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## A seemingly on-going sound change in Takuu language of Papua New Guinea: historical and theoretical implications\*

The Takuu language of Papua New Guinea shows both the lateral [l] and the flap rhotic [r] as regular reflexes of Proto-Nuclear-Polynesian \*l. Older speakers tend to pronounce it closer to [r] and younger speakers closer to [l]. This situation is likely to be described as a sound change in progress ( $r \rightarrow l$ ). However, it is possible to show that distribution of [l] and [r] is predictable, depending on strictly defined phonological environments and the age of the speaker. Thus, a seemingly on-going sound change turns out to be a series of seven different related sound changes which trigger each other. The closely related languages Nukeria and Nukumanu whose speakers maintain close contact with Takuu show only a part of the Takuu distributional patterns for liquids; in these cases we probably deal with shared sound changes that have recently originated in one of the languages. Intricate distributions involving laterals and rhotics on one hand and fricatives on the other are characteristic of Polynesian Outliers. The author suggests that distributions of this kind are responsible for irregular reflexes of Proto-Polynesian liquids and fricatives in modern Polynesian languages.

*Keywords:* sound change in progress, irregular sound changes, shared phonological innovations, theory of sound change, geminate consonants, liquid consonants, Polynesian languages, Polynesian Outliers, Takuu language of Papua New Guinea.

*Aller Lautwandel, soweit er mechanisch vor sich geht, vollzieht sich nach ausnahmslosen Gesetzen, d.h. die Richtung der Lautbewegung ist bei allen Angehörigen einer Sprachgenossenschaft, außer dem Fall, daß Dialektspaltung eintritt, stets dieselbe, und alle Wörter, in denen der der Lautbewegung unterworfenen Laut unter gleichen Verhältnissen erscheint, werden ohne Ausnahme von der Veränderung ergriffen.*

Hermann Osthoff und Karl Brugmann (1878), *Morphologische Untersuchungen auf dem Gebiete der indogermanischen Sprachen*. Band I. Hildesheim. S. XIII.

Takuu is a Polynesian Outlier spoken in the Autonomous Region of Bougainville, Papua New Guinea. Despite the turbulent history of the island, 12 Takuu survivors at the beginning of the

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\* Friends, colleagues and accidental strangers have all contributed to the uneasy birth of this study; I cannot mention all of them here. First of all, I would like to thank the people of Papua New Guinea who were always ready to help and make me feel at home on my way — Aruka Kareva, Brendon Wells, Edmond Teppuri, Rumano Mahara and Tom Puaria. This work would not be possible without the help of Claire Moyse, Maria Gaida, Nico Daams, Richard Feinberg, Ross Clark, Vladimir Belikov and many others. I am very grateful to Evgenia Korovina and William Wilson for their comments on a preliminary version of the paper. The field research has been supported by the Foundation for Fundamental Linguistic Research (2012) and by the Program of strategic development of the Russian State University for the Humanities (2013).

