

# Synchronic Phonetic Variation Drives Diachronic Sound Change: Further Evidence from Pre-Nasal Raising in Avestan

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## Introduction

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1. To elucidate the synchronic phonetic value of the vowel written orthographically as <ā> in Young Avestan by the phonetic phenomenon of pre-nasal raising.

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3. To situate the Young Avestan development in the context of acoustic-perceptual explanations for changes in pre-nasal vowel height.

# The Phylogeny of Iranian languages

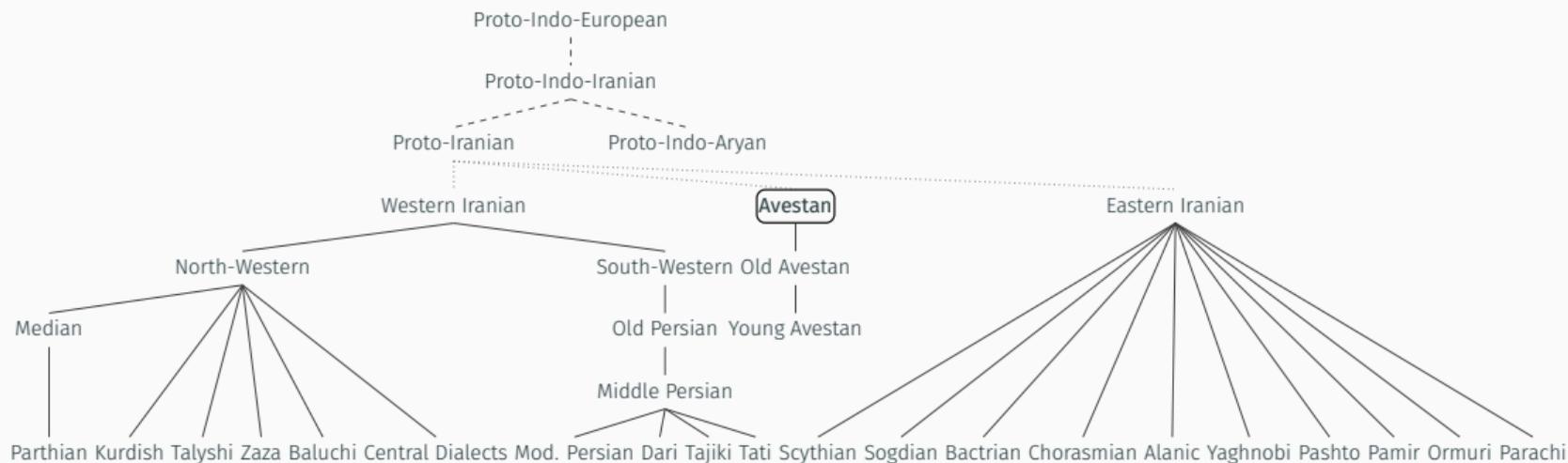


Figure 1: Phylogeny of Iranian Languages after Martínez and de Vaan (2014, 2)



# Roadmap

Data

Proposal: Pre-nasal raising

Comparison with previous accounts

Acoustic-perceptual motivations for pre-nasal raising

Appendix

Data

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## Where do we find <ā̄>?

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- (1) a. PIIr. \*-ā- \*[a:] > YAv. -<ā̄>- / \_\_ <ŋc>, <ŋk>, <ŋt>
- b. PIIr. \*-ā- \*[a:] > YAv. -<ā̄>- / \_\_ <ŋh>, <ŋ̄h>, <ŋ<sup>u</sup>h>
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- de Vaan’s claim of [a:] (2003, 383) is now widely accepted (cf. Hale 2008, 105, Beguš 2025, 383).
- I will discuss each of these contexts in turn and show why the claim that <ā̄> represented a low back unrounded vowel [a:] has no support.

1a. Plr. \*ā > YAv. ā̊ / \_\_ <ṇc>, <ṇt>, <ṇk>

YAv. Form	Gloss	Etymology / Cognate
<niiā̊ṇc->	downward-ADV	< PIIr. *[ni-a:nf̥j]
<ā̊ṇti>	3.PL.ACT.SBJV ending of thematic verbs	< PIE *[-o-onti]
<f(r)ā̊ṇkauuō>	Mountain-NOM.PL	

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Under Ferrer Losilla (2016)'s revised interpretation of <ṇ> as a nasal homorganic with the following obstruent, the environment can be phonetically written:

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Under Ferrer Losilla (2016)'s revised interpretation of <ŋ> as a nasal homorganic with the following obstruent, the environment can be phonetically written:

(2) a. \*-ā̄- \*[a:] > YAv. -<ā̄>- / \_\_ [ŋk], [nt], [ŋc]

1b PIIr. \*-ā- \*[a:] > YAv. -<ā̎>- / \_\_ <ŋh>, <ŋ̄h>, <ŋ<sup>u</sup>h>

Avestan	Sanskrit	PIIr. Etym.	Gloss	Translation
<nā̎ḡhābya>	['na:sa:b <sup>h</sup> ya:m]	*['na:sa:b <sup>h</sup> ya:m]	NOSTRIL-DU.INS	'with both nostrils'
<ā̎ḡ <sup>u</sup> harəna>-	-	Plr. *[a:-hwar-ana-]	PFX-EAT-NMLZ	'for food'
-ā̎ḡhe	-	-	2SG.MID.SBJV	Verbal ending

