2. Phonological Units

Chart 1 presents the phonemes of the Sio language as proposed in this paper. Allophonic variants are shown where relevant in square brackets under the respective phoneme.[1]

CHART 1: PHONEMIC CHART OF THE SIO LANGUAGE

Consonants						
Oral Stops	- Vl	p	p^w	t		k
						[c k q]
	- Vd	b	b^w	d	dʒ	g
	- Pre-Nas	^{m}b	$^mb^w$	^{n}d	^{n}dʒ	^{ŋ}g
Fricatives	- Vl			s		
	- Vd	β				
Nasals		m	m^w	n		ŋ
Lateral				l		
Flap				r		
				[r ɾ]		

[1] This analysis differs markedly from that presented by Capell (1976). Capell's analysis is discussed in Appendix A.

Vowels

High	i	u
	[i iː j]	[u uː w]
Mid	e	o
	[e eː]	
Low	a	ɔ
	[a aː]	[ɔ ɔː]

In addition to the vowels, eight diphthongs are found: /aį aų ɔį ɔų eį eų oį oų/. Stress is predictable, generally falling on the ultimate or penultimate syllable.

The allophonic variation between [k], [c] and [q]; [r] and [ɾ]; and long and short vowels is straightforward. When /k/ is followed by /o/ or /ɔ/ it is realized as a uvular [q]; when followed by /i/ it is realized as palatal [c]. In all other environments it is a velar [k].

1) /koko/ ['qo.qo] 'hill' /koŋa/ ['qo.ŋa] 'old'
/kɔpʷa/ ['qɔ.pʷa] 'food' /kɔla/ ['qɔ.la] 'waves'
/kilo/ ['ci.lo] 'again' /kise/ ['ci.se] 'scent'

The trill [r] occurs only in words of three or more syllables with two identical adjacent syllables in which /r/ is in the non-syllabic position. In such cases, both occurrences of /r/ are realized as [r]. All other occurrences of /r/ are realized as the flap [ɾ]. Examples are given in (2).

2) /rɔrɔni/ [rɔ.'rɔ.ni] 'everyone' vs ['rɔ.rɔ] 'many'
/tiriri/ ['ti.ri.ri] 'spurting'
/ruruŋa/ [ru.'ru.ŋa] 'fear' vs ['ru.ru] 'to be afraid'

Although vowel length may have been more extensive in the past, at the present time vowel length is only retained for contrasting minimal pairs and is predictable based on the grammatical function of the word. In general, between minimal pairs, verbs, adverbs, and prepositions have short vowels while nouns and adjectives have lengthened vowels. Examples are given in (3).

3) ['tuː] 'mountain' ['i.tu] 'he thinks' ['tu] 'speech marker'
['lɔː] 'water' ['i.lɔ] 'he goes' ['lɔ] 'in, on, with'
['maː] 'clear' ['ma] 'irrealis marker'

Most occurrences of vowel length are in monosyllabic words with a syllable pattern of CV. However, three incidences have been found of contrastive vowel length in two syllable words.

4) ['laː.la] 'rooster feather' ['la.la] 'afternoon'
['pɔː.sɔː] 'loose' [i.'pɔ.sɔ] 'it falls out'
['ᵐdiː.a] 'canoe brace' ['ᵐdi.a] 'which?'

In the remainder of this section, I will discuss other aspects of the basic phonemic system as shown in Chart 1. Stress will be the focus of section 2.1, semivowels and diphthongs will be discussed in 2.2, and the status of complex segments will be dealt with in 2.3.

2.1 Stress

As mentioned above, stress is predictable in the language, and generally falls on the penultimate syllable as seen in (5).

5) ['de.wa] 'yam species'
['ka.'pu.la] 'egg'
[ba.bu.'re.ka] 'fish species'
[pa.ta.ra.'wɔ.ŋa] 'sacrifice'

When suffixes are added to the root word, the stress will shift and remain on the penultimate syllable. Stress shift can be seen with the addition of the nominalizing suffix *-ŋa* in (6), the possessive suffixes in (7), and object suffixes in (8).

6) [i.pa.βa.'li.gi] 'he denies' [pa.βa.li.'gi.ŋa] 'betrayal'
[ta.'li.li] 'we (inc) wash' [li.'li.ŋa] 'baptism'
7) ['βi.gu] 'nose' [βi.'gu.ⁿda] 'our (inc) noses'
[ga.'wu.li] 'thigh' [ga.wu.'li.ᵑgu] 'my thigh'
8) [a.pa.'na.na] 'I teach' [a.pa.na.'na.ⁿdʒi] 'I teach them'
[si.'mo.ra] 'they see' [si.mo.'ra.na] 'they see me'

There are exceptions to this general rule when considering vowel glides and reduplication, but in both cases the exceptions are also predictable. When a word ends in a diphthong, that is, CVV̯, the stress falls on the final syllable of the word, as shown on (9).

9) [ŋa.'laj̯] 'large' [ᵐbʷa.ta.'qɔj̯] 'sore'
['ᵐbaɰ̯] 'hand' [nɔ.'nɔɰ̯] 'enmity'

When suffixes are added to words ending in the CVV̯ pattern, the stress once again falls on the penultimate syllable, as shown in (10). The glides do not separate into two syllables.

10) [si.'paj̯] 'they told' [si.'paj̯.na] 'they told me'
[i.'raj̯] 'he draws a bow' ['raj̯.ŋa] 'a bow tightening'
['ᵐbaɰ̯] 'hand' ['ᵐbaɰ̯.ᵑgu] 'my hand'

This pattern of vowel glides is clearly demonstrated in the conjugation of the verb root *o* 'to put'. Chart 2 shows the stress in the conjugation of the verb and then the shifting of the stress with the addition of the object suffix.

CHART 2: CONJUGATION OF VERB [o], 'TO PUT'

Subj Pref	Without Object Suffix	With Object Suffix *ⁿdʒi* '3p'
a '1s'	['aɋ] 'I put'	['aɋ.ⁿdʒi] 'I put them'
ku '2s'	['ku.o] 'you put'	[ku.'o.ⁿdʒi] 'you put them'
i '3s'	['i.o] 'he put'	[i.'o.ⁿdʒi] 'he put them'
ka '1pe'	['kaɋ] 'we (ex) put'	['kaɋ.ⁿdʒi] 'we put them'
ta '1pi'	['taɋ] 'we (in) put'	['taɋ.ⁿdʒi] 'we put them'
ka '2p'	['kaɋ] 'you (pl) put'	['kaɋ.ⁿdʒi] 'you put them'
si '3p'	['si.o] 'they put'	[si.'o.ⁿdʒi] 'they put them'

In cases of reduplication, the stress pattern depends on what form the reduplication takes. In the Sio language, there may be reduplication of whole words, reduplication of the first syllable only, reduplication of the medial syllable only and reduplication of the final syllable. Stress follows the general rule of falling on the penultimate syllable except in the case of the reduplication of the final syllable.

When an entire word is reduplicated, the primary stress falls on the penultimate syllable of the first word and a secondary stress falls on the penultimate syllable of the second word, as shown in (11).

11) ['qo.ŋa] 'old' ['qo.ŋa.ˌqo.ŋa] 'very old'
['sa.'la.ga] 'flash of light' [sa.'la.ga.sa.ˌla.ga] 'brilliant'
['dʒo] 'time' ['dʒo.ˌdʒo] 'always'

Most cases of first-syllable reduplication have alternant forms in which the whole word is reduplicated, and the stress remains on the penultimate syllable in each, as shown in (12).

12) [qɔ.'qɔ.so] or ['qɔ.so.ˌqɔ.so] 'seagrass'
[ŋo.'ŋo.lo] or ['ŋo.lo.ˌŋo.lo] 'cough'
[pi.'pi.ru] or ['pi.ru.ˌpi.ru] 'itchy'

When the medial syllable is reduplicated, the stress remains on the penultimate syllable, as shown in (13). This form of reduplication is the most infrequent.

13) [wa.'se.ci] 'new' [wa.se.'se.ci] 'very new'

However, when the final syllable is reduplicated, the stress is unaffected and does not shift to the penultimate syllable, as shown in (14).

14) ['mo.tu] 'stopped' ['mo.tu.tu] 'completely stopped'
['i.lo] 'inside' ['i.lo.lo] 'completely inside'
['u.ru] 'habitually' ['u.ru.ru] 'habitually every day'

Onomatopoeic words, which generally have the final syllable reduplicated, follow the same pattern.

15) ['ŋɔ.rɔ.rɔ] 'grunting sound'
['ŋe.re.re] 'snarling sound'
['ci.ci.ci] 'sound of drawing a bowstring'

When two words are combined to form a new word, the stress is handled in the same way as for whole word reduplication. A secondary stress falls on the penultimate syllable of the second word and the primary stress falls on the penultimate syllable of the first word.

16) ['taj.ne] 'woman' + [ta.'mɔ.ta] 'man' ['taj.ne.ta.ˌmɔ.ta] 'people'
['ti.na] 'mother' + ['ta.ma] 'father' ['ti.na.ˌta.ma] 'parents'
['ci.e] 'foot' + ['sa.ka] 'bad' ['ci.e.ˌsa.ka] 'sin'
['sɔ.wa] 'beach' + ['ne.ka] 'edge' ['sa.wa.ˌne.ka] 'shoreline'

2.2 Semivowels and Diphthongs

The decision as to whether phonetic semivowels are actually phonemes or surface manifestations of another phoneme is never easily made. There are restrictions on the distribution of [w] and [j]. For example, in word-initial position, the semivowel [w] can be found followed by any vowel, but the semivowel [j] can be followed only by the nonhigh, nonfront vocoids, [a ɔ o].

