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THE WUVULU VELAR OBSTRUENT PUZZLE SOLVED

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Exuberant free variation of the velar obstruents [g], [k], [x], and [ʔ] has been a long-standing puzzle in Wuvulu phonology. Blust (2008) made progress toward a solution by recognizing the allophony of [g] and [x], and by eliminating [ɣ] from the analysis. The present paper claims to complete the solution with two compelling arguments that are crucial to the problem: (1) neither [k] nor /k/ is associated with the velar allophones [x] and [g], and (2) oddly, /r/ is perhaps the best candidate for the phonemic form of the velars. This paper also evaluates Blust's (2008) correlation of the stricture features of [x] and [g] with the height of adjacent vowels, and suggests that the correlation could be generalized to include /l/ and its allophones [l] and [d].

1. INTRODUCTION.[1] Wuvulu and Aua are island possessions of Papua New Guinea (PNG). Wuvulu lies on the western edge of the Admiralties Islands—a group of islands north of PNG spanning nearly 250 miles of the Bismarck Sea.

Wuvulu has SVO constituent order typology. According to Lewis 2009 the genetic affiliation of the language is Austronesian, Malayo-Polynesian, Central-Eastern, Eastern Malayo-Polynesian, Oceanic, Admiralty Islands, Western.[2]

Documentation of Western Admiralties languages includes a small collection of lexemes recorded in the early 1900s by German ethnographers Thilenius (1903), Dempwolff (1904), and Hambruch (1908). In the 1970s Z'graggen (1975) and Blust (1978) elicited additional lexical data. Ross (1988) included Wuvulu data in his proposed subgrouping of the Western Admiralty Islands. Blust's 1978, 1996, and 2008 publications included initial and revised analyses of Wuvulu phonology.

2. BACKGROUND. The Wuvulu data corpus for this paper consists of 75 natural texts of various genres, a lexicon of approximately 2000 entries, and about 40 pages of grammatical notes taken during the translation of the New Testament into Wuvulu.

An objective of this paper is to evaluate areas in which the present phoneme proposal contrasts with previous proposals of Wuvulu phoneme inventories. Blust (1996) discussed what seemed to be excessive free variation of the velar consonants [g], [k], [x], and [ɣ]. Hafford 2007 resolved part of the problem, pointing out that [g] only occurs adjacent to a [+hi] vowel *i* or *u*, and that [x] never occurs adjacent to a [+hi] vowel. This analysis was eventually adopted by Blust (2008:283):

> Because the phonetic basis for such a statement of complementation is opaque, I initially was skeptical about its accuracy. However, on reexamining my fieldnotes, I discovered overwhelming support for Hafford's claim … where my fieldnotes show 172 supporting examples of this surprising correlation as against four contrary cases.

Blust 2008:275 comments on the novelty of the conditioning environment of the allophones [x] and [g]:

> Surprisingly, the complementation of velar obstruent allophones is phonetically conditioned, but follows no obvious phonetic principle. Wuvulu thus presents on the level of the allophone a challenge to phonological theory similar to that presented by sound changes that do not appear to be linguistically motivated.

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[1] I thank Juliette Blevins for encouraging me to write this paper. Thanks also to Victoria Anderson, Robert Blust, Lyle Campbell, Patricia Donegan, and Ken Rehg for their valuable comments.

[2] The International Organization for Standards (ISO) refers to the Wuvulu language with the designator *wuv*.

Before discussing whether Wuvulu allophony presents a challenge to phonological theory, we ask a more germane question: what is the underlying phoneme of [x] and [g]? The abstract of Blust 2008:275 suggests that the underlying phoneme is /k/:

> [Wuvulu] has been reported in earlier publications as having as many as four allophones of the velar stop /k/, all of which appeared to be in free variation. It is now clear that the allophony of /k/ involves both complementation and free variation (1).

Later, in the same paper (288) /k/ was removed from the phoneme inventory and replaced by /x/, with the following rationale:

> The argument for representing the velar obstruent phoneme as /k/ is basically that this yields a "complete" set of voiceless stops /p/, /t/, /k/, /ʔ/. However, there are more compelling arguments for representing this phoneme as /x/, because (1) it is more frequent than [k], (2) it occurs in the "elsewhere" environment in relation to [g], and (3) … it helps to fill in the set of fricatives with /f/, /x/, and /h/.