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Clayton (2020) has argued that <ŋ> represents a suprasegmental diacritic to mark nasalization on <h> that arose by the process of rhinoglottophilia:

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(3) a. PIIr. \*-ā- \*[a:] > YAv. -<ā̊>- / \_\_ [h̃], [h̃<sup>j</sup>], and [h̃<sup>w</sup>]

## 1c. PIIr. \*ā \*[a:] > YAv. <ā̇> / \_\_<h>]ω

Avestan	Sanskrit	Etymology (PIIr.)	Translation	Gloss
<buyā̇>	[bʰuːyaːs]	*[bʰuːyaːs]	‘might you be’	BE-2SG.PRES.ACT.OPT
<haēnayā̇>	[ˈsenaːyːas]	*[ˈsaynaːyːas]	‘of an army’	ARMY-GEN.SG.FEM
<dā̇>	[ˈədʰaːs]	*[ˈadʰaːs]	‘you made’	MAKE.AOR.2SG.ACT.IND

**Note:** Before enclitics (ca, etc.), becomes -ā̇s

<haēnayā̇sca>	[ˈsenaːyːas=cə]	*[ˈsaynaːyːas=ca]	‘and of the army’	ARMY.GEN.SG=AND
<dā̇scā>	[ˈədʰaːs=cə]	*[ˈadʰaːs=ca]	‘and you made’	MAKE.AOR.2SG=AND

## Proposal: Pre-nasal raising

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## Preponderance of nasal environments

- (4) a. PIIr. \*-ā- \*[a:] > YAv. -<ā̇>- / \_\_ [ŋk], [nt], [ɲc]  
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Source/Topic	Argument
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Internal *-h-	Clayton (2020): PIIr. *-h- (< PIIr. *-s-) spontaneously nasalized to [h̃].
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Word-Final *-h	<b>Proposal:</b> This same process applies to word-final glottal fricatives from PIIr. *-s (with Beguš 2025, 14–6).
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- My proposal, already suggested by Clayton (2020, 90 n. 10), is that <ā̇> represented the raised outcome of PIIr. \*ā before nasal(ized) consonants.

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- Phonetically, the vowel was most likely [ɛ(:)] or [æ(:)], although it is not possible to know with certainty which one exactly.

## Pre-nasal raising

- The claim that <ā̇> represented a raised vowel would be consistent with the typologically robust process of pre-nasal raising.

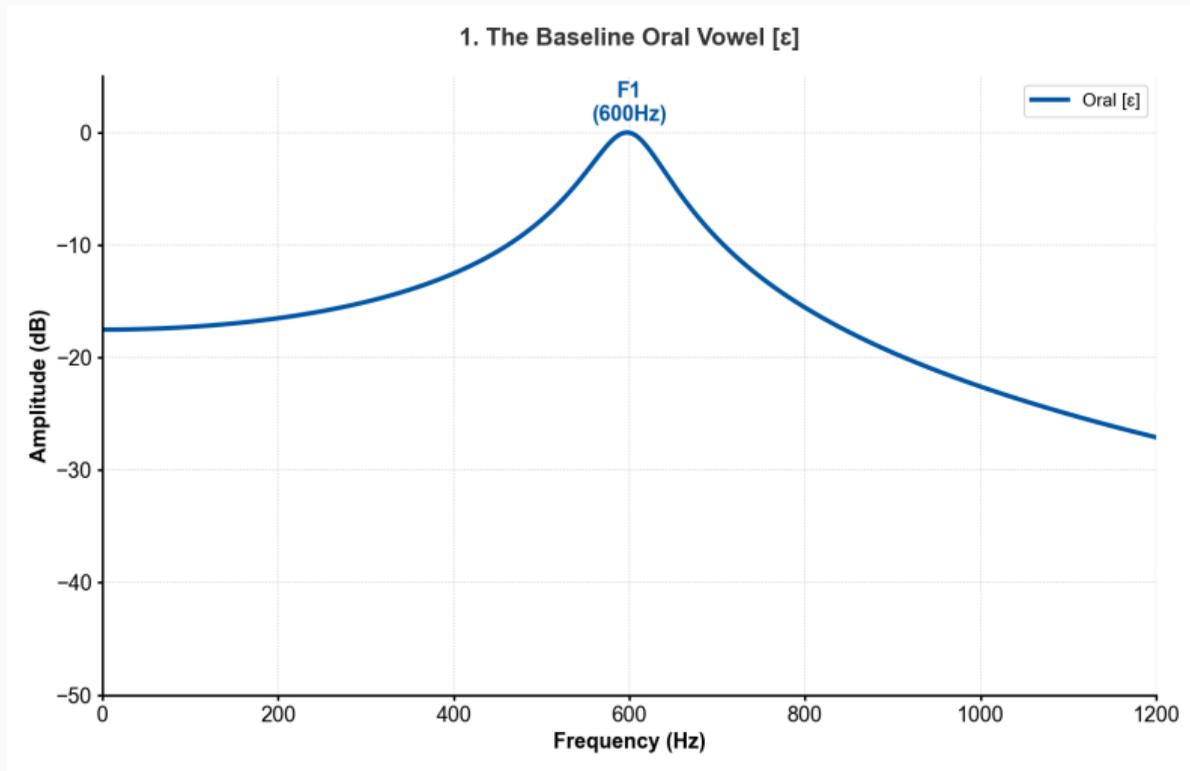
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- Phonetically, nasalization has a strong effect on F1-lowering in low vowels (raising), altering their perceived height and may also raise F2 for low vowels (Mielke, Carignan, and Thomas 2017, 333; Krakow et al. 1988, Beddor, Krakow, and Goldstein 1986a, 199, Wright 1986, 49 Foley 1975, 92, Wright 1975).