Contrasts are easily found between the semivowels, [w] and [j], and their phonetically similar contoids, as shown in (17-18).

17) [p] and [w] ['pi.si] 'cold' ['wi.si] 'heart'
[pʷ] and [w] ['pʷa.pʷa] 'crab type' ['wa.wa] 'uncle'
[b] and [w] [bɔ.'bɔ.ru] 'shell type' [wɔ.'wɔj] 'mango'
[ᵐb] and [w] ['ᵐbɔ.lo] 'kidney' ['wɔ.lo] 'rope'
[ᵐbʷ] and [w] ['ᵐbʷɔ.ᵑgo] 'flying fish' ['wɔ.ᵑgu] 'drum'
[β] and [w] ['vi.la] 'to help' ['wi.la] 'malaria'

18) [dʒ] and [j] ['dʒaɰ] 'to brush' ['jaɰ] 'to stretch'
[ⁿdʒ] and [j] ['ⁿdʒɔ] 'bush' ['jɔ] 'fire'
[s] and [j] ['sɔ] 'what' ['jɔ] 'fire'

However, no clear contrasts are found between the semivowels and their phonetically similar vocoids, [i] and [u]. The semivowels, [w] and [j], can be analyzed as realizations of /u/ and /i/ respectively in nonsyllabic positions. The high vowels /u/ and /i/ become onsets word-

initially before a vowel as in (19), and between vowels as in (20); they remain nuclear word-initially before a consonant as in (21), before or after a consonant as in (22-24), and word-finally as in (25-26). (The conditions under which nuclear /i/ and /u/ syllabify as part of a diphthong as opposed to a separate syllable peak will be discussed below.)

19)	# __ V:	/uaᵑgiŋa/ [wa.ᵑgi.ŋa] 'song'
		/ueue/ ['we.we] 'hole'
		/uia/ ['wi.a] 'right'
		/uuuua/ [wu.'wu.a] 'rotted out'
		/iɔŋɔŋo/ [jɔ.'ŋɔ.ŋo] 'yellow'
		/iaia/ ['ja.ja] 'uncle'
20)	V __ V:	/laiea/ [la.'we.a] 'village'
		/nunala/ [nu.'wa.la] 'age-mate'
		/lauuuuna/ [la.wu.'wu.na] 'breadfruit'
		/ᵐboio/ [ᵐbo.jo] 'morning'
21)	# __ C:	/uru/ ['uru] 'habitually'
		/uŋara/ [u.'ŋa.ra] 'current'
		/iⁿdʒiu/ [i.ⁿdʒi.u] 'he shaves it'
		/isupina/ [i.su.'pi.na] 'he carries it tightly'
22)	V __ C:	/iautɔŋa/ [jaɰ.'tɔ.ŋa] 'liberator'
		/mauma/ ['maɰ.ma] 'poison'
		/taine/ ['taj.ne] 'woman'
23)	C __ V:	/pua/ ['pu.a] 'to wash'
		/ⁿdue/ [ⁿdu.e] 'to go down'
		/nia/ ['ni.a] 'place'
		/ᵐbio/ [ᵐbi.o] 'shell armband'
24)	C __ C:	/ᵐbusali/ [ᵐbu.'sa.li] 'urine'
		/kuleŋa/ [ku.'le.ŋa] 'assistance'
		/muli/ ['mu.li] 'behind'
		/gigi/ ['gi.gi] 'fish hook'
25)	C __ #:	/dugu/ ['du.gu] 'bush'
		/ᵐbimu/ [ᵐbi.mu] 'fruit'
		/gauuli/ [ga.'wu.li] 'thigh'
		/iaβi/ ['ja.βi] 'sweet potato'
26)	V __ #:	/mamilau/ [ma.mi.'laɰ] 'sugarcane species'
		/tiu/ ['ti.u] 'to lower'
		/gurui/ [gu.'ru.i] 'sea cow'
		/luai/ [lu.'aj] 'curse'

Between morpheme boundaries, a word initial prefixal high vowel will be a separate syllable from the following vowel, as shown in (27).

27) /io/ → ['i.o] 'he puts' (< *i* '3s' + *o* 'to put')
/io/ → ['jo] 'still, yet'

This occurs very infrequently in the Sio language since only verb roots take prefixes and only two verb roots begin with vowels in the language. See 4.6 for the mophophonemic changes which occur when the other verb root which has a morpheme inital vowel, *oka* 'to walk', is inflected with the person prefixes.

The only exceptions to the above rule which have been found are given in (28).

28) ['ɪ.a] 'spear type'
['i.u] 'tail'

Clifton (1987) found a similar exception in his analysis of the Kope language. He chose to view the distinction between ['u.e] 'sugar cane' and ['we] 'arrow type' as one of vowel length, where the underlying form of ['u.e] is really /uue/ and ['we] is one of /ue/. This analysis would also be possible in Sio since long vocoids occur in nouns as discussed above.

In addition to semivowels being predictable, diphthongs are also predictable in the Sio language from sequences of nuclear vowels. The following chart shows which vowel sequences occur in syllable nuclei.

CHART 3: FREQUENCY OF CO-OCCURRENCE OF VOWELS

	i	e	a	ɔ	o	u
i	–	1	34	3	4	5
e	1	–	35	8	–	2
a	51	–	–	–	–	57
ɔ	25	–	–	–	–	16
o	3	6	19	–	–	2
u	7	2	23	1	1	–

Of the co-occurring vowel sequences, some are realized as separate syllables and some as diphthongs. The Sio language follows a fairly typical pattern of vowel sequences. When a low vowel is followed by a higher vowel, the sequence is realized as a diphthong; and when a higher vowel is followed by a lower vowel, the sequence is realized as two separate syllables. When two vowels occur together which have the same height, they are realized as separate syllables. Therefore the following patterns emerge.

Diphthongs: aj, aɰ, ɔj, ɔɰ, ej, eɰ, oj, oɰ
Separate Syllables: e.ɔ, e.a, e.o, i.ɔ, i.a, i.e, i.o, i.u, o.a, o.e, u.ɔ, u.a, u.e u.i, u.o

There are some systematic gaps in Chart 3. First, there are no sequences of identical vowels. Second, there are no sequences of low vowel followed by mid vowel. Any such sequences should be diphthongs, since they would consist of a low vowel followed by a higher vowel. Orthographically, there has been a distinction between diphthongs ending in high vowels and diphthongs ending in mid vowels. The relative frequency of the spellings is given in Chart 4.

CHART 4: FREQUENCY OF SPELLING OF DIPHTHONGS BEGINNING WITH LOW VOWELS

	i	e	o	u
a	34	17	10	47
ɔ	3	22	7	9

However, no clear phonetic contrast can be found between the diphthongs [aɻ] and [aɛ̯]; [aɰ] and [aʊ̯]; [ɔɻ] and [ɔɛ̯]; [ɔɰ] and [ɔʊ̯]. Since contrast is found between the front vowels /i/ and /e/ and the back vowels /u/ and /o/, it can be argued that there is a neutralization of the contrast between these two vowels when they are preceded by a lower vowel. The orthographic variation may be the result of speaker variation. The high back vowel, /u/, ranges from [u] to [o] depending on the speaker, as shown in (29). The high front vowel, /i/, reacts the same way and ranges from [i] to [e] as shown in (30).

29) ['laɰ] or ['laʊ̯] 'leaf' ['naɰ] or ['naʊ̯] 'face'
['mɔɰ] or ['mɔʊ̯] 'rainy season' ['wɔɰ] or ['wɔʊ̯] 'breeze'

30) ['taɻ] or ['taɛ̯] 'reflection' [ŋa.'laɻ] or [ŋa.'laɛ̯] 'big'
['tɔɻ] or ['tɔɛ̯] 'saltwater' ['qɔɻ] or [qɔɛ̯] 'tree'

Therefore, I analyze these eight phonetic diphthongs as four phonemic diphthongs, /aɻ/, /ɔɻ/, /aɰ/, and /ɔɰ/.

Generally, these sequences remain diphthongs even when suffixes are added. The sequence /ai/ is very strong and will never be realized as separate syllables. In rapid speech, when the vowel sequence /a#i/ occurs across word breaks, it can become a diphthong as seen in (31-32).

31) /lauea ilo/ → ['la.waɻ 'lo][2] 'into the village'
village into

32) /luma ilo/ → ['lu.maɻ 'lo] 'into the house'
house into

[2] The mid front vocoid, /e/, drops out when the sequence /a#i/ becomes a diphthong.

This type of change does not occur across word boundaries with any of the other sequences. One of the sequences, /ɔi/, has a tendency to syllabify as two syllables when a suffix is added, with the /i/ dropping to the mid vowel [e].

33) [pa.ˈqɔj] 'to marry' [pa.qɔ.ˈe.ŋa] 'marriage'
[i.ˈlɔj] 'he drags' [i.lɔ.ˈe.ndʒi] 'he drags them'

It is also interesting that mid vowels followed by high vowels occur much less frequently than low vowels followed by high vowels.

