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REVIEW ARTICLE

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The phonology of A'ingae

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Abstract

A'ingae (or Cofán, ISO 639-3: con) is an indigenous language isolate spoken in northeast Ecuador and southern Colombia. This paper presents the first comprehensive overview of the A'ingae phonology, including descriptions of (i) the language's phonemic inventory, (ii) phonotactics and a number of related phonological rules, (iii) nasality and nasal spreading, as well as (iv) stress, glottalisation, their morphophonology, and aspects of clause-level prosody.

1 | INTRODUCTION

This article constitutes the first comprehensive phonological sketch of A'ingae (or Cofán, ISO 639-3: con), an underdocumented and endangered language isolate spoken by about 1500 native speakers in the northeast Ecuadorian province of Sucumbíos and the southern Colombian department of Putumayo. The endonym *A'ingae* consists of *aʔi* '(indigenous) person' and the manner clitic *=ᵑgae* MANN.[1] Thus, to speak A'ingae is to speak like a member of the in-group. The exonym *Cofán* may derive from the name of the river *Río Cofanes*, which is where the Cofán people and European settlers first came in contact (Cepek, 2012). Section 2 gives background on the language, its speakers, previous literature, and data collection.

The topics discussed in the rest of the paper include a basic description of the A'ingae segmental inventory (Section 3) and an overview of the language's most prominent phonological phenomena. Section 4 discusses the language's phonotactic restrictions, long-distance laryngeal agreement, and other phonological processes. Section 5 explores the processes of iterative progressive and local regressive nasal spreading. Section 6 summarises the morphophonology of stress and glottalisation and touches on A'ingae clause-level prosody. Section 7 places aspects of A'ingae phonology against a broader typological and areal background.

[Corrections updated in the figures and examples to increase their sizing in HTML version on 11-Jun-2024, after first publication.]

2 | BACKGROUND

A'ingae is currently spoken in the eastern Andean foothills, which is a very linguistically diverse region. Despite previous unsubstantiated claims of genetic affiliation with other languages (e.g. Rivet, 1924; Rivet, 1952; Ruhlen, 1987), A'ingae remains classified as a language isolate (Hammarström et al., 2020). Before inhabiting their present territory in the Amazon Basin, A'ingae speakers used to live in the Eastern Andean Cordilleras (ca. 16th c). As a consequence of the Cofán migration, A'ingae shows properties typical of both Andean and Amazonian languages. For example, Andean phonological features include contrastive aspiration and the lack of tone. Amazonian features include contrastive vowel nasality, nasal spreading, and vowel glottalisation (AnderBois, et al., 2019; Dąbkowski, 2021a). The morphological profile of A'ingae is highly agglutinating and exclusively suffixing. The language has a flexible, predominantly subject–object–verb (SOV) word order.

In the Ecuadorian communities, A'ingae is acquired by children and spoken on a daily basis, though younger speakers (particularly those who leave the Cofán communities to go to school) use Spanish more often. In the Colombian communities, the language is considerably more endangered. In recent centuries and decades, the Cofán people have experienced exploitation at the hands of the colonial government, poachers, and oil companies, disrupting language transmission and putting their traditional way of life in danger. Outside of A'ingae-speaking community-lead primary schools, the language does not receive much institutional support. Despite the challenges, the Cofán people take pride in their cultural and linguistic heritage, and see A'ingae as one of the cornerstones of their ethnic identity (Cepek, 2012; Dąbkowski, 2021a).

There is little previous scholarship on the language. Phonetic and phonological works include Borman's (1962) early phonological description of A'ingae, Repetti-Ludlow et al.'s (2019) phonetic sketch, Dąbkowski's (2023b) diachronic account of A'ingae's post-labial raising, Sanker and AnderBois's (t.a.) internal reconstruction of A'ingae nasality, Dąbkowski's (2021b, 2023c; t.a.) work on morphophonology of stress and glottalisation, and chapters in Dąbkowski's (in prep.) and Hengeveld and Fischer's (in prep.) monographs.

The data presented in this paper comes from the author's original fieldwork, as well as prior publications on A'ingae and unpublished databases. All uncited data has been collected by the author in the course of in-person and remote fieldwork since the spring of 2017. Elicitation tasks included translation and grammaticality judgements. All the fieldwork data has been deposited in the California Language Archive as Dąbkowski (2020). All the data drawn from previous publications and databases are cited as such. A dialectal split has been anecdotally reported between the language's Ecuadorian and Colombian varieties (Dąbkowski, 2021a; Repetti-Ludlow et al., 2019). All data presented in this paper reflects the Ecuadorian language variety, with no further dialectal variation observed within Ecuador, although speakers sometimes remark that people from other communities speak differently.

3 | SEGMENTAL PHONOLOGY

The phonemic inventory of A'ingae is moderately large (Table 1), totalling 27 consonants, five simple vowels (Borman, 1962; Repetti-Ludlow et al., 2019), and 11 diphthongs (plus 16 nasal counterparts of the latter two).

TABLE 1 Phonemic inventory of A'ingae (based on Dąbkowski, 2023b).

PLAIN STOPS	*p*	*t*	*ts*	*tʃ*	*k*	*ʔ*
ASPIRATED STOPS	*p^h*	*t^h*	*ts^h*	*tʃ^h*	*k^h*	
PRENASAL STOPS	*^{m}b*	*^{n}d*	*^{n}dz*	*^{n}dʒ*	*^{ŋ}g*	
FRICATIVES	*f*		*s*	*ʃ*		*h*
ORAL SONORANTS	*ʋ*	*ɾ*		*j*	*ɰ*	
NASAL SONORANTS	*m*	*n*		*ɲ*		

i, ĩ	*ɨ, ɨ̃*	*o, õ*
e, ẽ	*a, ã*	
ie, ĩẽ	*ɨi, ɨ̃ĩ*	*io, ĩõ*
ei, ẽĩ	*oe, õẽ*	*oi, õĩ*
ia, ĩã	*ae, ãẽ*	*oa, õã*
ai, ãĩ		*ao, ãõ*

3.1 | Consonantal phonemes

Starting with the language's consonantal inventory, A notable feature of A'ingae is the existence of three stop series: plain voiceless (*p, t, ts, tʃ, k*), voiceless aspirated (*p^h, t^h, ts^h, tʃ^h, k^h*), and prenasalised voiced (*^{m}b, ^{n}d, ^{n}dz, ^{n}dʒ, ^{ŋ}g*). Within each series, there is a five-way contrast among labial stops, alveolar stops, alveolar fricatives, postalveolar fricatives, and velar stops. Since stops and affricates pattern together in many respects, I will use the term *stops* to collectively refer to all oral non-continuants.

There are four voiceless fricatives, contrasting labiodental (*f*), alveolar (*s*), postalveolar (*ʃ*), and glottal (*h*) places of articulation. The alveolar /s/ is sometimes realised as the aspirated [*s^h*], under conditions that remain unclear (Repetti-Ludlow et al., 2019). There are four oral sonorants, contrasting labial (*ʋ*), alveolar (*ɾ*), palatal (*j*), and velar (*ɰ*) articulations. The velar sonorant (*ɰ*) is rare, and does not appear word-initially or next to nasal vowels. The distribution and history of *ɰ* is further discussed in Paragraph 'The velar approximant'. Three nasal sonorants contrast labial (*m*), alveolar (*n*), and palatal (*ɲ*) articulations.

Finally, A'ingae has contrastive glottalisation. I present it here as a segmental glottal stop (*ʔ*), although it could alternatively be analysed as a feature of the syllabic nucleus, and shows metrical properties discussed in Section 6.2. A'ingae glottalisation does not contrast word-initially and never appears word-finally.

The phonemic status of each of the discussed consonants is demonstrated below in a quasi-minimal set, where each phone appears sandwiched between two instances of the vowel *a* or its nasalised counterpart *ã* (1–6).

(1) SIX PLAIN VOICELESS STOP PHONEMES
- a. *aˈrapa* — chicken
- b. *ˈkata* — launch
- c. *ˈatsa* — avocado
- d. *ˈatʃaʔk^{h}ɨ* — saliva
- e. *ˈʃaka* — fault
- f. *ˈ^{m}biaʔa* — long

(2) FIVE ASPIRATED VOICELESS STOP PHONEMES
- a. *p^{h}aˈp^{h}ak^{h}o* — floor
- b. *paˈt^{h}aɰa* — smallpox
- c. *ˈts^{h}ats^{h}a* — grate
- d. *tʃ^{h}aˈtʃ^{h}ats^{h}i* — resourceful
- e. *ĩˈɲãk^{h}a* — get hurt

(3) FIVE PRENASALIZED VOICED STOP PHONEMES
- a. *ˈnã^{m}ba* — get murky
- b. *ˈtsã^{n}da* — thunder
- c. *ˈpã^{n}dza* — hunt
- d. *^{n}dʒãˈ^{n}dʒak^{h}ɨ* — headdress
- e. *ˈã^{ŋ}ga* — carry

(4) FOUR VOICELESS FRICATIVE PHONEMES
- a. *ˈafa* — speak
- b. *ˈpasa* — pass
- c. *ˈaʃa* — half-finished
- d. *ˈtsaha* — grape

(5) FOUR ORAL SONORANT PHONEMES
- a. *joˈʃaʋa* — iron
- b. *saˈɾaɾo* — giant otter
- c. *ˈaja* — ghost
- d. *aˈɰat^{h}o* — count

(6) THREE NASAL SONORANT STOP PHONEMES
- a. *ˈmãmã* — mom
- b. *ˈãnã* — sleep
- c. *ˈpãɲã* — hear

By processes of nasal spreading, a vowel is nasalised before a prenasalised stop (3) and both before and after a nasal consonant (6). Nevertheless, each of the three stop series is contrastive and none of them can be collapsed as a purely allophonic variant of another series (conditioned e.g. by adjacent nasality). For example, the plain *p* (2b), the aspirated *pʰ* (2a), and the prenasalised *ᵐb* (1f) can all appear word-initially before an oral vowel. The contrastive status of all the above series is further demonstrated in Section 5.

