A low-angle photograph of tropical plants, including palm trees and pandanus trees, against a clear blue sky. The plants are silhouetted against the sky, creating a frame around the central text.

Highs and lows:
Tone splits from vowel height in Raja Ampat

Laura Arnold
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P-workshop, University of Edinburgh
14 May 2021

Tone split 1: Metnyo Ambel

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○

Tone split 2: Ma'ya

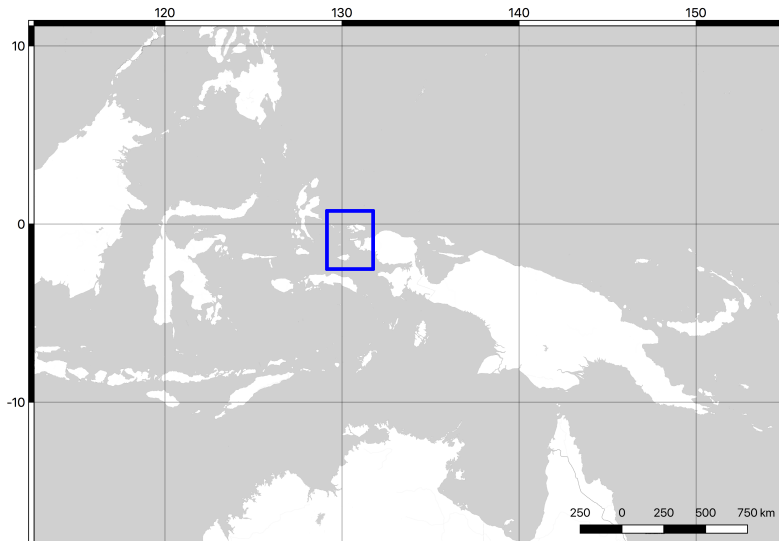
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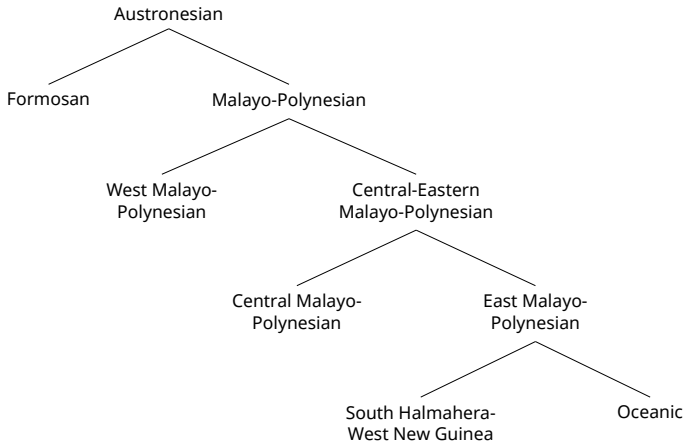
Discussion

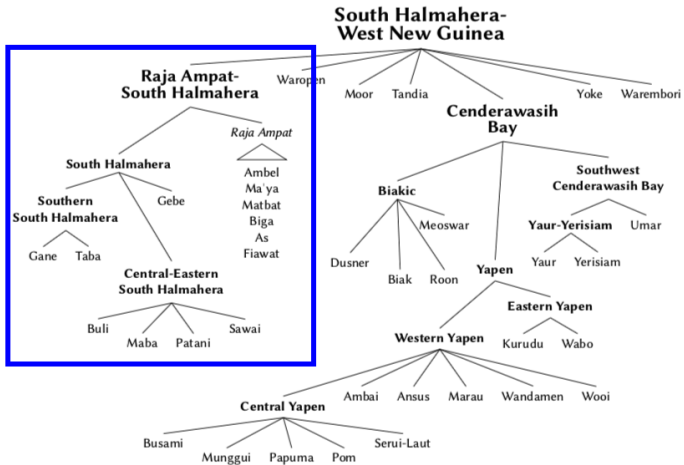
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Conclusions

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After Kamholz (2014)