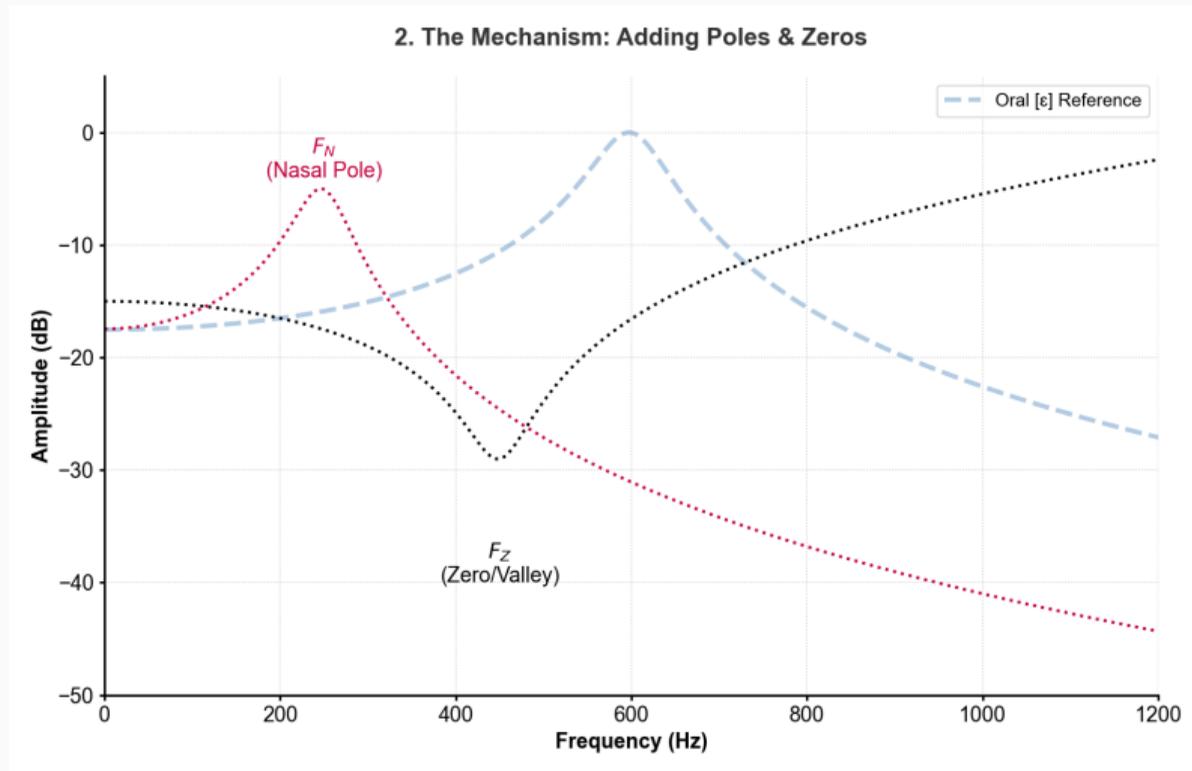
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- The actual dynamics of height perception of vowels in pre-nasal environments are much more complex.