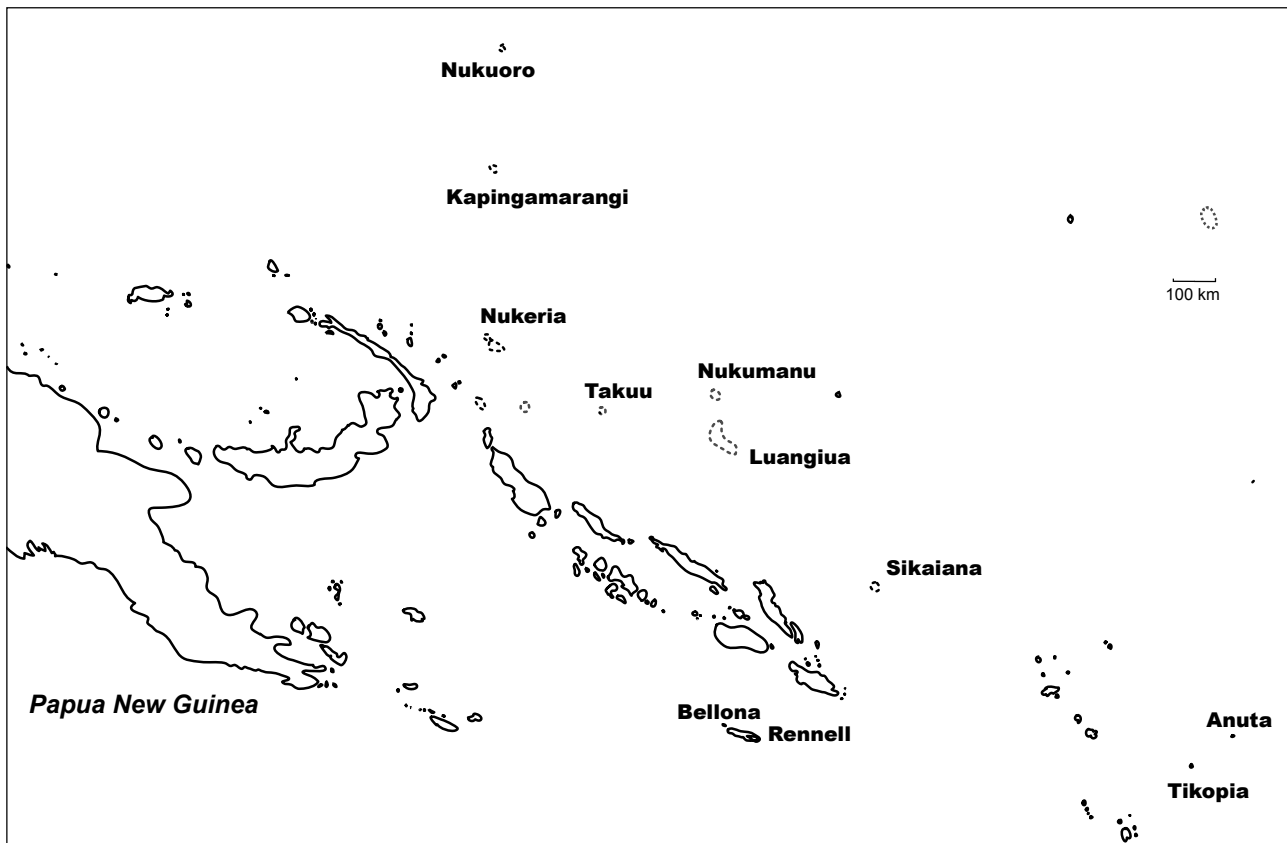


Figure 1. Map of Near Oceania. Captions indicate locations of the Polynesian Outlier languages mentioned in the text. Drawing by the author.

20<sup>th</sup> century had managed to keep their indigenous language and traditional practices alive. In the historical, cultural, and geographical aspects Takuu is particularly close to Nukeria and Nukumanu Polynesian Outliers of Papua New Guinea (Map 1)<sup>1</sup>. Since the Takuu chose to ban Christian churches and missionaries in the 1960s, it is probably the last community where traditional Polynesian religion is still openly practised. Nowadays, the number of speakers is approximately 2000 and Takuu’s social community is spread widely throughout Papua New Guinea; some 500 of them live on the atoll itself.

Since 1995, Richard Moyle has published a number of papers and three monographs on Takuu culture and language, based on his field research. His recent book became the first description of the language which includes a dictionary and a brief grammatical sketch (Moyle 2011). In Takuu, both [l] and [r] represent reflexes of Proto-Nuclear-Polynesian \*l. Here are some examples from my first Takuu wordlist that I collected on Buka (for Proto-Polynesian reconstructions see Greenhill and Clark 2011).<sup>2</sup>

[hua'rooroa]	‘long (of rope)’	← pNP *loa
[i'loa]	‘to know’	← pNP *ʔiloa

<sup>1</sup> I use the term “Nukeria”, since my consultants insist that it is the correct name of their language. According to them, “Nukuria” is a word from the “trade language”, which is what they call a language variety that Takuu, Nukeria and Nukumanu speakers use when they gather together.

<sup>2</sup> I make use of the following abbreviations: caus. = ‘causative’, dem. = ‘demonstrative’, dl. = ‘dual’, freq. = ‘frequentative’, imper. = ‘imperative’, indep. = ‘independent (of pronoun)’, pass. = ‘passive’, pl. = ‘plural’, pron. = ‘pronoun’, sg. = ‘singular’, syn. = ‘synonym’ (see Moyle 2011: ix-x).