Tone split 1: Metnyo Ambel

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Tone split 2: Ma'ya

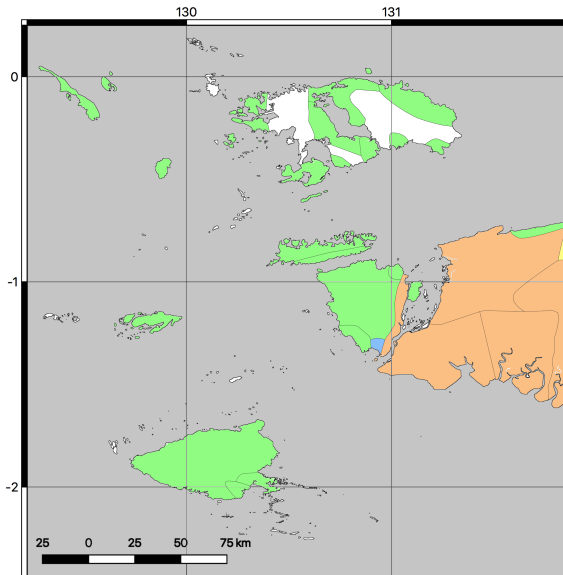
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Discussion

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Conclusions

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Tone split 1: Metnyo Ambel

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Tone split 2: Ma'ya

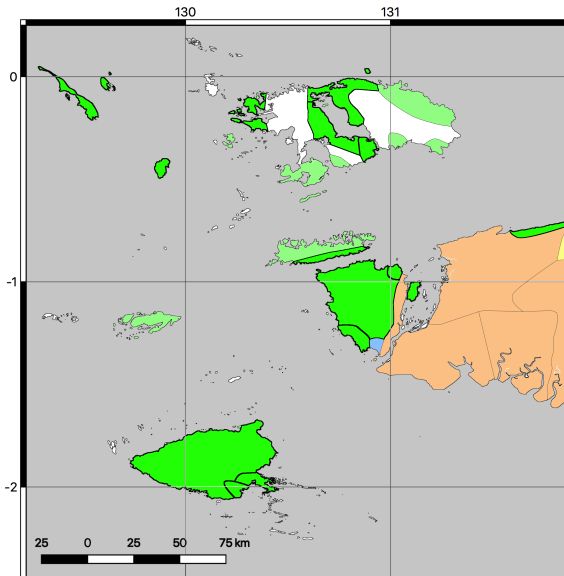
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Discussion

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Conclusions

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Tone splits from vowel height in Raja Ampat

1. Tone split 1: Metnyo Ambel
2. Tone split 2: Ma'ya
3. Discussion
4. Conclusions



Tone splits from vowel height in Raja Ampat

1. Tone split 1: Metnyo Ambel

2. Tone split 2: Ma'ya

3. Discussion

4. Conclusions

Tone split 1: Metnyo Ambel



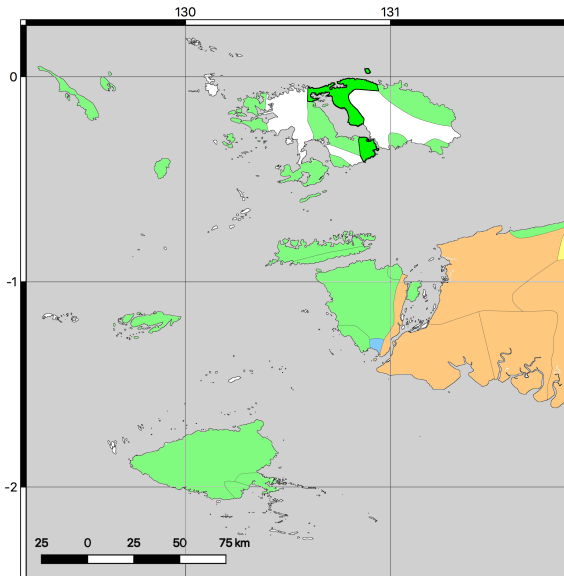
Tone split 2: Ma'ya



Discussion



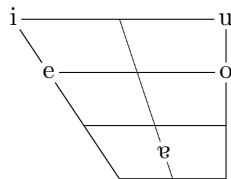
Conclusions





Ambel (Arnold 2018a,b)

	labial	coronal	velar	labial- velar
stops	p b	t d	k g	
fricatives	f (> h)	s		
nasals	m	n		
liquids		l r		
semivowels		j		w