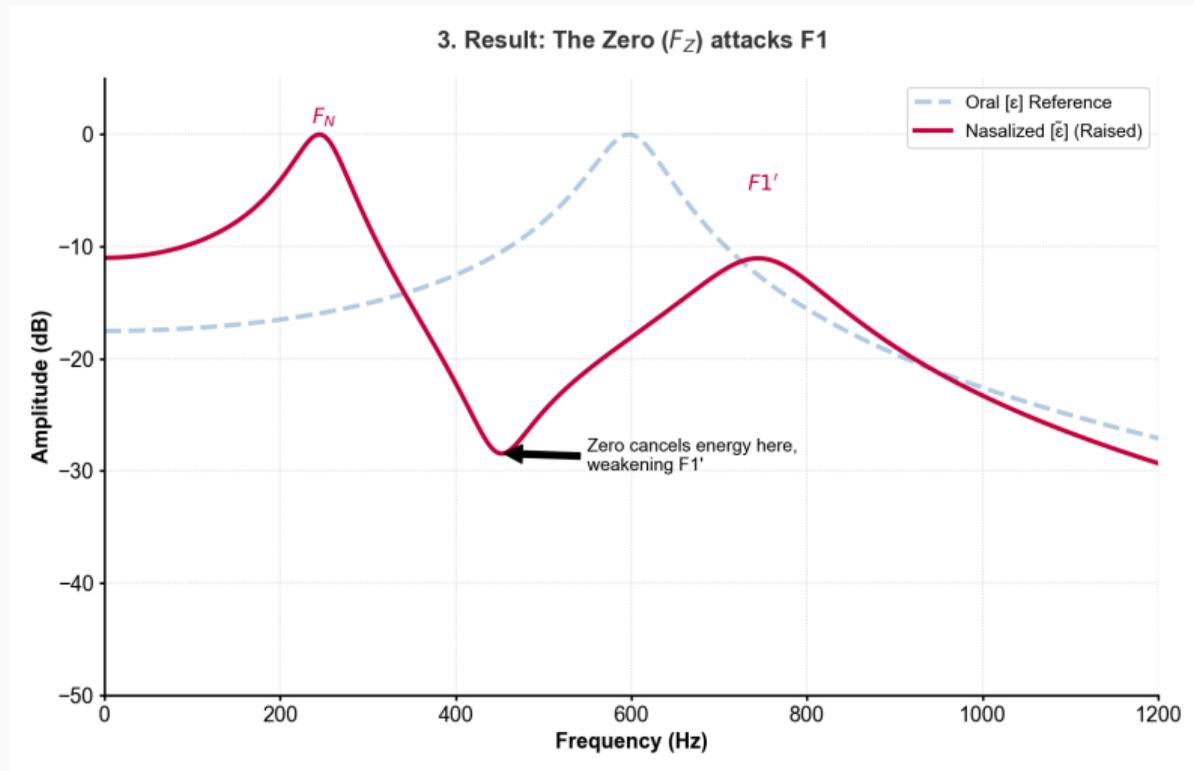
# F1 trajectory of a front low-mid oral vowel