Three problems with the above analysis are: (1) [h] is not phonemic, (2) speakers associate [k] with the glottal phoneme /ʔ/ and not with the velar allophones, and (3) the well-attested variant of the velar phones—alveolar trilled [r] —is not properly accounted for.

Language data suggest that historical *r has been backed in modern Wuvulu to the conditioned allophones [g] next to a [+hi] vowel and [x] elsewhere. This is perhaps the strongest support for the phoneme /r/. Trilled alveolar [r] is spoken on Wuvulu by older people and it is the only variant of /r/ spoken on Aua. When older speakers of Wuvulu switch to the [r] variant, it occurs everywhere that either [x] or [g] occurs in modern Wuvulu—a sound change in progress. Support for a rhotic phoneme comes from many Proto Oceanic historical data in which *r appears in positions wherever [x] or [g] appears in synchronic forms of those same data.

3. WUVULU PHONEMES. Wuvulu has five vowel phonemes and ten consonant phonemes. The canonical syllable shape is CV, though there can be word-final vowel deletion. Wuvulu stress seems to be best explained in terms of moraic trochees, though a few exceptions appear in the examples below. A fuller discussion of prosody is beyond the scope of the present paper.

3.1 VOWEL PHONEMES. The Wuvulu phoneme inventory has five vowels. The phoneme /e/ is produced as [ɛ]**.**

i	u
e	o
a	

Surface forms for the following data are taken from the Onne dialect of Wuvulu.

a	/nali/	[ˈna.di]	'okay'
	/parara/	[pa.ˈxa.xa]	'thunder'
e	/nene/	[ˈnɛ.nɛ]	'behind,later'
	/pie/	[ˈpi.jɛ]	'sand'
i	/nia/	[ˈni.ja]	'fish'
	/fafi/	[ˈfa.fi]	'afternoon greeting'
o	/bao/	[bao]	'box'
	/mafufuo/	[ˌma.fu.ˈfu.wo]	'morning'
u	/fufulu/	[fu.ˈfu.du]	'Wuvulu'
	/umu/	[ˈhu.mu]	'home'

3.2 CONSONANT PHONEMES. Table 1 shows consonant phoneme inventories that have been proposed for Wuvulu. The inventories of German sources and Ross are reproduced from Blust 1996. German source data are from ethnographers of the early 1900s—Thilenius (1903), Dempwolff (1905), and Hambruch (1908).[3]

TABLE 1. Wuvulu consonant phoneme proposals

German 1903-8			Ross 1988				Blust 1996				Hafford 2007			Blust 2008			
p	t	ʔ	p	t	k	ʔ	p	t	k	ʔ	p	t	ʔ	p	t		ʔ
b		g					b	(d)			b			b			
f	s		f		x		f			(h)	f			f		x	h
m	n		m	n			m	n	(ŋ)		m	n		m	n		
	l			l				l				l			l		
	r							(r)				r			(r)		
w	y						w				w			w			

3.2.1 STOPS. Excluding nasals, there are four stops in the language: /b/, /p/, /t/, and /ʔ/. Voiced and voiceless bilabial stop phonemes /b/ and /p/ are attested in all inventories, except that for some unknown reason Ross (1988) did not include /b/.

b	/bau/	[ˈbau]	‘old man’
	/raba/	[ˈxa.ba]	‘heavy’
	/biri/	[ˈbi.gi]	‘work’
p	/pau/	[ˈpau]	‘pandanus’
	/ropa/	[ˈxo.pa]	‘to rain’
	/pie/	[ˈpi.jɛ]	‘beach’

The voiceless alveolar stop /t/ is posited in each of the phoneme inventories of table 1. Early German ethnographers regarded /s/ as distinct from /t/. Subsequent analyses (including mine) recognize [t] and [s] as allophones of /t/. In Motu, an Austronesian language of PNG, /t/ becomes [s] preceding a front vowel *i* or *e* (Crowley 1997). In Wuvulu /t/ becomes [s] preceding a high vowel *i* or *u*. In Wuvulu, [s] is in free variation with alveolar affricate [t͡ʃ].

t	/tau/	[ˈtau]	‘papaya’
	/ʔatona/	[ʔa.ˈto.na]	‘Monday’
	/tifi/	[ˈt͡ʃi.fi] ~ [ˈsi.fi]	‘to deceive’
	/fetu/	[ˈfɛ.t͡ʃu] ~ [ˈfɛ.su]	‘to wash’

The glottal stop /ʔ/ is recognized in all proposals of table 1. Wuvulu glottal stop contrasts with Ø word-initially. Vowel-initial words are preceded by an almost imperceptible [h] which is considered to be non-phonemic.