Ambel (Arnold 2018a,b)

► Metnyo Ambel:

/H/		/Ø/	
tún	‘moon’	tun	‘thorn’
súp	‘bathe.1sg’	sup	‘repeat.1sg’
y-ún	‘1sg-pick.up’	y-un	‘1sg-know’

► Metsam Ambel:

/H/		/LH/		/Ø/	
páy	‘heron’	běy	‘sago’	gey	‘areca nut’



Tonal correspondences (Arnold 2020)

Set		Metsam		Metnyo		Proto-Ambel
A	-	H	::	H	}	*H
B	-	∅	::	∅		
C	-	∅	::	H	}	*∅
D	-	LH	::	∅		
E	-	LH	::	H	}	*LH

Tonal correspondences (Arnold 2020)

Set		Metsam		Metnyo		Proto-Ambel
A	-	H	::	H	}	*H
B	-	∅	::	∅	}	*∅
C	-	∅	::	H		
D	-	LH	::	∅	}	*LH
E	-	LH	::	H		



Correspondence set B: Metsam Ø :: Metnyo Ø

- Most items in set B can be reconstructed with *i or *u:

		Metsam	Metnyo	
1.	'earthquake'	suy	suy	*suy
2.	'enter'	sun	sun	*sun
3.	'five'	lim	lim	*lim
4.	'honey'	ful	hul	*ful
5.	'nine'	siw	siw	*siw
6.	'octopus'	kit	kit	*kit
7.	'good'	fey	hey	
8.	'house'	now	now	
9.	'two'	low	low	
				...



Correspondence set B: Metsam Ø :: Metnyo Ø

	Metsam	Metnyo	Other RASH cognates	Proto-RASH
7. 'good'	fey	hey	As <i>fi</i> , Biga <i>fi</i> , Buli <i>mafia</i> , Gane <i>fia</i> , Ma'ya 'fi ³ , Matbat <i>fi</i> ³	*fi
8. 'house'	now	now	Biga <i>pnu</i> 'village', Buli <i>pnu</i> 'village', Ma'ya 'pnu ³ 'village', Matbat <i>nu</i> ³ 'village'	*pnu 'village'
9. 'two'	low	low	As <i>lu</i> , Biga <i>lu</i> , Buli [<i>si</i>]lu, Gane <i>plu</i> , Ma'ya 'lu ³ , Matbat <i>lu</i> ³ , Taba <i>-lu</i>	*lu



Correspondence set B: Metsam Ø :: Metnyo Ø

- Most items in set B can be reconstructed with *i or *u:

		Metsam	Metnyo	
1.	'earthquake'	suy	suy	*suy
2.	'enter'	sun	sun	*sun
3.	'five'	lim	lim	*lim
4.	'honey'	ful	hul	*ful
5.	'nine'	siw	siw	*siw
6.	'octopus'	kit	kit	*kit
7.	'good'	fey	hey	*fi
8.	'house'	now	now	*nu
9.	'two'	low	low	*lu ...

Correspondence set C: Metsam Ø :: Metnyo H

- Most items in set C can be reconstructed with *e, *a, or *o:

	Metsam	Metnyo	
1. 'ascend'	sa	sá	*sa
2. 'canoe'	wan	wán	*wan
3. 'full'	fon	hón	*fon
4. 'rice'	fa	há	*fa
5. 'betel fruit'	nyan	nyán	*nyan
6. 'areca nut'	gey	gáy	*gey
7. 'rain'	mey	míy	*mey
8. 'coconut'	kowt	kút	*kowt
9. 'moon'	town	tún	*town

13/15
(~87%)



Correspondence set B: Metsam \emptyset :: Metnyo \emptyset

- Most items in set B can be reconstructed with *i or *u:

	Metsam	Metnyo	
1. 'earthquake'	suy	suy	*suy
2. 'enter'	sun	sun	*sun
3. 'five'	lim	lim	*lim
4. 'honey'	ful	hul	*ful
5. 'nine'	siw	siw	*siw
6. 'octopus'	kit	kit	*kit
7. 'good'	fey	hey	*fi
8. 'house'	now	now	*nu
9. 'two'	low	low	
			19/24 (~79%)