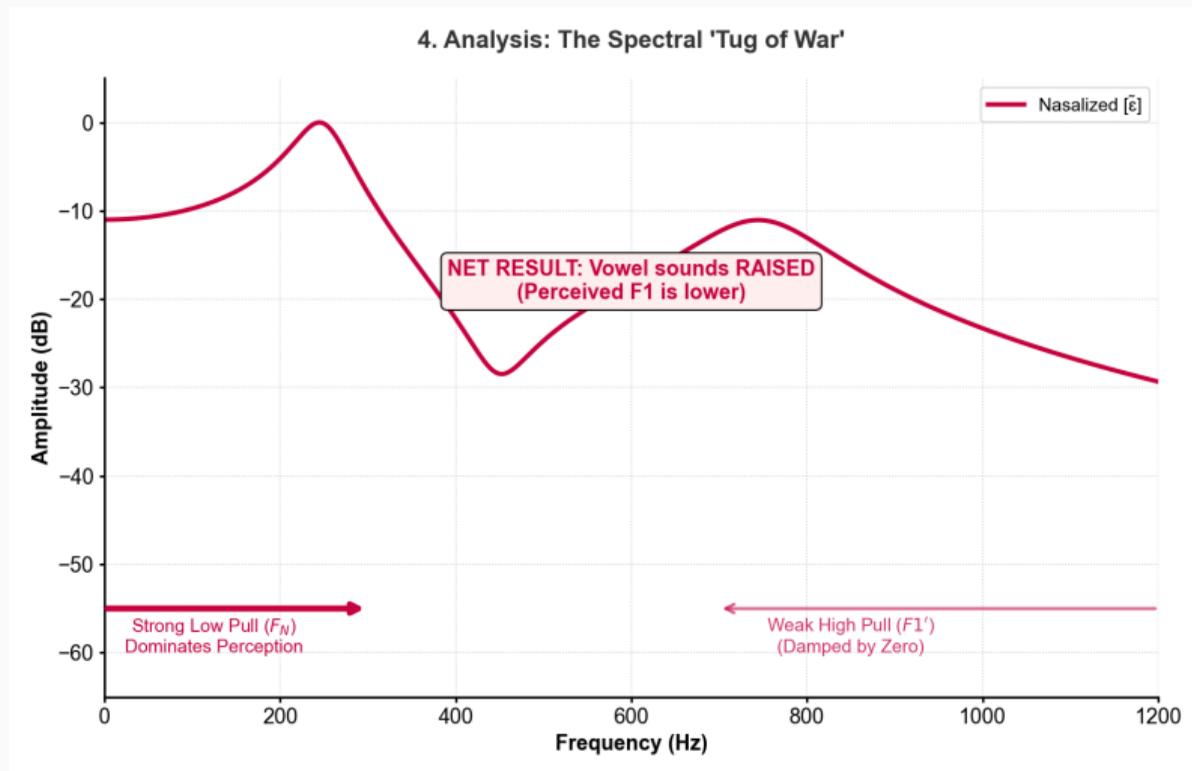
# Formants introduced by nasal coupling



# The first spectral peak in the F1 region after nasal coupling



# Result of the introduction of the formant FN and the anti-formant FZ



# What happens when there is little nasal coupling?

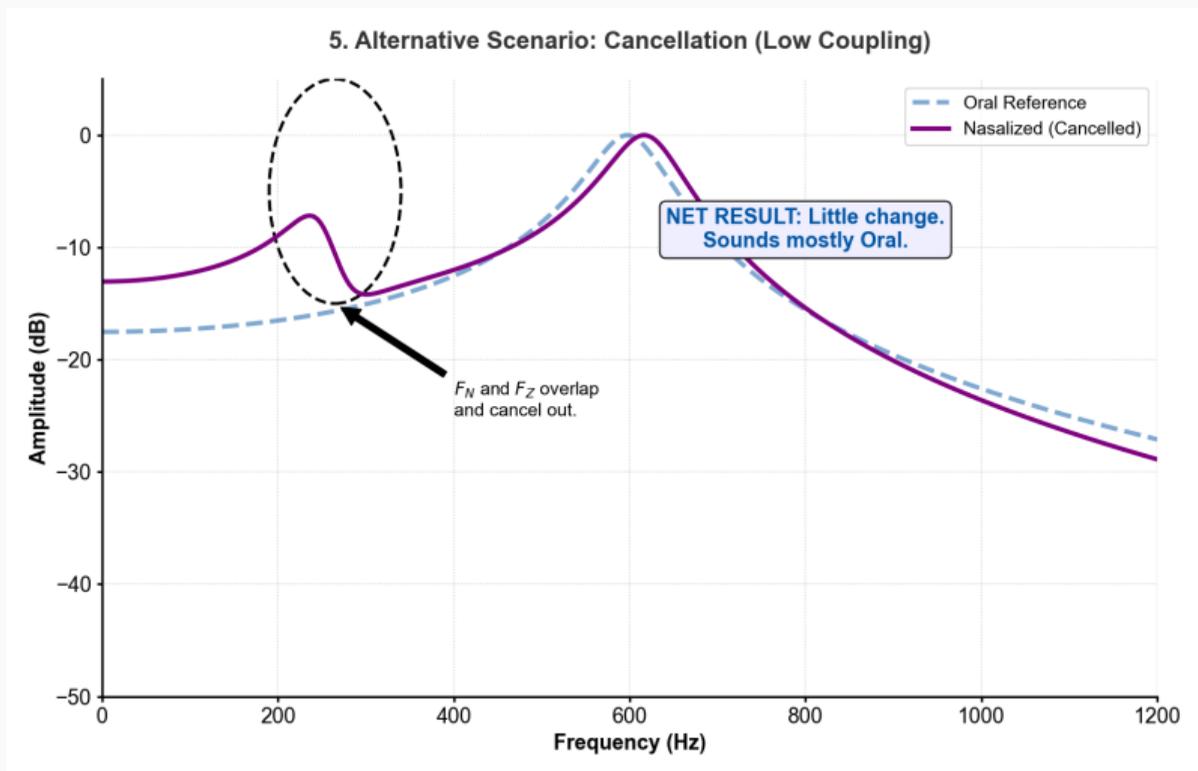


Figure 4: See references in Beddor, Krakow, and Goldstein (1986b, 200–1)

## Typological evidence

Plenty of examples (see Appendix). Will just discuss one that is most relevant.

- The following data is from Egurtzegi (2018, 178–9):
- /o/-raising contiguous to /n, m, ɲ, h̃/, as well as with the allophones [ɲ, ɲ̄, ɲ̥, ɲ̥̄, ɲ̥̄̄] of /n/ before an obstruent (exactly what I am proposing for Avestan!).
- Here, I just show examples of raising in the vicinity of /h̃/:

Standard Basque	Zuberoan	Transcription	Gloss
<i>ohore</i>	<i>uhure</i>	[u'h̃ure]	'honor'
<i>ohoin</i>	<i>uhuiñ</i>	[u'h̃uɲɲ]	'thief'
<i>inor</i>	<i>ihur</i>	[i'h̃ur]	'nobody'
<i>inon</i>	<i>ihun</i>	[i'h̃un]	'nowhere'
<i>inola</i>	<i>ihula</i>	[i'h̃ula]	'by no means'
<i>inoiz</i>	<i>ihuiz</i>	[i'h̃uiɟ]	'never'
<i>laino</i>	<i>lanhũ</i>	[lan'h̃u]	'cloud'
<i>anoa</i>	<i>anhua</i>	[an'h̃ua]	'food portion, supply'

## Comparison with previous accounts

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Feature Claim	Retraction Theory	Homorganic Interpretation
	<η> represents a uvular nasal [N] that triggered backing.	<η> represents a nasal homorganic with the consonant it precedes.
Phonetic Realization Implication	Invariably [N] Backing phonetically motivated by the uvular nasal	<ηk> = [ŋk], <ηt> = [nt], <ηc> = [ŋc] Retraction is <b>phonetically unmotivated</b> in <ηt> and <ηc> sequences.
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Phonetic Realization Implication	Invariably [N] Backing phonetically motivated by the uvular nasal	<ηk> = [ŋk], <ηt> = [nt], <ηc> = [ɲc] Retraction is <b>phonetically unmotivated</b> in <ηt> and <ηc> sequences.
Sources	de Vaan; Hoffmann and Forssman (1996, 44)	Clayton (2020, 80), Ferrer Losilla (2016) (contra Hoffmann and Narten 1989, 67; Hoffmann and Forssman 2004, 88; Kümmel 2017, 11)