Word-initially, the prenasalisation of prenasalised stops has a shorter duration and lower intensity (Repetti-Ludlow et al., 2019), that is, */ᵐb-, ⁿd-, ⁿdz-, ⁿdʒ-, ᵑg-/* are realised as *[ᵐ̆b-, ⁿ̆d-, ⁿ̆dz-, ⁿ̆dʒ-, ᵑ̆g-]* (7c–e, cf. 7a–b).[2] The velar stops */k, kʰ, ᵑg/* palatalise to *[c, cʰ, ᶮɟ]* before the front vowels *e* (8a–b) and *i* (8c). Nonetheless, the palatalised velars do not neutralise to the post-alveolar *tʃ, tʃʰ, ⁿdʒ* (8d, cf. 8a; 8e, cf. 8c). Since the word-initial partial denasalisation and palatalisation are non-contrastive phonetic details, they will not be reflected in the transcriptions throughout the rest of the paper.

(7) PRENASALIZED STOPS, PARTIALLY DENASALIZED WORD-INITIALLY

a. */ kʰɨᵐba /* *[ˈkʰɨ̃ᵐba]* tobacco
b. */ aⁿde /* *[ˈãⁿde]* land
c. */ ᵐbo /* *[ˈᵐ̆bo]* meet
d. */ ⁿda /* *[ˈⁿ̆da]* become
e. */ ⁿdʒo /* *[ˈⁿ̆dʒo]* fear

(8) VELAR STOPS PALATALIZED BEFORE FRONT VOWELS, BUT NOT NEUTRALIZED TO *tʃ, tʃʰ, ⁿdʒ*

a. */ ʃekeʔtʃo /* *[ˈʃeceʔtʃo]* loose pieces
b. */ kʰe /* *[ˈcʰe]* get lost
c. */ koᵑgi /* *[ˈkõᶮɟi]* ant sp.
d. */ metʃeʔɲo /* *[ˈmẽtʃẽʔɲõ]* squirrel cuckoo
e. */ kʰoⁿdʒi /* *[ˈkʰõⁿdʒi]* small fish sp.

3.2 | Vocalic phonemes

There are five contrastive vowel qualities: low (*a*), mid front (*e*), high front (*i*), high central/back (*ɨ*), and back rounded (*o*). Each of the five vowels has a nasal counterpart. Below, the contrastive status of every vowel is demonstrated with a quasi-minimal set, where each vocalic phoneme appears after a word-initial *h-* (9–10).

(9) FIVE ORAL VOWEL PHONEMES

a. *ˈha* go
b. *ˈheʔri* grimace
c. *ˈhi* come
d. *ˈhɨ* yes
e. *ˈhoʔe* those.INAN

(10) FIVE NASAL VOWEL PHONEMES

a. *ˈhãʔtʃʰĩ* flat (nose)
b. *ˈhẽ* sound
c. *ˈhĩ* be.INAN
d. *ˈhɨ̃* yeah
e. *ˈhõ* sow

Although five-vowel systems are very common, most of them feature a height-based contrast between two non-low non-front vowels, that is, *o* versus *u* (Crothers, 1978). The A'ingae contrast between two non-low non-front vowels is based on roundedness, that is, *ɨ* versus *o*. Since the A'ingae /*o*/ does not contrast with /*u*/, its realisation ranges quite widely [*o* ~ *u*], and is more extended than that of either front vowel /*e* vs. *i*/ (Brandt & AnderBois, t.a.). The stressed oral /ˈ*o*/ is typically realised as close ([ˈ*u*]) and the stressed nasal /ˈ*õ*/ is more open ([ˈ*ɔ̃*]). Unstressed /*o*/ and /*õ*/ are more variable but generally somewhat centralised (Brandt & AnderBois, t.a.). For the sake of consistency, the transcriptions presented in this paper do not reflect this phonetic detail and use *ɨ* and *o* throughout.

3.3 | Licit diphthongs

Finally, A'ingae has 11 distinct diphthongs, drawn from a proper subset of the logically possible combinations of two A'ingae vowels, including the opening *ie, io, ia, oa*, the closing *ei, oi, ai, ao*, the height harmonic *oe, ɨi*, and the narrow *ae* (11).[3] In rapid speech, the second vowel of /*ae*/ is often raised, approaching a merger with [*ai*]. In the manner case clitic = ^{ŋ}*gae* MANN, the realisation of /*ae*/ ranges from [əæ] to [ɛ] (i.e. [=^{ŋ}gəæ ~ =^{ŋ}gɛ]). A'ingae diphthongs are relatively rare; as such, the examples below do not form a minimal set.

(11) ELEVEN LICIT DIPHTHONGS

a. *ˈtsã^{n}die* man	b. *ˈk^{h}ɨi* lie down	c. *ˈõ^{m}bio* level
d. *ˈosei* fall	e. *ˈkoeʔhe* sun	f. *ˈtʃ^{h}oi* row
g. *ˈak^{h}ia* just because	h. *ˈfae* one	i. *ˈ^{ŋ}goaʔt^{h}i* boil
j. *ˈaiʔvo* body		k. *ˈtsaoʔpa* nest

A'ingae diphthongs are either wholly oral or wholly nasal. Some of the diphthongs have unambiguous underlyingly nasal counterparts (12). Other nasal diphthongs are attested only due to the spreading of nasalisation from adjacent nasal and prenasalised segments. Nasal spreading is discussed in Section 5.

(12) SELECT NASAL DIPHTHONGS

a. *ˈãʔ^{m}bĩã* have	b. *ˈãĩ* dog	c. *ˈtɨ̃ĩfa* chambira	d. *ˈkõẽ* mature	e. *ˈkõãkõã* trickster

4 | PHONOTACTICS AND MARKEDNESS AVOIDANCE

The A'ingae syllable structure can be schematised as (C)V(V)(ʔ). The eight syllable types so abbreviated are exemplified in (13–14). There are no onset clusters. All consonants can appear in the onset of a word-medial syllable. Word-initial onsets cannot host the velar approximant *ɰ* and the glottal stop *ʔ*. (Phrase-initially, an onset glottal stop is inserted in underlyingly vowel-initial words, but it is not contrastive in that position.) The glottal stop *ʔ* does not occur word-finally.

(13) PLAIN (NON-GLOTTALIZED) SYLLABLE TYPES

a. V: *ˈi* bring	b. VV: *ˈãĩ* dog	c. CV: *ˈse* be spicy	d. CVV: *ˈtɨi* rain

(14) GLOTTALIZED SYLLABLE TYPES

a. Vʔ: *ˈĩʔ.nã* cry	b. VVʔ: *ˈaiʔ.vo* body	c. CVʔ: *ˈseʔ.he* cure	d. CVVʔ: *ˈtɨiʔve* overmorrow

All A'ingae syllables are open or glottalised. Syllable-final glottalisation can be analysed as a feature of the nucleus or a segmental coda. Within an inner morphophonological domain, glottal stops interact with stress assignment and stress deletion phenomena, thus showing a close connection to metrical structure. The basic types of glottal-stress interactions are described and categorised in Section 6.2.

The nucleus must contain at least one vowel. If two vowel qualities are present, they must form one of the 11 licit diphthongs (§3.3). Except for certain morphophonological contexts discussed in Dąbkowski (in prep.), vowel hiatus in A'ingae is disallowed. Thus, when two (or more) vowels that do not form a licit diphthong appear adjacent to each other, (at least) one of them must be altered. Diphthongal processes, including processes aimed at illicit vowel sequence avoidance, are discussed in Section 4.1. In certain contexts, including the utterance-final position, vowels can be realised as creaky, devoiced, and/or heavily reduced, often to the point of seeming deletion.

Additionally, A'ingae shows a form of long-distance phonological agreement, whereby stops having the same place of articulation within a root must all be either aspirated or unaspirated (Repetti-Ludlow, 2021). The A'ingae laryngeal co-occurrence constraint is discussed in Section 4.2.

Most A'ingae roots are disyllabic; fewer are mono- and trisyllabic. At the level of the root, glottalisation is generally restricted to the rime of the penultimate syllable, giving rise to (C)VʔCV and (C)VCVʔCV as distinctive prosodic templates. A'ingae is an exclusively suffixing and encliticizing language.[4] The vast majority of functional morphemes are monosyllabic -CV or -ʔCV, interspersed with the occasional -V, -ʔV, -VCV, -CVCV, -ʔCVCV, and -CVʔCV. While glottalisation is contrastive at the level of the root, most glottal stop tokens are introduced by -ʔCV suffixes and enclitics. Aspects of A'ingae morphology receive treatment in Dąbkowski (2021b, 2023c, in prep., t.a.), Fischer and Hengeveld (2023), and Hengeveld and Fischer (in prep.).

4.1 | Diphthongal processes

In this section, I discuss various phonological processes affecting the A'ingae diphthongs. First, I describe the processes of diphthong legalisation (§4.1.1) aimed at averting illicit vowel sequences. I then present the processes of diphthong rounding (§4.1.2) and raising (§4.1.3) observed after labial consonants. All phonological processes discussed in this section and throughout the rest of the paper are to be understood as categorical, unless explicitly identified as gradient.

4.1.1 | Diphthong legalisation

Morphologically complex forms may give rise to underlying sequences of vowels that do not form a licit diphthong (cf. 11). This is commonly in forms suffixed with vocalic (-V) suffixes, such as the adnominal *-a* ADN or the causative *-ã* CAUS. Underlying sequences of /*ea*/ (15a–b) and /*ia*/ (15c–e) are converted to [*ia*]. The rule capturing illicit diphthong avoidance is stated in (16). This and other diphthongal processes discussed throughout this section apply to oral and nasal diphthongs alike.