[kere'kere]	'earth'	← pNP *kele
[kiri]	'bark (of tree)'	← pNP *kili
[laa]	'the Sun'	← pNP *laʔa
[laakau]	'tree'	← pNP *laʔakau
[le'llere]	'flying (of birds)'	← pNP *lele
[lua]	'two'	← pNP *lua
[ma'rama]	'the Moon'	← pNP *malama
[piso'uru]	'head'	← pNP *ʔulu
[raa]	'that'	← pNP *laa
[rima]	'hand'	← pNP *lima
[rua]	'hole'	← pNP *lua
[tee'laa]	'that (dem. indep.)'	← pNP *teela

Richard Moyle describes this situation as a change in progress. However, he writes that not all speakers agree that the two sounds are in free variation, with some insisting that only [l] is acceptable in some words, e.g. [laatou], [lonono], [luu], [moli]. There are instances where the shift from [l] to [r] has affected only part of the word, so that some may contain both *l* and *r*, e.g. [laro] and [la'rana]. Some use [r], but others believe that use of [l] in certain words is the 'correct' pronunciation of those words (Moyle 2011: 8–9). While working with Takuu speakers in 2013, I was puzzled by the same questions. Subsequently, this paper offers the results of my attempts to solve the Takuu 'linguistic challenge'.

First, I will make a brief sketch of Takuu phonology. Then I will describe the system of Takuu geminate consonants, a necessary pre-requisite for discussion of Takuu liquids. After that I will try to define and chronologically order the distributional patterns for Takuu liquids. Later, I will look for similar phenomena in genetically related languages, and finally, I will discuss the implications of my findings for Polynesian linguistics and theory of sound change in general.

### Takuu phonology

Takuu has relatively few distinctive phonological units in its phonemic inventory. However, both consonant and vowel geminates are attested in the language.

Table 1. Inventory of distinctive segments.

p	t	k	pp	tt	kk
m	n		mm	nn	
f~h	s		ff	ss	
v	l, r		vv	ll	
i		u	ii		uu
e		o	ee		oo
	a			aa	

Like most other Polynesian languages, Takuu shows some allophonic variation conditioned by phonological environments. The velar /k/ is sometimes realised as dorso-uvular [q]

in the context of the non-front vowels /a/, /o/ and /u/. In isolation the final monomoraic middle vowels /e/ and /o/ are raised and pronounced close to the corresponding high vowels [i] and [u], e. g. [koi] /koe/ ‘2nd person, sg.’, [namu] /namo/ ‘lagoon inside a reef’, etc.

According to Richard Moyle (2011: 8), there are widely differing opinions on whether [f] and [h] could be seen as free variants in Takuu, e.g. [faa'faa ~ haa'haa] ‘to touch with hand’, [fare ~ hare] ‘house’, [afi'afi ~ ahi'ahi] ‘evening’. For a small number of words, individual speakers insist that only [f] is acceptable, e.g. [fe'tuu] ‘star’. However, there appears to be no agreement as to what those words are. According to my consultant, [h] is the only acceptable pronunciation of the non-geminate consonant and [ff] is the only acceptable pronunciation of its geminate counterpart (my principal Takuu consultant is male and about 50 years old).

Takuu resembles most other Polynesian languages in allowing only open syllables and prohibiting consonant clusters, although vowel sequences appear to be unrestricted. The only permitted consonant cluster [nt] is found in the intervocalic pre-stressed position, e.g. [kan'tua ~ kana'tua] ‘back (of the body)’, [pon'tau ~ pono'tau] ‘large box-like logs drifted on to the island long time ago; as soon as they touched land, they opened up and warriors (*masaurani* spirits) got off and attacked the islanders (mythical)’, [man'tee] ‘Monday’ and [san'tee] ‘Sunday’.

Primary stress falls on the penultimate vocalic mora; secondary stress is placed on every second mora to the left of the stressed mora. This implies that long vowels are sequences of two identical short vowels, so that long vowels do not constitute independent phonological segments, cf. [mano] ‘ten thousand’ and [ma'noo] ‘shark, generic’, [a'rooha] ‘compassion’ and [aro'ffaa] ‘underside of chin’, etc. Note that long and short vowels do not show differences in quality, and a long vowel is acoustically almost twice as long as its short counterpart. However, the ‘non-past’ verbal particle /e/ is lengthened before a bimoraic word except for words which contain geminate consonants resulted from vowel deletion (see below); this is in contradiction with suggested analysis. Grammatical particles are mostly unstressed, even if they contain a long vowel.

