Reduplication, particularly partial reduplication, has received much attention in the recent literature within the general framework of autosegmental phonology. The nature of copying has been a focal point in the various theories that have been proposed. Marantz (1982), Yip (1982), Clements (1985), Broselow and McCarthy (1983), and McCarthy and Prince (1986), among others, treat reduplication as basically an affixational process. In their theories, only the segmental material of the base is copied. Other components, such as CV skeletons (strings of CV slots) in Marantz’s theory and prosodic units (syllables, moras, and feet) in McCarthy and Prince’s theory, are affixed to the base. The copied segments are then associated with the affixed CV slots or prosodic units. Steriade (1988) argues for a conceptually different approach to reduplication. In her theory, reduplication, whether total or partial, starts with the total copying of the base. Partial reduplication, with segmental loss, is a special case of total reduplication. The segmental loss results from rules of truncation and insertion, which operate on the string derived through total copying of the base.

This article addresses the theoretical issue of reduplication and discusses in detail the phonological properties of what Chao (1931) calls fanqie languages. I will show that data from these game languages support Steriade’s (1988) theory of reduplication.

In the traditional Chinese philological literature, fanqie is a method frequently used to specify the pronunciation of a novel character (that is, syllable) in terms of two known ones. Each of the two syllables is divided into two parts, an initial (the first consonant) and a final (the rest of the syllable). The initial of the first syllable is combined with the final of the second syllable. The newly formed syllable keeps the tone of the second syllable. For example, ma 55 is derived from may 51 and ka 55 through this process:1

\[(1) \quad \text{ma 55} \prec \text{may 51 ka 55}\]

Fanqie languages are language games constructed by first dividing a syllable from a given source language into an initial and a final. The initial is then combined with a new

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2 The digits are Chao’s (1931) notation for tones: 5 is the highest point on the pitch scale, 1 the lowest.
final, and the final with a new initial. Here is a sample of fanqie words from May-ka:2

(2) a. ma > may-ka ‘mother’
    b. pey > pay-key ‘north’
    c. pan > pay-kan ‘book’
    d. xway > xway-kway ‘meeting’

The two syllables (on the right-hand side of the arrow) constitute one fanqie word. As (1) and (2a) show, fanqie language formation (henceforth, FLF) is the reverse process of fanqie as a means of specifying the pronunciation of characters.

Although fanqie as a philological tool may not look like a typical case of reduplication, FLF is basically a reduplicative process. Reduplication is a productive morphological process in Chinese. For example, zow means ‘walk’, zow-zow means ‘take a walk’. Reduplicative words of this kind differ from fanqie words in that the latter undergo certain phonological alterations whereas the former do not. FLF is partial reduplication in the sense that each of the two syllables in a fanqie word loses part of the original material. In (2b) the first syllable of the fanqie word pay-key loses the final of the original syllable ey; whereas the second syllable loses the initial of the original syllable p.

The rest of this article is divided as follows. In section 1 I examine two earlier accounts of FLF (Chao (1931) and Yip (1982)) and show that both fail to explain some important properties of fanqie languages. In section 2 I give my account of FLF and show how it handles three Mandarin-based fanqie languages. In section 3 I discuss the tone patterns of fanqie languages. In section 4 I examine the properties of fanqie languages based on other dialects of Chinese; and I summarize the results in section 5.

1. Early Analyses of FLF

To my knowledge, there has been only one conceptually different analysis of FLF since the original paper of Chao (1931). Yip (1982), using data from Chao (1931), marks a significant theoretical departure from the traditional analysis of Chao (1931).3

1.1. Chao (1931)

According to Chao’s (1931) analysis of FLF, a fanqie word is derived first by copying the source syllable. Then each member of the resultant pair of syllables is divided into an initial and a final. The initial of a syllable is the initial consonant; the rest constitutes the initial. In forming fanqie words, the initial of one syllable is replaced by a new consonant, and the final of the other syllable is replaced by a new final. For example, pay-key (2b) is derived from pey ‘north’ in the following steps:

Yip (1982, 644) points out that this analysis runs into difficulty in cases where onglides are involved. Syllables such as (2d) xway ‘meeting’ are problematic. In Chao’s analysis, xway is first copied, giving xway-xway. Each of the two copies is then divided into the initial x and the final way. In the first syllable, the initial is replaced by ay; in the second syllable, the initial is replaced by k. However, the result, *x.ay-k.way, is ill-formed. Splitting xway into xw.ey yields *xw.ay-k.ey, which is still ill-formed. The correct form is xway-kway.

