

Reconstruction of A'ingae prenasalized stops

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1 Introduction

- Contrastive nasality on vowels is widely considered an areal feature of Amazonian languages (e.g. van Gijn 2014).
- Alongside this vowel alternation, many of these languages also have allophonic patterns in which nasal consonants have allophones with both oral and nasal components, particularly prenasalized voiced stops.
- For example, in Tapieté (Tupí-Guaraní), they show the patterns in (1). The distribution of nasal consonants is fully predictable from the nasality of following vowels.

(1) **Nasal and prenasalized stops in Tapieté (data from González 2005, mostly cited in Lapierre & Michael 2017)**

- a. [m] / $__\tilde{V}$
- | | |
|---------|--------------|
| [môhã] | ‘medicine’ |
| [hãñã] | ‘that’s why’ |
| [ŋãnta] | ‘tell off’ |
- b. [ᵐb] / $__\tilde{V}$
- | | |
|-----------|-------------|
| [tuᵐba] | ‘orphan’ |
| [ᵐdirete] | ‘your body’ |
| [puᵐga] | ‘upset’ |

- A number of recent works (e.g. Stanton 2018, Lapierre & Michael 2017, Wetzels & Nevins 2018) have analyzed such cases as arising from underlying nasal stops, e.g. [m].
- Prenasalized voiced stops, e.g. [ᵐb], arise allophonically in languages with nasal vowels due to “shielding” – i.e. velum closure occurs during the stop in order to preserve the contrastive lack of nasality on the following vowel.

This talk: We examine seemingly similar patterns in A'ingae (an isolate spoken in Ecuador and Colombia), but argue that these have a quite different explanation.

- A'ingae has a similar distribution of nasals and prenasalized stops (and affricates)¹:

¹There is a slight asymmetry, which we elaborate on below. While surface sequences like *[ma] do not occur, sequences of *[ᵐbã] are possible in surface forms, but arguably are likely not possible in underlying forms.

(2) Typical distribution of nasal and prenasalized stops² in A'ingae:

- a. [m] / ___ \tilde{V}
 [sĩmẽ] 'afternoon'
 [nãʔẽ] 'river'
 [ãpẽ] 'to eat'
- b. [ᵐb] / ___ V
 [ãᵐbak^hi] 'yuca planting'
 [ᵐdaro] 'piranha'
 [kõᵐgi] 'sweet potato'

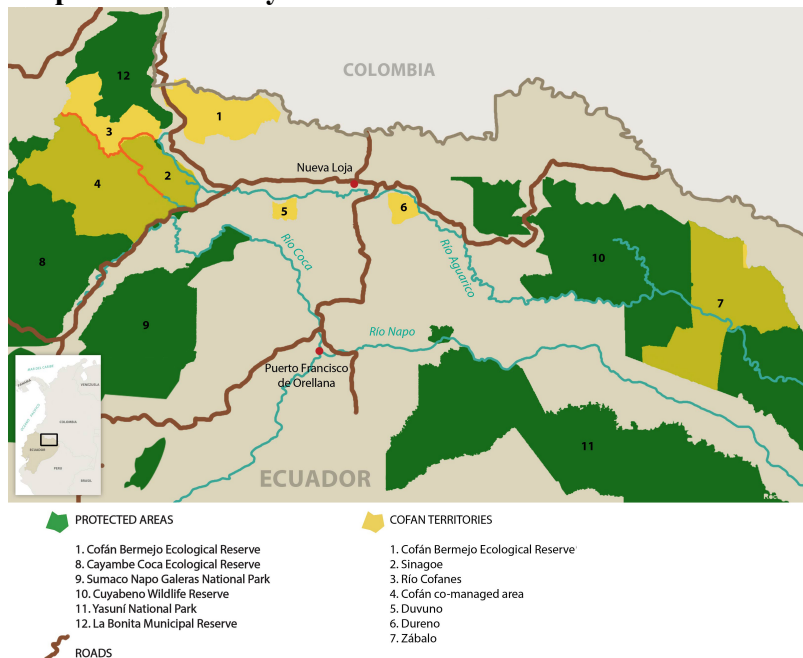
- Despite the similar surface patterns, however, we show that the shielding analysis, with prenasalized stops arising from nasals, is not applicable to A'ingae; the two series are not allophonically related.

