

Phonological Patterning of Prevocalic Glides in Squliq Atayal*

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There is ambiguity regarding how a consonant-glide (CG) sequence should be pronounced in the Romanized orthography of Squliq Atayal. In this paper the phonological behavior of these prevocalic glides in Squliq Atayal is examined in order to determine the nature of the glides. The commonly seen CG spelling in Squliq orthography corresponds to three distinct surface pronunciations: (1) tautosyllabic, (2) heterosyllabic with an intervening weak vowel, and (3) heterosyllabic yet segmentally adjacent. In previous literature only the first two pronunciations have been identified, but it is the contrasting syllabification patterns between (1) and (3) that support the classification of these surface glides into two categories: phonemic versus vocalically derived glides. An examination of morphologically related forms containing glides shows that the perplexing distribution of Squliq Atayal glides results from the coexistence of glide formation, vowel syncope, and resyllabification in the same system, which causes the distribution of phonemic glides and vocalic glides to overlap. The analysis suggests that the two types of glides in Squliq are different in phonological features, although they appear phonetically similar.

Key words: consonant-glide syllabification, derived glide, glide formation, Optimality Theory, phonemic glide, resyllabification, vowel syncope

1. Introduction

In the Romanized orthography of Squliq Atayal, how a consonant-glide (CG) sequence should be pronounced is ambiguous. For example, the same *ky* sequence is pronounced differently, as illustrated by the presence of intervening schwas in *mkyay* [məkəjaj] ‘dry’ and the lack of schwas in *kyahil* [kjaɦil] ‘skin’.¹ Cheng (2001:106–108) has already noticed the ambiguity and illustrates the point with several examples, some of which follow:

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¹ The symbol /y/ in the previous studies on Squliq has been changed to International Phonetic Alphabet (IPA) palatal glide /j/ for consistency, and *y* is kept here only for orthography.

(1)	<i>Orthography</i>	<i>Pronunciation</i>	<i>Gloss</i>
a.	syukun	ʃju.kun	‘answer (PV)’ ²
a’.	syukan ³	sə.ju.kan	‘broil (LV)’
b.	gyahan	ɣja.han	‘open (LV)’
b’.	gyagan	ɣə.ja.ɣan	‘choose (LV)’
c.	hwahun	hwa.hun	‘destroy (PV)’
c’.	hwakun	hə.wa.kun	‘support by the arm (PV)’
d.	twangiɣ	twa.ŋiɣ	‘increase (PV.AT)’
d’.	twasi’	tə.wa.ʃiʔ	‘laundry brush’ (loanword)
e.	gbyan	ɣə.βjan	‘evening’
e’.	mbyaq	mə.βə.jaq	‘come down (AV)’

There are different opinions in Atayal communities regarding whether an additional symbol such as ‘-’ or ‘_’ should be used in orthography to stand for the intervening weak vowels between CG. Inconsistency in orthography can be found in various printed documents at the present time.

The two types of CG pronunciation in (1) raise the question regarding the nature of the pre-vocalic glides involved. Focusing on the patterning of these surface glides, the paper will describe a third type of CG pronunciation which has not been discussed in previous Atayal literature: the consonant and the glide are segmentally adjacent but belong to separate syllables, such as *qbyangi* (qəβ.ja.ŋ-i) ‘hunt (with guns), LV.AT’. It will be argued that the contrasting patterns of tautosyllabic and heterosyllabic CG pronunciations provide direct support for the classification of the surface glides into two categories: phonemic versus derived glides. Glides in tautosyllabic CG are typically derived from vowels via glide formation, while a phonemic glide must be syllable-initial except in certain phonologically derived environments. The typical distributional patterns are obscured by vowel syncope and resyllabification rules in the language, which lead to the occurrence of phonemic glides in the tautosyllabic CG positions where vocalic (derived) glides usually occur.

Before a close examination of the patterns of phonemic and derived glides, background information and a literature review for Sqliq Atayal are given in §2. In §3, more data illustrating the three types of CG pronunciations are given: tautosyllabic CG sequences (represented by .CG, where the dots stand for syllable boundaries), heterosyllabic CG separated by an intervening vowel (CV.G), and heterosyllabic yet segmentally adjacent CG sequences (C.G). It is argued that the contrastive syllabification patterns of consonant-glide sequences call for a distinction between phonemic and derived glides. Section 4 offers an Optimality-theoretic account for the syllabification patterns of phonemic and derived glides, based on the idea that vocally derived glides are [+vocalic], while

² The abbreviations used in the paper are as follows: AV: agent voice; PV: patient voice; LV: locative voice; AT: atemporal; PRF: perfective.

³ Syllable-initial [j] may alternate with a fricative pronunciation both within and across speakers in Sqliq and there is a great deal of variation concerning this phenomenon. The fricative pronunciation is represented by *zy* in orthography and by [ʒj] in Cheng (2001); for example (1a') *syukan* [sə.ju.kan] may be pronounced as *szyukan* [sə.ʒju.kan]. In this paper, I assume that orthographic *zy* corresponds to one segment [ʒ] (i.e. [sə.zu.kan]), which is in variation with [j]. Only the glide variants are shown throughout the paper; the fricative variants are omitted for ease of presentation.

phonemic glides are [–vocalic]. Section 5 concludes and discusses related questions for future research.

2. Background of Squliq phonology and literature review

Previous studies on Squliq Atayal, such as Yamada & Liao (1974), Li (1980), and Egerod (1999), propose that there are 19 consonants in the inventory: /p t k q ʔ b[β] z g[ɣ] s c[tʰ] x h[h] m n ŋ r l j w/. The glides /j w/, however, are not found in the earlier work by Egerod (1965a, 1965b, 1966a, 1966b, 1980). As far as Squliq vowels are concerned, Li (1980) gives five vowels /i e a o u/, Yamada & Liao (1974) and Cheng (2001) include an additional schwa /i e a o u ə/, and Egerod (1965a, 1966a, 1980, 1999) lists two additional long vowels /i e a o u ii uu/. Complex syllable margins are not allowed (Huang 2006b). Stress in general falls on the final syllable. Vowels in the syllables before the penult are reduced to [ə] (see Egerod 1965a; Li 1980:369; Rau 1992:27). Squliq contains a number of segmental alternation processes, such as *b* → *p*, *g* → *w*, and *r* → *j* in word-final position (see Li 1980 for more details).

Disagreement in the consonant inventory mainly relates to the glides /j w/. In fact, even among the studies which agree on the phonemic status of glides, a given articulation may be analyzed differently, as either a glide or a vowel. For example, ‘live’ is *mqianux* in Egerod (1999) but *mqjanux* in Li (1980), although both studies recognize phonemic /j w/. The different ways that glide and vowel symbols are used in the various previous studies are summarized below.

Egerod (1965a, 1965b, 1966a, 1966b, 1980) allows multiple vowel sequences in the transcriptions since phonemic /j w/ are not posited, for example *qsiaʔ* ‘water’, *mqianux* ‘live’, *kgii* ‘hemp’, *ŋuhuu* ‘nose’, and *quau* ‘liquor, wine’. Egerod (1999) adopts phonemic /j w/ and substitutes the glide symbols in initial position (e.g. *jaqeh* ‘bad’), in intervocalic position (e.g. *qbujan* ‘lie in ambush’), and in syllable-final position when not following homorganic vowels (e.g. *quaw* ‘liquor, wine’). However, vowel symbols are retained for some of those surface glides in postconsonantal prevocalic position⁴ (e.g. *qsiaʔ* ‘water’ and *mqianux* ‘live’) as well as in syllable-final positions following homorganic vowels (*kgii* ‘hemp’ and *ŋuhuu* ‘nose’). Yamada & Liao (1974) include /j w/ in the phonemic inventory; the phonemes /j w/ appear in prevocalic positions such as /qəsijaʔ/ [qəsijaʔ]~[qəsjaʔ] ‘water’ and /məquwalax/ [məquwalax] ‘rain’ (p.113), in postvocalic (as well as intervocalic) positions as illustrated by /wajaj/ [wajaj] ‘thread’ (p.114), but not in those postvocalic positions where Egerod has geminate vowels, as indicated by the absence of word-final glides in /kəgi/ ‘hemp’ and /ŋuhu/ ‘nose’ (p.115).⁵ Li (1980) recognizes the phonemic status of /j w/ and

⁴ Some words in Egerod (1999) contain glide symbols *j w* even though they occur in postconsonantal prevocalic position, for example *hwinuk* ‘waist’, and *pmjon* ‘plant, PV’; some other words are given with variable transcriptions, for example *msiulun*~*msjulun* ‘clouds together’.

⁵ Yamada & Liao’s data are based on the Sqoyaw variety of Squliq Atayal spoken in Taichung. Their transcriptions indicate that stressed syllables are lengthened in the output, which are omitted here. They also show that penultimate syllables carry stress except when the penult contains a schwa, in which case stress falls on the final syllable. The stress patterns of Sqoyaw are different from the Squliq dialect spoken in Hsinchu, which in general exhibits final stress. Rau (1992:26) also reports that stress may fall on the penultimate syllables in the Squliq variety spoken in Wulai, Taipei County.

excludes the possibility of vowel sequences in transcriptions, for example *mqjanux* ‘live’ (Li 1980:397) and *kgij* ‘hemp’ (Li 1981:259). Later studies on Atayal, such as Rau (1992), L. Huang (1993), and Cheng (2001), present their analyses of different aspects of the language mostly on the basis of Li’s analysis of phonemic glides. Aside from the purely vocalic approach in the earlier works by Egerod, disparities are mainly observed in the analysis of postconsonantal prevocalic segments as either vowels (e.g. *mqjanux* in Egerod 1999) or as glides (e.g. *mqjanux* in Li 1980), as well as in the analysis of postvocalic glides as either part of a geminate vowel (e.g. *kgii* in Egerod 1999) or as glides (e.g. *kgij* in Li 1981).