In Chao’s analysis, a morpheme is represented as a string of segments that are considered as atomic units arranged in a simple linear sequence. The morpheme xway ‘meeting’ consists of four segments, x, w, e, and y, or their feature bundles, which are concatenated to form the linear string xway. Given this representation, the copying step in reduplication, which is part of FLF, involves the entire segmental string of the morpheme undergoing FLF. Because it is a linear representation, there is no question about what is copied under reduplication.

Yip’s (1982) analysis of FLF is set against the backdrop of autosegmental phonology. It is therefore necessary to sketch briefly the relevant theoretical issues of autosegmental phonology before we examine the implications of her analysis.

1.2. Excursus on Formal Representations of Phonological Forms

Since the advent of autosegmental phonology (Goldsmith (1976a,b)), phonological representations have been greatly enriched. In his analysis of the formal patterns of the verbal system of Classical Arabic, McCarthy (1979: 1981) postulates three autosegmental levels (or tiers) in the representation of phonological forms. Consonants and vowels form two separate tiers that are associated with the third tier, the prosodic template, which is also known in the literature as the syllabic or CV skeleton. The three tiers are morphemic in nature. For instance, the triliteral root kih ‘to write’ forms a consonantal tier, and a, the perfective active, is a tense morpheme that occupies the vocalic tier. They are associated with the Cs and Vs in a CV skeleton. The 9th binyan has the representation in (4):

(4) 9th binyan

<table>
<thead>
<tr>
<th>Consonantal tier</th>
<th>4th binyan</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV skeleton</td>
<td>C V C V C</td>
</tr>
<tr>
<td>Vocalic tier</td>
<td>a</td>
</tr>
</tbody>
</table>

(ktabab)

2. Unless otherwise noted, all data come from Chao (1931). Chao names each fanqie language after its word for ma ‘mother’, a practice that is followed here. As for transcription, Chao (1931) uses ū, ū, ū, ū for the high vowels as well as their corresponding glides. I use ǖ, ū, ū for vowels and ū, ū, ū, ū for glides. Tones are not specified unless tone patterns of fanqie languages are discussed.

3. A few definitions are in order here. I use the term source C to refer to C in the language from which a fanqie language is derived. Each fanqie word consists of two syllables. I call the syllable that retains the source onset the α-syllable, and the syllable that retain the source tone the α-syllable. The first segment of a branching onset, or the only segment of a nonbranching onset, I refer to as the onset-initial.
CV skeleta play a central role in autosegmental phonology, because they are composed of melody-bearing elements of Cs (specified as [+syllabic]) and Vs (specified as [-syllabic]) to which other tiers are associated. The term melody refers to elements on other autosegmental tiers, such as those forming the consonantal and vocalic tiers. As can be seen in (4), associating melodies to the slots in the CV skeleta crucially depends on the feature [syllabic]; consonants are associated with Cs and vowels with Vs.

The notion of tier segregation provides impetus for a reexamination of reduplication. What is copied in reduplication becomes an important theoretical issue. Marantz’s (1982) theory is an attempt to address that question. According to his theory, reduplication involves the following steps:

(5) a. Affix a uniform CV skeleton to the base.
    b. Copy the melodies of the base.
    c. Associate the melodies with the CV slots.

Association of the segmental melodies to CV slots is governed by two parameters: the directionality of association and the “driving mechanism.” The former determines whether the association proceeds from left to right or from right to left; and the latter determines whether association is template-driven or segment-driven. In the template-driven mechanism the CV slots in the reduplicative affix are first scanned; then Cs are associated with consonants and Vs with vowels on the segmental tier. In the segment-driven mechanism the procedure is reversed: association proceeds from segments, consonants to Cs and vowels to Vs. The two driving mechanisms have different empirical consequences, as we will see shortly. In either case unassociated CV slots and segments are discarded.

To see how this model of reduplication works, consider Agta pluralization (Marantz (1982)):

(6) a. takk i ‘leg’ takkaki ‘legs’
    b. uff u ‘thigh’ uffu ‘thighs’

First, by (5a), a uniform CV skeleton (here, CVC) is prefixed onto the base. The segments of the base are then copied (5b) and associated with the CV slots in a segment-driven manner—consonants to Cs and vowels to Vs, from left to right:

(7) Base

<table>
<thead>
<tr>
<th>t a k k i</th>
<th>u f f u</th>
</tr>
</thead>
<tbody>
<tr>
<td>C V C C V</td>
<td>V C C V</td>
</tr>
</tbody>
</table>

Affixing

CV skeleton

(5a) CVC + CVCCV CVC + VCCV

Copying

melody

<table>
<thead>
<tr>
<th>t a k k i</th>
<th>t a k k i</th>
<th>u f f u</th>
<th>u f f u</th>
</tr>
</thead>
<tbody>
<tr>
<td>C V C + C V C C V</td>
<td>C V C + V C C V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Association. 