Our Analysis: We propose a tentative diachronic account of a sound change in which plain voiceless stops and affricates became prenasalized when preceded by a nasalized vowel and followed by an oral vowel: T > ⁿD/Ṽ__V.

2 Background

- A'ingae (also Cofán or Kofán, ISO 639-3: con) is an isolate spoken in northeastern Ecuador and southern Colombia primarily along the Aguarico and San Miguel rivers.

(3) Map of A'i territory in Ecuador:



²The A'ingae series are not parallel. There is no velar nasal corresponding to the prenasalized velar stop [ᵐg], nor a prenasalized palatal stop corresponding to the nasal [ɲ]. There are also two prenasalized affricates, [ᵐdʒ] and [ᵐtʃ].

- Traditionally, the A'í lived more towards the Andean foothills, having migrated eastward in the last ~60yrs in response to the impacts of oil exploration and colonization.
 - The language has an estimated ~1,500-2,000 speakers and is still being robustly transmitted to children in some communities, but less so in others.
 - The data reported on here are from A'ingae as spoken in Zábalo and Dureno and collected as part of the A'ingae Language Documentation Project.
- (We believe the facts also hold at least for other Ecuadorian varieties of A'ingae).

2.1 Phonemic Inventory

- The inventory of vowel phonemes in A'ingae, as proposed by Repetti-Ludlow et al. (forthcoming), is listed in (4):

(4) Vowel phonemes of A'ingae:

	Front	Central	Back
High	i ĩ	ɨ ỹ	
Mid	e ĕ		o~u õ~ũ
Low		a ă	
Diphthongs	ai oe oa oi iĩ, ao		

- The inventory of consonant phonemes in A'ingae, as proposed by Repetti-Ludlow et al. (forthcoming), is listed in (5):

(5) Consonant phonemes of A'ingae:

	Bilabial	Labiodental	Alveolar	Post-alv.	Palatal	Velar	Glottal
Plosive	p ^h p ^m b		t ^h t ⁿ d			k ^h k ⁿ g	ʔ
Affricate			ts ^h ts ⁿ dʒ	tʃ ^h tʃ ⁿ dʒ			
Fricative		f	s	ʃ			h
Nasal	m		n		ɲ		
Approximant		v			j	ɰ	
Tap			r				

- A'ingae contrasts four series of oral/nasal stops: aspirated stops /T^h/, plain stops /T/, prenasalized voiced stops /ⁿD/, and fully nasal stops /N/.
- While the vowel nasality in sets like (6), which are common, may give the appearance of allophonic relationships between nasals and prenasalized stops, conditioned by vowel nasality, sets like (7) provide clear evidence against this.

- (6) [mõ] ‘sent’ [ᵐboi] ‘row, paddle’ [poi] ‘both’ [pʰoi] ‘get down low’
 (7) [mĩsĩ] ‘worm, larva’ [ᵐbĩʃĩ] ‘dog flea’ [pĩᵐdo] ‘hawk’ [pʰĩmĩ] ‘nick, dent’

- Note that, similar to languages with shielding-type allophony, A’ingae also has contrastive vowel nasality:

(8) **(Near-)minimal pairs showing contrastive nasality:**

[kõʔsĩ] ‘monkey’	[kose] ‘night’
[tsãpi] ‘forest’	[tsapi] ‘close one’s eyes (non-fut.)’
[tõ] ‘palm caterpillar’	[toe] ‘same’
[tʰĩtʰãkʰi] ‘friday’	[tʰĩtʰije] ‘to knock over’

- A’ingae syllables are uniformly of the form (C)V(?) in medial position and (C)V in word-final position

2.2 Nasality in A’ingae

In this section, we review several (related) phonological process in A’ingae having to do with nasality in consonants and vowels.