The divergent usages of glide or vowel symbols in the literature call for clarification of the nature of the surface glides in Squliq. Although most of the previous studies (except earlier works by Egerod) recognize phonemic glides, very few of them provide explicit arguments for /j w/ except Li (1980). Li (1980:355–356) offers five reasons for adopting phonemic glides in an attempt to explain why /ii uu/ in Egerod’s system should be analyzed as /ij uw/. The arguments are all concerned with stem-final postvocalic glides: (1) there are various diphthongs /aj aw uj iw/, but no /ij uw/; (2) given that most Atayal words end in a consonant, words with final /ii uu/ would be major exceptions; (3) /ii uu/ sequences are historically derived from a sequence where a vowel is followed by a consonant; (4) the distribution of /ii uu/ is limited only to word-final position; and (5) there are no phonemic long vowels other than [i:] and [u:].⁶

Four of the five reasons to support phonemic glides given by Li ((1), (2), (4), and (5)) are based on distributional asymmetry. Although distributional asymmetry may be related to the phonemic status of glides in the Squliq data, the argument does not appear to be convincing, in light of the preference to treat glides [j w] as nonsyllabic positional variants of, respectively, high vowels [i u] in the literature of generative phonology ever since the advent of syllable theory in the 1980s (Clements & Keyser 1983; Levin 1985; Selkirk 1984). In many languages, the occurrence of either glides [j w] or high vowels [i u] can be predicted from their different positions within a syllable. Featural distinctions between surface glides and vowels would be redundant in these languages, so surface glides and their corresponding vowels are identical in the underlying representation for reasons of economy. For example, surface glides in Mandarin are widely regarded as variants of their corresponding high vowels (Duanmu 2000, 2007; Lin 1989, 2007, among others). The glides in Mandarin Chinese words, for example /lian/ [ljaŋ] ‘bright’ and /suan/ [swan] ‘sour’, can be derived from underlying vowels by assuming that more sonorous segments occupy nucleus positions and that high vowels are turned into surface glides because they do not (exclusively) occupy the nucleus.⁷

⁶ Rau (1992:20) follows Li’s argument and states that adopting /j w/ would show the canonical structure of Atayal more clearly. Rau adds that some words necessitate /j w/ as separate phonemes because a vowel phoneme in the input of these words cannot help derive the correct form; for example [jəŋəliʔ] ‘fly’ must be analyzed as /jŋliʔ/ rather than /iŋliʔ/ (the word is quoted on authority of Scheerer’s /yeŋeli/ and Ogawa’s /juŋəli/). More data are needed to clarify the argument.

⁷ Whether postconsonantal onglides (e.g. /kuan/ [kwan] ‘close’) are in the nucleus or in the onset, and whether offglides (e.g. /lai/ [laj]) are in the nucleus or in the coda are controversial issues in Mandarin literature. No matter what the syllabic affiliation of the surface glides are, underlying vowels will be realized as glides as long as they are not the only segments under the nucleus node.

The third observation made by Li is based on the assumption that segmental alternations do not change major class features. Although the alternations between glides and true consonants observed in Li (1980) ($g \rightarrow w / _ \#$, as in *hmtuw/htgan* ‘come out’, and $r \rightarrow j / _ \#$, as in *mahij/hirun* ‘dry in the air’) very likely suggest the consonantal nature of the surface glides, notice that the observed rules do not actually support the existence of phonemic glides in Squliq because there is no need to posit glides at the underlying level to account for the alternations. In these forms the input representations contain stem-final true consonants, which then become glides, and thus have nothing to do with the issue of whether glides exist at the underlying level.⁸ Therefore, more compelling evidence is required for the status of phonemic glides. It will be argued in the following section that it is the contrasting syllabification patterns of prevocalic glides that provide support for distinguishing phonemic glides from vocally derived glides in Squliq.

Disagreement regarding the Squliq vowel inventory in previous studies is mainly to do with whether /ə/ should be recognized as a phoneme. The vowel [ə] is limited in its distribution, occurring only in nonfinal (unstressed) syllables,⁹ and most studies in the literature therefore exclude schwa from the Squliq vowel inventory (e.g. Egerod 1965a, 1965b, 1966a, 1966b, 1980, 1999; Li 1980, 1981). Yamada & Liao (1974) include /ə/ as a phoneme even though they have noticed that the distribution of /ə/ is highly constrained.¹⁰ Cheng (2001) lists /ə/ as a phoneme without further explanation.

The present study is based on the author’s fieldwork on the variety of Squliq spoken in Taoshan Village, Wufeng Township, Hsinchu County (hereafter Taoshan Squliq). In the varieties of Squliq analyzed in previous studies (e.g. Egerod 1980, 1999; Li 1980, 1981; Rau 1992), word-internal codas are restricted to morphologically infixed forms, but Taoshan Squliq more freely allows consonants in the codas of nonfinal syllables.¹¹ Cheng (2001:37–42) states that Taoshan Squliq differs from the Squliq in Fuxing Township, Taoyuan County, in the following three aspects: (1) while Fuxing Squliq has monophthongs /e/ and /o/, Taoshan Squliq retains historical *aj* and *aw*; mid vowels *e* and *o* variably occur only in a small number of words and thus have a very marginal status as phonemes; (2) high vowels /i u/ tend to be pronounced lower in Fuxing; and (3) (unstressed) syllables are less likely to drop in Taoshan Squliq than in Fuxing Squliq.¹² This study chooses the variety of Squliq spoken in Taoshan as the basis for discussion because it preserves surface glides [j w] in prevocalic as well as postvocalic environments, while many other Squliq varieties manifest variable degrees of monophthongization, which obscures the patterning of the glides.

⁸ The statements in Li (1980) imply that word-final homorganic vowel-glide sequences (e.g. *hmtuw* and *mahij*) are realized as long vowels at a phonetic level.

⁹ The absence of [ə] in the final syllable is due to the historical change of Proto-Austronesian *ə to Proto-Atayalic *u in this position (Li 1981).

¹⁰ Yamada & Liao (1974) state that /ə/ never occurs in word-initial position, in word-final position, or in the final syllable; /ə/ is always unstressed, and it never constitutes a word unless it has an additional vowel other than /ə/.

¹¹ The observation regarding word-internal codas in different Squliq varieties is based on the author’s observations.

¹² The data in the series of work by Egerod and Li are based on the Squliq variety spoken in Fuxing Township, Taoyuan County.

3. Three different surface pronunciations of CG

Words that are spelt with CG in the Romanized orthography of Squiliq Atayal in fact correspond to three different types of surface pronunciation, rather than two as described in the literature. The two types recognized hitherto are given below with further classification, based on the author's own fieldwork, and the data showing the third type of CG pronunciation are offered thereafter.

The first type of CG pronunciation contains tautosyllabic consonant-glide sequences (.CG).¹³ Notice that some of these tautosyllabic pronunciations arise through morpheme concatenation, so a corresponding vowel can be identified in related forms, as illustrated in (2), while other postconsonantal glides do not alternate with vowels in the language, as shown in (3).

- (2) CG in the same syllable (.CG); G alternating with V in related forms:

	<i>Orthography</i> ¹⁴		<i>Orthography</i>		<i>Gloss</i>
a.	m'abi'	mə.-ʔa.βiʔ	'byan	ʔə.βj-an	'sleep'
b.	tmami'	tə-ma.miʔ	tmmyan	tə.mə.mj-an	'pickle'
c.	smnhi'	s<əm.>nə.hiʔ	snhyaw	sən.hj-aw	'believe'
d.	tmutu'	t<ə.m>u.tuʔ	ttwan	tə.tw-an	'fell (trees)'
e.	muluw	m-u.luʷ	'lwan	ʔə.lw-an	'find'

- (3) CG in the same syllable (.CG); no glide-vowel alternation within the language:

	<i>Orthography</i>	<i>Pronunciation</i>	<i>Gloss</i>
a.	ryax	rjax	'day'
b.	syam	əjam	'pork'
c.	syup	əjup	'garbage'
d.	gyus	ɣjus	'intestines'
e.	bwax	βwax	'grain, rice'
f.	qwaw	qʷaw	'liquor, wine'
g.	lwax	lwax	'pillar'
h.	lpyung	lə.pjuŋ	'relatives by marriage'
i.	ksyuw	kə.əjuw	'borrow, lend'
j.	'nyal	ʔə.njal	'be on the way, come back'
k.	qrhyang	qə.rə.hjaŋ	'oil slick'

Both (2) and (3) above illustrate tautosyllabic CG pronunciations. The prevocalic glides in (2) are analyzed as underlying vowels in the synchronic grammar because they alternate with vowels in morphophonology. Due to the constraint that syllables must have onset consonants, vowels

¹³ See also the data in (1) for the first two types of CG pronunciation.