(15) ILLICIT DIPHTHONGS AVOIDED

	a.	b.	c.	d.	e.
	/ *^{n}dzeʔ^{n}dze -ã* /	/ *koʔfe -ã* /	/ *i^{n}dzɨ -a* /	/ *=^{n}dek^{h}ɨ -a* /	/ *hɨʔrɨ -ã* /
	[*ˈ^{n}dzẽʔ^{n}dzĩã*]	[*ˈkoʔfĩã*]	[*ˈĩ^{n}dzia*]	[*=^{n}dek^{h}ia*]	[*ˈhɨʔrĩã*]
	flecked -ADN	play -CAUS	green -ADN	PL.ANIM -ADN	burn -CAUS

(16) DIPHTHONG LEGALIZATION RULE

e, ɨ → *i* / _ *a*

The vowels e and ɨ raise and front to i before a.

4.1.2 | Postlabial rounding

The diphthong /*ae*/ often rounds to [*oe*] after the labial consonants *f, p, p^h, ^{m}b, υ*, and *m* (17). The process is optional and most common in fast speech. The rule capturing postlabial rounding is given in (18). The rounding process is seen as prescriptively incorrect. For example, when asked to translate 'made breed' (17b), a speaker may first produce *aˈtapõẽ,* but then correct it to *aˈtapãẽ.* The categoricity of postlabial rounding is at present unclear.

(17) DIPHTHONG *ae* ROUNDED POSTLABIALLY

	a.	b.	c.	d.	e.
	/ *faesɨ* /	/ *atapa -ẽ* /	/ *k^{h}ap^{h}oʔpa -ẽ* /	/ *υaeji* /	/ *siʔma -e* /
	[*ˈfoesɨ*]	[*aˈtapõẽ*]	[*ˈk^{h}ap^{h}oʔpõẽ*]	[*ˈυoeji*]	[*ˈsĩʔmõẽ*]
	other	breed -CAUS	landslide -CAUS	just	bruised -ADV

(18) POSTLABIAL ROUNDING RULE

ae → *oe* / C[LABIAL] _ (optional, speech-rate dependent)

After labial consonants, the first vowel of the diphthong ae may round and raise to oe, especially in rapid speech.

4.1.3 | Postlabial raising

Finally, A'ingae underwent a sequence of changes that resulted in the raising of **ai* to *ɨi* after labial consonants (Dąbkowski, 2023b). Evidence for this claim comes from the data reported in Borman (1976), a dictionary that reflects A'ingae as spoken ca. 50–70 years ago. In Borman (1976), the diphthong ai does not occur after labials (Dąbkowski, 2023b, pp. 3–4). (One identified exception is the word *ˈp^{h}ãĩɲã* ~ *ˈp^{h}ĩɲã* 'incline'.) Additionally, morphologically complex forms where the underlying sequence **a* + *i* arises at a morpheme boundary after a labial consonant are reported with *ɨi* (19). The sound change of postlabial raising is restated in (20).

(19) DIPHTHONG **a+i* RAISED POSTLABIALLY (Dąbkowski, 2023b, p. 6; based on Borman, 1976)

	a.	b.	c.	d.
	**taʔυa -ite*	**koehefa -ite*	**sãfã -ite*	**oʔma -ite*
	taˈυɨite	*koeheˈfɨite*	*sãˈfɨ̃ĩte*	*õˈmɨ̃ĩte*
	cotton -PRD	summer -PRD	San Juan -PRD	peach palm -PRD

(20) POSTLABIAL RAISING SOUND CHANGE (Dąbkowski, 2023b, p. 4)

**ai* > *ɨi* / C[LABIAL] _

*The diphthong *ai raised to ɨi after labial consonants.*

In modern productions, some instances of *ɨi* in morphologically complex forms have been levelled back to *ai* (Dąbkowski, 2023b, p. 6). The paradigmatic levelling is item- and speaker-dependent. Additionally, some speakers have acquired postlabial raising as an optional phonological rule, which can be applied productively to sequences of /*a* + *i*/ across morpheme boundaries, yielding [*ai* ~ *ɨi*] in derived environments (pp. 5–8). For more on postlabial raising, see Dąbkowski (2023b).

4.2 | Laryngeal agreement

Repetti-Ludlow (2021) and Repetti-Ludlow et al. (2019) report a long-distance constraint on laryngeal co-occurrence: Within a given morpheme, all stops and affricates that share the same place and manner of articulation must also agree in aspiration. The constraint is restated in (21).

(21) LARYNGEAL CO-OCCURRENCE CONSTRAINT (based on Repetti-Ludlow, 2021)
All the stops and affricates within one morpheme that share the same place and manner of articulation must all be aspirated or unaspirated.

For example, forms such as *ˈteʔta* 'flower', where the two alveolar stops are unaspirated (22), or *ˈtʰeʔtʰo* 'tooth', where both alveolar stops are aspirated (23) are allowed. However, hypothetical roots such as **ˈtʰeʔta* or **ˈteʔtʰo*, where the two stops differ only in the value of aspiration, are predicted not to exist. (One identified exception is the word *ˈkʰake* 'leaf', possibly from Chachi (Barbacoan) *haki*; ALDP, 2018.) If two obstruents mismatch in the place and/or manner of articulation, they may, but need not (24), have the same aspiration.

(22) STOPS WITH MATCHING PLACE AND MANNER — ALL UNASPIRATED

a.	b.	c.	d.	e.
oˈpipaʔtʃo	*ˈteʔta*	*teˈtete*	*ˈtoto*	*koˈkoja*
shoulder	flower	Waorani	whiten	demon

(23) STOPS WITH MATCHING PLACE AND MANNER — ALL ASPIRATED

a.	b.	c.	d.	e.
ˈpʰɨʔpʰɨ	*ˈtʰɨ̃tʰã*	*ˈtsʰatsʰa*	*ˈtʰeʔtʰo*	*ˈkʰaikʰoʔtʃo*
corn	lack flavor	grate	tooth	harpoon

(24) STOPS WITH MISMATCHED PLACE OR MANNER — NO AGREEMENT

a.	b.	c.	d.	e.
ˈpaʔtʰa	*ˈpakʰo*	*ˈtʰotsɨ*	*ˈtsɨʔtʰa*	*ˈkʰoʔpa*
wasp	streaked prochilod	black fly	bone	defecate

The laryngeal co-occurrence constraint (21) pertains only to tautomorphemic stops. Stops matching in place and manner across a morpheme boundary may, but need not (25), have the same value of aspiration (Repetti-Ludlow, 2021).

(25) DIFFERENT MORPHEMES — NO AGREEMENT

a.	b.	c.	d.	e.
ˈpʰi =pa	*ˈtoe -ʔtʰi*	*ˈtsʰorɨ =tsɨ*	*ˈtʃʰoi =ʔtʃo*	*ˈkã -kʰa*
sit =SS	same -PLC	old =3	row =SBRD	look -ATTN

Prenasalised voiced stops pattern with the unaspirated ones in that one morpheme may host a prenasalised stop and an unaspirated one, but not an aspirated one. This is consistent with Sanker and AnderBois's (t.a.) reconstruction of prenasalised stops as originating in sequences of a nasal and an unaspirated stop, that is, *NT > ᴺD. Finally, the vast majority of the roots with matching stops also have matching vowels (22c–e, 23a,c) or the second vowel is back, that is, either *a* (22a–b, 23b) or *o* (23d–e). For further discussion of these patterns, see Repetti-Ludlow (2021). For a discussion of exceptions, see Dąbkowski (in prep.).

5 | NASALITY AND NASAL SPREADING

A'ingae nasality is contrastive on both vowels (26–27a,c) and consonants (26–27b,d), in roots (26–27a–b) as well as functional morphemes (26–27c–d).

(26) Oral segments in roots … and in functional morphemes

a. *'hi*	b. *'ʋa =pi*	c. *'afa -hi*	d. *'ʋa =ʋe*
come	DEM =TERM	speak -INGR	DEM =ACC2

(27) Nasal segments in roots … and in functional morphemes

a. *'hĩ*	b. *'mã =pi*	c. *'^{n}daɾo -ʔhĩ*	d. *'ʋã =mã*
be.INAN	INDF.SEL =TERM	piranha -CORE	DEM =ACC

While nasality may be contrastive, the nasality of a segment may also result from progressive (Section 5.1) and regressive nasalisation (Section 5.2), whereby the nasal quality of one segment affects other adjacent segments. Both processes are word-bound, that is, nasality does not spread beyond the edge of a prosodic word. The generalisations drawn in the following subsections are based largely on native roots and morphologically complex forms. For a discussion of nasal spreading patterns in borrowings, see Dąbkowski (in prep.) and Sanker and AnderBois (t.a.).

5.1 | Progressive nasalisation

A'ingae has a process of iterative progressive nasalisation. The process is partly phonologically predictable, and partly morphologically and lexically conditioned. Progressive nasalisation is triggered by nasal stops and nasal vowels, and spreads rightward until a blocking segment is encountered. Different phonological and morphological classes give rise to different outcomes and show different degrees of permeability to nasalisation. The rest of this section is organised by the phonological class of the target of nasalisation.

5.1.1 | Vowels and glottals

Progressive nasalisation is triggered by nasal stops *m, n, ɲ* (28a–c) and nasal vowels *ã, ẽ, ĩ, õ, ɨ̃* (28d–e). As an outcome, vowels right of the triggering segment become nasal.[5]

(28) Nasal stops and vowels as triggers of progressive nasalization

a. / *mae* /	b. / *na* /	c. / *ɲa* /	d. / *õho* /	e. / *ɨ̃hi* /
[*'mõẽ*]	[*'nã*]	[*'ɲã*]	[*'õhõ*]	[*'ɨ̃hɨ̃*]
send	meat	1SG	bathe	rain

The glottals *h* (28d–e, 29a–d) and *ʔ* (29d–e) are completely permeable to progressive nasalisation. This is to say, if *h* and *ʔ* are the only intervening segments between two vowels and the first vowel is nasal, the second vowel is also always nasal. These generalisations hold exceptionlessly within A'ingae roots (29) and across morpheme boundaries, including suffixes and clitics such as the contrastive topic *=ha* CNTR (30a), the flat classifier *-he* FLAT (30b), the adnominal *-(ʔ)a* ADN (30c), the same subject conditional antecedent marker 2 *=ʔha* IF2.SS (30d), as well as the imperfective *-ʔhe* IPFV and the imperative *-ha* IMP (30e).