2.2.1 Glide-nasal stop alternations

- As seen above, A’ingae has voiced approximants: labiodental [v] and palatal [j].³
- There are also nasal stops: [m], [n], and [ɲ].⁴
- A number of suffixes and clitics with these exhibit phonologically-conditioned allomorphy between the glides and nasals,⁵ conditioned by the nasality of the preceding vowel:

	Morpheme	V _____	Ṽ _____
	Infinitive [-je]/[-ɲẽ]	[shaka-je] ‘to dance’	[kã-ɲẽ] ‘to look’
(9)	Assertive [-ʔja]/[-ʔɲã]	[hi-ʔja] ‘did come’	[hĩ-ʔɲã] ‘does exist’
	Irrealis [-ja]/[-ɲã]	[ᵐda-ja] ‘might become’	[kʰĩ-ɲã] ‘might lay down’
	Accusative 2 [-ve]/[-mẽ]	[tʰesi-ve] ‘jaguar (Acc2)’	[kõʔsĩ-mẽ] ‘monkey (Acc2)’
	Exclusive [-ji]/[-ɲĩ]	[tisi-ji] ‘only himself/herself’	[tʃonĩ-ɲĩ] ‘only nutrias’

³We set aside here the third voiced approximant [u], as it has no known nasal realizations, is very infrequent, and has a limited distribution not paralleled by the other glides (e.g. not occurring word-initially).

⁴[n] has no glide counterpart; there is no evidence for alternation with the oral alveolar approximant [ɹ].

⁵While previous literature has been unanimous in taking this distinction to nonetheless be phonemic, we leave open the possibility that the alternations between [m] and [v] and [ɲ] and [j] are in fact the result of a regular allophonic rule conditioned by the nasality/orality of adjacent vowels. The interpretation of these sounds hinges on the direction of causation underlying the surface distribution in which nasal consonants are always surrounded by nasal vowels.

2.2.2 Progressive consonant-induced vowel nasalization

- Phonetically, we might expect nasal consonants to cause some degree of nasalization of adjacent vowels.
- Above and beyond such phonetic nasalization, however, we also find clear phonological evidence that nasal onsets cause following vowels to become phonologically nasalized.
- In particular, the allomorphic pattern in (9) consistently produces the nasal form following NV sequences (where N is a nasal consonant):

	Root	Attested allomorph	Unattested allomorph
(10)	[kukamã] ‘colonist’	[kukamã-mẽ] ‘colonist (Acc2)’	*[kukama-ve]
	[tʃonĩ] ‘nutria’	[tʃonĩ-jĩ] ‘only nutrias’	*[tʃoni-ji]
	[nõpã] ‘make’	[nõpã-jẽ]	*[noɲa-je]

- Two pieces of data suggest that nasal consonants spread nasality onto following vowels, rather than vowels following nasal consonants simply always being underlyingly nasal:
 1. Nasal allomorphs themselves trigger nasal allomorphs in sequences of varying suffixes/enclitics:
 - The suffixes themselves have both nasal and non-nasal allomorphs; there is little evidence that the glides occur before underlyingly nasal vowels,⁶ so the vowels within these suffixes are likely oral.
 - Despite this, we find that allomorphs with nasal onsets themselves trigger allomorphs with nasal onsets.
 - For example, [tãⁿdã-jẽ-**pã**] tie-PASS-IRR ‘might/will be tied’, but not *[tãⁿdã-je-**ja**].⁷
 2. This same pattern is consistently found in borrowings from Spanish (e.g. [daʔnõ-**pẽ**] ‘to damage’, but not *[daʔno-**je**]).
 - Spanish and Kichwa, the main donor languages, do not have categorical nasal spreading to vowels after nasal consonants.

⁶Across morpheme boundaries, such sequences due to regressive nasal spreading seem to be permitted. However, we have confirmed only three cases within roots of glides followed by vowels that would be nasalized by a following nasal consonant, and they are all borrowings. There are no cases of glides followed by nasal vowels that cannot be attributed to a following nasal consonant.

⁷Sequences with an alternating suffix/clitic followed by a non-alternating suffix/clitic with a nasal onset do not behave in this way, though nasality does spread onto the preceding vowel: [ito-jẽ-^mbi], not *[ito-jẽ-mbi]. This asymmetry may reflect the relative timing of iterative phonology with subsequent morphemes, a difference in the phonologization of regressive vs. progressive nasal spreading, or simply indicate that only the nasality of the preceding vowel conditions the allomorphy.