2.3 Interpretation of Labialized Bilabials and Prenasalized Stops

When considering labialization and prenasalization, one must consider whether the rounding or nasalization occurs simultaneously with the release of the stop, or with a delayed release. One must also consider whether these should be treated as one segment, hence a separate phoneme, or as a consonant cluster of two existing phonemes.

Trubetzkoy (1973) outlines six principles for determining whether a sound is a single phoneme or a combination of phonemes. He states,

> In a given language only those combinations of sounds can be interpreted as monophonematic whose constituent parts are not distributed over two syllables, and which are, further, produced by a homogeneous articulatory movement. Their duration must not exceed the normal duration of single sounds. A combination of sounds that fulfills these purely phonetic prerequisites is only 'potentially monophonematic'. However, it will also be interpreted as being actually monophonematic, that is, as the realization of a single phoneme, if in accordance with the rules of the particular language it is treated as a single phoneme or if the general structure of the phonemic system of that language calls for such an evaluation. A monophonematic evaluation of a combination of sounds is particularly favored when its constituent parts cannot be taken as the realization of any other phonemes of the same language.

These principles will be kept in mind in the analysis of the labialized bilabials and the prenasalized stops.

2.3.1 *Labialized Bilabials.* This analysis will consider the labialized bilabials as separate phonemes. The constituent parts of /pʷ bʷ mʷ/ do not occur across syllable breaks, since all syllables are open (see section 5). Impressionistically, their duration is the same as for unlabialized bilabials, although this has not been verified by analyzed recorded voice text.

There is also historical basis for considering labialized bilabials as separate phonemes. Geraghty (1983:120-24) found that the voiceless and voiced bilabial stops, *pʷ and *bʷ, could be reconstructed for PEO. Ross (1988:94), in reconstructing POC phonology, states,

> The case with which POC m* can be reconstructed leads us to expect to find evidence for the reconstruction of POC p* and b* since it's apparently a language universal that a nasal occurs at a given point of articulation in a phoneme paradigm only if there is in that paradigm a stop at the same point of articulation.

Therefore the presence of /p* b* m*/ in the Sio language fits an expected Austronesian pattern.

One argument for considering the labialized bilabials as single units is based on the claim that the semivowel /w/ is not a phoneme in Sio. It could be argued that the underlying forms could be /pu/, /bu/, /mu/ instead of /p*/, /b*/, /m*/. However contrast is found between [p*] and [pu], [b*] and [bu], and [m*] and [mu].

34)	[i.'pu.a] 'he washes'	['i.p*a]	'it splits'
	['mu.i] 'yam species'	['m*e.m*e]	'rotten'
	[si.ta.'ᵐbu.'ᵐbu.a] 'they roll it over'	['tau.ᵐb*a]	'pit pit'

The labialized bilabials /p* b* m*/ occur both word initially and word medially and contrast with their unlabialized counterparts. However, there is limitation in their distribution before vowels. The frequency of these labialized bilabials varies, with the labialized bilabial voiceless stop, /p*/, being the most frequent and the labialized bilabial voiced stop, /b*/, occurring most infrequently. Contrast between the labialized bilabials and their unlabialized counterparts is shown in (35-38).

35)	b* vs b	[b*a.'li.ka] 'pond'	[ba.'lu.sa] 'black sugarcane'
		[ku.'lu.b*a] 'tree species'	[ma.la.'bo.gi] 'hawk'
		['nao 'b*e.o] 'pouting face'	['be.le.be.le] 'senseless talk'
36)	ᵐb* vs ᵐb	['ᵐb*e.a] 'to cook'	['ᵐbe] 'to fall down'
		['ᵐb*a.ᵑgi] 'sharp'	['ᵐba.ᵑga] 'tapioca bread'
		['ᵐb*i.ti] 'banana type'	['ᵐbi.ta] 'to scold'
37)	p* vs p	['p*a.li] 'lip'	['pa.la.la] 'axe handle'
		['p*ɔ.la] 'poison'	['pɔ.la] 'bush house'
		['p*e.ᵐbe] 'wallaby'	['pe.ᵑga] 'coconut branch'
		['p*i.si] 'dusk'	['pi.si] 'cold'
		['p*o.ka] 'he walks'	['po.ke] 'beetlenut leaf'
		['p*u.ra] 'you are able'	['pu.ro] 'red paint'
		['ka.p*a] 'stomach'	['ka.pa] 'crazy'
		['ᵐbu.p*u.'le.ŋa] 'dream'	['ᵐbu.pu] 'grandchild'
38)	m* vs m	['m*a.la] 'widow'	['ma.la] 'fighting spear'
		['m*ɔ.ta] 'snake'	['mɔ.ta] 'passage'
		['m*e.ta] 'seashell species'	['me.te] 'friend'
		['ᵐda.m*a] 'forehead'	['ta.ma] 'father'

Chart 5 shows the distribution of the labialized bilabials before each vowel. Only the labialized voiceless bilabialized stop, /pʷ/, occurs before every vowel.

CHART 5: VOWEL AND LABIALIZED BILABIAL CO-OCCURENCE CHART

	a	ɔ	e	i	o	u
pʷ	x	x	x	x	x	x
bʷ	x	–	x	–	–	–
ᵐbʷ	x	x	x	x	–	–
mʷ	x	x	x	–	–	–

The labialized bilabials also occur less frequently than their unlabialized counterparts. See section 5 for the Distribution of Phonemes Chart.

2.3.2 *Prenasalized Stops.* In the Sio language all voiced stops have a prenasalized counterpart. However, prenasalized stops have a greater frequency in the language. The prenasalized stops will be considered separate phonemes in the language for at least three reasons. First, there are no unambiguous consonant clusters in the language that would prove there is a CCV syllable pattern in the language. Also there are no consonant sequences across syllable breaks. Finally, in a related language, Mangap Bula, Bugenhagen is also treating prenasalized stops as separate phonemes.

Contrast between voiced stops and prenasalized voiced stops can be seen in (39-41).

39)	ᵐb vs b	/ᵐba.lo/ 'kidney'	/ba.'lu.sa/ 'sugarcane species'
		/ᵐbe.ᵐbe/ 'sugarcane species'	/be/ 'taro species'
40)	ⁿd vs. d	/ⁿdi.ⁿdi/ 'straight'	/di.'di.ŋa/ 'fence'
		/ⁿdau/ 'to tighten'	/dau.da/ 'to act crazy'
41)	ᵑg vs. g	/ᵑgo.a/ 'pig'	/go.a/ 'tree species'
		/ᵑga.ro/ 'crab species'	/ga.ro.ga.ro/ 'unripe'

A comparison of the frequency of voiced stops and prenasalized voiced stops is shown in Chart 6.

CHART 6: COMPARATIVE FREQUENCY BETWEEN VOICED STOPS AND PRENASALIZED VOICED STOPS (WORD INITIAL POSITION)

b	31	d	13	g	43
ᵐb	111	ⁿd	51	ᵑg	77

3. Lexical Patterns

3.1 Words

The vast majority of words in the Sio language consist of two, three or four syllables. Words of more than four syllables usually include reduplication or affixation of a prefix or suffix. Verb roots are predominantly two or three syllables, which is shown in Chart 7.

CHART 7: NUMBER OF SYLLABLES IN VERB ROOTS

1 syllable	2 syllables	3 syllables	4 syllables	5 syllables
53	295	176	23	2

Different morphemes may be added to the verb, which increases the number of syllables. The person prefix is always added. Other affixes include the reflexive prefix, the transitivizing suffix, and the object suffix. Not all verbs can take the reflexive prefix or the object suffix. In addition, no more than two of these three affixes may be added at one time, since the reflexive prefix and object suffix are mutually exclusive. If the verb becomes reflexive, meaning it acts upon the actor, then the object suffix cannot be added. The transitivizing suffix may be added in addition to the reflexive prefix or object suffix. As a result, even when inflected, verbs tend to have three, four or five syllables.

Chart 8 shows the distribution of syllables found in nouns.

CHART 8: NUMBER OF SYLLABLES IN NOUNS

1 syllable	2 syllable	3 syllable	4 syllable	5 syllable	6 syllable
37	463	343	166	5	1

It can be seen that the language tends to prefer two, three and four-syllable words.

Another unique feature of the language is that very few words begin with vowels. Chart 9 shows the number of dictionary entries beginning with vowels, out of approximately 2300 entries.

CHART 9: NUMBER OF WORDS WHICH BEGIN WITH VOWELS

a	ɔ	e	i	o	u
17	5	4	13	8	10

Of the words which begin with vowels, only two words are in the grammatical class of verb root, *o* 'to put' and *oka* 'to walk', and so can take a prefix. Thus, vowel sequences rarely arise across a morpheme boundary, as would happen when the verb roots are inflected with the personal pronoun prefixes of *a-*, *ku-*, *i-*, *ta-*, *ka-*, *si-*. See section 4.6.

3.2 Word Syllable Patterns

In the Sio language, nonreduplicated words have the following syllable patterns.