---

## Revised interpretation of <ŋh>, <ŋ̥h>, <ŋ<sup>h</sup>> sequences

Context	Phonetic Reality	Phonetic motivation for *[a] > [a:]?
<ŋh>, <ŋ̥h>, <ŋ <sup>h</sup> >	<b>Articulatory:</b> [h̃], [h̃ʲ], and [h̃ <sup>w</sup> ] (Rhinoglottophilia; Clayton 2020)	<b>No:</b> /h/ lacks [+back] feature; no articulatory motivation for retraction.
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# The lack of symmetry in word-final development of \*-as

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Putative Plr. *\*ā* retraction /\_ #h contradicts Plr. *\*-ah* > OAv. *ā* [ə(:)] (contra Beguš 2025, 9–11)

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Asymmetry in identical environment (/\_ #h): Plr. *\*/ǎ/* **raises**, whereas *\*/ā/* **backs**.

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## Acoustic-perceptual motivations for pre-nasal raising

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Mechanism

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Loss of Context

Vowel height shifts co-occur with the loss of nasalization conditioning (Beddor, Krakow, and Goldstein 1986b).

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Spectral effects of heavy nasalization **misattributed** to oral tract shape change (e.g., YAv. raising /\_ homorganic nasals).

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- The Young Avestan development provides evidence that such changes can also be virtually simultaneous.

# Thank you!<sup>1</sup>

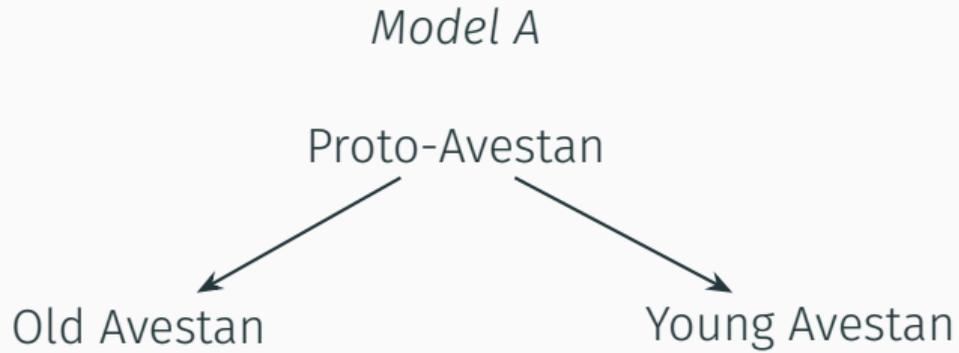
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1. I am indebted to the members of the PIES Graduate Seminar and the UCLA Phonology Seminar for their help and support. Special thanks to John Clayton and Stephanie Jamison for saving me from numerous errors.

## Appendix

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## Stages of Avestan



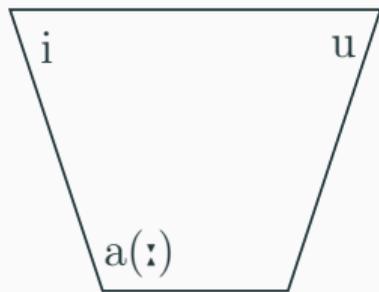
**Figure 5:** The putative relationships between Young and Old Avestan (de Vaan 2003, 8)

## Stages of Avestan



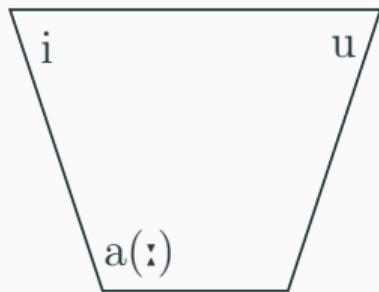
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## Evolution of the YAv. vowel inventory according to de Vaan (2003, 615–20)

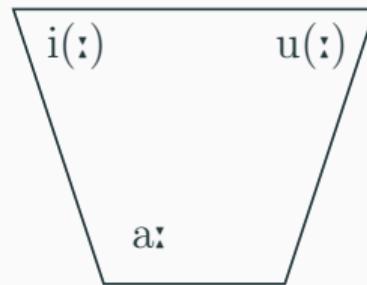


Stage I: Proto-Indo-Iranian

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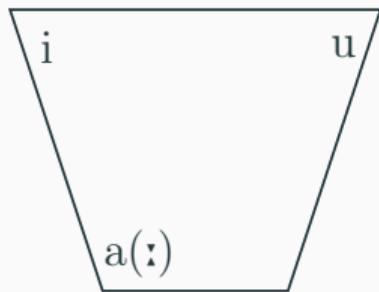