- If the adaptation were just because sequences like [ɲe] are not possible due to nasality of vowels conditioning nasality of sonorants, it is not clear that we would expect borrowings to so frequently preserve the nasal consonant and change the nasality of the vowel.

2.2.3 Nasal spreading

- Finally, we find that nasalization on vowels spreads progressively across certain classes of consonants, but not others.

Laryngeal consonants

- As noted by Fischer & Hengeveld (ms), laryngeal consonants – [ʔ] and [h] – consistently require the vowels preceding and following to ‘agree’ in nasality/orality.
- We see this clearly in alternations in suffixes/enclitics such as the progressive [-he]/[-hẽ] and contrastive topic marker, [-ha]/[-hã]:

- (11) [ke=**ha**] you-CT ‘as for you’ [ɲã=**hã**] I-CT ‘as for me’
 [kĩʔ=**he**] drink-PROG ‘is drinking’ [ã=**hẽ**] eat-PROG ‘is eating’

- We also see that such vowels then trigger nasal allomorphs for alternating clitics of the sort discussed in (9), e.g. [ɲãʔẽ=me] ‘river (ACC2)’, not [ɲãʔe=ve].

Sonorants

- For approximants [v] and [j], we have already seen above that a preceding nasal vowel causes these consonants themselves to be realized as nasal consonants.⁸
- Nasal consonants seem to cause nasality on the following vowel, as discussed above; to a somewhat smaller extent they also nasalize the preceding vowel.

Voiceless aspirated stops and prenasalized voiced stops

- As will be discussed below, nasal spreading is blocked by prenasalized stops and affricates; their most frequent position is between a nasal and an oral vowel, e.g. [kõŋgi] ‘ant’; [kõŋgi] ‘sweet potato’.

⁸[ɾ] and [w] occur primarily in word-medial positions between oral vowels and rarely occur next to nasal vowels. On top of this distribution, many of the cases of [ɾ] are in borrowings.

- Aspirated stops and affricates block nasal spreading, allowing roots such as [ãp^hi] ‘fall’, [sĩt^hi] ‘bite (animal)’, though they are most frequent between oral vowels.

Voiceless unaspirated stops, and fricatives

- For voiceless unaspirated stops and fricatives, the evidence regarding nasal spreading is somewhat more mixed.
- On the one hand, we do find a small set of words which have these consonants following a nasal vowel but followed by an oral vowel.
- Beyond being phonetically nasal, such words trigger the oral glide allomorphs for alternating clitics and suffixes:

(12)

[tsãpi]	‘forest’	[tsãpi-ve]	*[tsãpi-me]
[tiĩfa]	‘palm fiber’	[tiĩfa-ve]	*[tiĩfa-me]
[ãsi]	‘salt’	[ãsi-ve]	*[ãsi-me]
[kãse]	‘live’	[kãse-je]	*[kanse-je]

- At the same time, the preponderance of words in which these consonants are preceded by nasal vowels also have a following nasal vowel.
- This even includes a handful of borrowings in which vowels that are oral in the source language become nasalized when there is a nasal vowel in a neighboring syllable.

(13)

Gloss	Direction	Source Word	A’ingae form
‘confess’	Progressive	<i>confesar</i>	[kõfẽsẽ]
‘spear’	Progressive	<i>lanza</i>	[ⁿ dãsã]
‘cotton shirt’	Regressive	<i>cotón</i>	[kõtõ]
‘smoking pipe’	Regressive	<i>cachimba</i>	[kãt̪ĩ ^m ba]

3 Arguments for a historical split

- With this background in place, we return now to our central topic: the distribution of prenasalized voiced stops and affricates and how it supports a historical split between the unaspirated series and the prenasalized series.

Argument 1: Allomorph selection

- Certain suffixes and clitics begin with voiceless unaspirated stops after oral vowels and prenasalized stops after nasal vowels.