'S	'S.S	S.'S.S
['lɔ:] 'water'	['mo.ta] 'small'	[ta.'mɔ.ta] 'man'
['ni:] 'mosquito'	['i.la] 'fish net'	[me.'me.la] 'tongue'
['ŋa] 'name'	['pi.tu] 'star'	[ka.'bu.ŋe] 'taro'
['tu:] 'mountain'	['ka.pʷa] 'stomach'	[pu.'to.le] 'hunger'

S.S.'S.S	S.S.S.'S.S
[ka.to.'nɔ.ŋa] 'leader'	[pa.ta.ra.'uɔ.ŋa] 'sacrifice'
[le.le.'ga.ro] 'snake'	[a.pa.ru.'ru.a] 'I shake myself'
[ma.la.'bo.gi] 'bird species'	[i.pa.ti.'a.mo] 'he denies it'
[pa.sa.'ua.ŋa] 'clothing'	[i.pa.li.'li.ta] 'it is tangled up'

S.S.S.S.'S.S
[a.pa.gi.gi.'li.a] 'I mix it together'
[si.pa.ma.te.'te.u] 'they die at the same time'
[i.pa.mo.tu.'tu.i] 'it broke itself'

The only syllable patterns in the Sio language are V, VV̨, CV and CVV̨; there are no closed syllables. Three concurrent syllables containing only vowels cannot occur in the language. These syllables may combine in the following manner to produce word syllable patterns as follows.

One-Syllable Words

'V	[i] '3rd person singular pronoun'	
'VV̨	[aɻ] 'yes'	[aɰ] 'enclosed area'
'CV	[su] 'breast'	[ᵐbo] 'night'
'CVV̨	[kaɋ] 'upper body'	[mɔɋ] 'rainy season'

Two Syllable Words

'V.V	[i.u] 'tail'	[e.a] 'who'
'V.CV	[a.ra] 'good'	[i.ŋa] 'fish'
'CV.V	[ei.e] 'foot'	[ti.a] 'no'
CV.'VV̨	[lu.aɻ] 'curse'	
'CV.CV	[ku.lu] 'head'	[na.tu] 'child'
CV.'CVV̨	[si.saɰ] 'they agreed'	[ta.laɋ] 'we (inc) pull'
'CVV̨.CV	[taɻ.ne] 'woman'	[maɰ.ma] 'poison'

Three-Syllable Words

'V.CV.V	[i.ⁿdʒi.u] 'he shaves it'	[a.le.a] 'I stare'
V.'CV.CV	[a.bo.na] 'a white bush'	[u.ŋa.ra] 'current'
CV.'V.CV	[ve.ɔ.ŋa] 'secret'	[ni.a.ka] 'outside'
CV.'CV.V	[gu.ru.i] 'sea cow'	[ma.ri.a] 'abundance'
CV.CV.'VV̨	[mi.mi.aǫ̨] 'sugarcane species'	[ma.la.waę̨] 'far away'
CV.'CV.CV	[ga.vi.si] 'shaman's stone'	[ⁿdʒi.mo.na] 'moon'
CV.CV.'CVV̨	[ma.mi.laų̨] 'sugarcane species'	[ᵐbʷa.ta.qɔę̨] 'sore'
CV.'CVV̨.CV	[pa.saų̨.ŋa] 'meeting'	[na.naų̨.la] 'dolphin'
CVV̨.'CV.CV	[saų̨.re.re] 'whale'	[jaų̨.tɔ.ŋa] 'liberator'

Four-Syllable Words

V.CV.'CV.CV	[i.su.pi.na] 'he carries it tightly'
	[a.la.la.ga] 'I hang it up'
V.CV.'V.CV	[i.pi.a.na] 'he stretches his back'
	[i.dʒu.a.la] 'he rinses it'
V.CV.CV.'CVV̨	[i.pa.mo.raį̨] 'he looks at himself'
	[a.pa.sa.lɔę̨] 'I make fun of myself'
CV.CV.'CV.CV	[ba.bu.re.ka] 'fish species'
	[ka.pa.pu.ro] 'seashell species'
CV.CV.'CV.V	[si.ⁿda.we.a] 'they knead it'
	[ta.pa.gu.i] 'we (inc) play'
CV.CV.'V.CV	[si.pi.a.na] 'they stretch their backs'
	[ta.dʒu.a.la] 'we (inc) rinse it'
CV.V.'CV.CV	[lu.a.ⁿdo.ⁿdo] 'very long'
CV.CV.CV.'CVV̨	[si.pa.mo.raį̨] 'they see each other'
	[ta.pa.sa.lɔę̨] 'we (inc) make fun of each other'
CV.CV.'VV̨.V	[ka.ᵐbi.aį̨.e] 'shark'
CV.CV.'CVV̨.CV	[si.pa.daų̨.da] 'they are drunk'
	[ka.pa.jaų̨.la] 'we (exc) destroy ourselves'

Five-Syllable Words

CV.CV.CV.'CV.CV	[ma.gɔ.lo.gɔ.lo] 'ant species'
	[ma.la.ka.nɔ.ⁿdi] 'bird species (large rail)'
CV.CV.CV.'CV.V	[si.pu.pu.li.a] 'they turned it over'
	[ta.ⁿda.ma.le.a] 'we (inc) lick it'
CV.CV.CV.CV.'CVV̨	[si.pa.sa.ra.waį̨] 'they call themselves'
	[si.pa.ta.ta.raį̨] 'they get hung up'
V.CV.CV.'CV.CV	[i.ta.ᵐbʷa.li.li] 'he spins around'
	[a.pi.ti.ci.na] 'I knock on it'

V CV.CV.ˈCV.V	[a.ta,ᵐbu,ᵐbu.a] 'I rolled it'
	[i.pa.gu.gu.a] 'she gave birth to'
V CV.CV.CV.ˈCVV	[i.pa.sa.ra.waj] 'he calls himself'
CV.CV.CV.ˈV.CV	[ma.re.re.ɔ.ŋa] 'dependence'
	[ka.ra.si.a.na] 'heavy rain'

Six-Syllable Words

V.CV.CV.CV.ˈCV.V	[i.pa.gi.gi.li.a] 'he mixes it together'
	[a.pa.ma.ge.ge.a] 'I am ready for it'
CV.ˈCV.CV.CV.CV.CV	[ka.ᵐbʷa.re.ka.ᵐbʷa.re] 'hawk'[3]
CV.CV.CV.CV.ˈCV.V	[si.pa.ma.te.te.u] 'they died simultaneously'
	[ta.ta.ᵐbu.ᵐbu.li.a] 'we (inc) spin around'

4. Morphophonemic Rules

4.1 Environments Where /a/ → [ɔ]

One of the most frequent morphophonemic changes that occurs in the Sio language is for the low central vocoid, /a/, to go to the low back vocoid, [ɔ]. The different conditions under which this change occurs will now be presented.

4.1.1 *Addition of suffixes.* When a suffix which begins with a velar nasal /ŋ/, a prenasalized velar stop /ᵑg/, or a prenasalized dental stop /ⁿd/ is added to a morpheme which ends in the low mid voicoid, /a/, the /a/ generally becomes the low back vocoid [ɔ]. This can be seen in the possessive paradigm for *mata* 'eye' given in (42).[4]

42)	[ma.ˈtɔ.ᵑgu]	'my eye'	[ma.ˈta.ma]	'our (exc) eyes'
			[ma.ˈtɔ.ⁿda]	'our (inc) eyes'
	['ma.ta]	'your eye'	[ma.ˈta.ma]	'your (pl) eyes'
	['ma.ta]	'his eye'	[ma.ˈta.ⁿdʒi]	'their eyes'

This change also occurs when verbs are nominalized by adding *-ŋa*. When a verb root ends /a/, then the /a/ becomes [ɔ] when the suffix *-ŋa* is added, as shown in (43).[5]

43)	['mɔ.ra] 'to see'	[mɔ.ˈrɔ.ŋa] 'viewpoint'
	[pa.ˈɲe.a] 'to praise'	[pa.ɲe.ˈɔ.ŋa] 'praise'
	['go.na] 'to gather'	[go.ˈnɔ.ŋa] 'a gathering'

[3] This form is a reduplication.

[4] No noun stems end in /ɔ/, so no nonalternating paradigms can be given.

|ˈwa.ra| 'to put makeup on'	|wa.ˈrɔ.ŋa| 'makeup'
|ᵐbi.ta| 'to scold'	|ᵐbi.ˈtɔ.ŋa| 'scolding'
|ᵐbʷa.ˈra.ka| 'to pull down'	|ᵐbʷa.ra.qɔ.ŋa| 'a pulling motion'

Two cases have been found where this morphophonemic change does not occur.

44) |ˈpa.ra| 'to fight' |pa.ˈra.ŋa| 'battle'
|pa.ˈsa.wa| 'to dress oneself' |pa.sa.ˈwa.ŋa| 'clothing'

Several cases have been found where all low mid vocoids in the word become [ɔ] when the nominalizing suffix is added. There does not seem to be a predictable pattern for this occurence.

45) |mʷa.ˈsa.ra| 'to bark' |mʷɔ.sɔ.ˈrɔ.ŋa| 'barking'
|wa.ˈwa.la| 'to shake something' |wɔ.wɔ.ˈlɔ.ŋa| 'shaken'

Two cases have been found where a verb is nominalized in a different manner. In these cases /a/ in the penultimate syllable becomes [ɔ].