Metnyo Ambel tone split: Summary

	*i, *u	*e, *a, *o	Total
Set B			
Mets. Ø :: Metn. Ø	19	5	24
Set C			
Mets. Ø :: Metn. H	2	13	15

- ▶ Proto-Ambel *Ø > Ø / V [+close]
> High elsewhere
- ▶ Conditions account for 32/39 cognates in sets B & C (p=0.00006)



Tone splits from vowel height in Raja Ampat

1. Tone split 1: Metnyo Ambel

2. Tone split 2: Ma'ya

3. Discussion

4. Conclusions

Tone split 1: Metnyo Ambel

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Tone split 2: Ma'ya

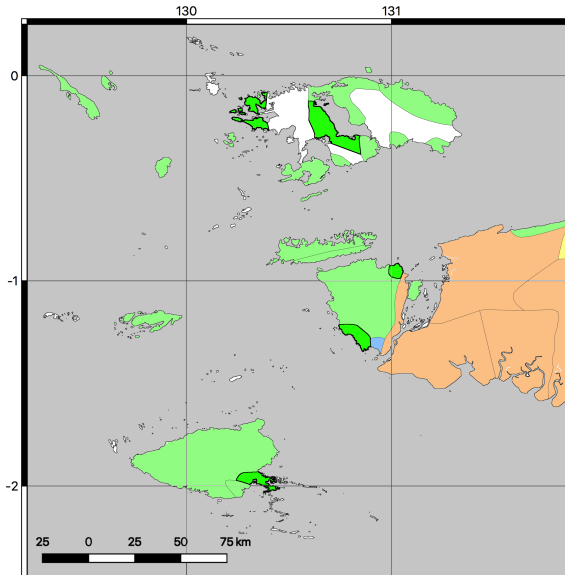
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Discussion

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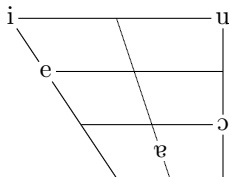
Conclusions

○○○



Ma'ya (Remijsen 2001)

	labial		coronal		velar		labial- velar	glottal
stops	p	b	t	d	k	g		(ʔ)
fricatives	f		s					
nasals		m		n				
liquids			l	r				
semivowels				j			w	





Ma'ya (Remijsen 2001)

► Tone:

Rise/Low	/ ¹² /	'sa ¹²	'sweep'
High	/ ³ /	'sa ³	'climb'
toneless		'sa	'one'

- Restricted to word-final syllables

► Stress:

- Primary correlate = length
- Penultimate and final syllables

e.g. ma'na³ 'grease' vs. 'mana³ 'light'

Tone split 1: Metnyo Ambel



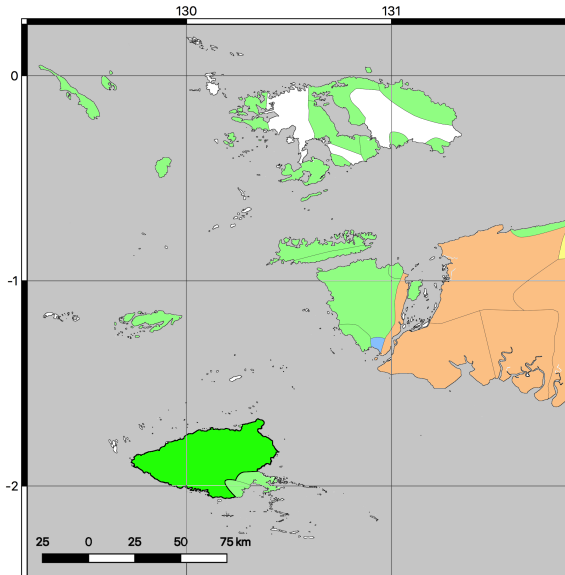
Tone split 2: Ma'ya



Discussion



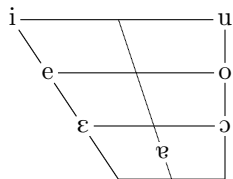
Conclusions





Matbat (Remijsen 2007)

	labial		coronal		velar		labial- velar
stops	p	b	t	d	k	g	
fricatives	f		s				
nasals		m		n		ŋ	
liquids			l	(r)			
semivowels				j			w