(5b) CVC + CVCV CVC + VCCV

left-to-right

takktaki uffu

Here, it is crucial that association is segment-driven and left to right. Otherwise, the result is ill-formed:

(8) a. Template-driven, left to right

<table>
<thead>
<tr>
<th>u f f u</th>
<th>u f f u</th>
</tr>
</thead>
<tbody>
<tr>
<td>C V C + V C C V</td>
<td></td>
</tr>
</tbody>
</table>

b. Segment-driven, right to left

<table>
<thead>
<tr>
<th>u f f u</th>
<th>u f f u</th>
</tr>
</thead>
<tbody>
<tr>
<td>C V C + V C C V</td>
<td></td>
</tr>
</tbody>
</table>

Consider now the theoretical implications of Marantz’s theory as spelled out in (5). (5a–b) indicate that reduplication is an affixational process, and copying involves the melodic materials only. According to McCarthy (1981, 387) and others, CV skeleta specify “the overall prosody, or syllable pattern, of a form,” and the affixed CV skeleta is independent of the CV skeleton of the base. One immediate consequence of this view is that the syllabic (or other prosodic) properties of the base are not carried over from the base to the reduplicative affix. As Clements (1985) points out, once the melody is copied, the information about the autosegmental linkage between the melody and the base CV skeleton is not available to the reduplicative affix. This leads to what Clements (1985) characterizes as problems of transfer. Typically under reduplication, phonological length and syllabicacy are transferred from the base to the reduplicative affix. In Mokilese, for example, the form pədək reduplicates as pədəpədək, suggesting that the reduplicative affix is CVC and association proceeds from left to right. But the form sədəpədək, which contains a long vowel, reduplicates as sədə-əsədək. Vowel length is transferred from the base to the reduplicative affix. Steriade (1988, 86) observes that given the standard representation of vowel length, Marantz’s theory fails to derive the correct form:
(9) Segment-driven (or template-driven), left to right

\[ s \rightarrow r \rightarrow k \]  
\[ C V C + C V V C V C \]  
\[ (= *s-r-r-k) \]

The same transfer effect can be observed with respect to syllabicity. Clements (1985, 3) observes that “vowels always preserve their status as vowels under reduplication, while glides always preserve their status as glides.” In Klamath distributive reduplication, the reduplicative prefix is CCV. The form *ya:mi reduplicates as yya:ma. But the copy-and-association model of (5) would derive the incorrect form *iya:ma, left to right, regardless of the driving mechanism:

(10) \[ C V C + C V V C V \rightarrow \]  
\[ \]  
\[ C V C + C V V C V \rightarrow \]  
\[ C V C \]  
\[ \]  
\[ [iya:ma] \]  
\[ (a:ma) \]  
\[ i a m a \]  
\[ i a m a \]  
\[ i a m a \]

Transfer effects are also attested in fanqie languages, as we will see in later sections. CV skeletons in McCarthy (1979; 1981), Marantz (1982), Yip (1982), and Clements and Keyser (1983), among other works, have essentially two properties. First, they serve as an anchor for the different autosegmental tiers so that the autosegments can be interpreted as being simultaneous along a single temporal sequence. Second, they determine the syllabic pattern of phonological forms. The CV slots are not grouped into hierarchical constituents; syllabicity is encoded in the Cs and Vs that make up the CV skeleton. Levin (1985) observes that there is redundancy in this notion of CV skeleton. For linking to take place properly among different autosegmental tiers, each tier must encode syllabicity. To avoid the redundancy, Levin proposes that skeleton be composed of timing slots, or x-slots, which are not specified for syllabicity. A skeleton of this sort provides a temporal organization for the autosegmental tiers without encoding syllabicity. It therefore has the first property of CV skeleton, but not the second. Syllabicity is encoded in the hierarchical structure that is defined on the skeleton of x-slots. A segment is syllabic if it is linked to the nucleus of a syllable. X-slots are not notional variants of Cs and Vs. For a morpheme consisting of three segments, c, v, and c, the theory making use of CV skeleton would give the structure in (11a). In a theory making use of x-slots, the same morpheme is represented as in (11b):