46) |si.ˈᵑga.ra| 'to decorate it' |si.ˈᵑgɔ.ra| 'decorations'
|ku.ˈla.ⁿda| 'to lie one's head on it' |ku.ˈlɔ.ⁿda| 'pillow'

4.1.2 *Multiplicity.* When multiple objects are being acted upon, or when an action is repetitive, certain morphophonemic changes occur. Commonly, the first syllable of the verb root is reduplicated to show this multiplicity as seen in (47).

47) a. |ˈso.la| 'to carry an item on one's shoulder'
|so.ˈso.la| 'to carry multiple items on one's shoulder'
b. |pu.ˈli.a| 'to turn an item over'
|pu.pu.ˈli.a| 'to turn multiple items over'
c. |ˈti.ke| 'to peek at'
|ti.ˈti.ke| 'to peek at repeatedly'

However, when the first syllable of a two-syllable verb root contains /a/ in the nuclear position, the /a/ becomes [ɔ] to show that multiple items are being acted upon as seen in (48).

48) a. |ˈsa.le| 'to dig an item up out of the ground'
|sɔ.le| 'to dig multiple items out of the ground'
b. |ᵐbʷa.re| 'to break an item'
|ᵐbʷɔ.re| 'to break multiple items'
c. |ˈla.mo| 'to slash tall grass with a bush knife'
|ˈlɔ.mo| 'to slash grass repeatedly'

[3] The only two verbs with /ɔ/, 'go' and 'come', cannot be nominalised.

4.1.3 Addition of the Reflexive Prefix. The reflexive prefix, *pa-*, is added to some transitive verb roots to show that the action is received by the actor or actors. When the first syllable of a two syllable transitive verb root contains /a/, then the /a/ becomes [ɔ] when the reflexive prefix is added as shown in (49).[6]

49)	['ka.le] 'to grab something'	[pa.'qɔ.le] 'to grab each other'
	['ta.ŋo] 'to touch something'	[pa.'tɔ.ŋo] 'to touch each other'
	[la.ŋe] 'to lie to someone'	[pa.lɔ.ŋe] 'to lie to oneself'

A similar morphophonemic change occurs when the reflexive suffix is added to a verb root which has a CVV syllable pattern which contains the diphthong /aj/. The diphthong /aj/ changes to the diphthong /ɔj/ when the reflexive suffix is added, as shown in (50).

50)	['paj] 'to tell'	[pa.'pɔj] 'to tell each other'
	['taj] 'to draw up'	[pa.'tɔj] 'to draw up for each other'

The one exception that has been found to the above pattern is given in (51).

51)	['sa.ŋa] 'to hold in hand'	[pa.sa.ŋa] 'to hold each other'

Another morphophonemic change occurs when the reflexive prefix is added to one-syllable verb roots. In these cases the reflexive prefix *pa-* becomes *paj* as seen in (52).

52)	['si] 'to surround'	['paj.si] 'to surround each other'
	['pe] 'to wrap around'	['paj.pe] 'to wrap around each other'
	['li] 'to chase someone'	[paj.li] 'to chase each other'

The one exception that has been found to the above pattern is given in (53).

53)	['qo] 'to buy'	['pa.qo] 'to trade'

One other morphophonemic change occurs when *pa-* is added to two-syllable verb roots in which /o/ is the nucleus of each syllable. The reflexive prefix *pa-* changes to *po-* as seen in (54).

54)	[ᵐbo.so] 'to be angry'	[po.ᵐbo.'so.a] 'to be angry at each other'
	['po.ro] 'to speak to'	[po.'po.ro] 'to speak to each other'

4.2 Transitivity

The most common way for an intransitive verb to become a transitive verb is for the transitivizing suffix *-a* to be added to the verb root. This pertains to verb roots which do not end in /a/ as shown in (55).

[6] There are no verb roots which begin with *(C)ɔ* which would not show alternations.

	Intransitive Verb	Transitive Verb
55)	[ˈŋɛ.lɛ] 'to laugh'	[ŋɛ.ˈle.a] 'to laugh at'
	[ma.ˈre.re] 'to lean'	[ma.re.ˈre.a] 'to lean on'
	[ta.ᵐbu.ˈli.li] 'to spin'	[ta.ᵐbu.li.ˈli.a] 'to spin something'
	[pa.ˈgu.gu] 'to give birth'	[pa.gu.ˈgu.a] 'to give birth to'
	[pa.ˈŋu.ŋu] 'to root'	[pa.ŋu.ŋu.a] 'to root up'

However when the stressed syllable of the intransitive verb root contains /ɔ/ in the syllabic position, the /ɔ/ generally becomes [a] to show the increased transitivity, as shown in (56).[7]

	Intransitive Verb	Transitive Verb
56)	[pa.ˈnɔ.na] 'to learn'	[pa.ˈna.na] 'to teach'
	[sa.ˈrɔ.wa] 'to call out'	[sa.ˈra.wa] 'to call out to'
	[pa.ˈnɔ.we] 'to steal'	[pa.ˈna.we] 'to steal from'
	[ˈlɔ.ŋɛ] 'to lie'	[ˈla.ŋe] 'to lie to'
	[ˈpɔ.ne] 'to shoot'	[ˈpa.ne] 'to shoot at'

Three intransitive verb roots have been found which are transitivized by combining the above two means of increasing transitivity. The vowel /ɔ/ becomes [a], and the transitivizing suffix, *-a*, is also added as shown in (57).

	Intransitive Verb	Transitive Verb
57)	[ˈtɔ.ⁿde] 'to look up'	[ta.ˈⁿde.a] 'to look up at'
	[ˈmɔ.te] 'to die'	[ma.ˈte.a] 'to die on someone'
	[ˈwɔ.ᵑgi] 'to sing'	[wa.ˈᵑgi.a] 'to sing to'

4.3 Verb roots starting with the voiceless velar stop /k/

Verb roots which have /k/ in the initial position undergo a morphophonemic change when the second person singular prefix, *ku-*, is added. Monosyllabic verb roots which have the CVV syllable pattern, and verb roots with two or more syllables undergo this morphophonemic change. In these cases the second person singular prefix, *ku-* becomes *pʷ*, and the initial /k/ of the verb root is dropped. Monosyllabic verb roots of the CV syllable pattern which start with /k/ do not undergo this change. Note the comparison between normal conjugation of *gema* 'to mix' in (58) and the irregular conjugation of *kale* 'to grab' in (59).

[7] There are no intransitive verbs with stressed /ɔ/ which would not show alternations.

58)	[a.ge.ma] 'I mix'	[ka.ge.ma] 'we (exc) mix'
		[ta.ge.ma] 'we (inc) mix'
	[ku.ge.ma] 'you mix'	[ka.ge.ma] 'you (pl) mix'
	[i.ge.ma] 'he mixes'	[si.ge.ma] 'they mix'
59)	[a.ka.le] 'I grab'	[ka.ka.le] 'we (exc) grab'
		[ta.ka.le] 'we (inc) grab'
	[pʷa.le] 'you grab'	[ka.ka.le] 'you (pl) grab'
	[i.ka.le] 'he grabs'	[si.ka.le] 'they grab'

Of the thirty verb roots beginning with /k/ that have been collected, the only two that have not followed this pattern are given in (60).

60)	[ka.pi] 'to go around'	[ku.ka.pi] 'you go around'
	[ka.ˈpi.ra] 'to squeeze'	[ku.ka.pi.ra] 'you squeeze'

Chart 10 lists the verb roots which follow this irregular conjugation.

4.4 Contraction

A contraction occurs in words of three or more syllables where the first two syllables are either CV.CV, CV.CV.V or CV.CVV and the first consonant is /s/ and the second consonant is one of the voiceless stops, /p t k/. When this pattern occurs, the first vowel drops out, without causing a change in the meaning. The contraction is optional, but often occurs in rapid speech. It is very similar to the English contraction *don't* for *do not*. Note the forms in (61).

61)	/sipane/	→ [spa.ne]	'they shoot'
	/sakamao/	→ [ska.maǫ]	'very bad'
	/sitapa/	→ [sta.pa]	'they pull'

This contraction has been observed to occur once across a word break in the expression in (62).

62)	/pila ŋana	məsi	kɔ/	'knife for carving'
	knife of	carving	only	

This expression has been reduced to the noun phrase in (63).