(29) Glottals permeable to nasal spread in roots

	a.	b.	c.	d.	e.
	/ noha /	/ kɨ̃hɨ /	/ tõho /	/ ĩʔha /	/ naʔe /
	[ˈnõhã]	[ˈkɨ̃hɨ̃]	[ˈtõhõ]	[ˈĩʔhã]	[ˈnãʔẽ]
	thorn	catfish	make sound	want	river

(30) Glottals permeable to nasal spread in functional morphemes

	a.	b.	c.	d.	e.
	/ ɲa =ha /	/ na -he /	/ kõẽ -ʔa /	/ kãʔhe =ʔha /	/ ã -ʔhe -ha /
	[ˈɲãhã]	[ˈñãhẽ]	[ˈkõẽʔã]	[ˈkãʔhẽʔhã]	[ˈãʔhẽhã]
	1SG =CNTR	fruit -FLAT	mature -ADN	be.ANIM =IF2.SS	eat -IPFV -IMP

A'ingae progressive nasalisation is iterative. This is to say, a nasalised segment further nasalises segments to its right (until the spread is blocked by an impermeable consonant, as discussed throughout the rest of the section). For example, in (30e), the root *ã* 'eat' nasalises the imperfective suffix *-ʔhe* IPFV to *-ʔhẽ*. Then, nasality spreads further onto the imperative suffix *-ha* IMP, turning it into *-hã*.

Within a single morpheme, a non-initial vowel may only be nasal if it is immediately preceded by a nasal stop or if the vowel of the preceding syllable is nasal. Thus, for example, (C)VCV, (C)ṼCV, and (C)ṼCṼ are all attested root shapes, but (C)VCṼ is not. The generalisation is restated in (31). This suggests that only the first vowel of a morpheme may be contrastively specified for nasality (which could be analysed as a floating nasal feature that associates from the left) and, consequently, that the nasality of non-initial vowels is in fact always due to spreading. (Exceptions include apparently lexicalised causatives, such as (*ˈtsã^{n}da) ˈvejãẽ* 'lightning strike', possibly from the no longer attested **veja* and the causative *-ẽ* CAUS.)

(31) Restricted distribution of vocalic nasality
Only the first vowel of a morpheme may be contrastively specified for nasality. I. e., a nasal vowel is always either (i) morpheme-initial, (ii) preceded by a nasal stop, or (iii) the vowel of the preceding syllable is nasal.

Nonetheless, permeability to nasal spreading varies with the target segment and morpheme, both root-internally and across morpheme boundaries. Throughout the rest of the section, I discuss progressive nasalisation as a morphologically-conditioned phonological process. Yet, since the extent of nasal spreading is often morpheme-specific, the nasal forms of suffixes and clitics may alternatively be treated as phonologically conditioned (weak) suppletion (Paster, 2007, 2009).

5.1.2 | Approximants

A'ingae has four oral approximants: palatal (*j*), labial (*ʋ*), alveolar (*ɾ*), and velar (*ɰ*). In native roots, none of the approximants ever appear after (or before) nasal vowels. In morphologically complex words and borrowings, the palatal *j* and the labial *ʋ* often alternate with nasal stops matching their place of articulation: *ɲ* and *m*, respectively. The alveolar *ɾ* and the velar *ɰ* never alternate with nasal stops.

The palatal approximant
After nasal vowels, the palatal *j* generally nasalises to *ɲ*. This holds of most suffixes and clitics, including the irrealis *-ja* IRR (32a), the assertive *-ʔja* ASSR (32b), the passive *-je* PASS (32c), the segmentally identical infinitival *-je* INF (32d), and the exclusive focus *=ji* EXCL (32e). Recall that progressive nasalisation is iterative (§5.1.1); as such, the resulting *ɲ* further nasalises the following vowel.

(32) PALATAL APPROXIMANT *j* NASALIZING TO *ɲ* IN FUNCTIONAL MORPHEMES

	a.	b.	c.	d.	e.
	/ *ã -ja* /	/ *ã -ʔja* /	/ *kã -je* /	/ *ã -je* /	/ *ɲa =ji* /
	[*ãɲã*]	[*ãʔɲã*]	[*kãɲẽ*]	[*ãɲẽ*]	[*ɲãɲĩ*]
	eat -IRR	eat -ASSR	look -PASS	eat -INF	1SG =EXCL

The passive *-je* PASS is nasalised to *-*^{ŋ}*ge* in historical passives. for example, compare the lexicalised intransitive (33a) with the synchronically detransitivized (33b). Additionally, *-*^{ŋ}*ge* varies with *-ɲe* as the realisation of postnasal *-je* PASS for at least some speakers (33c–d).

(33) PASSIVE *-je* PASS (OPTIONALLY) NASALIZING TO *-*^{ŋ}*ge*

	a.	b.	c.	d.
	**^{n}daʔɲo -je*	/ *^{n}daʔɲo -je* /	/ *ˈpaɲa -je* /	/ *ãp^{h}i -ã -je* /
	^{n}dãˈɲõ^{ŋ}ge	[*^{n}dãˈɲõɲẽ*]	[*pãˈɲãɲẽ ~ pãˈɲã^{ŋ}ge*]	[*ãˈp^{h}ĩãɲẽ ~ ãˈp^{h}ĩã^{ŋ}ge*]
	harm -PASS	harm -PASS	understand -PASS	fall -CAUS -PASS
	"got hurt"	"was harmed"	"was understood"	"be made fall"

The labial approximant

Historically, the labial *ʋ* has nasalised to *m* after nasal vowels. This can be seen for example, in *sĩˈmĩta* 'vanilla', a compound of *sĩ* 'black' and *ʋiita* < Kichwa *wayta* 'flower' (ALDP, 2018). (The change of Kichwa *ay* to *ɨi* shows postlabial raising, discussed in Section 4.1.3).

Functional morphemes, including the diminutive 2 *=ʔʋi* DMN2 and accusative 2 *=ʋe* ACC2 (34a–b), vacillate postnasally between nasal (*=ʔmĩ, =mẽ*) and oral (*=ʔʋi, =ʋe*) realisations (34c–d). The non-nasalisation of *ʋ* is innovative and shows that progressive nasalisation is no longer fully phonologically productive.

(34) PALATAL APPROXIMANT *ʋ* OPTIONALLY NASALIZING TO *m* IN FUNCTIONAL MORPHEMES

	a.	b.	c.	d.
	/ *kiɾi =ʔʋi* /	/ *tsaʔk^{h}ɨ =ʋe* /	/ *ãtĩã =ʔʋi* /	/ *k^{h}oma =ʋe* /
	[*ˈkiɾiʔʋi*]	[*ˈtsaʔk^{h}ɨʋe*]	[*ˈãtĩãʔmĩ ~ ˈãtĩãʔʋi*]	[*ˈk^{h}õmãmẽ ~ ˈk^{h}õmãʋe*]
	cat =DMN2	water =ACC2	relative =DMN2	chili =ACC2

The corporeal classifying suffix *-ʔʋo* CORP (35a) nasalises to *-ʔ^{ŋ}go* (as opposed to **-ʔmõ*) (35b–c). The diachrony of the exceptional *-je* (*-*^{ŋ}*ge*) PASS and *-ʔʋo* (*-ʔ^{ŋ}go*) CORP is further discussed in Paragraph 'The velar approximant'.

(35) CORPOREAL *-ʔʋo* CORP NASALIZING TO *-ʔ^{ŋ}go*

	a.	b.	c.	d.
	/ *aʔi -ʔʋo* /	/ *poʔtãẽ -ʔʋo* /	/ *kini -ʔʋo* /	**sĩ -ʋo*
	[*aiʔʋo*]	[*poˈtãẽʔ^{ŋ}go*]	[*ˈkĩnĩʔ^{ŋ}go*]	*ˈsĩ^{ŋ}go*
	person -CORP	shoot -CORP	stick -CORP	black -CORP

The velar approximant

The velar *ɰ* never appears after nasal vowels. It also never occurs in functional morphemes. As such, there is no evidence of an active phonological alternation with a nasal. (Notably, the A'ingae phonemic inventory lacks a velar nasal **ŋ* altogether.)

Overall, the velar approximant *ɰ* is rare; it occurs only in 27 roots, almost always followed by an *a* or *ɨ* (Sanker & AnderBois, t.a.). To account for its limited distribution, Sanker and AnderBois (t.a.) propose that Pre-A'ingae **ɰ* underwent different mergers, depending on the following vowel and nasality. Before front vowels, **ɰ* palatalised to *j*. Before the back rounded *o*, **ɰ* labialised to *ʋ*. In other positions, **ɰ* remained unchanged. The reconstructed (though no longer attested) nasal counterpart to the velar approximant, which I represent as *ɰ̃, occluded to ᵑg. These changes are restated in (36).

(36) Developments of velar approximant *ɰ (based on Sanker and AnderBois, t.a.)

	_ e, i	_ o	elsw.	
i. Pre-A'ingae	*ɰ	*ɰ	*ɰ	*ɰ̃
ii. A'ingae	j	ʋ	ɰ	ᵑg

In Sanker and AnderBois' (t.a.) reconstruction, the corporeal *-ʔʋo* corp goes back to **-ʔɰo*; its postnasal counterpart *-ʔᵑgo* is simply a reflex of the regularly nasalised **-ʔɰ̃o*. Likewise, the passive *-je* pass goes back to **-ɰe*, and *-ᵑge* is a reflex of **-ɰ̃e*. (Subsequently, *-ᵑge* has been partially replaced with *-ɲẽ* by analogical levelling.) Thus, the modern-day irregularities result from regular nasal spreading obscured by a primary split.

The alveolar approximant

The alveolar approximant ɾ never occurs after nasal vowels in native roots. In the habitual subject nominalizer *-ɾi* hsn (37a), the alveolar ɾ remains oral and blocks the spread of nasalisation (37b–d). For a discussion of ɾ in borrowings, see Dąbkowski (in prep.).

