.8 (Hammarström, Forkel, Haspelmath, & Bank, 2023) and/or the references cited in the current paper for each of these languages. Spontaneous Nasalisation categories and data sources are also provided.

Language	Glottocode	Language Family	Branch	Nasalisation Category	Source
Aguaruna	agua1253	Peruvian Amazonian	Jivaroan	Rhinoglottophilia	Botma 2004
Arabela	arab1268	Peruvian Amazonian	Zaparoan	Rhinoglottophilia	Rich 1963
Bangkok Thai	thai1261	Tai-Kadai	Tai	Rhinoglottophilia	Matisoff 1975
Brazilian Portuguese	braz1246	Indo-European	Romance	Edge nasalisation	Nevins & Cosat 2019
British English	stan1293	Indo-European	Western Germanic	Rhinoglottophilia and Rhinochthamalophilia	Matisoff 1975
Bzhedugh	bezh1247	Caucasian	West Circassian	Rhinosyrigmatophilia	Blevins & Garrett 1993; Arkadiev & Lander 2021
Cèmuhî	cemu1238	Austronesian	Oceanic New Caledonian	Rhinoglottophilia	Blevins & Garrett 1993
Cheha	chah1248	Afro-Asiatic	Ethiopian-Semitic	Rhinochthamalophilia	Ahland 2005
Endegeny	-	Afro-Asiatic	Ethiopian-Semitic	Rhinoglottophilia and Rhinochthamalophilia	Ahland 2005

Language	Glottocode	Language Family	Branch	Nasalisation Category	Source
Ennemor	-	Afro-Asiatic	Ethiopian-Semitic	Rhinoglottophilia and Rhinochthamalophilia	Ahland 2005
Fwâi	fwai1237	Austronesian	Oceanic New Caledonian	Rhinosyrigmatophilia	Blevins & Garrett 1993
Ganza	ganz1246	Blue Nile Mao	Omotic	Rhinoglottophilia	Smolders 2016
Gyeto	-	Afro-Asiatic	Ethiopian-Semitic	Rhinochthamalophilia	Ahland 2005
Haitian Creole	hait1244	French Creole	Circum-Caribbean	Edge nasalisation	Tẽzil 2019
Hindi	hind1269	Indo-European	Indic	Rhinosyrigmatophilia	Ohala 1983
Inor	inor1238	Afro-Asiatic	Ethiopian-Semitic	Rhinochthamalophilia	Boivin 1996
Kaimganj Pathan Urdu (KPU)	urdu1245	Indo-European	Indo-Aryan	Rhinosyrigmatophilia	Masood 1986
Kwangali	kwan1273	Atlantic-Congo	Southern Bantu	Rhinoglottophilia	Ladefoged & Maddieson 1996
Lahu	lahu1253	Sino-Tibetan	Tibeto-Burman, Lolo–Burmese	Rhinoglottophilia	Matisoff 1975
Moroccan Arabic	moro1292	Afro-Asiatic	Semitic	Rhinochthamalophilia	Zellou 2012
Pije	pije1237	Austronesian	Oceanic New Caledonian	Rhinosyrigmatophilia	Blevins & Garrett 1993
Seimat	seim1238	Austronesian	Western Admiralty	Rhinoglottophilia	Botma 2004

Language	Glottocode	Language Family	Branch	Nasalisation Category	Source
			Islands		
Silte-Wolane Gurage	silt1239	Afro-Asiatic	Ethiopian-Semitic	Rhinochthamalophilia	Botam 2004
Solsona Catalan	stan1293	Indo-European	Romance	Edge nasalisation	Reina 2019
Souletin Basque	soul1243	Language isolate	NA	Rhinoglottophilia	Igartu 2008
Swabian	swab1242	Indo-European	Western Germanic	Rhinosyrigmatophilia and Edge nasalisation	Griffen 1994; Reina 2019
Umbundu	umbu1257	Atlantic-Congo	Bantu	Edge nasalisation and Glidal nasalisation	Schadeberg 1982
Western Abenaki	west2630	Algic	Eastern Algonquian	Rhinochthamalophilia	Whalen & Beddor 1989; Costa 2007 Goddard 1971
Wichiʼ	wich1261	Matacoan	Mataguayo	Rhinoglottophilia	Rogers 2011
Zway Gurage	zayy1238	Afro-Asiatic	Ethiopian-Semitic	Rhinochthamalophilia	Botam 2004