63) [pila mɔ.skɔ] 'carving knife'

CHART 10: VERB ROOTS WITH IRREGULAR CONJUGATION

['kaɻ] 'to take'	['pʷaɻ] 'you take'
['ka.le] 'to carry on shoulder'	['pʷa.le] 'you carry on shoulder'
['ka.'le.le] 'to visit someone'	['pʷa.'le.le] 'you visit someone'
['ka.'lo.lo] 'to roll bilum string'	['pʷa.'lo.lo] 'you roll bilum string'
['ka.na] 'to burn'	['pʷa.na] 'you burn'
['ka.'ra.ti] 'to bite'	['pʷa.'ra.ti] 'you bite'
['ka.re.'re.a] 'to go around'	['pʷa.re.'re.a] 'you go around'
['ka.'so.ŋa] 'to ask'	['pʷa.'so.ŋa] 'you ask'
['ka.ro] 'to gather'	['pʷa.ro] 'you gather'
['ka.tu] 'to bump into'	['pʷa.tu] 'you bump into'
['kaɻ] 'to cover'	['pʷaɻ] 'you cover'
['ka.'we.a] 'to snatch'	['pʷa.'we.a] 'you snatch'
['qɔɕ] 'to marry'	['pʷɔɕ] 'you marry'
['qɔ.lo] 'to wade'	['pʷɔ.lo] 'you wade'
['qɔ.wa] 'to flee'	['pʷɔ.wa] 'you flee'
['ke.a] 'to bury someone'	['pʷe.a] 'you bury someone'
['ke.no] 'to sleep'	['pʷe.no] 'you sleep'
['ke.re] 'to grate'	['pʷe.re] 'you grate'
['ei.na] 'to praise'	['pʷi.na] 'you praise'
['ei.si] 'to slice'	['pʷi.si] 'you slice'
['qo.ta] 'to fasten around neck'	['pʷo.ta] 'you fasten around neck'
['qo.ti] 'to hold on the lap'	['pʷo.ti] 'you hold on your lap'
['ku.ra] 'to measure'	['pʷu.ra] 'you measure'
['ku.ᵑdu] 'to carry on the head'	['pʷu.ᵑdu] 'you carry on the head'

4.5 Ellipses

The vowel sequence /ie/ occurs only once in the Sio language, but is used in a very common word, *kie* 'leg'. When the possessive suffixes are added to this word, the /i/ drops out as shown in (64).[8]

64) ['ke.ᵑgu] 'my foot' ['ke.ma] 'our (exc) feet'
['ke.ᵑda] 'our (inc) feet'
['ei.e] 'your foot' ['ke.ma] 'your (pl) feet'
['ei.e] 'his foot' ['ke.ndʒi] 'their feet'

[8] The noun *take* 'faeces', never exhibits the insertion of /i/ in isolation or any other form.

4.6 *Irregular Conjugation of Verb Root* oka *'to walk'*

As was mentioned earlier in this paper, the Sio language does not have many verb roots which begin with a vowel, so it is not surprising that the only two-syllable verb root with a vowel in the word initial position has morphophonemic changes. Of the data collected thus far, oka is the only verb with this type of irregular conjugation. Note the conjugation in (65).

65)	*a-*	[a.'jo.ka]	'I walk'
	ku-	['p^{w}o.ka]	'you walk'
	i-	[i.'jo.ka]	'he walks'
	ka-	['qo.ka]	'we (exc) walk'
	ta-	['to.ka]	'we (inc) walk'
	ka-	['qo.ka]	'you (pl) walk'
	si-	['so.ka]	'he walks'

5. Distribution of Phonemes

Chart 11 shows the co-occurrence of phonemes before and after each other and the frequency in which they occur in that position. Even though the semivowels, [w] and [j], are allophones of /u/ and /i/, they are included in this table to show the frequency of their occurrence and the vowels with which they occur. Since I am considering the prenasalized voiced stops and labialized bilabials as units in the language, there are no consonant clusters or closed syllables. Therefore, I have omitted sequences of consonants from the chart. Since the lengthened vocoids have been shown to be allophones of their unlengthened counterparts, double vowels will not be shown in this chart.

Several observations can be made from the Co-occurrence of Phonemes Chart. The lateral, flap, voiceless stops, nasals and voiceless alveolar fricative are the consonants with the highest frequency in the language. The labialized bilabials have the lowest occurrence frequency and have a limited distribution with the vowels. They occur infrequently before and after the low back vowels, /u o/, but the pattern is consistent within the paradigm. As has been mentioned earlier, the chart shows that prenasalization has a higher load in the language than the non-prenasalized counterparts. Among the vowels, the low central vowel, /a/, has the highest load and the front mid vowel, /e/, has the lowest load in the language.

CHART 11: CO-OCCURRENCE OF PHONEMES CHART

	a	ɔ	e	i	o	u
p	244	33	11	59	45	67
t	139	34	30	74	41	70
k	195	57	60	84	70	77
b	11	10	6	6	4	13
d	14	5	1	11	–	6
g	39	8	26	20	23	23
ᵐb	59	28	18	36	28	52
ⁿd	36	5	28	19	23	25
ⁿdʒ	33	13	5	34	13	14
ᵑg	65	14	32	41	24	48
pʷ	34	8	6	1	1	1
bʷ	2	–	1	–	–	–
ᵐbʷ	41	11	13	1	–	–
mʷ	20	4	9	–	–	–
β	29	12	26	23	4	–
m	135	33	13	12	43	46
n	126	29	30	55	15	22
ŋ	233	12	35	22	34	9
s	140	39	20	86	44	48
dʒ	24	6	3	13	8	16
l	165	44	92	103	72	50
r	169	54	89	72	77	98
w	96	40	32	9	14	55
j	24	8	2	–	15	–

	p	t	k	b	d	g	ᵐb	ⁿd	ⁿdʒ	ᵑg	pʷ	bʷ	ᵐbʷ	mʷ	β	m	n
a	50	87	90	9	11	31	40	22	13	46	6	-	11	8	28	45	83
ɔ	12	30	38	4	3	12	16	10	7	21	3	-	4	-	3	17	19
e	2	19	28	1	1	11	14	12	6	24	3	-	3	1	7	19	11
i	26	36	45	2	4	12	13	10	9	20	1	-	1	-	13	21	47
o	18	28	37	-	-	20	12	12	4	11	-	-	-	-	2	14	32
u	15	31	50	3	6	8	28	16	8	16	4	1	9	2	5	18	24

5.1 Consonant Harmony

Consonants which occur word-initial were analyzed to discover which consonants could follow them. The analysis was restricted to separate morphemes and did not consider

CHART 11 (cont)

	ŋ	s	dʒ	l	r	w	j	a	ɔ	e	i	o	u
a	51	77	10	155	198	75	8	=	=	=	58	=	61
ɔ	87	25	3	46	61	21	2	-	-	1	26	-	21
e	32	17	6	31	36	12	1	44	11	-	-	2	2
i	47	28	6	60	64	9	1	46	4	2	-	5	8
o	44	10	7	36	42	7	2	29	-	6	9	-	2
u	36	19	4	89	89	27	3	33	1	3	12	1	-

words which contained more than one morpheme. Chart 12 shows the result of that analysis.

CHART 12: CONSONANT HARMONY CHART

	p	t	k	b	d	g	ᵐb	ⁿd	ᵑg	pʷ	bʷ	ᵐbʷ	mʷ	β	m	n	ŋ	s	dʒ	ⁿdʒ	l	r	w	j
p	+	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	+	+	-	+	+	+	+	-
t	+	+	+	-	-	+	+	+	+	+	-	+	+	+	+	+	+	-	-	-	+	+	+	-
k	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	-
h	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	+	+	-
d	-	-	-	+	+	+	-	-	-	-	-	-	-	+	+	-	+	-	-	-	-	-	+	+
g	-	+	-	+	-	+	-	-	-	-	-	-	-	+	+	+	-	+	+	-	+	+	+	-
ᵐb	+	+	+	-	-	-	+	+	+	+	-	+	-	-	+	+	+	+	-	+	+	+	-	+
ⁿd	-	-	+	-	-	-	+	+	+	-	-	-	+	-	+	+	+	-	-	-	+	+	+	-
ᵑg	+	+	+	-	-	-	+	-	+	+	-	+	+	-	+	+	+	+	-	+	+	+	+	-
pʷ	+	-	+	-	+	-	+	-	+	+	-	-	-	-	-	+	+	+	+	-	+	+	-	-
hʷ	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
ᵐhʷ	-	+	+	-	-	-	-	+	+	-	-	+	+	-	-	+	+	+	-	-	+	+	+	-
mʷ	-	+	+	-	-	-	-	-	+	-	-	-	+	-	-	+	+	+	-	-	+	+	-	-
β	-	+	-	-	+	+	-	-	-	-	-	-	-	+	-	-	-	+	+	-	+	+	-	-
m	+	+	+	+	-	+	-	+	+	-	-	-	-	+	+	+	+	+	+	+	+	+	+	-
n	+	+	+	-	-	-	+	+	+	-	-	+	-	-	+	+	+	-	-	+	+	+	+	-
ŋ	+	+	-	-	-	-	-	+	+	-	-	-	-	-	-	+	+	-	-	+	+	+	-	-
s	+	+	+	+	-	+	+	+	+	+	-	+	-	+	+	+	+	+	-	-	+	+	+	-
dʒ	-	-	+	-	-	+	-	-	-	-	-	-	-	+	+	-	-	-	+	-	+	+	+	-
ⁿdʒ	+	-	+	-	-	-	+	-	+	-	-	-	+	-	+	+	+	-	-	+	+	+	+	-
l	+	+	+	+	-	+	+	-	+	-	-	+	-	+	+	+	+	+	-	-	+	-	+	-
r	+	+	+	-	+	+	+	+	+	-	-	-	-	+	-	+	+	+	+	-	-	+	+	-
w	-	+	+	-	-	-	+	-	-	-	-	-	-	-	+	+	+	+	+	-	+	+	+	-
j	-	-	+	-	-	+	-	-	-	-	-	-	+	+	+	+	+	+	-	-	+	+	+	-

When looking at chart 12, it is apparent that every phoneme may follow itself. No evidence was found of /bʷ/ following itself, but since /bʷ/ data is so limited this is to be expected.