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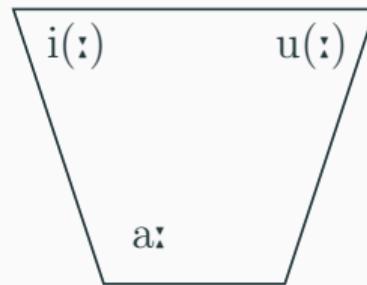


Stage II: Old Avestan

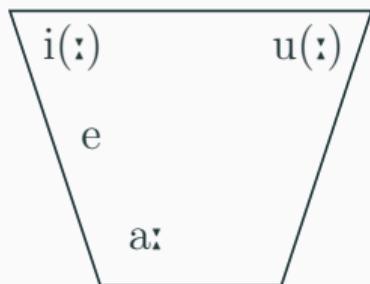
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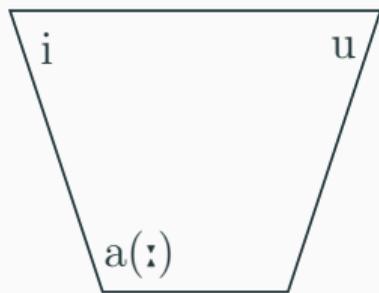


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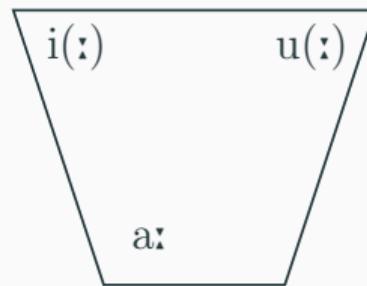


Stage III: Early Young Avestan

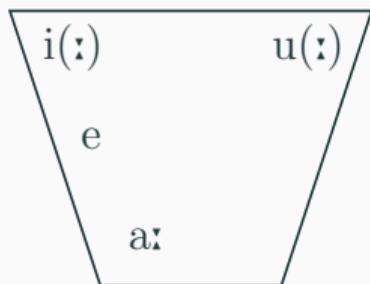
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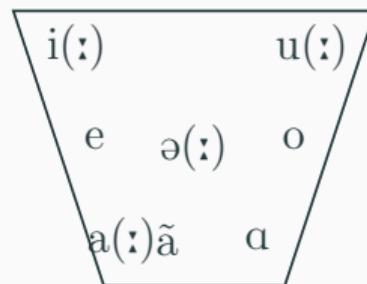
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Stage II: Old Avestan



Stage III: Early Young Avestan



Stage IV: Late Young Avestan

## Other environments in which <ā̇> is attested

The other words and contexts in which we find ā̇ where it is not followed by a nasal(ized) consonant are arguably all secondary and can be explained readily through analogical processes (de Vaan 2003, 384–6):

- e.g., *huδā̇biiō* (Y 4.4) and *hudā̇biiō* (34.13), but the oblique stem was replaced by the nom.sg. *hudāh* (2003, 384).
- Such a development would find a parallel in Vedic Sanskrit where the *bh*-cases of PIE historic animate \*s-stems often feature analogical outcomes from the nominative case (cf. Beguš 2025, 101, Sandell 2014, 197–8, Jamison 1991, 81–2).

## Romanian pre-nasal raising and Northern Cities Shift

- A similar type of raising of the vowel /ă/ is also attested in the development of Romanian from Latin (Renwick 2012, 26, 31):

(3) Latin \*ă > Romanian /ɨ/ \_\_ N

- a. Latin *campus* ‘field’ > Romanian *câmp* /kɨmp/ ‘id.’
- b. Latin *lana* ‘wool’ > Romanian *lână* /lɨnɨ/ ‘id.’
- c. Latin *mane* ‘tomorrow’ > Romanian *mâine* /mɨine/ ‘id.’

- In the so-called Northern Cities Shift, the vowel /æ/ and /a/ are both raised in pre-nasal position (Dinkin 2011) which like the Romanian development, supports a similar hypothetical development in Avestan.
- Similarly, in the Philadelphia Neighborhood Corpus, the most extensive corpus of American English recorded speech, there is a significant difference in the increase of height of the diphthong /aw/ before nasal consonants (Fruehwald 2012, 30).

## Pre-nasal raising in the dialects of Gascon

- In Gascon, as well as in Occitan dialects such as Lengadocian and Provençal, the vowel /ɛ/ is raised to /e/ in contact with a following nasal consonant as well as a preceding nasal (see Egurtzegi 2018, 174 with references).
- /ɛ/ > /e/ raising in nasalization contexts in Gascon:

Gascon	Provençal	Latin	Gloss
['bɛŋgo]	['veŋgo]	<i>veniō</i>	'I come'
[ben] / [be] / [bẽ]	[veŋ]	<i>venit</i>	'he comes'
[bent] / [ben] / [beŋ]	[vẽŋ]	<i>ventum</i>	'wind'

## Raising of /a/ in Bayonnese Gascon

More localized raising of /a/ in the Gascon variety of the valley of Aure.

