

The Segmental Sound Patterns of Rapanui*

(1) Phonetic description of 13 surface consonants

	Labial		Dental		Alveolar		Palatal		Velar		Glottal
	+voi	-voi	+voi	-voi	+voi	-voi	+voi	-voi	+voi	-voi	-voi
Stop		[p]		[t]						[k]	[ʔ]
Aff						[ts]					
Fric	[β]					[s]	~	[ç]			[h]
Nas	[m]		[n]						[ŋ]		
Tap					[ɾ]						

Three of the surface consonants are marginal in the language - [s]~[ç] and [ts]. These are found only in loan words (mostly from Spanish) and will be ignored for the moment. I will come back to them at the end of the squib. This leaves just 10 native contrastive consonants.

(2) Phonetic description of 10 contrastive consonants

	Bilabial	Dental	Alveolar	Velar	Glottal
Stop	[p]	[t]		[k]	[ʔ]
Fric	[β]				[h]
Nas	[m]	[n]		[ŋ]	
Tap			[ɾ]		

(3) Phonetic description of 5 surface/contrastive vowels (ignoring length)

	Front	Central	Back/ Round
High	[i]		[u]
Mid	[e]		[o]
Low		[a]	

Syllable structure

The language has a very simple syllable structure, with no codas or clusters = CV, CVV

Vowel distribution

The vowels show very little variation. The changes that are found are restricted to prosodically motivated lengthening (not discussed) and epenthesis of [a] to break up consonant clusters in borrowings.

(4) [paratane] ‘Britain’

* Based on the description of Du Feu (1996). Rapanui is an Eastern Malayo-Polynesian language spoken on Easter Island (Isla de Pascua) in the South Pacific about 2,500 miles from the coast of Chile.

Vowel-vowel combinations

All vowels but [e] show co-occurrence restrictions. The following charts provide the distribution of vowels in vowel-vowel sequences as discussed by Du Feu (1996:185-186).

(5) VV sequences

	i	u	e	o	a
i	--	iu	ie	io	ia
u	ui	--	ue	--	ua
e	ei	eu	ee	eo	ea
o	oi	ou	oe	--	oa
a	ai	au	ae	ao	--

- A sequence of two identical vowels (except [ee]) is not allowed.
- A sequence of [uo] is not found.

When the illicit sequences would result from morpheme concatenation, a glottal stop is epenthesized between them.

Sequences of three adjacent vowels are limited to the following:

(6) VVV sequences¹

[aia]	maiare	‘luckless (of fisherman)’
[aua]	aua	‘fence’
[aea]	maea	‘stone’
[aui]	kauī	‘sew’
[kaue]	kaue	‘lasso’
[uau]	ruau	‘old woman’
[oai]	moai	‘statue’

Vowel behavior in morphology

The 12 grammatical morphemes composed of only a single vowel (summarized in De Feu, 1996: 6-8) are given in (7).

- (7)
- | | |
|-----|---|
| [e] | agentive, copul. coord., exclamation, numeral-quantity, state(verbal), vocative |
| [o] | disjunctive. coord., possessive, reply to vocative |
| [i] | past, relational particle |
| [a] | possessive, person singular |
| [u] | --- |

Note that [e] is most common and that [u] is never used as a separate morpheme.

¹ There are likely restrictions on vowel sequences based on prosodic structure. Not enough information is given in De Feu’s grammar. Full combinations of vowel sequences allowed in stressed and unstressed syllables are necessary. However, the prosodification of the above examples is as follows if we assume that the language builds a binary trochee at the right edge of the word: [mai(are)], [a(ua)], [ma(ea)], [ka(ui)], [ka(ue)], [ru(au)], [mo(ai)].

There are a number of morphemes exhibiting limited allomorphy involving [o]~[a].

- | | | |
|-----|---------------------------------|--------------------------------|
| (8) | [o]~[a] | possessive |
| | [mo]~[ma] | benefactive |
| | [no]~[na], [ʔo]~[ʔa], [ro]~[ra] | demonstrative postnominal |
| | [no]~[na] | limitative |
| | [ro]~[ra] | action (realized/non-realized) |
| | [to]~[ta] | spatial particle |

Vowel behavior discussed thus far leads to the following hypotheses:

- [a] is phonologically minimal because it is epenthetic in borrowings.
- [e] is phonologically minimal because 1) it occurs most frequently in grammatical morphemes, and 2) it is the only vowel allowed to appear in identical sequence.
- [a] and [o] differ minimally because they appear in several allomorph pairs.