¹⁴ There are different versions of orthography regarding the usages of *y*, *w*, and ' in word-final positions. Some people omit *y* and *w* in words without final glottal stops if the glides follow homorganic vowels, such as (2e) written as *mulu* rather than *muluw*, and at the same time adopt word-final ' to represent glottal stops in words such as (2d) *tmutu*'. Other people will adopt *y* and *w*, such as (2e) as *muluw*, but omit word-final ' (e.g. *tmutu*) even if glottal stops are produced.

undergo glide formation and become surface glides in Squliq (Huang 2006a); if gliding does not take place, an onsetless syllable would occur in (2d) *[tə.tu.an], for example.¹⁵

While the glides in (2) correspond to vowels in some morphologically related forms, those in (3) do not. Therefore, whether the glides in (3) come from vowels cannot be readily inferred. It will be discussed later whether tautosyllabic postconsonantal glides such as those in (3) should also be analyzed as surface manifestation of underlying vowels, despite the lack of dynamic alternation with vowels in the synchronic grammar.

The second type of pronunciation that corresponds to CG spelling involves an intervening weak schwa or apical vowel (CV.G), as already shown in some examples from previous studies in (1); more examples are given in (4) below.

(4) Heterosyllabic CG with an intervening weak vowel (CV.G):		
	<i>Orthography</i>	<i>Gloss</i>
a.	mkyay mə.-kə.jaj	‘dry (AV)’
b.	tgyup tə.ɣə.jup	‘sink’
c.	qsyu’ qə.sɪ.juʔ	‘pestle’
d.	mshyu’ mə-s.hə.juʔ	‘straight’
e.	ghyaq ɣə.hə.jaq	‘(feel) cold’
f.	qhyang qə.hə.jaŋ	‘shoulder’
g.	rhyal rə.hə.jal	‘earth, ground’
h.	mbyaq mə.-βə.jaq	‘come down (AV)’
i.	byacing βə.ja.tɛiŋ ~ βija.tɛiŋ ~ βja.tɛiŋ	‘moon’
j.	qyunam qə.ju.nam	‘hunting area’
k.	qwihing qə.wihiŋ	‘water leech’
l.	hwinuk hə.wi.nuk	‘waist’
m.	kyaqih kə.-ja.qih	‘bad’
n.	myubing mə.-ju.βiŋ	‘stingy’
o.	mtyu’ mə.-tə.juʔ	‘six (AV)’
p.	mhyaw mə.-hə.jaw	‘chase (AV)’

There is in fact a third type of pronunciation that corresponds to CG spelling which has not been pointed out in the literature: CG corresponds to heterosyllabic consonant-glide sequences without intervening vowels (C.G).

(5) Heterosyllabic CG without intervening vowels (C.G):		
	<i>Orthography</i>	<i>Gloss</i>
a.	kinyayan (tawpu’) k<in.>ja.j-an	‘dried (e.g. radish) (PRF, LV)’
b.	sinyukan ɕ<in.>ju.k-an	‘burn (esp. feathers or hair) (PRF, LV)’

¹⁵ It is assumed in Huang (2006a) that the roots in (2a–d) end with a vowel in the input; the vowel-ending hypothesis is identical to that of Cheng (2001:67–68). Huang (2006a) is based on the Squliq variety spoken in Jianshi Township, Hsinchu County. The two Squliq varieties are identical in terms of the application of glide formation but different in a number of other aspects. As far as (2e) is concerned, it is hypothesized that glide formation is preceded by deletion of stem-final glides.

- c. hmyapas h<ə**m**.>ja.pas ‘joke (AV)’
 d. smyawkay s-ɪ**m**.-jaw.kaj ‘drizzle (AV)’
 e. qbyangi qəβ.ja.ŋ-i ‘hunt (with guns) (LV.AT),’¹⁶

Despite the fact that prevocalic consonant-glide sequences are permitted within a syllable as in (2) and (3), the glides and the preceding consonants are syllabified into separate syllables in (5). The difference in the .CG (data (2) and (3)) and C.G (data (5)) pronunciations can be clearly heard in data elicitation.¹⁷ The contrast seems to suggest that syllabification patterns could provide a clue to the different nature of surface glides.

The paper will show below that how a prevocalic glide is syllabified with respect to the preceding true consonant is indicative of its underlying nature. The argument is based on an examination of the ways that a prevocalic glide alternates among the three CG syllabification patterns in morphologically related forms. Morphological concatenation leads to CG in different prosodic positions, which results in different pronunciations of CG due to the influence of relevant phonological processes. The hypothesis is that surface glides of different sources may exhibit different patterns of syllabification.

Given the three CG syllabification patterns (.CG, CV.G, C.G), there are nine logical possibilities if prevocalic glides in both penultimate and final syllables are considered,¹⁸ three patterns in each of the two positions. Table 1 below is organized to show the three logical possibilities (.CG,

Table 1: Nine logical possibilities for the distribution of prevocalic glides

Representative examples:	Penultimate	Final
A. hə.βja.tə-i / hə.βjat ‘pull out’	.CG	.CG
B. (not found in Squliq)	CV.G	.CG
C. (not found in Squliq)	C.G	.CG
D. pə.-nja.ŋ-i / mə.-na.jaŋ ‘reclaim (land)’	.CG	CV.G
E. Pə.ju.t-an / P<ə.m>u.jut ‘extinguish, turn off’	CV.G	CV.G
F. təh.ja.j-un / tə.hu.jaj ‘succeed’	C.G	CV.G
G. kja.p-i / k<ə m .>jap ‘catch’	.CG	C.G
H. qə.ju.w-an / qə m .juʔ ‘infect’	CV.G	C.G
I. k<in.>ja.j-an / k<ə m .>jaj ‘dry’	C.G	C.G

¹⁶ The root *qbuyang* is glossed as ‘to lie in ambush’ in Egerod (1980:512, 1999:226).

¹⁷ In data elicitation, sometimes the consultants are asked to answer the question of how many ‘beats’ there are in a word, and they would often respond with answers such as ‘two beats *kə* and *mjut* in [kə.mjut] “pluck”’ or ‘two beats *qəm* and *juʔ* in [qə**m**.juʔ] “infect”’, which supports the syllabification judgment.

¹⁸ The discussion here does not include those forms where the CG sequences are shifted to pre-penultimate positions and undergo additional phonological changes, such as *kəyuuw/pksaygani* [pə-k.saj.ɣ-a.ni] ‘borrow, lend’ and *kmyut/kawtani* [kawt-ani]/kawtanay [kawt-anaj] ‘pluck’, which have rarely been discussed in the literature. More research is needed to collect examples of this kind in order to identify the motivations of the phonological processes involved.

CV.G, and C.G) of prevocalic glides in the final syllables, further classifying each of them according to the syllabification patterns of the same glides when they are shifted to the penultimate syllables upon suffixation.

Of the nine logical possibilities, seven are found in Squliq.¹⁹ The seven patterns and the proposed analysis are discussed below.

Pattern (A) refers to those cases where prevocalic glides in final syllables remain tautosyllabic with the preceding consonant when shifted to the penultimate syllables upon suffixation. More examples are given below to show that this pattern is quite common, and that a wide variety of consonants can precede the glide:

(6) Pattern (A) (consistent .CG): ²⁰				
<i>G in penultimate syllables</i>		<i>G in final syllables</i>		<i>Gloss</i>
a.	hbyaci hə.βja.tɛ-i ²¹	hmbyat h<əm>.βjat		‘pull out’
	hbyataw hə.βja.t-aw	hmnbyat h<əm><.n>ə.βjat		
	hbyatun hə.βja.t-un	hbyat hə.βjat		
b.	psyaxi pə.-əja.x-i	smyax s<.m>jax		‘lighten’
	psyaxan pə.-əja.x-an			
c.	ksyugi kə.əju.γ-i	ksyuw kə.əjuw		‘borrow, lend’
	pksyugi pə-k.əju.γ-i			
	ksyugan kə.əju.γ-an			
	ksyugay kə.əju.γ-aj			
	kinsyugan k<in.>əju.γ-an			
d.	kyuci kju.tɛ-i	kmyut k<ə.m>jut		‘pluck’
	kmyuta k<ə.m>ju.t-a	kmnyut k<əm>.<n>jut		
	knyutan k<ə.n>ju.t-an			
e.	inrkyasan ʔ<in.>rə.kja.s-an	mrkyas mə.-rə.kjas		‘grow’
f.	pgyaran pə.ɣja.r-an	mgyay mə.-ɣjaj		‘escape’
	mgyara mə.-ɣja.r-a			
g.	lngyaqan lə.ŋja.q-an	mlngyaq mə-lə.ŋjaq		‘swim’
h.	’nyugan ʔə.nju.γ-an	m’yuw mə-ʔjuw		‘change, exchange’
	’myuga ʔə.mju.γ-a			
i.	twangi twa.ŋ-i	tmwang t<ə.m>wan		‘add’
	twangan twa.ŋ-an	ptwang pə.-twan		
	twangay twa.ŋ-aj	stwang sɪ.-twan		
		mttwang mə.-tə.-twan		

¹⁹ The reason that patterns (B) and (C) are absent is presumably because a syncope rule in Squliq targets the antepenultimate vowel before the foot (i.e. right before the penultimate syllable) but not the penultimate vowel.