### Takuu geminate consonants

Every Takuu consonant possesses its geminate counterpart. The bulk of apparent minimal pairs for geminate consonants is explicitly attested. Importantly, in Takuu a lexical word is always attested as part of either a noun phrase or a verb phrase, that is to say, following either determiners or tense-aspect-mood markers. Therefore, only noun phrases and verb phrases as a whole can be considered as minimal pairs. Because of this, below I list examples of shortest possible natural phrases, i. e. including the articles *te* ‘definite, sg.’, *naa* ‘definite, pl.’, verbal markers, and so on.

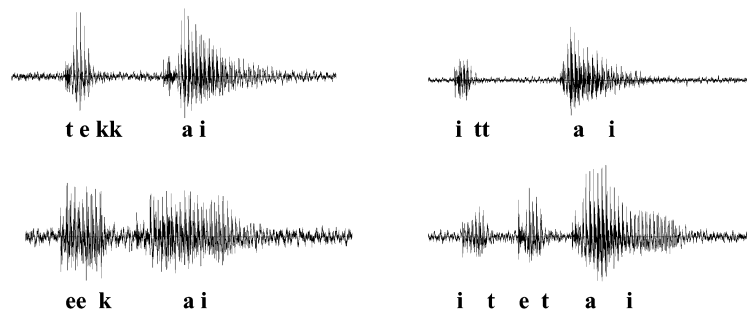


Figure 2. Oscillograms of Takuu minimal pairs with contrasting plain and geminate consonants (Speech Analyzer 3.1; one-second intervals): [te'kkai] ‘the tale’, [ee'kai] ‘he eats’, [i'ttai] ‘on the shore (short form)’, [i'tet'ai] ‘on the shore (long form)’. Additional Takuu oscillograms and spectrograms can be found in on-line supplementary materials.

[te 'paa]	'pearl oyster'	[te 'ppaa]	'flat rock'
[naa 'taa]	'styles of canoe design'	[naa 'ttaa]	'bailers (of canoe)'
[naa 'kai]	'food, tubers'	[naa 'kkai]	'fables'
[te 'nehu]	'a kind of fish, used for bait'	[te 'nnehu]	'stonefish'
[ee 'miti]	's/he dreams'	[e 'mmiti]	'he sucks (his mother's breast)'
[naa 'vare]	'slime (of fish)'	[naa 'vvare]	'drunkards'
[ee 'haa]	'four'	[ee 'ffaa]	'(an egg) hatches'
[te 'sura]	'hole (in a net)'	[te 'ssura]	'slater'
[te 'luu]	'a type of song'	[te 'lluu]	'sheltered area'
[te 'ria]	'nit'	[te 'llia]	'edible shellfish sp.'

### Phonological contexts where geminate consonants are attested

Although double consonants are frequent, they are attested in contexts that are predictable either from the grammatical or the historical points of view.

**Rule 1.** Double consonants occur in words with initial /t/ that follow the definite article /te/. The /e/ in /te/ is elided and the initial /t/ of the following word is doubled. Both forms are found in free variation.

[te 'tama ~ 'ttama]	'the person'
[i te 'tai ~ i 'ttai]	'in the sea'
[te 'tono ~ 'ttono]	'the mangrove'
[te 'tuna ~ 'ttuna]	'the moray eel'
[te tee'voo ~ ttee'voo]	'the table'
[te ti'pua ~ tti'pua]	'the spirit'

**Rule 2.** Similarly, the specifier particle /ko/ and the particle /soko/ 'alone' behave the same way in combination with the personal pronouns /koe/ '2nd sg.', /koorua/ '2nd dl.' and /kootou/ '2nd pl.'

[ko 'koe ~ 'kkoe]	'you (sg.)'
[soko koo'rua ~ sokkoo'rua]	'only you (dl.), yourselves (dl.)'