Given the distribution of the vocalic segments and the tenets of the Parallel Structures Model, there are two likely interpretations of Rapanui vowels. These are given in (9) and (10). Note that there are segments composed of only a single feature and because there is no difference in place behavior between consonants and vowels (e.g. no vowel place harmony), only C-place features are necessary.

In (9), there are three phonologically high vowels distinguished by place, there is one phonologically mid vowel, and there is one phonologically low vowel. Neither the mid nor the low vowel has place.

(9) PSM feature chart for Rapanui vowels (option 1)

		C-place [lab]	C-place [cor]	V-manner [closed]	V-manner [open]
High	/e/			✓	
	/u/	✓		✓	
	/i/		✓	✓	
Mid	/o/			✓	✓
Low	/a/				✓

Option 2 in (10) differs from (9) in that there is no phonological mid vowel and there are two low vowels differentiated via place.

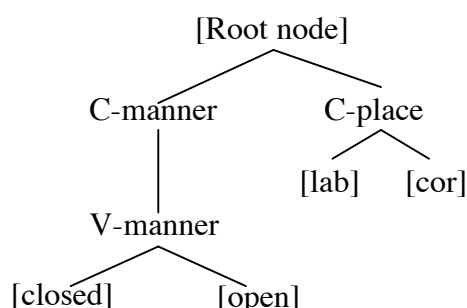
(10) PSM feature chart for Rapanui vowels (option 2)

		C-place [lab]	C-place [cor]	V-manner [closed]	V-manner [open]
High	/e/			✓	
	/u/	✓		✓	
	/i/		✓	✓	
Low	/a/				✓
	/o/	✓			✓

Both of these options captures the feature minimality of [e] and [a], and the similarity of [a] and [o]. I will choose the feature specifications in (10).

The fully specified representation compatible with both (9) and (10) is given in (11).

(11) Fully-specified Rapanui PSM Vowel Geometry



Consonant distribution and features

Recall the set of contrastive consonants.

(12) Phonetic description of 10 contrastive consonants

	Bilabial	Dental	Alveolar	Velar	Glottal
Stop	[p]	[t]		[k]	[ʔ]
Fric	[β]				[h]
Nas	[m]	[n]		[ŋ]	
Tap			[ɾ]		

Since there seem to be no restrictions on the occurrence of these segments (within the bounds of the syllable structure of the language), there seem to be only three means by which to establish the feature specification of each consonant - surface phonetic characteristics, principles of the PSM and lexical distribution/alternations (to be discussed).

The **phonetic characteristics** are fairly straightforward and will be discussed below.

One **principle of the PSM** says that every segment composed of a complex combination of features implies a segment composed of single features (or something to that effect).

Intervocalic [β], [ɾ] and [k] are all subject to **lexical substitution** by [ʔ]. This means that some words that have one of these three segments for some speakers have a glottal stop for other speakers. De Feu claims that this is lexical, not phonological, in nature and that it “does not appear to be an ongoing process.” That said, the similar behavior of these three segments might suggest that they form a class of some type that makes them susceptible to neutralization to glottal stop.

Using a combination of phonetic characteristics, PSM principles and lexical substitution facts, there are a number of fairly straightforward ways we might assign features to the individual segments, and there are a number of problems/alternative analyses that arise.

[h] is clearly a continuant without an oral place of articulation. Therefore, we might assign it C-manner[open].

(13) PSM feature chart for Rapanui /h/

	C-manner [open]
/h/	✓

Among the labial consonants, [β] has the weakest closure and does not seem to form a series with other segments with similar manner of articulation. Therefore, we might assign it C-place[lab].

(14) PSM feature chart for Rapanui /β/

	C-place [lab]
/β/	✓

Among the coronal consonants, [ɾ] has the weakest closure and does not seem to form a series with other segments with similar manner of articulation. Therefore, we might assign it C-place[cor].

(15) PSM feature chart for Rapanui /ɾ/ (discussed further below)

	C-place [cor]
/ɾ/	✓

This would leave /p/ and /t/ as labial and coronal stops, respectively.