[3] Four important publications on Wuvulu appear to be based primarily on data elicited from a lone informant, a “Harry Lopes”—Blust 1978, 1996, 2008, and Ross 1988. This informant was most likely Harry Lopa of Auna Village. He is the only “Harry” from Wuvulu and no one on Wuvulu has ever heard of the name “Lopes.” The *Lopa* surname is from a Buka laborer who married into Wuvulu during the German plantation of the early 1900s. Harry Lopa was in high school on Manus Island in the 1970s (250 miles from Wuvulu) and later worked on Manus in a government role. No language informant is named for the Wuvulu data of Ross 1988. In personal communication Ross (2011) told me that his data were from Blust. While on Manus Island in 1975 as a part of his post-doctoral work through the Australian National University, Blust collected data from 27 Admiralties language communities.

ʔ	/ʔupu/	[ˈʔu.pu]	‘grandparent, grandchild’
	/upu/	[ˈhu.pu]	‘green coconut’
	/ʔaro/	[ˈʔa.xo]	‘under’
	/ʔaroʔ	[ˈha.xo]	‘spouse’

3.2.2 FRICATIVES. The voiceless labio-dental fricative /f/ is attested in all previous analyses. It is sometimes voiced when intervocalic.

f	/fainaroaʔ	[ˌfai.na.ˈxo.wa]	‘eight’
	/lofu/	[ˈlˠo.fu]	‘brother of a male’

3.2.3 NASALS. There is unanimous agreement among proposals that /m/ and /n/ are phonemes. Although /ŋ/ appears in Blust 1996, it was included based on a single datum and was dropped in subsequent publications.

m	/maremare/	[ˌma.xɛ.ˈma.xɛ]	‘cough’
	/umu/	[ˈhu.mu]	‘house’
n	/nali/	[ˈna.di]	‘okay’
	/anuna/	[ha.ˈnu.na]	‘its meaning’

3.2.4 LIQUIDS. The phoneme /l/ has three allophones: [d] adjacent to a high vowel, [lˠ][4] preceding [o], and [l] elsewhere. The conditioning environments for these allophones are discussed further in the section on phonological theory.

l	/lalo/	[ˈla.lˠo]	‘in, inside’
	/paʔale/	[ˈpa.ʔa.lɛ]	‘dolphin’
	/ʔoloroa/	[ˌʔo. lˠo.ˈxo.wa]	‘six’
	/lomi/	[ˈlˠo.mi]	‘no’
	/liai/	[di.ˈai]	‘again’
	/balu/	[ˈba.du]	‘child’
	/oli/	[o.ˈdi]	‘we should go’
	/olumanu/	[ˌo.du.ˈma.nu]	‘three’

The phoneme /r/ has three allophones, [r], [x], and [g]. The status of /r/ is discussed more fully below in the section on velar obstruents.

r	/ranu/	[ˈxa.nu]	‘fresh water’
	/loralora/	[ˌlˠo.xa.ˈlˠo.xa]	‘sore’
	/rirei/	[gi.ˈgei]	‘door’
	/fariri/	[fa.ˈgi.gi]	‘slowly’
	/rufu/	[ˈgu.fu]	‘village’

3.2.5 GLIDES. Ross (1988) is the only linguist who does not list /w/ as a separate phoneme. I analyze /w/ as a phoneme based on its conformity to canonical CV syllable shape, as well as its predictability.