**Rule 3.** Similarly, ['tonu] 'directly, very' yields [i loto 'tonu ~ i lo'ttonu] 'in the centre (of)', if combined with ['loto] 'inside'.

**Rule 4.** The 'causative, simulative' suffix /haka-/ is optionally shortened to /hak-/ before stems which begin with /k/, resulting in a geminate.

[kaa] 'sharp' →	[ha'kkaa ~ haka'kaa] 'to sharpen'
[kanu] 'pattern' →	[ha'kkanu ~ haka'kanu] 'to decorate with a pattern'
*faka-kii 'throat' (lit. 'causing to speak') →	[ha'kkii ~ haka'kii] 'larynx'
*kupu 'south (wind)' →	[a'nake ha'kkipu ~ a'nake haka'kipu] 'south-east wind direction' (syn. ['kipu ha'kaa'nake])
[koro'koro] 'long straight lines in the sky' →	[ha'kkoro ~ haka'koru] 'to gather (of clouds)'

[kohu] ‘smoke (as seen from far away)’ →	[ha'kkohu ~ haka'kohu] ‘to burn smth. so as to produce smoke’
[kuru'miti] ‘to crave for food’ →	[hakkurumi'tia ~ hakakurumi'tia] ‘to be forced to crave for food, pass.’

The word *hakkaa'toa* ‘completely’ is not accepted in its non-reduced form which contrasts with the etymologically related word *hakkaa'toa ~ hakakaa'toa* ‘to complete’. It is the only word for which an expanded form is not attested.

**Rule 5.** In Takuu most verbs agree in number with their plural subjects by reduplicating the penultimate syllable of the stem. When the syllable is reduplicated, the vowel is elided, forming an initial consonant. However, among older speakers the syllabic reduplication is sometimes retained (cf. Moyle 2011: 11–12).

[e a'puru] ‘(it) sinks’	[e a'ppuru] ‘(they) sink’
[ee 'keri] ‘(he) digs’	[e 'kkeri] ‘(they) dig’
[ee 'mori] ‘(he) is slow’	[e 'mmori] ‘(they) are slow’
[e ma'nia] ‘(he) is slippery’	[e ma'nnia] ‘(they) are slippery’
[ee 'vusu] ‘(he) boxes’	[e 'vvusu] ‘(they) box’
[ee 'horo] ‘(he) swallows’	[e 'fforo] ‘(they) swallow’
[e ma'sike] ‘(he) stands up’	[e ma'ssike] ‘(they) stand up’
[e ka'rana] ‘(he) calls out’	[e ka'llana] ‘(they) call out’

**Rule 6.** To indicate repeated action, the final two syllables of the word are reduplicated. With plural subjects, there is double reduplication (cf. Moyle 2011: 11–12).

[ee 'kata] ‘(he) gives a laugh’	[e kata'kata] ‘(he) laughs (repeatedly)’
[e 'kkata] ‘(they) give a laugh’	[e kata'kkata] ‘(they) laugh (repeatedly)’
[ee 'toro] ‘(he) collects shellfish (one)’	[e toro'toro] ‘(he) collects shellfish (repeatedly)’
[e 'ttoro] ‘(they) collect shellfish (one)’	[e toro'ttoro] ‘(they) collect shellfish (repeatedly)’
[ee 'hatu] ‘(he) composes (a story)’	[e fatu'fatu] ‘(he) composes stories (repeatedly)’
[e 'ffatu] ‘(they) compose (a story)’	[e fatu'ffatu] ‘(they) compose stories (repeatedly)’

**Rule 7.** There are no  $C_1V_1C_1V_1$  words attested in Takuu, but  $C_1C_1V_1V_1$  words are common. It is easy to see that  $C_1C_1V_1V_1$  words are derived from Proto-Polynesian  $C_1V_1C_1V_1$  words<sup>3</sup>.

[k'kii] ‘food eaten with another food as relish’	← *kiki id.
[l'lee] ‘fly (of birds), swim (of fish)’	← *lele id.
[m'mii] ‘urinate, urine’	← *mimi ‘urinate’
[n'noo] ‘brown noddy ( <i>Anous stolidus</i> )’	← *ŋoŋo id.
[p'pee] ‘butterfly (generic)’	← *pepe id.
[t'too] ‘blood’	← *toto id.
[s'sii] ‘edible shellfish sp.’	← *sisi ‘univalve shellfish’

<sup>3</sup> C stands for any consonant; V stands for any vowel.