It is also apparent that certain groups of phonetically similar phonemes do not co-occur in the same word. There is a restriction in their co-occurrence. Laterals and flaps do not co-occur in the same word. When a lateral occurs in the word initial position, then a flap may not follow and vice versa.

This same pattern occurs between the prenasalized voiced stops and affricates, and the voiced stops and affricates. Voiced stops do not occur in the same word as their prenasalized counterparts. When a word begins with a voiced stop or affricate, the rest of the voiced stops and affricate in the word will not be prenasalized and likewise, when a word begins with a prenasalized stop or affricate, the rest of the voiced stops or affricate in that word will also be prenasalized.

Affricates and fricatives operate in the same manner. If the voiceless aveolar fricative, /s/, occurs in the word-initial position then the voiced affricate, /dʒ/, and the prenasalized affricate, /ⁿdʒ/, will not occur in the same word.

Certain groups of phonetically similar phonemes do not have any restriction on their co-occurences within a word. The voiceless and voiced stops are able to co-occur within a word. Likewise the nasals /n/ and /ŋ/ co-occur within a word.

Some Austronesian languages have restrictions as to which consonants may occur between two identical vowels. There seems to be no such restriction in the Sio language. Laterals, flaps, nasals, fricatives, affricates, voiced and voiceless stops and prenasalized voiced stops and affricates all occur between identical vowels as is shown below.

Voiceless Stops:	/papa/ 'toward'	/loqo/ 'to fill up'	/toto/ 'to cut'
Voiced Stops:	/baba/ 'grandparent'	/didiŋa/ 'fence'	/togo/ 'similar'
PreNas Stops:	/siᵐbi/ 'meat'	/qoᵑdo/ 'platter'	/aᵑga/ 'and'
Labialized Bilabials:	/kapʷa/ 'stomach'	/kaᵐbʷaŋe/ 'waist'	/ᵐdamʷa/ 'forehead'
Fricatives:	/βɔβɔra/ 'cold'	/gaβisi/ 'shaman's stone'	
Affricates.	/dʒidʒiβi/ 'poison'		
PreNas Affricates:	/maⁿdʒa/ 'drizzle'		
Nasals	/sama/ 'to know'	/tini/ 'skin'	/logo/ 'fly'
Laterals:	/belebele/ 'jabber'		
Flaps:	/ᵑgere/ 'to write'		

5.2 *Vowel Harmony*

There do not seem to be any rules regarding vowel harmony in the Sio language. This observation is demonstrated in Chart 13.

CHART 13: VOWEL CO-OCCURENCE IN CVCV SYLLABLE PATTERN

	a	ɔ	e	i	o	u
a	+	+	+	+	+	+
ɔ	+	+	+	+	+	+
e	+	+*	+	+	÷	+
i	+	+	+	+	+	+
o	+	+*	+	+	+	+
u	+	+	+	+	+	+

* This sequence only as a result of morphophonemic rules.

5.3 *Distribution of Vowel Sequences*

Vowel sequences generally occur word finally, and only infrequently occur word initially. Only five examples of word-initial vowel sequences have been found: [ʔaɰ] 'enclosed area', [ʔaj] 'yes', [ʔe.a] 'who', [ʔi.u] 'tail', [ʔu.a] 'spear type'; in each case the sequence constitutes a word. There are no verb roots which begin with a vowel sequence. Chart 14 shows the frequency of vowel sequences in the word-final and word-medial positions. It can be seen from the chart that vowel sequences which end with the low back vowel, /ɔ/, do not occur word-finally, but only word-medially. This is due to the morphophonemic change of /a/ → [ɔ] when certain suffixes are added (see section 4.1). This change can be seen in (66).

66) [pʷa.ˈre.a] 'to rest' [pʷa.re.ˈɔ.ŋa] 'vacation'
[ˈβi.a] 'life' [βi.ˈɔ.ᵑgu] 'my life'
[lu.a] 'to vomit' [lu.ˈɔ.ŋa] 'vomit'

CHART 14: FREQUENCY OF VOWEL SEQUENCES IN WORD-FINAL AND WORD-MEDIAL POSITION

	Final	Medial		Final	Medial		Final	Medial
ɔj	23	2	eɰ	2	0	oɰ	2	0
ɔɰ	15	1	i.ɔ	0	3	u.ɔ	0	1
aj	32	19	i.a	28	5	u.a	19	4
aɰ	27	31	i.o	4	0	u.e	2	0
e.ɔ	0	8	i.u	5	0	u.i	6	1
e.a	35	0	o.a	18	1	u.o	1	1
ej	1	0	oj	8	1			

Vowel sequences occur following all consonants, but not all vowel sequences occur following all consonants. Vowel sequences occur more frequently with voiceless stops, laterals and fricatives than with the other consonants. Chart 15 shows the distribution of vowel sequences following consonants.

CHART 15: DISTRIBUTION OF VOWEL SEQUENCES IN RELATION TO CONSONANTS

	ai	au	ɔi	ɔu	eɔ	ea	ei	eu	iɔ	ia	io	iu	oa	oi	ou	uɔ	ua	ue	ui	uo
b	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
d	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
g	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	2	–
k	5	5	7	1	1	2	–	–	–	2	–	–	1	1	–	–	2	–	–	1
l	6	3	2	2	1	9	–	1	1	5	–	1	2	–	1	1	5	–	–	–
m	1	4	–	2	–	–	–	1	–	–	–	–	4	2	–	–	–	–	1	–
ᵐb	1	1	1	1	–	–	–	–	–	4	3	–	–	1	–	–	2	–	1	–
ᵐbʷ	1	1	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
mʷ	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
n	–	6	–	2	1	1	–	–	–	5	–	1	1	1	–	–	–	–	–	–
ⁿd	3	3	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	2	–	–
ⁿdʒ	–	6	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
ŋ	6	2	–	–	–	2	–	–	–	–	–	–	2	–	–	–	1	–	–	–
ᵑg	1	4	–	–	–	–	–	–	–	1	1	–	1	1	–	–	1	–	–	–
p	3	3	–	1	–	1	–	–	–	3	–	–	1	2	–	–	1	–	–	–
pʷ	2	1	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
r	6	–	1	1	2	5	–	–	–	3	–	–	2	1	–	–	3	–	1	–
s	1	7	2	2	–	1	1	–	1	2	–	–	3	–	–	–	2	–	–	–
t	6	3	2	1	1	2	–	–	–	3	–	1	1	–	–	–	2	–	2	–
β	1	–	–	–	2	3	–	–	1	1	–	–	–	–	–	–	–	–	–	–
z	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–

6. Loan Words

The majority of Sio loan words are taken from Melanesian Pidgin, although words are also taken from English, German and Kâte. When loan words are taken into the language, the Sio stress pattern is superimposed upon the word, so that stress generally falls on the penultimate syllable. Certain other generalizations can also be made about the way loan words are assimilated into the Sio language.

a) The Sio CV syllable pattern always remains intact. Since there is no CVC pattern in the language, derived forms that end in consonants are assimilated by either dropping the final consonant or by adding a vowel to the word-final consonant, which is more common.

balus 'airplane' becomes ['bɔlu]
lam 'lamp' becomes ['lamu]

b) Consonant clusters which do not occur in the language are generally changed by inserting a vowel between the two consonants.

glas 'glass' becomes [ga'lasi]
bris 'bridge' becomes [bi'risi]

c) Consonants which do not occur in the language, but occur in the loan word, are assimilated by substituting a Sio phoneme whose point of articulation is close to that of the borrowed word.

fail 'file' becomes ['paɻli]
anka 'anchor' becomes ['aᵑga]

d) Generally, the vowel quality is retained as the loan word is assimilated into the language. The following are exceptions to that rule.

mani 'money' becomes ['moni]
kot 'court' becomes ['qɔtu]
sambɔŋ 'heaven' becomes ['saᵐba]

e) In addition to the above changes, verbal forms are inflected with all the person prefixes.

skel 'to weigh' becomes [a'skeli] '1 weigh' (*a* '1s')
win 'to win' becomes [ka'wini] 'we (exc) win' (*ka* '1pe')

f) Words that fit the Sio phonological system are generally assimilated without change.

anutu 'God' is retained as [a'nutu]
pasa 'communion' is retained as ['pasa]
miti 'Bible' is retained as ['miti]
pepa 'paper' is retained as ['pepa]

Chart 16 shows the most commonly used Sio loan words with the origin of the loan word.