(14) **Alternating forms (from Fischer & Hengeveld ms)**

- a. **-pa ‘nominalizer’**
/ʃaka-pa/ [ʃakapa] ‘fail-NMLZ; fault’
/hẽ-pa/ [hẽ^mba] ‘sound-NMLZ’
- b. **-ta ‘new topic marker’**
/va-ta/ [vata] ‘this-TOP’
/haʔnõ-ta/ [haʔnõⁿda] ‘now-TOP’

- Others consistently have prenasalized stops and trigger local nasal spreading:

(15) **Non-alternating forms (from Fischer & Hengeveld ms)**

- a. **-^mbi ‘negation’**
/ʃaka-^mbi/ [ʃakã-^mbi] ‘fail-NEG; did not fail’
/hẽ-^mbi/ [hẽ-^mbi] ‘sound-NEG; didn’t sound’
- b. **-ⁿga ‘dative’**
/ijo-ⁿga/ [ijõ-ⁿga] ‘snake-DAT’
/ãĩ-ⁿga/ [ãĩⁿga] ‘dog-DAT’

- Conversely, there are no suffixes or clitics with a uniformly plain voiceless stop that occur at the same prosodic level, though there are high level clitics with this form, e.g. the 2nd person marker =ki.

Argument 2: Facts about the lexicon

- Voiceless unaspirated stops almost never occur between a nasal and oral vowel; the few exceptions are likely borrowings, e.g. [tsãpi] ‘forest’, which may be from Kichwa *tʃampira* ‘palm tree’.
- Prenasalized stops overwhelmingly occur between a nasal vowel and an underlying oral vowel, e.g.

– t^hẽ^mba ‘branch’; tʃãⁿdi ‘became clear’; ẽt^hĩⁿge ‘middle’

– However, nasal spreading induced by suffixes/enclitics somewhat obscures the source of this distribution, i.e. if the consonant nasalizes the vowel or if the vowel nasalizes the consonant

- There are a few word-internal exceptions flanked by nasal vowels, which largely seem to result from the widespread reduplication process or analogical reshaping by comparison with other reduplicated forms, e.g.

– tãⁿdã ‘tie’

– kõⁿgõ ‘rot’

- However, prenasalized stops also occur word-initially, where they contrast with voiceless unaspirated stops:
 - ^hdoje ‘to split’ vs. toji ‘involuntary’
 - They are relatively infrequent in this position (~90 roots, vs. ~450 roots with initial voiceless stops, though their frequencies are similar word-internally).
 - Many word-initial cases are in recent borrowings, e.g. Sp. *gasolina* > ^hgasorinã ‘gasoline’; Sp. *bombillo* > ^mbõ^mbijo ‘light bulb’.
 - ~30% of the roots with word-initial prenasalized stops are known borrowings.
- To explain the word-initial cases, we propose a more speculative sound change that followed the conditioned prenasalization of stops: deletion of nasal ^ẽ and ^ĩ word-initially.
 - ^ẽ and ^ĩ are infrequent word-initially in the modern language (relative to their oral counterparts and to other nasal vowels), and never occur word-initially before prenasalized stops or affricates.
 - At least one presumably early borrowing seems to reflect this deletion (*engañar* > ^hgã^hga ‘fishing lure’).
 - This change would have eliminated the complementary distribution of voiceless and prenasalized stops, making them contrastive.

Argument 3: Adaptations in borrowings

- While some borrowings exhibit exceptional phonotactics, many borrowings are adapted and align with patterns of inherited words.
- Post-nasal unaspirated stops are often borrowed as prenasalized stops:
 - e.g. *contar* ‘tell’ > kõⁿda; *compa(dre)* ‘godfather’ > kõ^mba
 - There are additional cases in Kichwa borrowings, but they may originate from a Kichwa dialect with postnasal voicing.
 - Where the stop remains voiceless after a nasal, it is usually also followed by a vowel that was likely at least partially nasalized by a following nasal consonant, e.g. *compañero* ‘companion’ > kõpãñẽro; *campana* ‘bell’ > kãpãñã.
 - Sometimes nasality seems to spread across the consonant, producing nasal vowels on both sides, e.g. *cotón* ‘shirt’ > kõtõ, though some cases of a preceding oral vowel and following nasal vowel are preserved, e.g. *boton* ‘button’ > ^mbotõ