(37) Alveolar approximant ɾ not nasalizing

a.	b.	c.	d.
/ koʔfe -ɾi /	/ sema -ɾi /	/ ˈana -ɾi /	/ ã -ɾi /
[koˈfeɾi]	[sẽˈmãɾi]	[ãˈnãɾi]	[ˈãɾi]
play -hsn	work -hsn	sleep -hsn	eat -hsn

5.1.3 | Fricatives

A'ingae fricatives do not nasalise. However, in roots, they are largely permeable to nasal spreading (Sanker & AnderBois, t.a.). This is to say, if two vowels are separated by a fricative and the first vowel is nasal, the second vowel will almost always be nasal, too (38).

(38) Fricatives permeable to nasal spread in roots

a.	b.	c.	d.	e.
ˈtẽfẽ	ˈtãsĩ	ˈmɨ̃sã	ˈpãʃã	ˈkɨ̃ʃõ
sulid	reconcile	make moldy	pass	fall in love

Fricatives do not allow for spreading across morpheme boundaries (Sanker & AnderBois, t.a.), as can be demonstrated with a variety of suffixes, including the plural subject marker *-ʔfa* pls (39a), the diffused classifier *-foʔtʃo* dffs (39b), the permissive suffix *-ʔse* perm (39c), the different subject *=si* ds (39d), or the subject nominalizer *-ʔsɨ* sn (39e).

(39) Fricatives blocking nasal spread in functional morphemes

a.	b.	c.	d.	e.
/ ã -ʔfa /	/ ã -foʔtʃo /	/ ã -ʔse /	/ ã =si /	/ ã -ʔsɨ /
[ˈãʔfa]	[ˈãfoʔtʃo]	[ˈãʔse]	[ˈãsi]	[ˈãʔsɨ]
eat -pls	eat -dffs	eat -perm	eat =ds	eat -sn

5.1.4 | Unaspirated stops

Here, I discuss unaspirated stops, grouping voiceless stops and prenasalised voiced stops together. In native roots, two different behaviours are attested (Sanker & AnderBois, t.a.). First, some unaspirated stops are permeable to nasal spreading. This is to say, if two vowels are separated by an unaspirated stop and the first vowel is nasal, the second vowel will also often be nasal, that is, ṼTṼ (40).

(40) PLAIN STOPS PERMEABLE TO NASAL SPREAD IN ROOTS
a. *ˈsẽpẽ* stinging bee sp. b. *ˈãtĩã* relative c. *ˈõtsĩã* put on one's head d. *ˈãtʃã* mosquito e. *ˈtsĩkõ* behave

Second, in many cases where two vowels are separated by an unaspirated stop, the first vowel is nasal, the stop is prenasalised, and the second vowel is oral (41). The vast majority of A'ingae prenasalised stops appear in this configuration (i.e. flanked by a nasal vowel to the left and an oral vowel to the right, Ṽ^{N}DV). In fewer roots, prenasalised stops appear word-initially. In that position, they are also typically followed by oral vowels, that is, ^{N}DV- (42).

(41) PRENASALIZED STOPS BLOCKING NASAL SPREAD IN ROOTS
a. *ˈkʰɨ̃ᵐba* tobacco b. *ˈãⁿde* land c. *ˈĩⁿdzɨ* green d. *ˈmãⁿdʒi* squeeze e. *ˈmãᵑgɨ* drag

(42) WORD-INITIAL PRENASALIZED STOPS FOLLOWED BY ORAL VOWELS
a. *ˈᵐbɨtʰo* run b. *ˈⁿdaro* piranha c. *ˈⁿdzija* calm down d. *ˈⁿdʒoho* be afraid e. *ˈᵑgetʰi* divide

Morpheme-internal sequences of a prenasalised stop followed by a nasal vowel, that is, ^{N}DṼ, arise regularly due to regressive nasalisation, that is, when the vowel is nasalised by a following nasal stop, for example, *ˈᵐbĩnĩ* 'blind', or a prenasalised stop, for example, *ˈᵑgãᵑga* 'scatter'. In addition, there are some exceptional ^{N}DṼ sequences that cannot be attributed to regressive nasalisation. These include cases of seeming reduplication such as *ˈtãⁿdã* 'tie' and *ˈkõᵑgõ* 'rot' (Sanker & AnderBois, t.a.), apparently derived from the no longer independently attested **tã* and **kõ*.[6] Other instances of ^{N}DṼ include the roots *ˈfĩᵑgĩ* 'winnow', *ˈᵐbĩʃĩ* 'flea', plausible cases of lexicalised causatives with *-ã/-ẽ* CAUS, such as *ˈãʔᵐbĩã* 'have', and borrowings. Finally, there are some exceptions where an unaspirated stop blocks nasal spreading without prenasalising, that is, ṼTV, including *ˈnẽpi* 'disappear', *ˈnãpi/ˈnẽpi* 'arrive' and many plausible borrowings (Dąbkowski's, in prep.; Sanker & AnderBois, t.a.).

Functional morphemes with unaspirated voiceless stops show split behaviour. Some morphemes prenasalise the stop and block nasal spreading (Ṽ^{N}DV). Other morphemes block nasal spreading without stop prenasalisation (ṼTV). Many morphemes with the labial *p* and alveolar *t* prenasalise them, including the associative *-ʔpa* ASSC (43a), the nominalizer *-ʔpa* N (43b), the same subject marker *=pa* SS (43c), the same subject conditional antecedent marker *=ʔta* IF.SS (43d), and the reportative clitic *=te* RPRT (43e).

(43) LABIAL *p* AND ALVEOLAR *t* PRENASALIZED TO ^{m}*b* AND ^{n}*d* IN MANY FUNCTIONAL MORPHEMES

a. / *tʃã -ʔpa* /	b. / *ã -ʔpa* /	c. / *ã =pa* /	d. / *ã =ʔta* /	e. / *ã =te* /
[*ˈtʃãʔ^{m}ba*]	[*ˈãʔ^{m}ba*]	[*ˈã^{m}ba*]	[*ˈãʔ^{n}da*]	[*ˈã^{n}de*]
mother -ASSC	eat -N	eat =SS	eat =IF.SS	eat =RPRT

Nevertheless, the same stops *p* and *t* in other functional morphemes block the spread of nasalisation without undergoing prenasalisation. This class includes the owner nominalizer =*pa* ON (44a), the habitual subject nominalizer -*pari* HSN (44b), the terminative case clitic =*pi* TERM (44c), and the periodic classifier -*ite* PRD (44d).

(44) LABIAL *p* AND ALVEOLAR *t* REMAINING ORAL IN OTHER FUNCTIONAL MORPHEMES

a. / *tʃã =pa* /	b. / *^{n}daʔɲo -pari* /	c. / *naʔe =pi* /	d. / *na -ite* /
[*ˈtʃãpa*]	[*^{n}dãɲõˈpari*]	[*ˈnãʔẽpi*]	[*ˈnãĩte*]
mother =ON	harm -HSN	river =TERM	fruit -PRD

Functional morphemes containing the other voiceless unaspirated stops (*ts, tʃ, k*) never prenasalise. This includes the third person subject clitic =*tsɨ* 3 (45a), the round classifier -*ʔtʃo* RND (45b), the similative marker =*ʔkã* SML (45c), the second person subject clitic =*ki* 2 (45d), the diurnal classifier -(*ʔ*)*ki* DRN (45e), and others.

(45) OTHER VOICELESS STOPS NEVER PRENASALIZED IN FUNCTIONAL MORPHEMES

a. / *ã =tsɨ* /	b. / *kã -ʔtʃo* /	c. / *ɲa =ʔkã* /	d. / *ã =ki* /	e. / *ma -ki* /
[*ˈãtsɨ*]	[*ˈkãʔtʃo*]	[*ˈɲãʔkã*]	[*ˈãki*]	[*ˈmãki*]
eat =3	look -RND	1SG =SML	eat =2	INDF.SEL -DRN

Finally, there are functional morphemes that contain underlyingly prenasalised voiced stops, which do not alternate with voiceless unaspirated stops. These morphemes include, for example, the benefactive =^{m}*be* BEN (46a), the negative -^{m}*bi* NEG (46b), the animate plural =^{n}*dek^{h}ɨ* PL.ANIM (46c), the dative =^{ŋ}*ga* DAT (46d), and the first person subject clitic =^{ŋ}*gi* 1 (46e). The first vowel to the left of a prenasalised morpheme also becomes nasal due to regular regressive nasalisation (to be discussed in Section 5.2).

(46) PRENASALIZED STOPS AS UNDERLYING IN FUNCTIONAL MORPHEMES

a. / *ke =^{m}be* /	b. / *ha -^{m}bi* /	c. / *aʔi =^{n}dek^{h}ɨ* /	d. / *ke =^{ŋ}ga* /	e. / *ha =^{ŋ}gi* /
[*ˈkẽ^{m}be*]	[*ˈhã^{m}bi*]	[*aʔˈĩ^{n}dek^{h}ɨ*]	[*ˈkẽ^{ŋ}ga*]	[*ˈhã^{ŋ}gi*]
2SG =BEN	go -NEG	person =PL.ANIM	2SG =DAT	go =1

5.1.5 | Aspirated stops

Most A'ingae aspirated stops occur in oral contexts. In roots, among the aspirated stops preceded by a nasal vowel, a split behaviour is observed: in some instances, the aspirates are permeable to nasal spreading (47); in other cases, they block the progressive nasalisation (48) (Sanker & AnderBois, t.a.). Note that positing independently specified nasal vowels in the second syllables of (47) would run afoul of the generalisation in (31).