²⁰ These affixed forms are elicited in sentence contexts. For example, the form [h<əm><.n>ə.βjat] is obtained from a sentence such as *ima’ hmnbjat tawpu’ hani* [i.maʔ həm.nə.βjat taw.puʔ ha.ni] ‘Who pulled out the radish?’

²¹ Palatalization in Squliq changes underlying /t, s/, to [tɛ] and [ɛ] respectively before the environments of /i, j/.

j.	hwahun	hwa.h-un	hmwah	h<ə.m>wah	‘demolish’
	hwahi	hwa.h-i	hmnwah	h<əm.><n>wah	
	hwahaw	hwa.h-aw	hinwah	[h<in.n>wah]	
k.	pqwasan	pə.-qwas-an	mqwas	[mə.-qwas]	‘sing, study’

Although these tautosyllabic postconsonantal glides are not found to alternate with vowels in Squliq, a comparison with the more conservative Mayrinax dialect of Atayal suggests that historically they come from vowels. The prevocalic glides correspond to vowels in Mayrinax cognates; for example (6b) [sɪ.mjax] ‘lighten’ and (6f) [mə.ɣjaɟ] ‘escape’ are, respectively, [cu.mi.ʔax] and [ma.ɣi.jaj] (or [ma.ɣi.aj]) in Mayrinax. Similarly, some of the postconsonantal glides in monomorphemic words, as shown previously in (3), are found to correspond to vowels in Mayrinax; for example (3a) [rjax] ‘day’ and (3d) [ɣjus] ‘intestines’ are [riʔax] and [ɣijus] (or [ɣius]) in Mayrinax.²²

It is proposed that the postconsonantal glides in pattern (A) are still vocalic in the synchronic grammar of Squliq, while all the other kinds of glides in Table 1 are non-vocalic in nature and hence analyzed as phonemic glides. Without the synchronic distinction between vocally derived and phonemic glides, it would be difficult to derive all the observed patterns. The glides in (A) come from underlying high vowels, which undergo glide formation in order to avoid onsetless syllables in Squliq (Huang 2006a). The consistent occurrence of vocally derived glides in postconsonant position (e.g. (6a) [hə.βja.tun] ‘pull out’) rather than in syllable-initial position (*[həβ.ja.tun]) will be accounted for via a set of constraints demanding proper association of segmental features and syllabic positions within Optimality Theory in the next section.

As far as the glides in attested patterns (D) through (I) are concerned, they are characterized by the fact that they involve syllable-initial glides in at least one of the two positions. In the proposed analysis, while derived glides always occur in postconsonantal position (pattern (A)), phonemic glides typically show up in syllable-initial positions (patterns (D) through (I)); all the other aberrant realizations of phonemic glides in non-initial positions are due to interactions with other phonological processes in the language, including syncope and resyllabification. The six attested patterns involving phonemic glides are discussed below.

The three patterns (D)(E)(F) all involve syllable-initial glides in their final syllables which are separated from the preceding consonant by a vowel (i.e. CV.G). More data illustrating the three patterns are given below (the representative examples in Table 1 are included and repeated here for convenience):

(7) Patterns (D)(E)(F):

(D) Penultimate .CG		Final: CV.G	Gloss
a. pə.- nja .ŋ-i	p<in.> nja .ŋ-an	mə.- na .jaŋ	‘reclaim (land)’
b. k<ə.m> ja .l-a	kja .l-an	k<ə.m> a .jal	‘speak’
c. kə. rja .s-un		kə. ra .jas	‘cross over’
d. p-in.- teju .q-an	pə.- teju .q-i	pə.- tu .juq	‘spit’

²² The Mayrinax data are based on the author’s own field notes. It is also observed that the surface glides in patterns (D) to (I), which are argued to be phonemic below, do not correspond to Mayrinax vowels.

(E) Penultimate <i>CV.G</i>		Final: <i>CV.G</i>	Gloss
e. ʔə.ju.t-an	ʔə.ju.tə-i	ʔ<ə.m>u.jut	‘extinguish, turn off’
f. hə.wa.k-un	hə.wa.k-aj	h<ə.m>a.wak	‘support by the arm’
g. kə.jaj-aj		mə.-kə.jaj	‘dry’
h. pə-k.-ʔə.ja.j-un		mə.-ʔu.jaj	‘hungry’
(F) Penultimate <i>C.G</i>		Final: <i>CV.G</i>	Gloss
i. təh.ja.j-un		tə.hu.jaj	‘succeed’
j. q<in.>ja.t-an	q<ə.m.>ja.t-a	q<ə.m>a.jat	‘rear, bring up’
k. ɕ<in.>ju.k-an	s<im.>ju.k-a	s<i.m>a.juk	‘burn (e.g. hair)’
l. ɣ<ə.m>.jaŋ-a		ɣ<ə.m>a.jaŋ	‘spread’

The above data show that the glides manifest all three logical possibilities (.CG, CV.G, and C.G) when shifted to penultimate syllables upon suffixation. For example, the glide in [mə.na.jaŋ] is in the environment of CV.G in the final syllable, and it appears in the environment of .CG when shifted to penultimate syllables (i.e. [pə.nja.ŋi]), which is a case of pattern (D). The glide in [ʔə.mu.jut] is also in the environment of final CV.G, but the glide remains CV.G in the penult ([ʔə.ju.t-an]), illustrating pattern (E); the glide in [tə.hu.jaj] is CV.G in the final syllable, but becomes C.G in the penult ([təh.ja.j-un]), which is a case of pattern (F).

Unlike the vocalic glides in pattern (A), the surface glides in (D)(E)(F) are analyzed as phonemic. In the proposed OT analysis, phonemic glides typically occur in syllable-initial positions because of high-ranking constraints that demand association of non-vocalic glides with syllable margins. Pattern (E) involves syllable-initial glides in both positions, so what remains to be accounted for is the penultimate .CG in pattern (D) and the alternation between CV.G and C.G in (F). Pattern (F) is discussed first followed by (D) because (D) involves more complexities, as explained below.

It is observed that Taoshan Squiliq exhibits a vowel syncope rule that affects pre-tonic vowels, which is not reported in previous studies on other varieties of Squiliq. As the data (7i) to (7l) of pattern (F) suggest, vowels are deleted when they are shifted to antepenultimate syllables. For example, (7j) /in, qajət, an/ ‘realis, rear, LV’ realizes as [qin.ja.tan] rather than *[qə.nə.ja.tan] (in which boldface [ə] corresponds to /a/). The example shows that syncope of antepenultimate vowels causes the expected CV.G syllabification to become the C.G of pattern (F).²³

As far as the penultimate .CG pattern of (D) is concerned, the data (7a) to (7d) suggest that the same syncope process also applies, and that it is further followed by resyllabification of the preceding consonant into the following syllable, leading to tautosyllabic CG sequences (.CG). For example, in words such as /p, najaŋ, i/ [pə.nja.ŋ-i] ‘reclaim (land), LV.AT’, the penultimate vowel of the root is syncopated when it is shifted to the antepenult upon suffixation; although the resultant preceding consonant [n] is a legitimate coda in the language, it syllabifies together with the

²³ The nature of the rule awaits more research because not all antepenultimate vowels are syncopated, as is shown by the contrast in the examples with similar configurations: (7d) /p, in, tujuq, an/ → pintjuqan (syncope applies to the antepenultimate vowel) → [pin.təju.q-an] (palatalization), and (7h) /p, k, ʔujaj, un/ → [pək.ʔə.ja.jun] (syncope does not apply to the antepenultimate vowel; epenthesis between /p/ and /k/).

following glide rather than remaining as the coda of the preceding syllable. The rightward syllabification of the phonemic glides to the onset position is responsible for the confusion between vocalic and phonemic glides in the observed data because the penultimate .CG syllabification of the phonemic glides partially resembles the patterning of vocalic glides.

Pattern (D) is elusive because, from many of the relevant examples, it cannot be predicted phonologically whether the glides are syllabified as onsets or codas. For example, in the CG sequences of (7c) [kə.rja.sun] ‘cross over’ (pattern (D)) and (7i) [təh.ja.j-un] ‘succeed’ (pattern (F)), onset syllabification is found in the former example but not in the latter, despite the fact that both the consonants [r] and [h] can be internal codas. Coda syllabification of pattern (F) appears to be simpler in nature because internal codas are tolerated in Taoshan Squiliq while the onset syllabification of (D) is unexpected.

Although examples such as (7c) appear to be arbitrary, the onset syllabification in some other examples of pattern (D) seems to be better motivated. The data of pattern (D) are therefore further classified based on whether the unexpected onset syllabification in the penult is forced by other considerations, as shown below:

Table 2: Pattern (D) further classified based on the patterning of CG in the penult

Sub-patterns	Environments	Examples	Gloss
1. Forced	C__ #__	a. pin.teju.qan b. kja.l-an	‘spit’ ‘speak’
2. Variable	C__ #__ V__	c. ein.nju.kan~ein.ju.kan ²⁴ d. kja.pi~kə.japi ²⁵ e. qə.βja.ŋi~qəβ.ja.ŋi ²⁶	‘burn (e.g. hair)’ ‘catch’ ‘hunt (with guns)’
3. Arbitrary	V__	f. kə.rja.sun g. pə.nja.ŋi	‘cross over’ ‘reclaim (land)’

In the first sub-type of (D), the preceding consonant in CG cannot be a coda because leftward syllabification is impossible. In words such as [pin.teju.qan], leftward syllabification would create illicit complex codas (*[pint.juqan]), and in other examples such as [kja.lan], the consonant is already at the left word edge. Onset syllabification of CG in the first sub-type of pattern (D) is motivated by the need to salvage otherwise unsyllabifiable consonants.