Matbat (Remijsen 2007)

► Tone:

Low	/ ¹ /	na ¹ n ‘betel’	
High	/ ³ /		de ³ ‘house’
Extra-high Fall	/ ⁴¹ /		de ⁴¹ ‘1PL.I-go.down’
Low Fall	/ ²¹ /	na ²¹ n ‘name’	
Low Rise	/ ¹² /	na ¹² n ‘animal’	
Rise-Fall	/ ¹²¹ /		de ¹²¹ ‘sick’



Tonal correspondences: Ma'ya and Matbat (Arnold 2018c)

Set		Matbat		Ma'ya	
A	–	Extra-High	::	Rise	1/41
B	–	High	::	High	17/41
C	–	High	::	Rise	12/41
D	–	High	::	toneless	1/41
E	–	Rise	::	Rise	2/41
F	–	Low	::	Rise	2/41
G	–	Low Fall	::	toneless	4/41
H	–	Low Fall	::	Rise	2/41

Tonal correspondences: Ma'ya and Matbat (Arnold 2018c)

Set		Matbat		Ma'ya	
A	–	Extra-High	::	Rise	1/41
B	–	High	::	High	17/41
C	–	High	::	Rise	12/41
D	–	High	::	toneless	1/41
E	–	Rise	::	Rise	2/41
F	–	Low	::	Rise	2/41
G	–	Low Fall	::	toneless	4/41
H	–	Low Fall	::	Rise	2/41



Correspondence set C: Matbat High :: Ma'ya Rise

- All items in set C have non-close vowels

		Matbat	Ma'ya	
1.	'canoe'	wa ³ ŋ	'wa ¹² k	
2.	'fire'	ya ³ p	'la ¹² p	
3.	'four'	fa ³ t	'fa ¹² t	
4.	'full'	fo ³ n	'fo ¹² n	
5.	'ground'	ba ³ t	'ba ¹² t	
6.	'mother'	ne ³ n	'ne ¹² n	
7.	'rice'	fa ³ s	'fa ¹² s	
8.	'sand'	ye ³ n	'le ¹² n	
9.	'see'	-ε ³ ŋ	'-e ¹² m	
10.	'snake'	ko ³ k	'ko ¹² k	...



Correspondence set B: Matbat High :: Ma'ya High

- Many items in set B have close vowels...

		Matbat	Ma'ya
1.	'breast'	su ³	'su ³ s
2.	'enter'	hu ³ ŋ	'su ³ n
3.	'five'	li ³ m	'li ³ m
4.	'good'	fi ³	'fi ³
5.	'kill'	bu ³ n	'bu ³ n
6.	'louse'	wu ³ t	'u ³ t
7.	'two'	lu ³	'lu ³
8.	'village'	nu ³	'pnu ³
9.	'white'	bu ³	'bu ³ s
10.	'woman'	(wa ¹ t)bi ³ n	'pi ³ n



Correspondence set B: Matbat High :: Ma'ya High

- ...but some do not

	Matbat	Ma'ya
11. 'come'	bo ³ t	'bo ³ t
12. 'mountain'	he ³ l	'ye ³ l
13. 'sea turtle'	fe ³ n	'fe ³ n
14. 'eight'	-wa ³ l	'wa ³ l
15. 'ascend'	ha ³	'sa ³
16. 'seawards'	lo ³ w	'lo ³ l
17. 'three'	to ³ l	'to ³ l

Correspondence set B: Matbat High :: Ma'ya High

		Matbat	Ma'ya	Other RASH cognates
11.	'come'	bo ³ t	'bo ³ t	Batta bu¹t , Biga bu³t , Kawe Ma'ya but , Laganyan Ma'ya but , Wauyai Ma'ya but , Salawati bu³t
12.	'mountain'	he ³ l	'ye ³ l	Proto-Ambel * i³l , Biga i³l , Kawe Ma'ya yil , Laganyan Ma'ya yil , Wauyai Ma'ya yil
13.	'sea turtle'	fe ³ n	'fe ³ n	Proto-Ambel * fi³n , Batta fi¹²n , Biga fi³n , Buli <i>fen</i> , Gane <i>fen</i> , Kawe Ma'ya fin , Laganyan Ma'ya fin , Salawati fi³n , Sawai <i>fɛn</i> , Taba <i>hen</i>