(47) ASPIRATED STOPS PERMEABLE TO NASAL SPREAD IN ROOTS

a. *ˈp^{h}ĩp^{h}ĩ*	b. *ˈãt^{h}ã*	c. *ˈpɨ̃ts^{h}ã*	d. *ˈhãʔtʃ^{h}ĩ*	e. *ˈõk^{h}ã*
calm down	ganoid fish	duck	flat (nose)	envelop

(48) ASPIRATED STOPS BLOCKING NASAL SPREAD IN ROOTS

a. *ˈãp^{h}i*	b. *ˈʃĩʔp^{h}i*	c. *ˈãt^{h}e*	d. *shĩˈk^{h}apa*	e. *sãˈk^{h}opa*
fall	younger sister	stop	coriander	wing

In functional morphemes, aspirates always block nasal spreading (Sanker & AnderBois, t.a.), including the egressive *=ʔt^{h}e* EGR (49a), the place classifier *-ʔt^{h}i* PLC (49b), the adjectivizer *-ts^{h}i* ADJ (49c), the attenuated imperative *-k^{h}a* ATTN (49d), and the delimited space classifier *-k^{h}ɨ* DLM (49e).

(49) ASPIRATED STOPS BLOCKING NASAL SPREAD IN FUNCTIONAL MORPHEMES

a. / *naʔe =ʔt^{h}e* /	b. / *hẽ -ʔt^{h}i* /	c. / *sã -ts^{h}i* /	d. / *ã -k^{h}a* /	e. / *^{ŋ}geɲo -k^{h}ɨ* /
[*ˈnãʔẽʔt^{h}e*]	[*ˈhẽʔt^{h}i*]	[*ˈsãts^{h}i*]	[*ˈãk^{h}a*]	[*^{ŋ}gẽˈɲõk^{h}ɨ*]
river =EGR	sound -PLC	dry -ADJ	eat -ATTN	banana -DLM

5.2 | Regressive nasalisation

Nasal stops (50b–c) and prenasalised voiced stops (50a,d–e) nasalise the vowel to their left, across a glottal stop if present (50b–c). The process is fully general and operates within roots (50a–b) and across morpheme boundaries (50c–e). Phonetically, regressive nasalisation is partial—though velum lowering may begin near the start of the vowel, it is often delayed as late as the vowel's midpoint, and reaches full aperture before or at the triggering segment (Bennett et al., 2024). As such, the process is suggestive of extensive controlled coarticulation, and thus differs from the fully phonologized progressive nasalisation. Nonetheless, the phonological distinction between nasal and oral vowels is neutralised before nasal and prenasalised stops. For example, *ˈĩʔnã* 'cry' (50b) may not contrast with a hypothetical **iʔnã*.

(50) REGRESSIVE NASALIZATION

a. / *tsa^{n}da* /	b. / *iʔna* /	c. / *tsa =ʔma* /	d. / *aʔi =^{m}bi* /	e. / *jaja =^{ŋ}ga* /
[*ˈtsã^{n}da*]	[*ˈĩʔnã*]	[*ˈtsãʔmã*]	[*ˈaʔĩ^{m}bi*]	[*ˈjajã^{ŋ}ga*]
thunder	cry	ANA =FRST	person =NEG	dad =DAT

Regressive nasalisation is not iterative. This is to say, only the first vowel to the left of a nasal or prenasalised stop is affected—farther vowels remain oral (50d), and preceding approximants do not turn into nasals (50e). Nonetheless, certain distributional patterns reveal a preference for morpheme-internal nasal agreement that goes beyond the nasal spreading as predicted solely by progressive (§5.1) and non-iterative regressive nasalisation. For example, the oral approximants (*j, ʋ, ɾ, ɰ*) never appear before nasal vowels in native roots (Sanker & AnderBois, t.a.), that is, morpheme-internally, *RṼ sequences are banned. In borrowings, the *RṼ ban may be obeyed (e.g. Sp. *lanza* > *ˈ^{n}dãsaʔtʃo* 'spear') or disobeyed (e.g. Sp. *grande* > *ˈɾã^{n}de* 'large'). For a further discussion of phonological patterns in borrowings, see Dąbkowski (in prep.).

In morphologically complex forms, some of the root-level restrictions discussed above are obscured (Sanker & AnderBois, t.a.). for example, in roots, prenasalised stops (§5.1.4) and oral approximants (§5.1.2) are typically followed by oral vowels. However, in words with suffixes and clitics, prenasalised stops (51a–b) and oral approximants (51c–d) often appear before nasal vowels due to regressive nasalisation.

(51) PRE-NASAL APPROXIMANTS AND PRENASALIZED STOPS IN MORPHOLOGICALLY COMPLEX FORMS

	a.	b.	c.	d.
	/ *tsa^{n}da =ne* /	/ *si^{m}ba -^{m}bi* /	/ *va =ma* /	/ *^{n}daro =^{ŋ}ga* /
	[*ˈtsã^{n}dãnẽ*]	[*sĩˈ^{m}bã^{m}bi*]	[*ˈvãmã*]	[*ˈ^{n}darõ^{ŋ}ga*]
	thunder =ELAT	fish -NEG	DEM =ACC	piranha =DAT

6 | PROSODY AND GLOTTALISATION

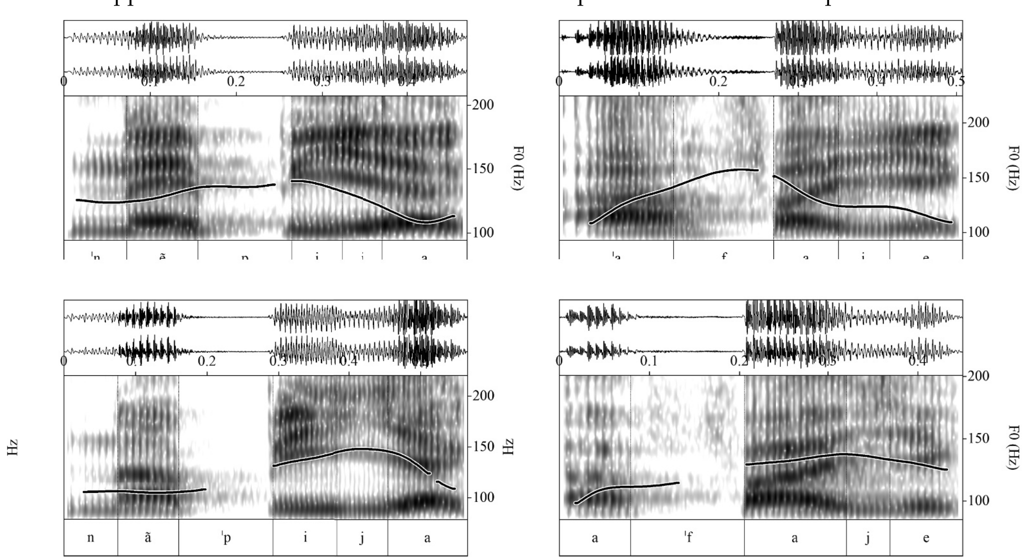
In A'ingae, at least three levels of the prosodic hierarchy can be established: the prosodic word, the phonological phrase, and the intonational phrase. Section 6.1 presents phonetic evidence for stress and glottalisation, contrastive at the level of the phonological word. Section 6.2 discusses the basic types of their morphophonological interactions. Section 6.3 describes the prosodic expressions of pluractionality via glottal stop insertion and reduplication. Section 6.4 touches on clause-level prosody and the discursive use of falsetto.

6.1 | Realisation of stress and glottalisation

A'ingae stress correlates primarily with longer duration and often with a higher F0 (Repetti-Ludlow et al., 2019). Each phonological word has exactly one primary stress peak. The position of stress is contrastive in roots (52a–b) and in morphologically complex forms (52c–d) (Dąbkowski, 2021b). Corresponding spectrograms (Boersma & Weenink, 2023; Elvira García, 2022) are given below.

(52) STRESS CONTRASTIVE IN ROOTS AND INFLECTED FORMS

	a.	b.	c.	d.
	ˈnẽpi -ja	*nãˈpi -ja*	*ˈafa -je*	*aˈfa -je*
	disappear -IRR	arrive -IRR	speak -INF	speak -PASS



Glottalisation can be realised as a glottal stop, creakiness, or entirely deleted in rapid speech (Repetti-Ludlow et al., 2019). Nonetheless, in roots, the presence of glottalisation is contrastive (53a–b) (Borman, 1962; Fischer & Hengeveld, 2023; Repetti-Ludlow, 2021), and in morphologically complex forms, the position of glottalisation is contrastive as well (53c–d) (Dąbkowski, 2023c).

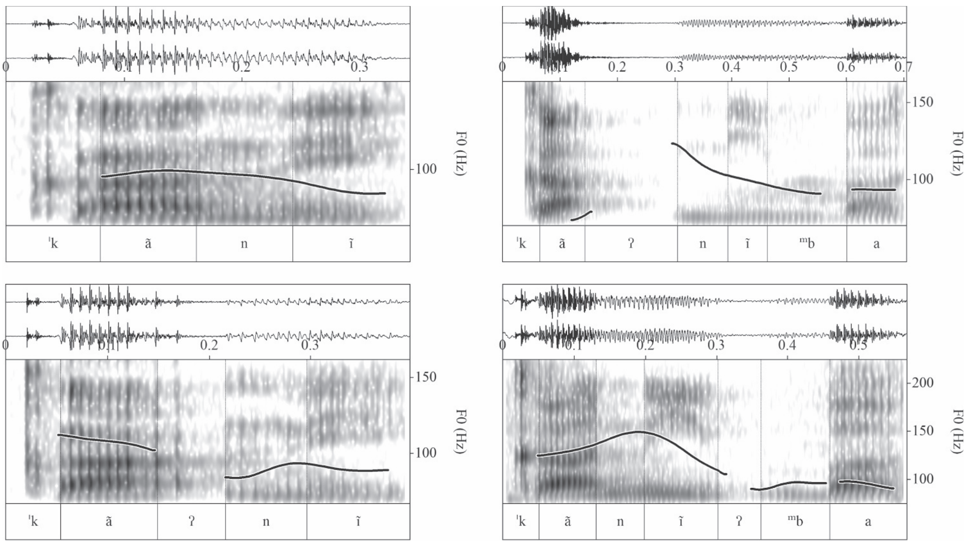
(53) Glottalization contrastive in roots and inflected forms

a. *ˈkãnĩ* yesterday

b. *ˈkãʔnĩ* enter

c. *ˈkãʔnĩ -^{m}ba* enter -ss

d. *ˈkãnĩ -ʔ^{m}ba* enter -n



6.2 | Morphophonology of stress and glottalisation

Word stress and glottalisation partake in a rich system of morphophonological interactions, where their presence and position depend on phonological factors, root class, and partly idiosyncratic (diacritic) properties of the suffixes and clitics attached to the root. A sample of the interactions discussed in Dąbkowski (2023c) is illustrated in (54).