²⁴ The glide directly follows a vowel (CV.G) when it is in the final syllable: s<i.m>a.juk ‘burn (e.g. hair)’. The consonant in the .CG pronunciation results from spreading from the preceding consonant.

²⁵ This example kja.pi~kə.japi in fact should be classified as pattern (G) because the glide is in the environment of C.G in the final syllable: [kə.m.jap]. Patterns (D) and (G) are the same in terms of penultimate .CG syllabification because they differ only in whether the final glide is CV.G or C.G. Because examples with final CV.G and penultimate .CG due to word-initial positions have not been located, the word kja.pi~kə.japi from pattern (G) is placed here to illustrate the factor of word-initial environment (#__). See below for related discussion.

²⁶ The glide directly follows a vowel (CV.G) when it is in the final syllable: q<ə.m.>bu.jaŋ ‘hunt (with guns) (AV)’.

In the second sub-type of (D), the .CG pronunciation in the penult has a syllable-initial variant. On the assumption that phonemic glides tend to associate with syllable margins, it seems that the syllable-initial pronunciation of the glide is the norm, and that the tautosyllabic pronunciation with the preceding consonant is a later development, which is more likely to occur in connected speech. The data seem to suggest that the distributional distinction between phonemic and vocally derived glides becomes unstable due to their phonetic similarities. The legitimate .CG pronunciation that involves vocalic glides might in some instances have led speakers to tolerate .CG articulation with phonemic glides.

The data in the third sub-type of (D) are considered as truly exceptional in the present analysis. Unlike the second sub-type, syllable-initial variants of the examples in the third sub-type, such as *[kəɾ.ja.sun] and *[pə.n.ja.ŋi], are explicitly rejected by the consultants, even though this variety of Squliq allows internal codas (e.g. [r] and [n]). It appears very difficult to formulate a generalization stating why the true consonant preceding the phonemic glide does not stay in coda position. In light of the variation pattern in the second sub-type, it is speculated here that the third sub-type is a further step toward acceptance of phonemic glides in tautosyllabic CG, with lexicalized .CG pronunciation.

The next three patterns (G)(H)(I) differ from (D)(E)(F) in that they contain C.G in the final syllables.²⁷ More examples are given below:

(8) Patterns (G)(H)(I):

(G) Penultimate .CG	Final: C.G	Gloss
a. kja.p-i~kə.ja.p-i	k<əɱ.>jap	‘catch’
b. sɪ.pjaŋ-i	sɪp.jaŋ~sɪ.pə.jaŋ ²⁸	‘deliberate’
(H) Penultimate CV.G	Final: C.G	Gloss
c. qə.ju.w-an	q<əɱ.>juʔ	‘infect’
d. tə.jaj.ʔ-an	t<əɱ.>jajʔ	‘propose marriage’
e. kə.ja.j-aj	k<əɱ.>jaj	‘dry’
(I) Penultimate C.G	Final: C.G	Gloss
f. k<in.>ja.j-an	k<əɱ.>jaj	‘dry’
g. βəh.ja.ŋ-un	mə-h.jaw~mə-hə.jaw	‘chase’

²⁷ The C.G pronunciations in (F)(G)(H)(I) are not observed in all varieties of Squliq: they occur in the Squliq variety in Taoshan Village in the present study, but not in other Squliq varieties spoken in Jianshi Township, Hsinchu County, for example, according to the author’s field notes. More research is needed to see how the different varieties of Squliq may differ.

²⁸ Notice that when the consonant in CG is an obstruent, C.G in the final syllable may vary with Cə.G pronunciation, which is also illustrated by (8g) [mə-h.jaw~mə-hə.jaw] ‘chase (AV)’. Given that sonorant codas are cross-linguistically preferred to obstruent codas, the variation is attributed to an optional epenthesis rule which avoids obstruent codas by inserting a schwa.

Notice that the alternations between penultimate CV.G and final C.G in pattern (H) always involve a schwa vowel (e.g. [tə.jaj.ʔan]/[təm.jajʔ]), which is different from pattern (F) in that (F) may involve different full vowels (e.g. [qin.ja.tan]/[qə.ma.jat], [təh.ja.jun]/[tə.hu.jaj]) in the alternations between penultimate C.G and final CV.G. Given that phonemic glides are non-vocalic in the proposed analysis, the intervening vowel in the penultimate CV.G in pattern (H) can be attributed to a schwa epenthesis rule, which breaks up two consecutive non-vocalic segments in syllable margins (e.g. /tjajʔ, an/ [tə.jaj.ʔ-an] ‘propose marriage, LV’).²⁹ The occurrence of C.G in the final syllables in (H) thus does not require an additional account, since the glide is not preceded by a vowel to start with. As to pattern (I), the consistent C.G syllabification in both positions also follows directly from the assumption that the glides are not preceded by a vowel in the underlying representation. What is peculiar is pattern (G), in which the epenthesis rule does not apply to break up penultimate CG, as is illustrated by (8a) [kja.pi].

The unexpected penultimate .CG of pattern (G) in fact echoes that of pattern (D) discussed above. The patterns (D) and (G) are the same in terms of the onset syllabification of the phonemic glides in the penults, and the three sub-types of (D) hold similarly for (G). That is to say, examples of pattern (G) could also be further classified according to whether the .CG syllabification is motivated and whether variations are found. Examples (8a) and (8b) under pattern (G) belong to the second and third sub-types, respectively,³⁰ so their peculiar behavior is considered exceptional and lexicalized, as in the corresponding cases in (D). Further research is needed to identify possible principles that are responsible for the unexpected onset syllabification of the phonemic glides in these cases.

To summarize, the diverse patterning of prevocalic glides in Squliq calls for the glides to be classified into two types: derived prevocalic glides are always tautosyllabic with the preceding consonants, while phonemic prevocalic glides usually remain in syllable-initial position. It is demonstrated that relevant phonological processes in the language may obscure the typical distribution of phonemic glides. Syncope and onset syllabification of the preceding consonants in CG result in phonemic glides in tautosyllabic postconsonantal position (.CG) and lead to confusion with vocalic glides. The distinction between the two types of glides can only be revealed through their patterning in other morphologically related forms.

4. A formal account of the patterning of the glides

The need to distinguish vocally derived glides and underlying glides in Squliq bears on the issue of how vowels and glides are represented in phonological theories. The literature describes

²⁹ An alternative analysis is to assume that the schwas before the glides in pattern (H) exist at the underlying level and that they get syncopated before syllable-initial glides in the final syllables (e.g. /əm, təjajʔ/ → təməjajʔ → [təm.jajʔ]). If more data shows that the schwa may alternate with other full vowels in other morphologically related forms, the deletion analysis should be adopted instead.

³⁰ If the example (8a) [kja.pi] is produced without the variant [kəja.pi] by a speaker, it would constitute an example of the first sub-type of pattern (G).

various ways to capture the formal distinction between vowels and glides, as discussed in Levi (2004). Levi (2004) reviews four approaches to the representation of underlying glides: lexical marking, the use of the feature $[\pm\text{consonantal}]$, and two alternatives within feature geometry (Vowel-Place Theory and Revised Articulator Theory). In the Lexical Marking approach, while vowels have no special marking and surface as vowels or glides, underlying glides are lexically marked as unlinkable to a nucleus position; in this approach, vowels and glides are identical in terms of segmental features. Employing the feature $[\pm\text{consonantal}]$ differentiates underlying glides from vowels by specifying glides as $[\text{+consonantal}]$ and vowels as $[\text{–consonantal}]$ (e.g. Hayes 1989; Hyman 1985, 2003; Rosenthal 1994, 1997); vocally derived glides are similar to vowels in being $[\text{–consonantal}]$. For example, in the version of feature geometry constructed by Clements & Hume (1995), derived glides have features under the V-place node while underlying glides have features under C-place. In Revised Articulator Theory (Halle 1995; Halle et al. 2000), vowels have $[\text{dorsal}]$ as their designated articulator but glides do not.³¹

Later work such as that of Nevins & Chitoran (2008) and Padgett (2008) has argued for employing the feature $[\pm\text{vocalic}]$ to distinguish vowels from glides, in addition to the feature $[\pm\text{consonantal}]$, which differentiates glides from true consonants. The $[\pm\text{vocalic}]$ distinction between vowels and glides in models such as that of Nevins & Chitoran (2008) can be directly translated into the feature $[\text{consonantal}]$ in work such as that of Hyman (1985):

(9) Different usages of the feature $[\pm\text{consonantal}]$:

	Nevins & Chitoran (2008)	Hyman (1985)
Vowels	$[\text{+vocalic}, \text{–consonantal}]$	$[\text{–consonantal}]$
Glides	$[\text{–vocalic}, \text{–consonantal}]$	$[\text{+consonantal}]$
Consonants	$[\text{–vocalic}, \text{+consonantal}]$	

What is controversial is how vowels, glides, and true consonants should be categorized phonologically and what features or representations best capture their contrastive patterning.