(11) a. Segmental tier  
\[ c v c \]  
\[ CV skeleton \]  
\[ C V C \]  
\[ b. Segmental tier \]  
\[ c v c \]  
\[ Skeleton of x-slot \]  
\[ x x \]  
\[ Syllabic structure \]  
\[ o \]  
\[ ]  
\[ ]  
\[ ]

In (11b) v and c form a constituent, namely, the rime. The two representations of syllables have different empirical implications. I adopt Levin’s notation in my analysis of FLF. The data from fanqie languages give evidence for a constituent approach to syllabicity.

1.3. Yip (1982)

Let us now turn to Yip’s (1982) analysis of FLF. Following McCarthy (1979; 1981), Yip assumes that there is a uniform CV skeleton for all morphemes of a given Chinese dialect. For Mandarin, it has the form shown in (12a). Like the source language from which it is derived, a fanqie language has a fixed skeleton as well, only in this case the skeleton consists of two syllables with preassociated materials. For May-ka, the CV skeleton consists of two instances of (12a) with ay and k linked to their appropriate slots, as in (12b):

(12) a. Mandarin skeleton  
\[ C G V C \]  
\[ b. May-ka skeleton \]  
\[ C G V C \]  
\[ T \]  
\[ C G V C \]  
\[ T \]  
\[ a y \]  
\[ 15 \]  
\[ k \]

It is understood that the tones, the CV slots, and the segments are on three distinct autosegmental tiers. Note that the tone of the first syllable is specified in the May-ka skeleton. The preassociated melodies (tones and segments) take precedence over those that are copied and then associated with the CV slots. The skeleton lack a full set of melodies, which triggers the copying of the base melodies and subsequent association. As an illustration, consider the derivation of the fanqie word may 11-ka 55 (2a) from ma 55:

(13) Base melody  
\[ \text{ma 55} \]  
\[ \text{Skeleton} \]  
\[ C G V C \]  
\[ T \]  
\[ C G V C \]  
\[ T \]  
\[ a y \]  
\[ 15 \]  
\[ k \]

The following abbreviations are used: C or c = consonant, G or g = glide; V or v = vowel; S or s = sonorant; o = onset; n = nucleus; r = rime; and s = syllable. Where both are used, the lowercase c, g, v, s refer to segments and the uppercase C, G, V, S to slots in CV skeleton.
Skeleton +

melody

CGVC
a y 15 k

Association

ma 55 ma 55

CGVC

CGVC

a y 15 k

Output

may 15 (11) ka 55

We see that the o-syllable loses the source final a as well as the source tone 55; the r-syllable loses the source initial m. These are the direct result of preassociation. Note that the segment m cannot be linked to G, which is the slot reserved for glides. Where association is prohibited, the slots in the skeleton remain empty.

The behavior of the glides presents a problem for Yip's analysis. Consider the May-ka data in (14):

(14) a. yaq > yay-kyaq 'sun'
   (> ye-tyaq)

b. wan > way-kan 'curved'
   (*-kwan)

In (14a) the o-syllable yay becomes ye through a rule of rime reduction; k palatalizes when preceding y in May-ka. We observe that the front glide y of the source syllable is present in the r-syllable in (14a); but in (14b) the back glide w disappears from the r-syllable. Within Yip's approach, both forms can be derived correctly as follows:

(15) Skeleton

CGVC

CGVC

a y k

Skeleton +

melody

CGVC

CGVC

a y k

y aŋ y aŋ

yay-kyaq

(> ye-tyaq)

To derive the correct surface forms of the second syllable (the r-syllable), y must be associated with G so that it will surface, and w must be associated with C so that it will not surface. But nothing in Yip's theory prevents us from associating y with the initial C and w with G, as in (16):

(16) a. yaŋ aŋ yaŋ aŋ

CGVC

CGVC

a y k

>yay-kan

(> *ye-kan)

b. wan wan

CGVC

CGVC

a y k

= way-kwan

The behavior of the glides proves to be just as problematic for Yip (1982) as it is for Chao (1931). The problem arises from the copy-and-association model of reduplication that is assumed in Yip's analysis. As noted earlier, copying the materials on the segmental tier of the base syllable does not preserve the syllabic properties of the base, which are, as we will see in section 3, essential in the explanation of the facts listed in (16).