Moreover, singular subject and plural subject frequentative verb forms show that in derivation Rule 5 “ $C_1V_1C_1V_1C_2V_2 > C_1C_1V_1C_2V_2$ ” precedes Rule 6 “ $C_1V_1C_1V_1 > C_1C_1V_1V_1$ ”.

[hakale'llere], not [hakallee'llee]	‘fly (a kite)’
[ttoto], not [to'ttoo]	‘bleed, be bloody’
[hakanu'nnunu], not [haka'nnuu'nnuu]	‘continually making a rumbling sound (as of a stomach), cf. 'nnuu ‘make a whirring or vibrating noise, whimper’

Cf. also: [no'nnono] ‘human brain’ ← \*lolo ‘brain matters’.

Note that compound words with  $C_1V_1C_1V_1$  sequences do not follow this rule.

[hana'papa], not [hana'ppaa]	‘inedible mollusc sp.’, cf. [ppaa] ‘pearl oyster’
[kakaamata], not [kkaamata]	‘to begin, freq.’, cf. [kaamata] ‘to begin’
[maa'sisi], not [maa'ssii]	‘cigarette lighter (Tok Pisin)’
[pepe'au], not [ppee'au]	‘foam on the sea, suds’, cf. [pe'au] ‘wave’

$C_1V_1C_1V_1$  sequences are permitted if followed by two or more syllables, which is only possible in compounds, derivations and loans. In such contexts, they are not transformed into double consonants.

[akaka'ssia], not [akkaa'ssia]	freq., pass. from [aa'kasi] ‘to kick’
[koko'rosi], not [kkoo'rosi]	‘cockroach’
[pupu'kau], not [ppuu'kau]	‘whole coconut shell with a small hole but without meat’
[rurupe'ia], not [lluupe'ia]	‘fish sp.’

Rules 2 and 3 are similar to Rule 5, but involve grammatical words rather than derivational morphemes. Rules 1–5 (with minor variations) but *not* Rule 6 are also found in Kap-ingamarangi (Lieber, Dikepa 1974), Nukeria and Nukumanu (author’s own fieldwork data of 2013), Nukuoro (Carroll, Soulik 1973), Sikaiana (Donner 1987) and Tuvalu (Milner 1958, Besnier 2000). Remarkably, Luangiua shows reduced vowels rather than double consonants in the above-listed contexts (Salmond 1974: 223)<sup>4</sup>.

### Do geminate consonants represent independent phonological segments in Takuu?

It is evident that double consonants occur under easily recognisable conditions in Takuu, even though many apparent minimal pairs for geminate consonants are attested in the language. Moreover, we can formulate a general rule: elision of the vowel happens in certain environments which favour vowel reduction, such as the definite article *te*, the pre-stressed vowel and the causative suffix *haka*.<sup>5</sup> Grammatical and phonological descriptions of the language would benefit from an analysis of double consonants as surface representation of underlying sequences

<sup>4</sup> Anna Salmond defines these vowels as devoiced, but transcribes them as [ə].

<sup>5</sup> Even Hovdhaugen (1992) reports on extra-short vowels of partially reduplicated syllables in Samoan.

of phonemes rather than independent phonological segments. A few  $C_1C_1V_1V_1$  and  $C_1C_1V_1C_2V_2$  Takuu words can be understood as underlying  $C_1V_1C_1V_1$  and  $C_1V_1C_1V_1C_2V_2$  sequences.

['ffine] 'woman'	← pNP * <i>fafine</i> , cf. [haa'hine] 'women'
['lloo] 'coconut cream'	← pNP * <i>lolo</i> id.
['vvee] 'grass, lawn'	← pNP * <i>wewe</i> 'rubbish, refuse'

The majority of  $C_1C_1V_1C_2V_2$  verbs have a frequentative or intensive semantic aspect.

['kkiva] 'be shiny'	cf. [kiva'kiva] 'id., freq.'
['mmaha] 'be heavy'	cf. [hakamaha'mmaha] 'imper. freq. caus.'
['vvoro] 'to stab through, hurl (a spear)'	cf. [voro'sia] 'id., pass.'