- Voiced stops are usually preserved as such after a nasal and are sometimes preserved word-initially:
 - Word-initial voiced stops are borrowed as prenasalized stops (e.g. *barato* ‘cheap’ > ^mbarato) or glides (e.g. *banano* ‘banana’ > vanãñō)
 - Voiced stops after nasals become prenasalized stops, e.g. *mandar* ‘send’ > mãⁿda; *domingo* ‘Sunday’ > dõmĩ^ŋgo.
 - Voiced stops are also sometimes preserved after /l/, which is adapted as prenasalization, e.g. *soldado* > sĩⁿdaro
 - Voiced stops between oral vowels or other oral sonorants are often borrowed as glides, e.g. *cobija* ‘shelter’ > kovija, *barbudo* > ^mbavoro ‘bearded catfish’, likely reflecting lenition within the Spanish forms.
 - And [d] between oral vowels is often borrowed as the tap, e.g. *radio* > rarijo
- Word-initial nasals are sometimes borrowed as prenasalized stops:
 - *morcilla* ‘sausage’ > bosija
 - though not always, e.g. *martillo* ‘hammer’ > martijo
 - Suggests that the lack of nasality on the following vowel is perceived as a cue that the preceding consonant is prenasalized rather than a full nasal.
 - While this would also be consistent with a relationship between the nasal series and the prenasalized series, other evidence strongly favors the relationship between the voiceless unaspirated series and the prenasalized series

Argument 4: Laryngeal co-occurrence constraints

- Modern A’ingae has a constraint against aspirated and voiceless unaspirated stops of the same place of articulation within a root (Repetti-Ludlow et al., forthcoming).
- Prenasalized stops pattern like voiceless unaspirated stops for this constraint.
 - Most cases where they occur with aspirated stops are morphologically complex (e.g. t^hĩ^ŋ dĩⁿdije ‘to shiver’).
 - But they co-occur within roots with voiceless unaspirated stops of the same place of articulation, e.g. kō^ŋgi ‘ant’; kō^ŋgi ‘sweet potato’.
 - Some such co-occurrence examples seem to be influenced by reduplication and exhibit exceptional vowel nasalization patterns (e.g. tãⁿdã ‘tie’; kō^ŋgō ‘rot’).

- Consistent with a recent history in which voiceless unaspirated stops and prenasalized stops were part of the same series.

4 Conclusions

- Several lines of evidence point towards a relationship between the voiceless unaspirated series of stops and affricates and the prenasalized voiced series.
 - Allomorphic alternations between voiceless unaspirated and prenasalized consonants
 - Limited (and largely complementary) distributions of both series within the lexicon
 - In borrowings, unaspirated stops often end up as prenasalized voiced stops after nasals, and voiced stops in non-nasal environments often are borrowed as approximants
 - Aspirated stops won't co-occur with homorganic unaspirated or prenasalized stops, but unaspirated and prenasalized stops can co-occur with each other
- What drove the historical process of prenasalizing voiceless unaspirated stops and affricates?
- **Phonetic coarticulation and reanalysis**
 - Spread of nasality from a nasal vowel into a following stop or affricate could produce prenasalized stops
 - However, it is not clear why the conditioning environment would also require that the following vowel be oral
 - Perhaps in a fully nasal environment, nasality within the consonant was more likely to be attributed to coarticulatory spread and factored out
- **Phonological contrast preservation**
 - Could this parallel the shielding account for prenasalized stops developing from nasals?
 - The parallel case would be that orality is specified as a target gesture, and prenasalization develops to block it from spreading from the consonant and following vowel to the preceding nasal vowel
 - But there is no evidence for orality spreading within A'ingae, and substantial evidence for nasal spreading
 - If oral consonants are unspecified for nasality and transparent to spreading nasality, but voiceless unaspirated stops block that spreading in order to preserve their own orality, the resulting partially nasalized stops might be particularly prone to reanalysis as being marked for that [nasal][oral] structure

- There are extensive nasal spreading processes in modern A'ingae, in addition to what seems to be contrastive nasality both on consonants and on vowels
- A fully integrated account of all the nasal spreading processes and the limited distributions of other consonants relative to vowel nasality is still in progress

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