This paper adopts the assumption that phonemic glides are specified with the feature $[\text{–vocalic}]$ like other true consonants while derived glides carry the feature $[\text{+vocalic}]$ just as vowels do, irrespective of whether an additional binary feature is needed to distinguish glides from true consonants. A crucial observation concerning the Squliq data here is that intervocalic CG sequences are syllabified differently, which is captured by the need to associate different features of the two types of glides to appropriate syllabic positions in the proposed analysis.

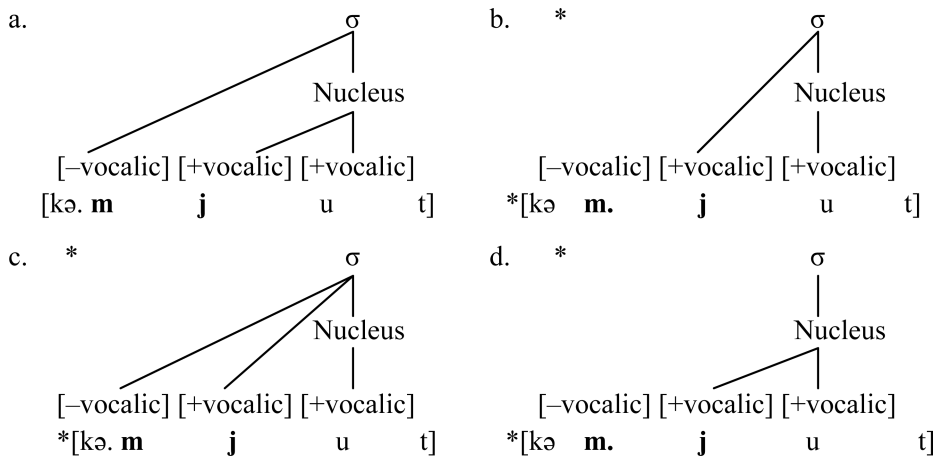
In the proposed OT analysis, three constraints play a major role in regulating the distribution of phonemic and vocalic glides: *CC against two consecutive $[\text{–vocalic}]$ segments in the onset, and the other two constraints against $[\text{–vocalic}]$ and $[\text{+vocalic}]$ segments linking up to syllable nuclei and margins, respectively. The definitions of the three constraints are given next, together with other relevant OT constraints:

³¹ See Levi (2004) for a more detailed review and comparison of the four approaches.

(10) OT constraints in the analysis of Squiliq prevocalic glides.³²

- a. *CC: Two consecutive [–vocalic] segments in the onset are prohibited.
- b. *P/G: [–vocalic, –consonantal] segments do not link to syllable peaks.
- c. *M/V: [+vocalic] segments are prohibited from syllable margins (Prince & Smolensky 1993, 2004).
- d. Onset: Syllables must have onsets.
- e. Max-IO-C: Every consonant in the input has a correspondent in the output (McCarthy & Prince 1995).

As far as CG sequences with vocalic glides are concerned, it should be borne in mind that they remain tautosyllabic in both final and penultimate positions, even if the preceding consonant in CG can be a permissible coda. The ill-formedness of heterosyllabic CG with vocalic glides is attributed to *M/V, which penalizes [+vocalic] segments linking up to syllable margins. Candidates that do not link the glides to the Nucleus node are ruled out by *M/V, including heterosyllabic (11b) and tautosyllabic (11c). Although (11d) satisfies *M/V by associating the vocalic glide directly to Nucleus, the structure is ruled out by the ONSET constraint.

(11) Vocalic glides and the preceding consonants are tautosyllabic.³³

The OT tableau in (12) illustrates how the *M/V and Onset constraints force vocalic glides to occupy postconsonantal (.CG) position.³⁴

³² The *M/V and *P/G constraints follow the format of the margin and peak constraints in Prince & Smolensky (1993, 2004). The constraint *M/V is defined as ‘V may not associate to Margin nodes (Ons & Cod)’, and *P/C as ‘C may not associate to Peak (Nuc) nodes’ in Prince & Smolensky (2004:109).

³³ Only the associations to the onset and nucleus of the syllable under discussion are shown to avoid confusion.

³⁴ The underlined portions of the candidates represent the segments that are linked directly under the Nucleus node throughout the paper.

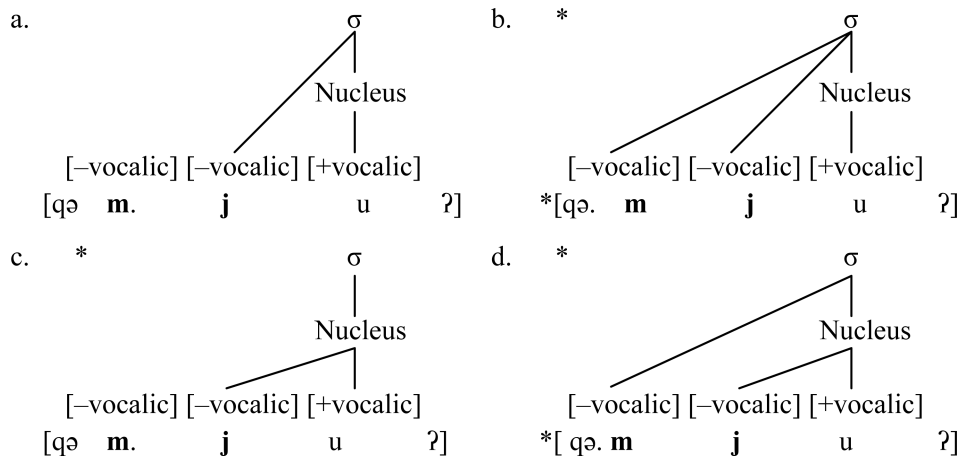
(12) Vocalic glides in postconsonantal position:

/ k<Vm>iut/ ³⁵	ONSET	*CC	Max-IO-C	*M/V	*P/G
a. → [kə.mj <u>u</u> t] (11a)					
b. [kə <u>m</u> .j <u>u</u> t] (11b)				*!	
c. [kə.mj <u>u</u> t] (11c)				*!	
d. [kə <u>m</u> .j <u>u</u> t] (11d)	*!				

Tautosyllabic CG with vocalic glides satisfies *M/V by linking the [+vocalic] glide to the nucleus node, as shown in (a), while heterosyllabic CG would be ruled out by *M/V because the vocalic glide is linked directly to the syllable node, as illustrated by (b). Candidate (c) shows that tautosyllabic CG with vocalic glide also involves a violation of *M/V if the glide is linked to the syllable node rather than to Nucleus. Candidate (d) shows that heterosyllabic CG with vocalic glides under Nucleus satisfies *M/V, but it leads to an onsetless representation, which is also prohibited in the language.

In the case of phonemic prevocalic glides, the assumption that phonemic glides are featurally [-vocalic] together with the *CC constraint account for the heterosyllabic affiliation of CG with phonemic glides. The constraint *CC demands heterosyllabic parsing of CG as shown in (13a) because tautosyllabic CG sequence (13b) would violate the *CC constraint. Other structures with tautosyllabic CG, such as (13d), are banned by the constraint *P/G (*Peak/Glide). A comparison of the heterosyllabic CG in (13a) and (13c) suggests that the phonemic glide would necessarily link to the syllable node due to the Onset constraint.

(13) Phonemic glides in syllable-initial position:



³⁵ It is assumed that the infix /Vm/ ‘agent voice (dynamic)’ contains an empty vowel slot *V*, which accounts for their infixing behavior after the stem-final consonant in order to avoid onsetless syllables.

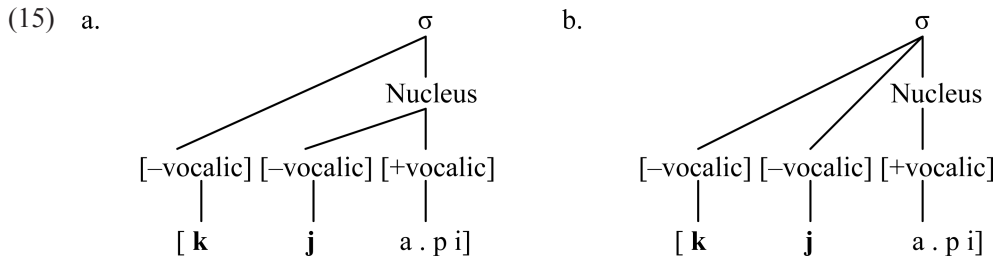
The table below demonstrates how the suggested constraints interact to produce heterosyllabic parsing of CG sequences in the case of phonemic glides:

(14) Phonemic glides in syllable-initial position:

/q<Vm>juʔ/	ONSET	*CC	Max-IO-C	*M/V	*P/G
a. →[qə <u>m.ju</u> ʔ] (13a)					
b. [qə <u>.mju</u> ʔ] (13b)		*!			
c. [qə <u>m.ju</u> ʔ] (13c)	*!				*
d. [qə <u>.mju</u> ʔ] (13d)					*!

The table in (14) shows that when the glides are [–vocalic], the constraint *CC becomes relevant and rules out candidate (b) which contains tautosyllabic CG. Candidate (c) illustrates that in heterosyllabic CG, a phonemic glide does not link to the Nucleus node because it would simultaneously produce violations of Onset and *P/G. Although candidate (d) avoids a violation of *CC by associating the glide under Nucleus, it fails to satisfy *P/G as optimal candidate (a) does.