[4] The phone [lˠ] is a dental [l] with a fricative release.

w	/warieni/	[ˌwa.gi.ˈjɛ.ni]	‘today’
	/welowelo/	[ˌwɛ.lo̞.ˈwɛ.lo̞]	‘round’

The phone [j] is infrequent and is not considered to be phonemic. In order to conform to the canonical CV syllable shape, when /i/ is preceded by a consonant and followed by a non-high vowel, [j] is inserted as a syllable onset between /i/ and the non-high vowel. Word-initial /i/ becomes [j] when followed by a non-high vowel.

/pie/	[ˈpi.jɛ]	‘beach’
/iauʔ	[ˈjau]	1st person singular pronoun

4. VELAR OBSTRUENTS. As previously mentioned, earlier analyses of Wuvulu phonology posit four velar phones in free variation: [ɣ], [g], [x], and [k]. These analyses were revised to recognize the conditioned allophones [x] and [g]. The revision also excludes [ɣ] due to its rarity. This leaves each of [x] and [g] in free variation with [k]. This is problematic, since [k] is virtually absent in my corpus.

4.1 THE ABSENCE OF [K]. The notion that [k] should be excluded as a velar allophone is suggested by the manner in which words are borrowed into Wuvulu from English and Tok Pisin (TP). The phone [k] is always borrowed as [ʔ] in Wuvulu. Examples are TP *buk* [buk] ‘book’ > [buʔu], TP *kilok* [kilok] ‘clock’ > [ʔiloʔo], and *America* [əmɛrikə] > [amɛxɛʔa]. Furthermore, historical data suggest that word-initial *k has been deleted (data from Blust 2008:292):

Proto Austronesian		Blust data
*kururu ‘lightning’	>	ugugu[5]
*kalia ‘cod’	>	alia

Additional grounds for excluding [k] comes from the online *Austronesian comparative dictionary* (*ACD*), which represents synchronic Wuvulu data. Many Wuvulu entries in the *ACD* include word-medial /k/ in positions that correspond to historical *r:

Proto Oceanic		Blust (*ACD*)	Hafford data
*parara ‘thunderclap’	>	pakaka	/parara/ [paxaxa]
*muri ‘stern of canoe’	>	muki[6]	/muri/ [mugi]
*quraŋ ‘spiny crawfish’	>	uka	/ura/ [uga]

ACD data are from Blust’s fieldnotes, in which [k] was recorded.[7] In contrast, historical *r data correspond with synchronic Wuvulu /r/ and its allophones.

4.2 /R/ AS THE PHONEME OF THE VELAR OBSTRUENTS. Rhotic dorsalization, or the backing of a coronal [r], is well-attested in Romance languages (French [r] > [ʀ], Haden 1955). Variants of the backed rhotic include European Portuguese [r] > [ʀ], Brazilian Portuguese [r] > [x] (Whitlam, Davies, and Harland 1997:viii–xi), and Puerto Rican Spanish, in which “trilled /r/ becomes the uvular trill [r] or the velar fricative [x]” (Goldstein and Iglesias 1996:84).

A similar change appears to have occurred in the diachronic phonology of Wuvulu, where there is evidence that trilled alveolar [r] has backed to a velar obstruent, [x] or [g]. In personal communication, Ken Rehg (2011) stated that a similar change has occurred in Ngatikese, an

[5] My corpus has /ururu/ [ugugu] ‘thunder,’ and /utila/ [usida] ‘lightning’.

[6] The *ACD* still lists /muki/ ‘stern of canoe’ in its phonemic representation, though Blust (2008:291) has switched from /k/ to /x/ as the representative phoneme.

[7] It seems unlikely that the [k] uttered by Blust’s lone informant is idiolectal. It remains a mystery why Harry Lopa would have uttered [k] at all, let alone the 51 times he produced it in the small dataset that was elicited from him.

Oceanic language. The diachronic details of rhotic backing are not known for Wuvulu, but a plausible sequence is [r] > [ɣ], followed by a change in manner, [ɣ] > [g] adjacent to a high vowel and [ɣ] > [x] elsewhere. It is outside the scope of this analysis to speculate further on the details of rhotic backing in Wuvulu.

One of the crucial arguments of this paper is that /r/ is perhaps the best candidate for the phoneme that underlies [r], [x], and [g]. There are three arguments in support of /r/: (1) the existence of the variant [r] in synchronic dialects of Aua and Wuvulu wherever [x] or [g] can occur, (2) the correspondence of Proto Oceanic *r with [x] and [g] in synchronic Wuvulu, and (3) the borrowing of [r] from Tok Pisin and English as Wuvulu [x] and [g].