Again, in case of verbs it is possible to find derived and etymologically related forms which show consonants separated by vowels rather than geminated.

According to Richard Moyle (2011: 7), whereas most Takuu speakers utilise double consonants, a very small number of people pronounce the same words with a vowel between those consonants: [sa'samu] rather than ['ssamu] 'beat'. My own consultants pronounced a couple of words with non-geminated consonants: [na'nahu] rather than ['nnahu] 'ashes', but cf. pNP \**gaa-lafu* 'charcoal'. The same happened to my Nukeria consultants: [hi'hipa] 'a sea creature similar to jellyfish' rather than [hhipa], [ro'roi] 'to prepare food with coconut cream' rather than [rroi], etc. and my impression is that non-geminated forms are used for words which a particular speaker has not used for many years; in trying to remember such words, people always remember the expanded, or, more accurately, the underlying forms.

Expanded forms also occasionally occur in songs (see also Moyle 2011: 7).

['nono]	poetic for ['nnoo] 'noddy'
['lele]	poetic for ['llee] 'to fly'
['ki'kila]	poetic for [saa'kila] 'to look or glance once out of the corner of one's eye'

The same phonetic process is found in traditional Nukeria songs, including songs in fables (author's own fieldwork data of 2013). Three alternative explanations for this poetic lack of gemination can be offered. First, expanded forms are outwardly archaic, corresponding to their Proto-Polynesian forebears. Second, they can provide an additional syllable when one is required to fill up a prescribed duration for a poetic line. Third, double consonants are not perceived when sung; consequently, the double consonant words would become incomprehensible in songs. Another phonetic marker of the Takuu poetic language is that [a] vowels frequently, but not identically or consistently, shift to [o] (Moyle 2007: xxi). The same [a] to [o] shift is attested in Nukumanu (Johnstone, Feinberg 2006) and Nukeria songs (author's own fieldwork data of 2013).

To sum up, geminated consonants do not have phonemic status in Takuu, Nukeria, Nukumanu and Sikaiana, though Takuu is on the verge of incorporating geminated consonants in its phonological system, since the geminate counterpart of [r] is [ll] and the geminate counterpart of [h] is [ff]. In Nukeria, Nukumanu and Sikaiana all single and double consonants show the same quality; acoustically they differ in duration only. The fact that Takuu geminate consonants are twice longer as their plain counterparts also supports the suggestion that geminate consonants do not represent independent phonological segments. Note that the 'non-past' verbal particle /e/ is lengthened before  $C_1VC_2V$  bimoraic words, but not before  $C_1C_1VC_2V$  bimoraic words resulted from deletion of a vowel between two identical consonants.

No borrowings show double consonants, but this may be an accidental gap in the lexicon, since double consonants are expected in words with the structure  $C_1V_1C_1V_1C_2V_2$  and  $C_1V_1C_1V_1$ .

### Distributions of Takuu liquids

According to my principal consultant, younger speakers do not pronounce the [r] words correctly, they tend to substitute [r] for [l] everywhere. He also mentioned that a few elders on Takuu pronounce [r] everywhere. It is difficult to verify these statements. Below I will discuss the data that I have gathered with my consultant and the data from Richard Moyle's dictionary (2011). Moyle (2011: 8–9) writes: "Since [h] and [r] are the dominant forms, I have entered all these forms under those letters, listing as variants those words for which [f] or [l] are claimed by some Takuu to be more correct". My consultant is male and about 50 years old; I assume that Moyle's principal consultants were of the same age sex group. I was unable to find a minimal pair contrasting [l] and [r] in the speech of the same speaker, but I did find one example in Moyle 2011: [lau] 'leaf, sg.' ~ [rau] 'leaf, pl.'. My consultant, however, asserts that both pronunciations [lau] and [rau] are correct.

Moyle (2011: 8–9) also mentions that some speakers use [f] and [l] as opposed to [h] and [r] in certain words as a means of emphasis, being quite aware that this differs from common usage. I have not studied or observed any such use of geminate consonants.