As far as the more complicated patterns (D) and (G) are concerned, the occurrence of phonemic glides in the environment of .CG means that two adjacent [–vocalic] segments before a nucleus vowel can be tolerated.³⁶ Forms such as /kja.p i/ ‘to catch, PV.AT’ in (8a) presumably contain consonant sequences that either violate *P/G (15a) or *CC (15b).



Given that true consonant clusters are not permitted in syllable margins in Squliq (Huang 2006b), (15a), rather than (15b), seems to better represent the .CG sequences with phonemic glides in patterns (D) and (G).

In the proposed analysis, the contrasting syllabification patterns of intervocalic CG are primarily attributed to the different features of the glides, together with a set of OT constraints that regulate proper association of segments to prosodic positions. If there is no featural distinction between the two types of glides, a successful account for the seven attested patterns in Table 1 would have to rely on the mapping between the input and output, which poses difficulties because of its complexities. Given that phonemic economy carries little weight in an output-based theory such as OT, recognizing the existence of phonemic glides has the advantage of offering a more transparent

³⁶ Alternatively, the phonemic glides in the environment of .CG may mean that the [–vocalic] feature of the glide has become [+vocalic] in the output, thus linking directly under the nucleus node.

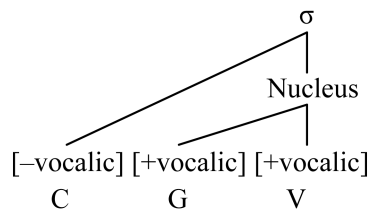
account. As far as learning is concerned, it also appears much more straightforward for a learner to encode the contrasting syllabification patterns directly in representations.

5. Discussion and conclusion

This paper has highlighted the phonological patterning of prevocalic glides that have been unrecognized in previous studies of Squliq, and discussed its implications for the phonology of the language. It is argued that the contrasting syllabification patterns of prevocalic glides provide direct support for the distinction between phonemic glides and vocally derived glides in the language. The clues to identifying the nature of the glides lie in the syllabification patterns of prevocalic glides across the paradigm: vocalic glides are consistently tautosyllabic with the preceding consonants, while phonemic glides are typically syllable-initial in the language.

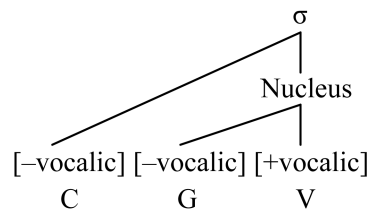
Complications mainly relate to phonemic glides. As explained in §3, phonemic glides may appear in postconsonantal positions (.CG) as the result of resyllabification, if syncope (or lack of epenthesis) leads to segmentally adjacent CG. Since vocalic glides typically occur in postconsonantal position, the proposed analysis implies that two similar-sounding tautosyllabic CG sequences in the penult may have different phonological representations, as illustrated below:

- (16) a. Typical tautosyllabic CG
with vocalic glides:



Examples: ?in.rə.kja.san (6e)

- b. 'Forced' tautosyllabic CG
with phonemic glides:



kja.lan (7b)

Postconsonantal vocalic glides in (16a) come from underlying vowels through glide formation, while phonemic glides as in (16b) may also occur in this environment when forced by other considerations in the phonology of the language. The ambiguous CG sequences arise from the coexistence of glide formation, syncope, and resyllabification in the phonological system of Squliq.

Phonological distinctions between prevocalic glides perceived as similar are not uncommon across languages. For example, Chitoran (2002) argues that in Romanian, there is a representational difference in glide-vowel sequences, for example *bjătă* 'poor' (fem.) versus *beătă* 'drunk' (fem.) and *polwăre* 'pollution' versus *paloăre* 'pallor', despite the similarity in sound of the pairs [ja] versus [ea] and [wa] versus [oa]. For the sake of clarity, Chitoran (2002) adopts the terminological distinction of 'glide-vowel sequences' for [ja] and [wa], in which the vowel is argued to take a mora by itself, and 'diphthongs' for [ea] and [oa], where the glide and the vowel share a mora. The two terms would also be helpful to distinguish the two types of tautosyllabic CG in the case of Squliq Atayal as shown in (16). In (16a), the vocally derived glide and the following vowel can be said to constitute a diphthong, while (16b) contains a glide-vowel sequence. Squliq diphthongs

are similar to those in Isbukun Bunun (Huang 2008) and Spanish (Colina 2012; Hualde 1997) in that they involve surface glides that come from underlying vowels.³⁷ The existence of both rising diphthongs and prevocalic phonemic glides in Squliq is complicated by the occurrences of post-consonantal glide-vowel sequences that are to a certain extent unpredictable.

While the postconsonantal phonemic glides in (16b) are compelled by syllabic constraints, the motivations of other tautosyllabic CG pronunciations containing a phonemic glide appear elusive (i.e. the second and third sub-patterns in Table 2). It is speculated here that the pronunciation (e.g. (7a) [mə.-na.jaŋ]/[pə.nja.ŋ-i] ‘reclaim (land)’) is a later development, and is induced by the presence of similar-sounding tautosyllabic CG with vocalic glides. On the basis of a study of five Romance varieties with different degrees of contrast between rising diphthongs (*iV*) and hiatus, Chitoran & Hualde (2007) observe that if there is a robust class of words with pre-existing [jV] diphthongs from other historical sources in a language, the originally heterosyllabic vowel sequences in the language will be more likely to become lexical diphthongs. Chitoran & Hualde (2007) hypothesize that the diphthong words act as attractors for words with heterosyllabic sequences, leading to the change from hiatus to diphthong. Although the two types of tautosyllabic CG in Squliq have different phonological representations, phonetic similarities may have served as a kind of attractor and motivated the observed changes. A falsifiable prediction of the hypothesis is that changes from heterosyllabic C.G to tautosyllabic .CG will not occur if diphthong formation has not taken place first.³⁸ Research on more Austronesian languages is needed to better understand the principles governing the change of intervocalic CG syllabification such as that in Squliq Atayal.

As mentioned above, the two types of tautosyllabic CG pronunciations do not sound perceptually distinguishable, although they differ in phonological representation. Their phonetic similarity is reflected in the unanimous adoption of the same symbols for prevocalic glides in present-day Squliq orthography. The Squliq data therefore constitute a potential case in which distinct phonological representations persist in spite of phonetic similarities. Levi (2008) also gives examples showing that phonological contrasts between glides are not necessarily accompanied by phonetic contrasts. Encoding phonological differences directly in phonetics is presumably more natural, and it is the lack of phonetic differences that calls for an explanation. The production and perception experiments in Chitoran (2002) show that Romanian [ja] and [ea] are phonetically distinguishable, consistent with the proposed phonological distinction, but the back pairs [ua] and [oa] are not. Chitoran (2002) points to the low frequency of [ua] and the reduced distance between the first two formants in back rounded glides to explain the phonetic neutralization. In the case of Squliq, it remains for future studies to shed light on the question of whether the two types of glides, albeit sounding similar, are different in some phonetic details.

The present study has pointed out three possible pronunciations of surface CG in Squliq orthography and revealed the underlying nature of the two types of glides, but whether the contrast of vocalic and phonemic glides should be reflected in orthography is a separate issue. Given that

³⁷ While Isbukun diphthongs contain two moras, Romanian diphthongs come from stressed mid vowels historically and are seen as containing a single mora. See Chitoran (2002) and the references therein for the details regarding Romanian.

³⁸ A competing hypothesis is that the occurrence of the postconsonantal phonemic glide is simply due to the tendency to maximize onsets.

the two types of glides in the context of tautosyllabic CG are perceptually similar in Squliq, it would be complicated for speakers to differentiate diphthongs and glide-vowel sequences in writing.³⁹ Employing only the glide symbols to reflect the surface pronunciations is more practical. Another issue is whether the orthography should capture all three pronunciations at the cost of using additional symbols. In the current orthographic system, issued in 2005 by the Ministry of Education and Council of Indigenous Peoples, Executive Yuan, the underscore symbol (‘_’) is employed to distinguish the occurrence of a nasal plus an obstruent (*n_g*) from a single velar nasal (*ng*). If the underscore symbol needs to be adopted anyway, it would be more economical to extend the use of the same symbol to glides, that is, a low dash between CG to indicate the necessity of the intervening weak vowel in pronunciation (e.g. *h_winuk* for *hwinuk* ‘waist’ in (41)).⁴⁰ The underscore symbol in the current orthographic system in fact stands for either a weak vowel or a syllable boundary, because it applies to cases of intervening vowels (i.e. *nVg*) and cases of segmentally adjacent sequences (i.e. *n.g*). The two kinds of heterosyllabic pronunciation can be further differentiated, if necessary, by using a dot for the syllable boundary between adjacent segments (i.e. *n.g* and *C.G*). Pure CG spelling represents only cases of tautosyllabic CG.

This paper has proposed an OT analysis to capture the interactions of the various factors that affect the syllabification patterns of phonemic and derived glides. With the assumption that phonemic and derived glides are characterized by a difference in segmental features, the analysis is able to account for the syllabification patterns of the glides via a set of ranked constraints demanding proper association of segmental features and syllabic positions. Derived glides are always under Nucleus because syllable margins avoid sonorous [+vocalic] segments (*M/V), while phonemic prevocalic glides are syllable-initial because nuclei avoid [–vocalic] glides (*P/G).⁴¹ The constraints *M/V and *P/G are not specifically designed for the Squliq data; they are respectively members of two different sets of inherently ranked constraints that reflect the avoidance of higher-sonority segments in syllable margins and lower-sonority ones in syllable nuclei (Prince & Smolensky 1993, 2004).