(16) PSM feature chart for Rapanui /p/ and /t/

	C-place [lab]	C-place [cor]	C-manner [closed]
/p/	✓		✓
/t/		✓	✓

Given the use of C-manner[closed], there must be a segment composed of only this feature. There are two additional segments that unambiguously stops: /ʔ/ and /k/. Since there does not seem to be any independent use for a glottal closure feature (C-laryngeal[closed]) and the glottal stop does not make use of an oral place of articulation, the starting assumption might be that the placeless stop is /ʔ/. This might also be suggested by the fact that the glottal stop is the epenthetic consonant in the language, and as such it might be expected to be featurally minimal and as non-sonorous as possible (to make a good onset).

(17) Tentative PSM feature chart for Rapanui glottal stop (to be revised)

	C-manner [closed]
/ʔ/	✓

However, we run into a problem with specifying /k/. The only option left, if we want this segment to be a phonological stop, is to say that it is C-manner[closed]&C-place[dor].

(18) Tentative PSM feature chart for Rapanui velar stop (to be revised)

	C-place [dor]	C-manner [closed]
/k/	✓	✓

The problem with this is that there is no evidence of another C-place[dor] segment in this language, and the model predicts that there should be a segment composed of only this place feature if /k/ has both a dorsal feature and a stop feature. In the absence of evidence of such a segment, there are two options. First, we could assume that /k/ is the only C-place[dor] segment in the language and is not a phonological stop. Second, we could assume that C-manner[closed] maps onto an oral stop gesture in this language and that the glottal stop is something else. This leaves /k/ as the placeless oral stop in this language.

Both options provide a satisfactory result and it is difficult to choose between them. As seen in (19), the former option would result in [β], [ɾ] and [k] forming the class of mannerless consonants, thus suggesting an explanation for their occasional lexical neutralization to glottal stop (the best, least sonorous, minimal onset). However, it leaves us with a feature (C-place[dor]), which is used by only one segment. This is not particularly economical (under a Clement's-like definition of feature economy).

(19) PSM feature chart for Rapanui non-nasal consonants (option 1)

		C-place			C-manner	
		[lab]	[cor]	[dor]	[closed]	[open]
Mannerless	/β/	✓				
	/ɾ/		✓			
	/k/			✓		
Stop	/ʔ/				✓	
	/p/	✓			✓	
	/t/		✓		✓	
Continuant	/h/					✓

The second option of allowing the velar stop to be the phonologically placeless stop requires that the glottal stop be treated as something else. There are two options here. First, it could be a C-laryngeal[closed] segment. Second, it could be an empty root node.² These two options are given in (20) and (21), respectively.

² Thanks to Martin Krämer for pointing out this option.

(20) PSM feature chart for Rapanui non-nasal consonants (option 2)

		C-place		C-laryn	C-manner	
		[lab]	[cor]	[closed]	[closed]	[open]
Mannerless	/β/	✓				
	/ɾ/		✓			
Non-oral stop	/ʔ/			✓		
Oral stop	/k/				✓	
	/p/	✓			✓	
	/t/		✓		✓	
Continuant	/h/					✓

(21) PSM feature chart for Rapanui non-nasal consonants (option 3)

		C-place		C-manner	
		[lab]	[cor]	[closed]	[open]
Featureless	/ʔ/				
Mannerless	/β/	✓			
	/ɾ/		✓		
Stop	/k/			✓	
	/p/	✓		✓	
	/t/		✓	✓	
Continuant	/h/				✓

Assuming that the glottal stop is featurally just that, we are left again with a segment composed of a single feature not used elsewhere in the language. On the other hand, assuming that the glottal stop is just a featureless root node, we derive a minimal/economical set of features and structures, but we are left the consequences of dealing with empty root nodes.

Note that this issue of how to interpret the stop series is not just a consequence of the PSM, but seems to also be an issue in the acquisition/diachrony of these types of inventories (and/or languages). In looking at the range of Pacific languages with small inventories, there is a tendency to avoid having four contrastive plain stops and either one of them is lost over time (e.g. Hawaiian - [p], [k], [ʔ], Maori - [p], [t], [k]) or laryngeal contrasts are used to provide unambiguous cues to place and manner specifications (e.g. Takuu - [p], [t], [k], [p^h], [t^h], [k^h], [ʔ], [h]).