Bayonnese Gascon	(Late) Latin	Gloss
[enz]	antius [antius]	'but'
[quen]	quantum [k <sup>w</sup> antũ]	'how much'
[ten]	tantum [tantũ]	'so much'
[sen]	sanguem [saŋg <sup>w</sup> ẽ]	'blood'
[sent]	sanctum [saŋktũ]	'Saint'

# The evidence of Middle Iranian languages against a retraction hypothesis

- **General Evidence:** Evidence from other Iranian languages suggests that vowels in the Plr. sequences *\*-ah* and *\*-āh* might have been similarly raised.
- **Reflexes of Plr. *\*-ah*:**
  - **Khotanese:** Plr. *\*-ah* > -ä [-e].
  - **Sogdian:** Attests a high vowel [-i] as the reflex.
- **Reflexes of Plr. *\*-āh*:**
  - **Khotanese:** Regularly develops into -e [-ε:].
  - **Sogdian:** Attests [-a].
- **Conclusion:**
  - Nothing in these developments suggests vowel retraction.
  - The Sogdian and Khotanese reflexes are consistent with the claim that Plr. *\*-a* and *\*-ā* were raised in the word-final position before *\*/h/*.

## Pre-nasal raising in Germanic

- Raising of PIE \*/eNC/:
  - Rule: PIE \*/eNC/ > /iNC/.
  - Examples: \*/b<sup>h</sup>end<sup>h</sup>-/ 'bind' > OE *bindan*, OHG *bintan* (Lass 1994, 24, 53)

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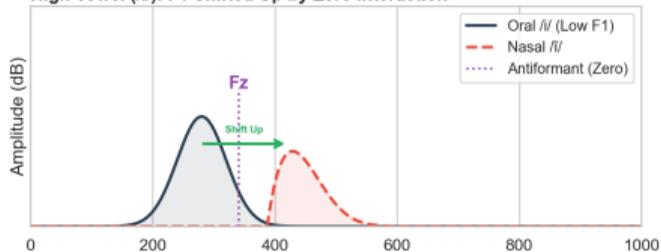
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  - Short vowels before nasals: Shows variation ⟨a⟩ ~ ⟨o⟩.
    - Examples: *mann*, *monn* 'man'; *wanian*, *wonian* 'wane'.
  - Long vowels: OE *mōna* 'moon', *mōnaþ* 'month'.
  - Old Frisian Parallel: OFr *mōna*, *mōnath*.
  - Process: \*/α:/ and \*/α/ were nasalized and "was subject to rounding and raising" (Lass 1994, 38–42)

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  - **Process:** \*/α:/ and \*/α/ were nasalized and "was subject to rounding and raising" (Lass 1994, 38–42)
- **Later development of OE Pre-Nasal Vowels (i-umlaut rare for æ):**
  - **Oldest Sources:** Show ⟨æ⟩.
    - Examples: *ænid* 'duck', *ænd* 'and'.
  - **Later Sources:** Show ⟨e⟩.
    - Examples: *ened* 'duck', *sendan* 'send' (< \**sandjan*) (Lass 1994, 64)

## Acoustic Consequences of Vowel Nasalization (Antiformants not visualized for clarity)

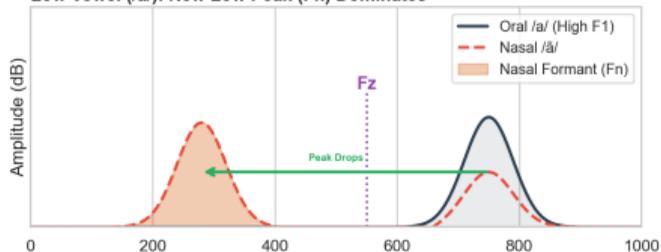
### High Vowel (/i/): F1 Shifted Up by Zero Interaction



#### HIGH VOWEL (/i/)

1. Low Oral (280Hz)
2. Nasalization adds a zero Anti-Formant (Fz) near 350Hz.
3. The 'center of gravity' shifts higher to ~420Hz.

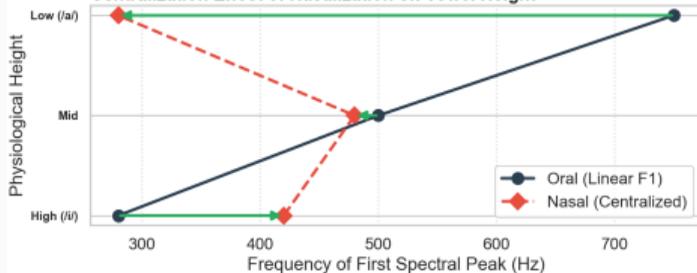
### Low Vowel (/a/): New Low Peak (Fn) Dominates



#### LOW VOWEL (/a/)

1. High oral F1 750Hz
  2. Nasal coupling adds slow peak (Fn) ~280Hz.
  3. A zero Anti-formant (Fz) ~550Hz separates the Fn from the old F1.
- Perception: Vowel sounds higher.

### Centralization Effect of Nasalization on Vowel Height



#### SUMMARY

Nasalization pulls high and low vowels toward the center (400-500Hz).

Figure 6: See Ohala (1974, 367) with references

# References

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