The proposed analysis supports the position of Nevins & Chitoran (2008), Padgett (2008), and Levi (2004, 2008) in positing a featural difference between glides and vowels.⁴² Given that both phonemic and vocally derived glides may appear in the same environment of .CG, as shown in (16), the analysis would be more abstractive if the distinction between derived and phonemic glides is attributed to underlying syllabic affiliation rather than to segmental features.

³⁹ As summarized in §1, both vowel and glide symbols are employed in Egerod (1999). Although the use of vowels and glides in Egerod (1999) largely reflects the typical distribution of the two types of prevocalic glides discussed here, the ambiguous sequences of diphthongs or glide-vowel sequences are mostly represented only by vowel symbols.

⁴⁰ Marking the existence of the intervening weak vowel by additional symbols such as a dash has been proposed in the literature (e.g. Cheng 2001).

⁴¹ In an alternative mora-based approach, phonemic glides would be [–vocalic] and nonmoraic while vocalic glides would be moraic.

⁴² Notice that, although these authors all agree that there is a featural distinction between phonemic and derived glides, they differ in the features used to distinguish the two types of glide. While Nevins & Chitoran (2008) and Padgett (2008) adopt the feature [vocalic], Levi (2004, 2008) argues for Revised Articulator Theory (Halle 1995; Halle et al. 2000), according to which phonemic and derived glides have different designated articulators (place features).

References

- Cheng, Ju Chang. 2001. *Cong Yinyunxue de Jiaodu Kan Taiyayu de Biaoyin Xitong: Yi Taoshan Fangyan Wei Li* [A Phonological Perspective of Phonetic Symbolic System of Atayal: The Case of Tausa]. Hsinchu: National Hsin-Chu Teachers' College MA thesis.
- Chitoran, Ioana. 2002. A perception–production study of Romanian diphthongs and glide-vowel sequences. *Journal of the International Phonetic Association* 32.2:203–222.
- Chitoran, Ioana, & José Ignacio Hualde. 2007. From hiatus to diphthong: the evolution of vowel sequences in Romance. *Phonology* 24.1:37–75.
- Clements, George N., & Elizabeth V. Hume. 1995. The internal organization of speech sounds. *The Handbook of Phonological Theory*, ed. by John A. Goldsmith, 245–306. Cambridge: Blackwell.
- Clements, George N., & Samuel J. Keyser. 1983. *CV Phonology: A Generative Theory of the Syllable*. Cambridge: MIT Press.
- Colina, Sonia. 2012. Syllable structure. *The Handbook of Hispanic Linguistics*, ed. by José Ignacio Hualde, Antxon Olarrea & Erin O'Rourke, 133–151. Malden: Wiley-Blackwell.
- Duanmu, San. 2000. *The Phonology of Standard Chinese*. Oxford & New York: Oxford University Press.
- Duanmu, San. 2007. *The Phonology of Standard Chinese* (2nd edition). Oxford & New York: Oxford University Press.
- Egerod, Søren. 1965a. Verb inflexion in Atayal. *Lingua* 15:251–282.
- Egerod, Søren. 1965b. An Atayal–English vocabulary. *Acta Orientalia* 29:203–220.
- Egerod, Søren. 1966a. A statement on Atayal phonology. *Artibus Asiae Supplementum* 23:120–130.
- Egerod, Søren. 1966b. Word order and word classes in Atayal. *Language* 42.2:346–369.
- Egerod, Søren. 1980. *Atayal–English Dictionary*. London & Malmö: Curzon Press.
- Egerod, Søren. 1999. *Atayal–English Dictionary* (2nd edition), ed. by Jens Østergaard Petersen. Copenhagen: Det Kongelige Danske Videnskabernes Selskab.
- Halle, Morris. 1995. Feature geometry and feature spreading. *Linguistic Inquiry* 26.1:1–46.
- Halle, Morris, Bert Vaux, & Andrew Wolfe. 2000. On feature spreading and the representation of place of articulation. *Linguistic Inquiry* 31.3:387–444.
- Hayes, Bruce. 1989. Compensatory lengthening in moraic phonology. *Linguistic Inquiry* 20.2: 253–306.
- Hualde, José Ignacio. 1997. Spanish /i/ and related sounds: an exercise in phonemic analysis. *Studies in the Linguistic Sciences* 27.2:61–79.
- Huang, Hui-chuan J. 2006a. Resolving vowel clusters: a comparison of Isbukun Bunun and Squliq Atayal. *Language and Linguistics* 7.1:1–26.
- Huang, Hui-chuan J. 2006b. Squliq Atayal syllable onset: simple or complex? *Streams Converging into an Ocean: Festschrift in Honor of Professor Paul Jen-kuei Li on his 70th Birthday*, ed. by Henry Y. Chang, Lillian M. Huang & Dah-an Ho, 489–505. Taipei: Institute of Linguistics, Academia Sinica.
- Huang, Hui-chuan J. 2008. Competition between syllabic and metrical constraints in two Bunun dialects. *Linguistics* 46.1:1–32.
- Huang, Lillian M. 1993. *A Study of Atayal Syntax*. Taipei: Crane.

- Hyman, Larry M. 1985. *A Theory of Phonological Weight*. Dordrecht: Foris.
- Hyman, Larry M. 2003. *A Theory of Phonological Weight*. Stanford: CSLI.
- Levi, Susannah V. 2004. *The Representation of Underlying Glides: A Cross-linguistic Study*. Seattle: University of Washington dissertation.
- Levi, Susannah V. 2008. Phonemic vs. derived glides. *Lingua* 118.12:1956–1978.
- Levin, Juliette. 1985. *A Metrical Theory of Syllabicity*. Cambridge: MIT dissertation.
- Li, Paul Jen-kuei. 1980. The phonological rules of Atayal dialects. *Bulletin of the Institute of History and Philology Academia Sinica* 51.2:349–405.
- Li, Paul Jen-kuei. 1981. Reconstruction of Proto-Atayalic phonology. *Bulletin of the Institute of History and Philology Academia Sinica* 52.2:235–301.
- Lin, Yen-Hwei. 1989. *Autosegmental Treatment of Segmental Processes in Chinese Phonology*. Austin: University of Texas at Austin dissertation.
- Lin, Yen-Hwei. 2007. *The Sounds of Chinese*. Cambridge & New York: Cambridge University Press.
- McCarthy, John, & Alan Prince. 1995. Faithfulness and reduplicative identity. *Papers in Optimality Theory*, ed. by Jill N. Beckman, Laura Walsh Dickey & Suzanne Urbanczyk, 249–384. Amherst: GLSA.
- Nevins, Andrew, & Ioana Chitoran. 2008. Phonological representations and the variable patterning of glides. *Lingua* 118.12:1979–1997.
- Padgett, Jaye. 2008. Glides, vowels, and features. *Lingua* 118.12:1937–1955.
- Prince, Alan, & Paul Smolensky. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar*. Manuscript. Amherst: University of Massachusetts; New Brunswick: Rutgers University.
- Prince, Alan, & Paul Smolensky. 2004. *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden: Blackwell.
- Rau, Der-Hwa V. 1992. *A Grammar of Atayal*. Taipei: Crane.
- Rosenthal, Samuel. 1994. *Vowel/Glide Alternation in a Theory of Constraint Interaction*. Amherst: University of Massachusetts dissertation.
- Rosenthal, Samuel. 1997. *Vowel/Glide Alternation in a Theory of Constraint Interaction*. New York: Garland.
- Selkirk, Elisabeth. 1984. On the major class features and syllable theory. *Language Sound Structure: Studies in Phonology*, ed. by Mark Aronoff & Richard T. Oehrle, 107–136. Cambridge: MIT Press.
- Yamada, Yukihiro, & Ying-chu Liao. 1974. A phonology of Tayal. *Research Reports of the Kochi University* 23.6:109–117.

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賽考利克泰雅語滑入音的音韻行為

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在賽考利克泰雅語的書寫符號系統中，輔音後接滑音的音串在發音上常產生混淆。本研究對於泰雅語賽考利克方言的滑入音音韻行為作一檢視，以釐清其本質。泰雅語拼寫系統中的 CG（輔音後接滑音之音串），對應至三種不同的發音：(1) 同音節、(2) 異音節且以弱元音隔開、以及 (3) 異音節但音段相鄰。前人文獻中只注意到前兩種發音方式，然而 (1) 與 (3) 的對比，證明了泰雅語的滑音在本質上應分為成音位滑音與元音衍生而來的滑音兩類。檢視含滑入音詞彙的構詞相關型式後發現，賽考利克泰雅語滑入音的音韻行為之所以看似複雜，是因為滑音形成規律、弱元音刪略規律、與音節重整同時作用於此一音韻系統中，導致成音位滑音與元音性滑音的分布產生交疊的情形。本研究顯示，賽考利克泰雅語兩類滑音的語音雖然類似，卻有不同的音韻徵性。

關鍵詞：成音位滑音，衍生滑音，滑音形成，元音-滑音音節劃分，元音刪略，音節重整，優選理論