Remarkably, in Takuu [ll] is the only geminate counterpart for both [l] and [r] (see above). Geminated consonants are less susceptible to sound changes in comparison with their plain counterparts; for example, Takuu  $ffV_1$  corresponds to Proto-Polynesian  $*fV_1fV_1$ , while Proto-Polynesian  $*fV_1C_1V_1$  corresponds to Takuu  $hV_1C_1V_1$ , although some speakers accept both variants. Thus, it is possible to suggest that [ll] reflects an archaic realisation of the segment. This reconstruction is hypothetical, but it should be noted that Takuu [l] and [r] derive from Proto-Polynesian  $*l$  [Biggs 1978; for a recent summary on the question see Marck 2000: 120–124, 237–247]. The exact phonetic realisations of Proto-Polynesian  $*l$  and  $*r$  are subject to speculation. However, it is true that a sound change like  $/r/ \rightarrow \emptyset$  is more natural and common in comparison with  $/l/ \rightarrow \emptyset$ . This is an argument in favour of the widely accepted reconstructions for Proto-Polynesian  $*l$  and  $*r$ , since  $*r$  becomes  $\emptyset$  in Tongan and Niue, while in Nuclear Polynesian languages  $*r$  merges with  $*l$ . Richard Moyle (personal communication, 2014) has mentioned to me that in the 1994–2009 period there were fewer than ten people on Takuu, all of them elderly, who regularly used [f] and [l].

Rule 1:  $*l \rightarrow r$ ,  $*ll \rightarrow ll$ .

It should be noted that the sound change  $r \rightarrow l$  and vice versa is one of the most common types of sound change found in the world's languages and one that is quite easily explained from the physiological point of view.

According to my consultant, the following items are not subject to variation: [hakale'llere] 'to try to fly (a kite)', [le'llee] 'swimming about (pl.)', [lea'llea] 'be possessed by a spirit (freq.)', [hakali'lliri] 'to tease', [hakalu'lluru] 'to take shelter (pl.)', [matali'lliri] 'versatile', [lo'llosi] 'protect (pl.)', cf. [roo'rosi] 'id. (sg.)', etc. In other words, the segment agrees with the following double consonant in the derived form.

Rule 2:  $*rV_1llV_1V_1 \rightarrow lV_1llV_1V_1$ ,  $*rV_1llV_1rV_1 \rightarrow lV_1llV_1rV_1$ .

This sound change is natural and can be described as assimilation, induced by a kind of lateral harmony spreading leftwards in the word.

Sometimes, the same root shows different realizations of the segment in derived forms and compounds. Sometimes, the same root shows two different liquids.

- [ee 'lua] 'two', but [sinahuru maa rua] 'twelve (10 + 2)', [matarua maa 'rua] 'twenty (2 × 10 + 2)'  
 [i 'laro] 'below'  
 [laa'raa] 'dorsal fin (of sharks)', reduplication  
 [laa'rona] 'pass., be supported'  
 [la'uru] 'hair (on one's head)'  
 [loto'roto] 'centre portion of a channel or passage through the reef which is unobstructed by rocks', reduplication

My informants accept [i 'raro], [raa'raa], [raa'rona], [roto'roto], [ra'uru], but not [ee 'rua]. This may be a hint that realisation of the segment depends on its position within the word and on the quality of the accompanying vowel. A statistical analysis of the lexical entries in Moyle's dictionary allows to formulate the following rules (the reason for separating Rule 3 from Rule 4 is given below):

Rule 3: \*r → l /#\_a.

Rule 4: \*r → l /#\_o.

	li	ri	le	re	la	ra	lo	ro	lu	ru
/#_	9	51	7	33	183	65	64	24	6	47
/_#	1	265	5	202	51	235	47	178	1	196
totals:	10	316	12	235	234	300	111	202	7	243

Some of the examples are as follows:

- [rima] 'arm, hand'  
 [riri'aki] 'to swing on a swing'  
 [rehu'rehu] 'small rain cloud'  
 [rei] 'whale tooth'  
 [rue] 'men's dance type'  
 [rutu'rutu] 'tree sp.'

A number of words that contain final syllables *-la* and *-lo* violate Rule 3. However, the appearance of such syllables depends on the vowel that they follow.

	i_	e_	a_	o_	u_	_#
li	9	0	19	4	1	1
le	22	3	13	1	0	5
la	109	64	26	2	6	51
lo	146	47	6	16	3	47
lu	10	2	4	0	7	1