(54) Stress–glottal interactions

	i. plain / *kãtsĩ^{ŋ}gĩã* / stoke (fire)	ii. stressed / *ˈafase* / offend	iii. glottalized / *ak^{h}eʔpa* / forget
a. bare root, i. e. -∅	i. *kãˈtsĩ^{ŋ}gĩã*	ii. *ˈafase*	iii. *ˈak^{h}eʔpa*
b. inner recessive, e. g. *-hi* ingr	i. *kãtsĩ^{ŋ}gĩãhĩ*	ii. *ˈafasehi*	iii. *ˈak^{h}eʔpahi*
c. inner dominant, e. g. *-je* pass	i. *kãtsĩ^{ŋ}gĩãɲẽ*	ii. *afaˈseje*	iii. *ak^{h}eˈpaje*
d. inner glottalized, e. g. *-ʔhe* ipfv	i. *kãtsĩ^{ŋ}gĩãʔhẽ*	ii. *aˈfaseʔhe*	iii. *aˈk^{h}epaʔhe*
e. outer recessive, e. g. *-ja* irr	i. *kãtsĩ^{ŋ}gĩãɲã*	ii. *ˈafaseja*	iii. *ˈak^{h}eʔpaja*
f. outer dominant, e. g. *-k^{h}a* attn	i. *kãtsĩ^{ŋ}gĩãk^{h}a*	ii. *afaˈsek^{h}a*	iii. *ak^{h}eʔˈpak^{h}a*

Roots can be classified as plain (54i), stressed (54ii), or glottalised (54iii) (Dąbkowski, 2023c). The first category consists of roots that do not have underlying stress. On the surface, underlyingly stressless forms receive default penultimate stress (54a.i). The second category contains roots that have underlying stress on the first syllable. Unless later overridden by a suffix, the underlying stress surfaces faithfully (54a.ii). The third category includes roots with a glottal stop. The glottal stop surfaces in the coda of the penultimate syllable. On the surface, stress is regularly assigned to the syllable which contains the second mora to the left of the glottal stop. As such, even though the stress of (54a.iii) is word-initial, there is no need to specify it as underlyingly present.

In morphologically complex forms, stress depends on the morphophonological class of the suffixes attached. Here, I adopt Dąbkowski's (2023c) terminology, categorising suffixes as *inner* (templatically closer to the root), *outer* (farther away from the root), *recessive* (preserving prior metrical specification), *dominant* (deleting prior metrical specification), and *glottalised* (whose stress assignment patterns are due to the glottal stop).

Inner recessive suffixes preserve preexisting stress and glottalisation, but do not assign stress themselves. Underlyingly stressless verbs with inner recessive suffixes receive penultimate stress (54b.i). Underlying stress and glottalisation surface faithfully (54b.ii–iii). *Inner dominant* suffixes delete underlying stress and glottalisation. On the surface, the destressed forms receive regular penultimate stress (54c.i–iii). *Inner glottalised* suffixes override underlying stress and glottalisation. New stress is assigned to the syllable which contains the second mora to the left of the glottal stop. That is, stress falls on the last syllable of the root if heavy (a diphthong) (54d.i). Otherwise, stress is assigned to the syllable which precedes it (54d.ii–iii).

Outer recessive suffixes preserve preexisting stress and glottalisation if present (54e.iii–iii). Otherwise, they assign stress to the syllable that immediately precedes them (54e.i). Note that although the surface forms with inner recessive (54a) and outer recessive suffixes pattern identically, stress assignment proceeds via different mechanisms. The different origin of stress has consequences for more complex forms with additional suffixes. *Outer dominant* suffixes preserve preexisting glottalisation (54f.iii) but always stress the syllable to their immediate left (54f.i–iii). In the outer domain, the presence of glottalisation has no effect on stress. For further discussion and analyses of A'ingae stress and glottalisation, see Dąbkowski (2021b, 2023c, in prep., t.a.).

6.3 | Expressions of pluractionality

In addition to regular subject plurality expressed with *-ʔfa* PLS, A'ingae verbs can be marked for pluractionality via prosodic means. First, pluractionality may be expressed by inserting a glottal stop (55). The glottal stop surfaces in the coda of the penultimate syllable. Stress is assigned to the syllable with the second mora to the left of the glottal stop in trisyllabic roots (55d–e) and to the glottalised syllable in disyllabic roots (55a–b).

(55) GLOTTAL STOP EXPRESSING PLURACTIONALITY (based in part on Dąbkowski, 2023c, p. 7)

	a.	b.	c.	d.	e.
	/ *ˈana -ʔ* /	/ *pa^{n}dza -ʔ* /	/ *atapa -ʔ* /	/ *op^{h}at^{h}ɨ -ʔ* /	/ *o^{n}dik^{h}ɨ -ʔ* /
	[*ˈãʔnã*]	[*ˈpãʔ^{n}dza*]	[*ˈataʔpa*]	[*ˈop^{h}aʔt^{h}ɨ*]	[*ˈõ^{n}diʔk^{h}ɨ*]
	sleep -PLA	hunt -PLA	breed -PLA	pick -PLA	don -PLA

Additionally, pluractionality may also be expressed with reduplication. The A'ingae reduplicant is a verbal suffix of the form *-ʔσ* PLA; the glottal stop is a fixed segment and the reduplicated syllable is copied from the right edge of the base (56) (Dąbkowski, 2023a). The reduplicant may attach to bare verbal roots or verbs derived with causative *-ã/-ẽ/-ɲa* CAUS.

(56) REDUPLICATION EXPRESSING PLURACTIONALITY ON DISYLLABIC ROOTS

	a.	b.	c.	d.	e.
	/ *ˈana -ʔσ* /	/ *koʔfe -ʔσ* /	/ *fɨ^{n}dɨi -ʔσ* /	/ *etʃ^{h}oẽ -ʔσ* /	/ *pasia -ʔσ* /
	[*ˈãnãʔnã*]	[*ˈkofeʔfe*]	[*ˈfɨ̃^{n}dɨ̃ʔ^{n}dɨi*]	[*ˈetʃ^{h}oʔtʃ^{h}õẽ*]	[*ˈpasiʔsia*]
	sleep -PLA	play -PLA	sweep -PLA	mix -PLA	stroll -PLA

Productive reduplication is restricted to disyllabic roots. This is to say, while disyllabic roots reduplicate productively, reduplication of monosyllabic and trisyllabic roots is impossible. Among the disyllabic verbs, the reduplicant can attach to stressless (56c–e), stressed (56a), and glottalised roots (56b). Underlying glottal stops are overridden (56b). Stress is assigned to the first syllable. If the stem ends in a diphthong, the diphthong is truncated to its first component in the stem, but surfaces fully in the reduplicant (56c–e). For an analysis of the disyllabicity restriction on A'ingae reduplication and the prosodic shape of the reduplicated stem, as well as a discussion of non-productive reduplicative patterns, see Dąbkowski (2023a).

6.4 | Clause-level prosody and falsetto

In A'ingae, prosody does not distinguish between different illocutionary clause types. As such, declarative (57a–b), polar interrogative (57c), content interrogative, imperative (57d), permissive, hortative, and prohibitive clauses all have the same falling pitch contour (Hengeveld & Fischer, in prep.). (This may be related to the fact that illocutionary force is conveyed by overt morphology; Hengeveld & Fischer, in prep.)

Cosubordinate and subordinate clauses, including non-final chained clauses (57a) and temporal/conditional antecedents (57b), are associated with a pitch rise (Hengeveld & Fischer, in prep.). Specifically, a high tone attaches to the stressed syllable of the last word of the (co)subordinate clause; a down-stepped high tone is maintained throughout the rest of the word (*kõẽˈhĩsi* in 57a; *ˈkɨ̃ɲãʔhẽʔnĩ* in 57b).

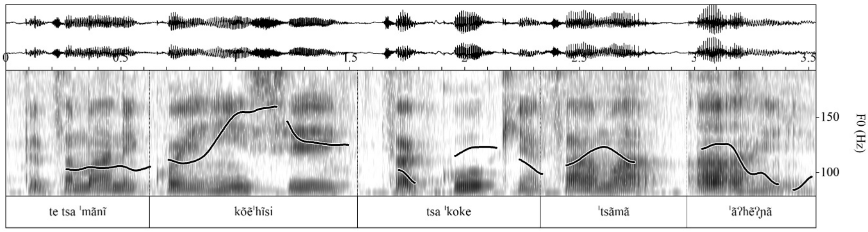
(57) Prosodic contours (data from AnderBois and Silva, 2018)

a. cosubordinate clause + declarative clause

=te tsa ˈmãnĩ kõẽ-ˈhĩ=si | tsa ˈkoke ˈtsã=mã ˈã-ʔhẽ-ʔña

rprt ana groundnut mature-ingr=ds | ana hare ana=acc eat-ipfv-assr

"When groundnut was ready for harvest, the hare would eat it." (`20170804_kuke_chiste_FACQ`)



b. temporal/conditional clause + declarative clause

ˈtsõ=ᵐba =te ˈhi=pa tsa joˈʃavã=mã tsa koˈkãmã ˈkɨ-ɲã-ʔhẽ=ʔnĩ | ˈpãⁿdo {F ˈtsɨi F} =ʔfaʔo

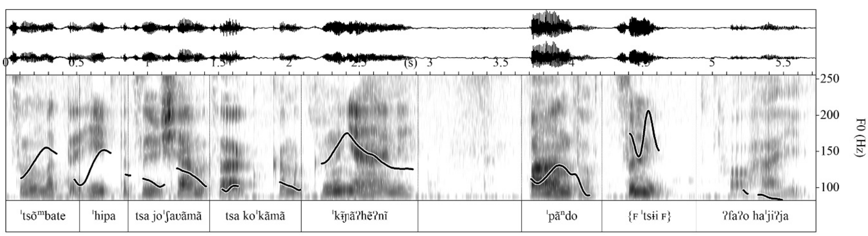
do=ss =rprt come=ss ana iron=acc ana Spaniard red-caus-ipfv=if.ds | fox walk=eval

ha-ˈji-ʔja

go-prsp-assr

"When the Spaniard came back and was heating the iron, the fox passed by."