Correspondence set B: Matbat High :: Ma'ya High

- ...but some do not

	Matbat	Ma'ya
11. 'come'	bo ³ t	'bo ³ t
12. 'mountain'	he ³ l	'ye ³ l
13. 'sea turtle'	fe ³ n	'fe ³ n
14. 'eight'	-wa ³ l	'wa ³ l
15. 'ascend'	ha ³	'sa ³
16. 'seawards'	lo ³ w	'lo ³ l
17. 'three'	to ³ l	'to ³ l

Ma'ya tone split: Summary

	*[+close]	*[-close]	Total
Set B			
Mat. H :: Ma'ya H	10	7	17
Set C			
Mat. H :: Ma'ya LH	0	12	12
Set D			
Mat. H :: Ma'ya Ø	0	1	1

- ▶ Proto-Ma'ya-Matbat *High > High / V [+close]
> Rise elsewhere
- ▶ Conditions account for 22/30 cognates in sets B, C, D (p=0.001)



Tone splits from vowel height in Raja Ampat

1. Tone split 1: Metnyo Ambel

2. Tone split 2: Ma'ya

3. Discussion

4. Conclusions



Diachronic effect of vowel quality on tone

“...intrinsic fundamental frequency variations caused by vowel height rarely, if at all, give rise to the development of phonological tones”

Hombert (1977)

“...tone rarely or never originat[es]... from vowel height”

Hombert et al. (1979)



Diachronic effect of vowel quality on tone

► Tonogenesis:

- **U** (Angkuic; Svantesson 1988, 1991)
- **Limburgian Dutch** (Germanic; Boersma 2017)
- **Cèmuhî** (Oceanic; Rivierre 2001)

Open syls with prevocalic
voiceless obstruents
> H if the vowel was *i or *u
otherwise > L

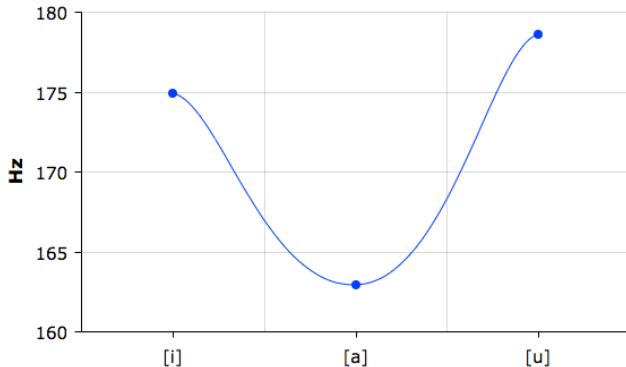
► Tone splits:

- **Bench'** (Omotic; Tesfaye an
- **Lugbara** (Moru-Madi; Andersen 1986)
- **Yerisiam** (SHWNG; Kamholz 2014)

Formerly predictable extra-high
pitch on High-toned syllables with
/i/ or /u/ > Extra-High tone

Intrinsic fundamental frequency (IF0)

- ▶ All else being equal, close vowels are produced with higher f_0 than non-close vowels



English: extrapolated from Whalen and Levitt (1995)



Intrinsic fundamental frequency (IF0)

► Tonogenesis:

- **U** (Angkuic; Svantesson 1988, 1989)
- **Limburgian Dutch** (Germanic; Boersma 2017)
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Intrinsic fundamental frequency (IF0)

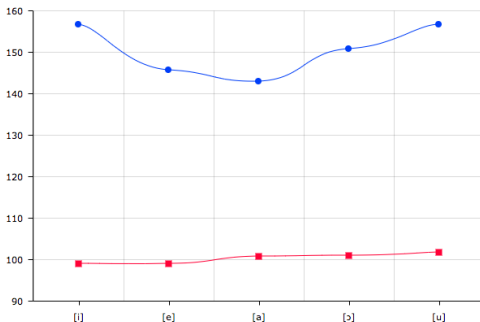
- ▶ Proto-Ma'ya-Matbat *High > High / V [+close]
> Rise elsewhere