CHART 16: COMMONLY USED LOAN WORDS IN THE SIO LANGUAGE

Sio	Original	Origin*	Gloss
[ˈaj.ni]	*ain*	MP	'iron'
[a.ˈnu.tu]	*anutu*	K	'God'
[ˈa.ᵑga]	*anka*	MP	'anchor'
[ˈba.li]	*bal*	MP	'ball'
[ˈbɔ.lu]	*balus*	MP	'airplane'
[bi.ˈri.si]	*bris*	MP	'bridge'
[ˈbo.ti]	*bot*	MP	'motorboat'
[ga.ˈla.si]	*glas*	MP	'glass'
[haŋ.ˈsi.ci]	*hausik*	MP	'clinic'
[ˈka.ra]	*kar*	MP	'car'
[ka.ˈraŋ.ti]		G	'cabbage'
[ˈka.ti]	*kat*	MP	'playing cards'
[ˈqɔ.pi]	*kopi*	MP	'coffee'
[ˈqɔ.tu]	*kot*	MP	'court'
[ˈqo.pi]	*copy*	E	'copy'
[ˈla.ma]	*lamb*	E	'lamb'
[ˈla.mu]	*lam*	MP	'lamp'
[ma.ra.ˈsi.ne]	*marasin*	MP	'medicine'
[ma.ˈsi.ne]	*masin*	MP	'machine'
[ˈma.te.ˌma.te]	*matmat*	MP	'cemetery'
[ˈmɔ.ᵑda/ˈma.ᵑde]	*Mande*	MP	'Monday'

*TP= Tok Pisin; K= Kâte; G= German; Y= Yabim; E= English

7. Intonation Patterns

The intonation patterns of the Sio language will now be presented. In general, stressed syllables have increased length, pitch and intensity. These have not been found to be contrastive. Also, the item or action in focus in the clause has raised pitch and slightly increased length on the stressed syllable, which gives emphasis to that part of the clause. Different clause types will be presented, and the pitch will be marked in the following manner; Four levels of pitch will be used to show the intonation of a clause, with a 1 indicating a high pitch, and a 4 indicating a low pitch.

Declarative Statements: Declarative statements, whether indicating past or future statements, all have the same intonation. The pitch drops slightly at the end of the clause as shown in (67).

CHART 16: (cont)

Sio	Original	Origin	Gloss
[ᵐbelo]	*bel*	MP	'bell, bottle'
[ᵐbu.ku]	*book*	MP	'book'
[mi.ti]	*miti*	K	'Bible'
[mo.ni]	*mani*	MP	'money'
[nɔ.ni]		K	'goat'
[ⁿda.nge]	*danka*	G	'thank you'
[paj.ja pa.ni]	*prai pan*	MP	'frying pan'
[paj.li]	*fail*	MP	'file'
[pa.mu]	*pam*	MP	'pump'
[pa.paj]	*papaya*	E	'papaya'
[pa.sa]	*pasa*	Y	'communion'
[pe.pa]	*pepa*	MP	'paper'
[ri.ŋi]	*ring*	E	'to telephone'
[sa.laj]	*salim*	MP	'to send'
[sa.re.re]	*sarere*	MP	'Saturday'
[sɔ.ⁿda]	*Sande*	MP	'Sunday'
[sa.ᵐba]	*sambɔŋ*	K	'heaven'
[se.li]	*sel*	MP	'sail'
[ske.li]	*skel*	MP	'to weigh'
[wi.li,wi.li]	*wilwil*	MP	'bicycle'
[wi.ni]	*win*	MP	'to win'
[ji.si]	*yis*	MP	'yeast'

---

67) a. 3 3 3-4
nanja a-pane ⁿgoa. 'I shoot a pig.'
1s 1s-shoot pig

b. 3 3 3 3-4
nola nanja a-pane ⁿgoa. 'Yesterday I shot a pig.'
yesterday 1s 1s-shot pig

c. 2-3 3 3 3 3-4
wurita nanja ma a-pane ⁿgoa. 'Tomorrow I will shoot a pig.'
tomorrow 1s IRR 1s-shoot pig

Negative Statements: Negative statements are marked with the negation marker at the end of the clause. There is a slight falling pitch on the negation marker as shown in (68).

68) 3 2-3
i-sama tia. 'He doesn't know.'
3s-know NEG

Negative statements may be amplified so that they are an emphatic negative, and can carry the sense that something will never happen. These statements have an entirely different intonation pattern than regular negative statements. The negation marker is followed by an amplifier and the length is longer, and the pitch of the negation marker is sharply higher followed by a sharply falling pitch on the amplifier as shown in (69).

69) 3 1-4 4
i-sama ti-a ᵇdo! 'He doesn't know at all!'
3s-know NEG completely

Dubitative Statements: When an event is uncertain or there is doubt that it took place, intonation is marked differently from a future event which the speaker expects will take place. The dubitative marker is placed at the end of the clause, and that marker has a lower tone and increased length as shown in (70).

70) a. 3 2-4 4
ku-lonɔ tia tɔ. 'Perhaps you didn't hear.'
2s-hear NEG DUB
b. 3 2-4 4
ma si-mɔ tɔ. 'Perhaps they will come.'
IRR 3p-come DUB

Conditional Statements: Conditional statements are marked by a rising pitch at the beginning of the condition clause and a lowering of the pitch at the end of the clause.

71) 3-2 3 3 3-2 3 3 3 3-4
aᵐᵇbowɔᵑᵍga i-toa, aⁿdɛ ma nana a-lɔ lae.
if ship 3s-comes ashore then IRR 1s 1s-go Lae.
'If the ship comes ashore, I will go to Lae.'

Imperative Statements: Positive imperative statements are marked by a pitch that is sustained until the end of the clause when the pitch drops sharply. Depending on the urgency of the command, the command will vary in intensity or loudness.

72) 2 2-4
ku-mɔ wailele. 'Come quickly.'
2s-come quickly

Prohibitive commands have a slightly different intonation pattern. The prohibitive word is put at the end of the clause, and there is an increased length on the stressed syllable of that word with a falling pitch on the second syllable of the prohibition word.

73) 3 3 2-4
ku-veta ŋine ⁿdimo. 'Don't do that.'
2s-do DEM PROHIB

Yes/No Questions: This type of question is marked with the negative morpheme at the end of the clause. There is length on the first syllable of the negative morpheme and a rising pitch on the second syllable.

74) 3 3 2-1
wɔⁿgai-toa, tia? 'Has the ship has come ashore?'
ship 3s-come.ashore NEG

Either Or Questions: These questions are marked with a rising and lowering pitch. The negative morpheme is put between the two choices and there is a rising pitch on the negative morpheme, with a lowered pitch and the second choice.

75) 3 3 3 2-3 2-1 4
noko ilo pa kɔpi tia, ti? 'Do you want coffee or tea?'
2s insides DIR coffee NEG tea

Either/or constructions may also be expressed by a different grammatical construction, and the intonation pattern is slightly different. The pitch of the negation word rises with the pitch of the contrasting words lower.

76) 3 3 4 2-4 4
ma i-veta tɔ-ku tia tɔ-ku. 'He may do it and he may not.'
IRR 3s-do DUB-and NEG DUB-and

Who Questions: These questions are marked with a rising and falling pitch on the who question word.

77) 2-4 4
ea i-pai-no? 'Who told you?'
who 3s-told-2s

What, Where and Which Questions: These questions have a similar intonation pattern as declarative statements. However, the question word is generally put at the end of the clause, and there is increased length on the stressed syllable of the question word, with a low pitch.

78) a. 3 2-4 4
kinzi si-lɔ ᵑdia? 'Where are they going?'
3p 3p-go where

b. 3 3 2-4 4
noko pʷ-ai kaiᵐbo ᵑdia? 'Which string did you take?'
2s 2s-take string which

c. 3 2 4
noko pʷ-ai sɔ? 'What did you take?'
2s 2s-take what

When Questions: In these questions, the question word is placed at the front of the clause, and there is a slight rising and falling pitch on the question word.

79) 3 2-4 3 3 3-4
zo mana ma si-taulo si-mɔ? 'When will they return?'
day which IRR 3s-return 3s-come

How Questions:

80) a. 2 2 3 3 1-4 4
mana mana ŋana noko natu kɔ? 'How is your child?'
how how about 2s child LMTR

b. 3 2-4 4
i-veta mɔsi mana? 'How is he making that?'
3s-make way how

Rhetorical Questions and Why Questions: Generally "why" questions are rhetorical questions in the Sio language, and imply rebuke. They are not used to gain information. The "why" question is marked by a question phrase, and can be placed at either the beginning or end of the clause. Fronting the question phrase is done for emphasis, and the intonation pattern varies.

81) a. 3 3 2-3 4 3 4
noko ku-veta ŋine ŋana sɔ kɔ? 'Why did you do that?'
2s 2s-do DEM about what LMTR
[why]

b. 2 1 3 4 4 4 4
ŋana sɔ kɔ ᵑga noko ku-veta ŋine? 'Why did you do that?'
about what LMTR 2s 2s-do DEM
[why]

Other questions can also be used in a rhetorical sense. The normal intonation pattern is exaggerated with stressed syllables having increased length and pitch.

81) a. 1-4 2-3 3 3-2-3 2-4
'ea i-'pai-no 'tu ku-'veta ŋine? 'Who told you to do that?'
who 3s-told-2s PUR 2s-do DEM (You shouldn't have done that.)

b. 2-3 3 3-2-3 3-2 2-1
noko ⁿde tamɔta ŋalae, tia? 'You are an important man, no?'
2s are man big NEG (You are not an important man.)

Insults: Insulting phrases are marked with a certain tone which implies disgust, and the final word of the phrase is marked with increased length on the stressed syllable followed by a sharp falling tone.

82) a. 3 2-3 3 1-4
noko mata pʷau ti-a. 'You don't have any eyebrows'
2s eye hair NEG

b. 3 2-3 1-4
noko nao ki-se. 'You have a smelly face'
2s face smelly

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