(`20170804_kuke_chiste_FACQ`)

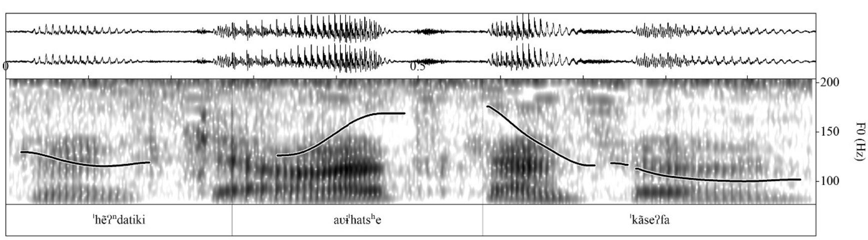


c. interrogative clause

ˈhẽʔⁿda =ti=ki avɨˈha-tsʰ-e ˈkãse-ʔfa

then =ynq=2 rejoice-adj-adv live-pls

"Do you live happily then?" (`20170801_escuela_CLC`)

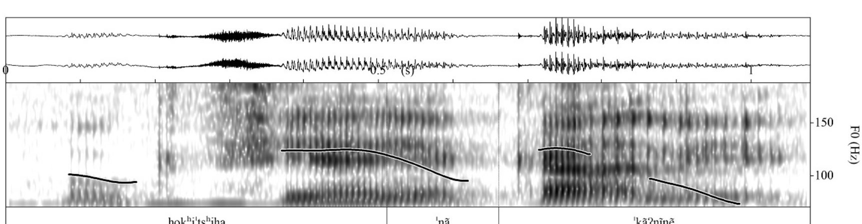


d. imperative clause

hokʰiˈtsʰi-ha ˈɲa ˈkãʔnĩ-ɲẽ

get out-imp 1sg enter-inf

"Get out of my way so I can enter!" (`20170804_kuke_chiste_FACQ`)

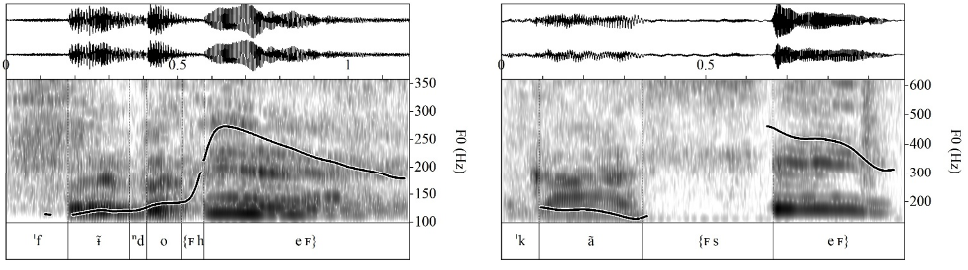


Finally, A'ingae has a discursive use of falsetto (a vocal register characterised primarily by a higher F0, as well as reduced harmonics-to-noise ratio, steeper spectral slope, and higher jitter; Childers & Lee, 1991; Keating, 2014; Neiman et al., 1997; Sanker et al., 2018). In A'ingae, falsetto consistently appears on a single syllable, which is typically stressed or phrase-final. Falsetto can be used to signal a shift between speakers or perspectives in a narrative, convey speaker excitement (Sanker et al., 2018), or indicate that an event lasted for a long time. The realisation of falsetto can be seen on ˈ*tsii* in (57b) and in (58).

(58) FALSETTO (data from AnderBois and Silva, 2018)

a. *'fĩ^{n}do* {$_F$ *-ʔje* $_F$}
scream-IPFV (20170804_kuke_chiste_FACQ)

b. *'kã* {$_F$ *se* $_F$}
live (20170803_dyandyaccu_LC)



7 | DISCUSSION AND CONCLUSIONS

In conclusion, I have presented an overview of the core aspects of A'ingae phonology. A'ingae shows a number of processes whose broad strokes resemble patterns observed in Amazonia and beyond. Yet, a closer look reveals intricacies that often distinguish A'ingae from the previously described languages. For example, A'ingae has a process of postlabial rounding (§4.1.2). While labial consonants have been previously observed to round adjacent vowels (e.g. Galloway, 1990; Lakshmi, 1982; Lionnet, 2017), the A'ingae postlabial rounding targets uniquely diphthongs. Additionally, A'ingae diphthongs underwent the change of postlabial raising (§4.1.3). Vowel raising after labial consonants has been—to best of my knowledge—previously unreported.

A'ingae shows regressive (§5.2) and progressive (§5.1) nasalisation. Thus, it falls squarely within the Amazonian sprachbund, where nasal spreading abounds van Gijn (2014). The two directionalities of A'ingae nasalisation, however, are characterised by markedly different properties. Regressive nasalisation is non-iterative, gradient, and exceptionless. Progressive nasalisation is iterative, categorical, and morphologically conditioned. This suggests that the two processes are governed by different modules of the A'ingae grammar and underscores the care with which nasal spreading should be studied cross-linguistically.

Relatedly, A'ingae has two series of sonorants (oral and nasal) and three series of stops (plain, aspirated, and prenasalised). While the surface distribution of the five series is partially conditioned by the presence of nasality, and thus somewhat reminiscent of other languages in the region, neither series can be easily collapsed as a purely allophonic variant of another (§3.1, §5). This distinguishes A'ingae from neighbouring languages, where at least one series is typically derived on the surface. For example, in Desano and Wanano (Eastern Tukanoan), voiced stops and the palatal glide are realised as nasal stops in nasal contexts (i.e. *b, d, j, g* → *m, n, ɲ, ŋ* / ~ _) (Silva, 2016; Stenzel, 2007). In Panãra (Jê), nasal stops are realised as postoralized before oral vowels (e.g $m \rightarrow m^{p}$ / _ V) and oral stops as prenasalised after nasal vowels (e.g. $p \rightarrow {}^{m}p$ / Ṽ _) (Lapierre, 2020).

Glottalisation and stress are closely linked in the A'ingae phonology, and stress is often assigned to the syllable with the second mora to the left of the glottal stop (§6.2). Metrical restrictions on glottalisation have been reported, for example, in Danish (North Germanic), where a glottal accent may only appear on ‘a sonorous second mora of a heavy syllable that is a monosyllabic foot’ (Itô & Mester, 2015, p. 14), and Mixtec (Oto-Manguean), where glottalisation is ‘associated with the initial mora of the foot’ (Penner, 2019, p. 257). In the previously reported cases, however, glottalisation appears on the stressed syllable. In A'ingae, an unusual pattern is seen: glottalisation surfaces preferentially in the unstressed syllable that immediately follows the prosodic peak of the word.

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CONFLICT OF INTEREST

The author has no competing interests to declare.

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ENDNOTES

[1] The following glossing abbreviations have been used: 1 = first person, 2 = second person, 3 = third person, ACC = accusative, ACC2 = accusative 2, ADJ = adjectivizer, ADN = adnominal, ADV = adverbializer, ANA = anaphoric, ANIM = animate, ASSC = associative, ASSR = assertive, ATTN = attenuated imperative, BEN = benefactive, CAUS = causative, CNTR = contrastive topic, CORE = core, CORP = corporeal, DAT = dative, DEM = demonstrative, DFFS = diffused, DLM = delimited, DMN2 = diminutive 2, DRN = diurnal, DS = different subject, EGR = egressive, ELAT = elative, EVAL = evaluative, EXCL = exclusive, FLAT = flat, FRST = frustrative, HSN = habitual subject nominalizer, IF = conditional, IF2 = conditional 2, IMP = imperative, INAN = inanimate, INDF = indefinite, INF = infinitive, INGR = ingressive, IPFV = imperfective, IRR = irrealis, MANN = manner, N = nominalizer, NEG = negative, ON = owner nominalizer, PASS = passive, PERM = permissive, PL = plural, PLA = pluractional, PLC = place, PLS = plural subject, PRD = periodic, PRSP = prospective, RND = round, RPRT = reportative, SBRD = subordinator, SEL = selection, SG = singular, SML = similative, SN = subject nominalizer, SS = same subject, TERM = terminative, YNQ = polar interrogative.

[2] Based on Dąbkowski's (2021b, 2023c, in prep., t.a.) analyses, stress is shown as underlyingly present only if its position in morphologically related words is not predictable from the language's regular morphophonological rules. Contra Dąbkowski (2023c, in prep.), glottal stops are represented as underlyingly linearised. This convention has been adopted for expository ease, despite Dąbkowski's (2023c, in prep.) analysis of root glottal stops as underlyingly floating. Stress and glottalisation are further discussed in Section 6.2.

[3] The 11 diphthongs are identified based on phonological criteria, such as the position of stress discussed in Section 6.2. A different count is given by Repetti-Ludlow et al. (2019), who use phonetic measurements to identify only six diphthongs (*ai*, *oe*, *oa*, *oi*, *ïi*, *ao*).

[4] The pluractional glottal stop infixation discussed in Section 6.3 may be seen as a possible exception.

[5] Alternatively, the vowels in (28a–c) could be specified as underlyingly nasal. Nonetheless, since the vowels right of a nasal stop are always nasal, I represent them as underlying oral and attribute their nasality to nasal spreading.

[6] Note, however, that neither root functions independently in contemporary A'ingae. Additionally, the reduplication of monosyllabic roots is not productive in A'ingae. For a description and analysis of A'ingae productive reduplication, see Section 6.3.

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