- ▶ Proto-Ambel *∅ > ∅ / V [+close]
> High elsewhere



Intrinsic fundamental frequency (IF0)

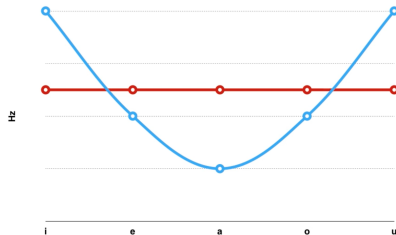
- ▶ All else being equal, close vowels are produced with higher f_0 than non-close vowels...
- ▶ ...except in low-pitched contexts



Taiwanese Chinese: extrapolated from Zee (1980)

Intrinsic pitch

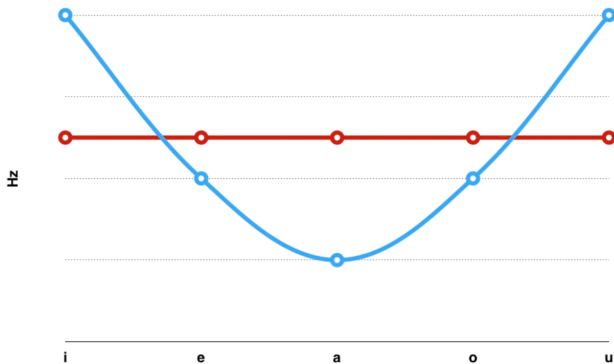
- ▶ An auditory mechanism by which hearers perceive close vowels as *lower* in pitch than non-close vowels
- ▶ Thought to be auditory compensation for IF0 – ‘compensatory listening’ (Gussenhoven 2007)



e.g. Hombert 1977; Stoll 1984; Silverman 1987; Fowler and Brown 1997

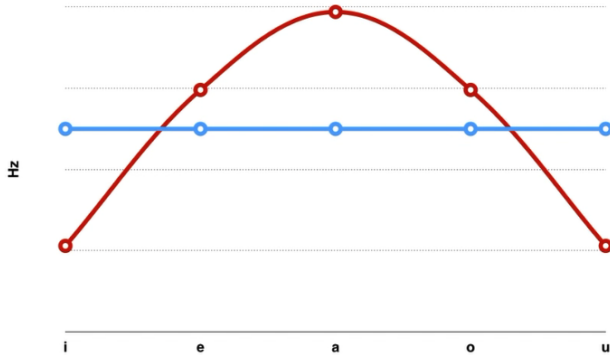


Intrinsic pitch





Intrinsic pitch





Tone splits from vowel height in Raja Ampat

1. Tone split 1: Metnyo Ambel

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Takeaway messages

- ▶ Two more examples of developments of tone from vowel quality
- ▶ Metnyo Ambel: First attestation of High tone on non-close vowels
- ▶ High tone on close vowels: Intrinsic fundamental frequency
- ▶ High tone on non-close vowels: Neutralisation of IF0 in low-pitched contexts + continued compensation with Intrinsic Pitch
- ▶ Why twice in Raja Ampat...?



Current research

- ▶ Tonogenesis:
 - ▶ U (Angkuic; Svantesson 1988, 1989)
 - ▶ **Limburgian Dutch** (Germanic; Boersma 2017)
 - ▶ **Cèmuhî** (Oceanic; Rivierre 2001)

- ▶ Tone splits:
 - ▶ **Bench'** (Omotic; Tesfaye and Wedekind 1994)
 - ▶ **Lugbara** (Moru-Madi; Andersen 1986)
 - ▶ **Yerisiam** (SHWNG; Kamholz 2014)
 - ▶ **Ma'ya** (SHWNG; Arnold 2018c)
 - ▶ **Ambel** (SHWNG; Arnold 2020)



Tone and vowel height in eastern Austronesian

- ▶ Unexpected sound changes may be due to “the continued operation of an inherited structural pressure after the separation of the daughter languages from a common ancestor” (Blust 2017: 342)
- ▶ ‘Synchronic and diachronic investigations in Raja Ampat-South Halmahera’
 1. Phonological analyses of the word-prosodic systems of undocumented RA languages
 2. Phonetic investigations into IF0 in RA (with Jiayin Gao & James Kirby)
 3. Subclassification of RASH and reconstruction of proto-RASH