To be concrete and to keep our feature system as economical as possible, let us assume the possibility of featureless segments and the specifications in (21).

We are left with having to specify the nasal consonants with features. There are two things we might do here. We might simply assume that nasality necessarily implies mapping to a nasal manner feature. This option is given in (22).

(22) PSM feature chart for Rapanui nasal consonants (option 1)

	C-place [lab]	C-place [cor]	C-manner [nasal]
/ŋ/			✓
/m/	✓		✓
/n/		✓	✓

This has the disadvantage of introducing another feature. Another option is to consider other aspects about the articulation of these segments and to “reuse” features used elsewhere in the system. Note that nasal stops involve both stopping the flow of air and having continuous flow of air. In essence, they are phonetically both stops and continuants. Thus, I will assume the following feature specifications.

(23) PSM feature chart for Rapanui nasal consonants (option 2)

		C-place		C-manner	
		[lab]	[cor]	[closed]	[open]
Stop+ Continuant	/ŋ/			✓	✓
	/m/	✓		✓	✓
	/n/		✓	✓	✓

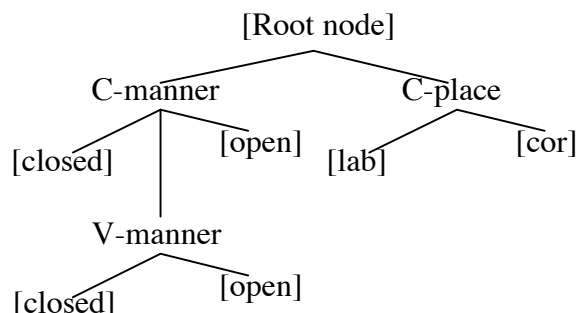
Note that this option for the feature specification of nasals may help to explain why nasals in some language behave like stops, but in other languages they do not. In the former language type, they may have a C-manner[closed] feature, but in the latter language type, they may not - perhaps only C-manner[nasal].

I will assume the following feature specifications for native Rapanui segments. As we have seen, there are some areas in which there are other options. This requires further investigation. Note the economy of feature use, representations and the symmetry across the inventory.

(24) PSM feature chart for native Rapanui segments (one possibility)

		C-place		C-manner		V-manner	
		[lab]	[cor]	[closed]	[open]	[closed]	[open]
Featureless	/ʔ/						
Mannerless	/β/	✓					
	/ɾ/		✓				
Stop	/k/			✓			
	/p/	✓		✓			
	/t/		✓	✓			
Stop+ Continuant	/ŋ/			✓	✓		
	/m/	✓		✓	✓		
	/n/		✓	✓	✓		
Continuant	/h/				✓		
High	/e/					✓	
	/u/	✓				✓	
	/i/		✓			✓	
Low	/a/						✓
	/o/	✓					✓

(25) Rapanui PSM Feature Geometry (one option)

**Non-native [s]~[ç] and [ts]**

Recall that there are two segments found in Rapanui that are borrowed from other languages (particularly Spanish). There is a coronal fricative that varies in articulation between a “lamino-post-alveoldental” and a “palatal”, and there is a “lamino-postalveolar” affricate. While the addition of the fricative poses few challenges to the set of features used to define the segment inventory, the affricate is slightly trickier.

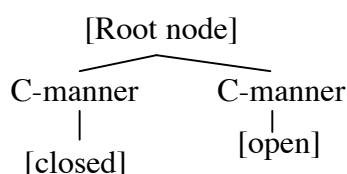
Since Rapanui has both a C-place[cor] segment (i.e. [ɾ]) and a C-manner[open] segment (i.e. [h]), and no native combination of these two, it is easy to imagine that this combination has been introduced to the language via borrowing.

(26) PSM feature chart for Rapanui borrowed coronal fricative

	C-place [cor]	C-manner [open]
/s~ç/	✓	✓

The question is how to deal with the affricate. There are several options. First, we could simply analyze the affricate as a cluster of two existent segments (i.e. [ts]). However, given the very restrictive syllable structure of the language, it seems highly unlikely that the only cluster allowed would be one that is so cross-linguistically marked. Second, we could analyze the affricate as a phonological contour segment. The structure of which is given in (27).