The first argument for /r/ is that in the Aua dialect, [r] is produced in the same environments in which [x] and [g] are produced in Wuvulu dialects. For example, /rufu/ ‘village’ is pronounced [rufu] in the Aua dialect and [gufu] in Wuvulu dialects. (Variants are /warea/ ‘speak’ as [warea] and [waxea] in dialects from Aua and Wuvulu, respectively.) As mentioned previously, elderly Wuvulu speakers and Aua speakers of all ages still produce alveolar trilled [r] in environments in which [x] and [g] occur in Wuvulu dialects.

A second reason for considering /r/ is that historical support for /r/ is found in the following data from Blust 2008:290–92.

Proto Oceanic		Blust data
*rua ‘two’	>	*gua*
*mariri ‘cold’	>	*magigi*
*muri ‘stern of canoe’	>	*mugi*
*raun ‘leaf’	>	*xauna*
*rato ‘whale’	>	*xaʔo*
*rodom ‘dark’	>	*xoxo*

The above data show *r > velar obstruent ([g] adjacent to a [+hi] vowel and [x] elsewhere).

The third argument in favor of /r/ as the phoneme of [x] and [g] has to do with the manner in which Wuvulu borrows words from English and Tok Pisin (TP). Wuvulu borrows [r] from these languages as [g] if adjacent to a high vowel, or as [x] elsewhere. TP *meri* [mɛri] ‘female’ is borrowed as [mɛgi], TP *kakaruk* [kakaruk] ‘chicken’ is borrowed as [ʔaʔaxo], and English *truck* is borrowed as [taxaʔa]. (Note also the borrowing of [k] as [ʔ] in *truck*.)

5. A CHALLENGE TO PHONOLOGICAL THEORY. We now return to the question of phonetic motivation for the complementation [g] adjacent to a [+hi] vowel and [x] elsewhere. Blust (2008) asked why vowel height would be a conditioning environment for the allophones [x] and [g]. The argument was that on the on the one hand, a high vowel favors the less sonorant voiceless consonant [x] over [g], but on the other hand, a high vowel favors [g] over [x] for reasons of stricture. Scalar feature values <+feature> were utilized, rather than conventional binary values [+feature], allowing for finer distinctions of sonority and constriction among the vowels. The five vowels are grouped into two stricture classes, where ‘+’ and ‘-’ refer to scalar values of ‘more’ and ‘less’, respectively (from Blust 2008:285):

[i], [u] =	<+constricted>	[o], [a], [e] =	<–constricted>
	<–sonorant>		<+sonorant>

Blust pointed out that although vowel height correlates well with theoretically expected differences of manner, it does not correspond with expected differences of voicing. This conundrum can is resolved on a language-specific basis. Although stops are less sonorous than fricatives, a given language may choose to treat either the voiced stop or the voiceless fricative as ‘more sonorous’.

The correlation of consonantal stricture features with adjacent vowel height could also be applied to allophones of /l/ where [d] surfaces whenever /l/ is adjacent to a high vowel. Data include /*manufilufilu*/ ‘bird’ > [manufidufidu], /*ali*/ ‘to pull upward’ > [adi], /*lifo*/ ‘tooth’ > [difo]. The generalization is that /l/ and /r/ are non-continuant adjacent to a high vowel and continuant

before a non-high one.

6. CONCLUSION. An important conclusion of this paper is that the phone [k] does not participate in the allophony of the velar obstruents and that /k/ should not be considered as candidate phoneme for the velars. Language data suggest that historical *k has merged with [ʔ].

Another conclusion of this research is that /r/ is the phoneme that underlies the allophones [x] and [g]. Of the previous inventories, only the German linguists gave /r/ phonemic status (but they problematically also included /g/). The alternation of [r] with [x] and [g] in all dialects of the language and the historical trace of *r suggest /r/ as the best choice for the underlying phoneme rather than /x/, or worse, /k/. The association of [r] with [x] and [g] is also supported by evidence from borrowing. These conclusions lead to a nuanced explanation for the language data. This analysis also reviews an important theoretical question regarding the phonetic motivation for the conditioned alternations between voiced stops [g] and [d] adjacent to a [+hi] vowel with the corresponding continuants [x] and [l] elsewhere.