References I

- ANDERSEN, TORBEN, 1986. Tone splitting and vowel quality: Evidence from Lugbara. *Studies in African Linguistics* 17:55–68.
- ARNOLD, LAURA, 2018a. *A description of Ambel, an Austronesian language of West New Guinea*. Ph.D. thesis, The University of Edinburgh.
- , 2018b. Lexical tone in Metnyo Ambel. *Oceanic Linguistics* 57(1):199–220.
- , 2018c. A preliminary archaeology of tone in Raja Ampat. In: Antoinette Schapper (ed.), *Contact and substrate in the languages of Wallacea, part 2*, 7–39. NUSA: Linguistic Studies of Indonesian and Other Languages in Indonesia 64.
- , 2020. Highs and lows: Towards reconstructing the word-prosodic system of proto-Ambel. *Transactions of the Philological Society* 118:141–158.
- BLUST, ROBERT, 2017. Odd conditions: Context-sensitive sound change in unexpected contexts. *Journal of Historical Linguistics* 7:322–371.
- BOERSMA, PAUL, 2017. The history of the Franconian tone contrast. In: Wolfgang Kehrein, Björn Köhnlein, Paul Boersma, and Marc van Oostendorp (eds.), *Segmental structure and tone*, 27–98. Berlin/Boston: Walter de Gruyter GmbH.
- FOWLER, CAROL A. AND JULIE M. BROWN, 1997. Intrinsic f_0 differences in spoken and sung vowels and their perception by listeners. *Perception & Psychophysics* 59:729–38.

References II

- GUSSENHOVEN, CARLOS, 2007. A vowel height split explained: Compensatory listening and speaker control. In: Jennifer Cole and José Ignacio Huade (eds.), *Laboratory Phonology 9*, 145–72. Berlin; New York: Mouton de Gruyter.
- HOMBERT, JEAN-MARIE, 1977. Development of tones from vowel height? *Journal of Phonetics* 5:9–16.
- HOMBERT, JEAN-MARIE, JOHN OHALA, AND WILLIAM G. EWAN, 1979. Phonetic explanations for the development of tones. *Language* 55(1):37–58.
- KAMHOLZ, DAVID, 2014. *Austronesians in Papua: Diversification and change in South Halmahera–West New Guinea*. Ph.D. thesis, University of California, Berkeley.
- REMIJSEN, BERT, 2001. *Word-prosodic systems of Raja Ampat languages*. Utrecht: LOT.
- , 2007. Lexical tone in Magey Matbat. In: Vincent J. van Heuven and Ellen van Zenten (eds.), *Prosody in Indonesian languages*, 9–34. Utrecht: LOT.
- RIVIERRE, JEAN-CLAUDE, 2001. Tonogenesis and evolution of tonal systems in New Caledonia, the example of Cèmuhî. In: Shigeki Kaji (ed.), *Proceedings of the symposium Cross-linguistics studies of tonal phenomena*, 23–42. Tokyo: Institute for the Study of Languages/Cultures of Asia/Africa.
- SILVERMAN, KIM E. A., 1987. *The structure and processing of fundamental frequency contours*. Ph.D. thesis, University of Cambridge.

References III

- STOLL, GERHARD, 1984. Pitch of vowels: Experimental and theoretical investigation of its dependence on vowel quality. *Speech Communications* 3:137–50.
- SVANTESSON, JAN-OLOF, 1988. U. *Linguistics of the Tibeto-Burman area* 11:64–133.
- , 1989. Tonogenetic mechanisms in northern Mon-Khmer. *Phonetica* 46:60–79.
- TESFAYE, ASHENAFI AND KLAUS WEDEKIND, 1994. Aspects of Omotic tonogenesis. *Journal of Ethiopian Studies* 27(2):1–19.
- WHALEN, D. H. AND ANDREA G. LEVITT, 1995. The universality of intrinsic F_0 of vowels. *Journal of Phonetics* 23:349–66.
- ZEE, ERIC, 1980. Tone and vowel quality. *Journal of Phonetics* 8:247–258.



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