(27) Tentative PSM Feature Geometry for Rapanui borrowed affricate



This option makes use of features already used by the language, but has the somewhat unexpected consequence of creating [ts̥] out of features that one might expect to map to [kh] since placeless C-manner[closed] maps to [k] and placeless C-manner[open] is [h].

A third option does the most damage to the native phonological system in that it entails a diachronic restructuring of segments, but there may be evidence that such a restructuring has taken place in the language. This third option is that the presence of [ts̥] in the primary

linguistic data, with its “weak” manner compared with both [t] and [s] has led to its interpretation as C-place[cor].

(28) PSM feature chart for Rapanui borrowed $\widehat{ts}/$ (discussed further below)

	C-place [cor]
$\widehat{ts}/$	✓

This has the consequence of forcing /r/ to have different feature specification than that of previous generations. One likely candidate for re-structured /r/ is that it has become a phonological approximant (the first in Rapanui).

(29) Tentative PSM feature chart for Rapanui /r/ as a result of affricate borrowing

	C-manner [closed]	V-manner [closed]
/r/	✓	✓

There are two types of evidence suggesting that this may be what has happened (is happening?) in this language. First, Rapanui speakers are increasingly and heavily influenced by Spanish as it is a territory of Chile and about one-quarter of the population are Spanish-speaking Chileans. Given the approximant nature of Spanish [r], it seems likely that the similar native segment would be interpreted as an approximant by bilingual speakers.

The second type of evidence for /r/ restructuring comes from the patterns of lexical substitution discussed above. Recall that intervocalic [β], [r] and [k] have been replaced by [ʔ] in some lexical items over the years. This suggested that these three segments form a class and I interpreted that class as a set of featurally minimal consonants. While De Feu states that the substitution of [β] and [k] “does not appear to be an ongoing process”, she claims that “intervocalic *r* is still being deleted in some words”. This suggests that the unity of the [β], [k], [r] class has been broken, that the process of glottal stop substitution by minimal consonants (perhaps due to the introduction of non-alternating $\widehat{ts}$), and that the /r/ is somehow dispreferred enough that it tends to delete when not in initial position. If /r/ is now the only approximant in the language, this might be enough to dictate occasional deletion.

Stage I

- Tendency to simplify single feature segments, i.e. / β, r, k/ --> [ʔ]

Stage II

- Introduction of single featured $\widehat{ts}/$
- Reinterpretation of /r/ as an approximant
- Loss of tendency to simplify single feature segments
- Tendency to delete non-initial approximant segment, i.e. /r/ --> []

Of course, this discussion is highly speculative, but it is also highly suggestive. More research is needed here.

The tentative feature specification for individual Rapanui segments (including borrowed segments) is given in (30).

(30) PSM feature chart for contemporary restructured Rapanui segments (one possibility)

		C-place		C-manner		V-manner	
		[lab]	[cor]	[closed]	[open]	[closed]	[open]
Featureless	/ʔ/						
Mannerless	/β/	✓					
	/ts/		✓				
Stop	/k/			✓			
	/p/	✓		✓			
	/t/		✓	✓			
Stop+ Continuant	/ŋ/			✓	✓		
	/m/	✓		✓	✓		
	/n/		✓	✓	✓		
Continuant	/h/				✓		
	/s/		✓		✓		
Approximant	/r/			✓		✓	
High	/e/					✓	
	/u/	✓				✓	
	/i/		✓			✓	
Low	/a/						✓
	/o/	✓					✓

Wish list

- Fuller description of the phonetic nature of the segments
- Fuller description of the stress system
- Fuller description of the vowel distribution (e.g. possible reductions, restrictions on adjacency as a function of stress, etc.)
- Evidence for choosing one feature-specification option over another
- Actual data, rather than just generalizations about the data patterns
- OT analysis of the contrasts and distribution

References

- De Feu, V. 1996. *Rapanui*. Routledge, London.
- Morén, B. 2003. The Parallel Structures Model of Feature Geometry. *Working Papers of the Cornell Phonetics Laboratory* 15, pp. 194-270. Ithaca, New York.
- Morén, B. In press. Consonant-Vowel Interactions in Serbian: Features, Representations and Constraint Interactions. *Lingua*.