Blust's (2008) correlation between classes of vowels and velar consonants according to scalar values for the features <CONSTRICTED> and <SONORANT> also appears to work more generally for allophones of /l/ as well as those of /r/. However, since sounds patterns are ultimately related to the physical and perceptual constraints of human speech, one would expect these patterns to be recurrent cross-linguistically, as Ohala (1983:189) reminded us:

> To be sure we are dealing with sound patterns that are due primarily to these universal factors, it is necessary to look for them repeated in several unrelated languages.

It is possible that a cross-linguistic pattern will emerge that correlates stricture features of vowels and consonants. True *recurrence* would involve the stopping of a continuant adjacent to high vowels (or the devoicing of a fricative without devoicing of the corresponding stops), though it is not necessary that the alternation involve the same obstruents found in Wuvulu ([x] and [g]).

REFERENCES

BLUST, ROBERT. 1978. *The proto-Oceanic palatals*. Memoir No. 43. Wellington: The Polynesian Society.

BLUST, ROBERT. 1996. The linguistic position of the Western Islands, Papua New Guinea. In *Oceanic studies*: *Proceedings of the First International Conference on Oceanic Linguistics*, ed. by John Lynch and Fa‘afo Pat, 1–46. *Pacific Linguistics Series* C-133. Canberra: Pacific Linguistics.

BLUST, ROBERT. 2008. A reanalysis of Wuvulu phonology. *Oceanic Linguistics* 47(2):275–93.

CROWLEY, TERRY. 1997. *An introduction to historical linguistics*. Auckland: Oxford University Press.

DEMPWOLFF, OTTO. 1904. Über aussterbende Völker. (Die Eingeborenen der ‘Westlichen Inseln’ in Deutsch Neu-Guinea). *Zeitschrift für Ethnologie* 36:384–415.

GOLDSTEIN, BRIAN A., and AQUILES IGLESIAS. 1996. Phonological patterns in normally developing Spanish-speaking 3- and 4-year-olds of Puerto Rican descent. *Language, Speech, and Hearing Services in Schools* 27:82–90.

HADEN, ERNEST F. 1955. The uvular /r/ in French. *Language* 31(4):504–10.

HAFFORD, JAMES A. 2007. Wuvulu phonology. Unpublished paper for Linguistics 699, supervised by Robert Blust, University of Hawai‘i at Mānoa.

HAMBRUCH, PAUL. 1908. Wuvulu und Aua (Maty- und Durour-Inseln). *Mitteilungen aus dem Museum für Völkerkunde*, 2/1. Hamburg: Lucas Gräfe & Sillem.

LEWIS, M. PAUL (ed.). 2009. *Ethnologue: Languages of the world*, 16th edition. Dallas: SIL International.

LYNCH, JOHN; MALCOLM ROSS; and TERRY CROWLEY. 2002. *The Oceanic languages*. Curzon Language Family Series. Richmond: Curzon Press.

OHALA, JOHN J. 1983. The origin of sound patterns in vocal tract constraints. In *The production of speech*, ed. by Peter F. MacNeilage, 189–216. Berlin: Springer-Verlag.

ROSS, MALCOLM D. 1988. *Proto Oceanic and the Austronesian languages of Western Melanesia*. Pacific Linguistics C-98. Canberra: Australian National University.

THILENIUS, GEORG. 1903. Ethnographische Ergebnisse aus Melanesien: Die westlichen Inseln des Bismarck Archipels. *Abhandlungen der Kaiserlichen Leopoldisch-Carolinischen Deutschen Akademie der Naturforscher* 80:103–406. Halle: Ehrhardt Karras.

WHITLAM, JOHN; VICTORIA DAVIES; and MIKE HARLAND. 1997. *Harper Collins Portuguese dictionary*. Glasgow: Harper Collins Publishers.

Z’GRAGGEN, JOHN A. 1975. Comparative wordlists of the Admiralty Islands languages. Collected by William E. Smythe. *Working Papers in Papua New Guinea Languages* 14:117–216.

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