Another problem facing Yip's (1982) analysis concerns the tone patterns of fanqie languages. Consider the following data from May-ka, Mey-ka, and Man-t'a, all of which are based on Mandarin Chinese:

(17) a. May-ka ma 55 > may 15 (11)-ka 55 'mother'

pan 15 > pay 15 (35)-kan 15 'book'

taw 51 > tay 15 (11)-kaw 51 'path'

b. Mey-ka ma 55 > mey 51-ka 55

pan 15 > pey 51-kan 15

taw 51 > tey 51-kaw 51

c. Man-t'a ma 55 > man 55-t'a 55

pan 15 > pan 15 (35)-tan 15

taw 51 > tan 51-t'aw 51

Of the two syllables of a fanqie word, the r-syllable contains the source rime and carries
the source tone in all three fanqie languages. Our focus is on the o-syllable, which obtains a new tone. The tones on the o-syllable differ from the source tones in May-ka and Mey-ka. In Man-t’a, however, both the r-syllable and the o-syllable keep the source tone. We now observe that in May-ka and Mey-ka the nucleus of the o-syllable is a (May-ka) or e (Mey-ka) regardless of the vowel quality of the source syllable. In these two fanqie languages the o-syllable loses the source tone. In Man-t’a, by contrast, the vowel quality of the source syllable remains the same in both the o-syllable and the r-syllable. In this fanqie language the o-syllable keeps the source tone. I express this observation in (18):

(18) If the vowel of the source syllable remains in the o-syllable, the o-syllable keeps the source tone.

A detailed account of fanqie language tone patterns is given in section 3.

Now let us consider how Yip (1982) explains generalization (18). The skeletons for the three fanqie languages are as follows:

(19) a. May-ka C G V C T C G V C T
     a y 15 k

b. Mey-ka C G V C T C G V C T
     e y 51 k

c. Man-t’a C G V C T C G V C T
     n t

The CV skeleton of the o-syllable comes with a preassociated tone in May-ka and Mey-ka, but not in Man-t’a. To derive the May-ka, Mey-ka, and Man-t’a counterparts of taw 51, we first copy the melodies (including the tone) and then associate them with the skeleton, yielding the following structures:

(20) a. May-ka t a w 51 t a w 51
     C G V C T C G V C T = tay 15 (11)-
     a y 15 k

b. Mey-ka t a w 51 t a w 51
     C G V C T C G V C T = tay 51-
     e y 51 k

However, generalization (18) remains unexplained. It is simply a result of prespecified skeletons.

In Chao (1931) there is no fanqie language where the new tone occurs on the r-syllable, and the o-syllable retains the source tone. New tones, if any, do not occur on the r-syllable. However, a fanqie language with just this property can be derived with the skeleton in (21a). Copying the melodies taw 51 and associating them with Cs and Vs (and Ts) gives (21b):

(21) a. R-syllable preassociated with a tone

     C G V C T C G V C T
     a y k 15

b. Skeleton + melody

     t a w 51 t a w 51
     C G V C T C G V C T = tay 51-kaw 15
     a y k 15

The kind of fanqie language exemplified in (21) is not attested. Yet Yip’s (1982) analysis of FLF incorrectly predicts that fanqie languages with such tone patterns should exist.

2. The Analysis of FLF

In this section I propose my theory of FLF and apply it in the derivation of Mandarin-based May-ka, Mey-ka, and Man-t’a. In later sections I extend the theory to fanqie languages based on other Chinese dialects.

2.1. Copy and Substitution

Following Steriade (1988), I assume that partial reduplication always involves total copying of the base as its first step. Excessive material is truncated and new material is
inserted. Both operations are constrained so as to yield the correct result. Specifically in FLF, I propose that the first step is to copy the source syllable in its entirety, including its syllable structure and suprasegmental substances such as tone. This produces a string with two identical copies of the source syllable. We have seen that in May-ka, Mey-ka, and Man-t’a the first copy loses its rime and the second copy loses its onset-initial. These losses result from replacing the source rime with a new rime in the first copy, and the source onset-initial with a new initial in the second copy. I define substitution as an operation on the constituent structure of the syllable. It replaces a presupposed constituent with another constituent of the same type. The constituent that can be substituted varies across fanqie languages. It involves the entire rime (section 2.2), the nucleus (section 4.1), and feature values (section 4.2). For each fanqie language, the definition of substitution specifies the locus of operation (namely, the constituent to be replaced) and the new constituent. New materials can also be inserted, as in Man-t’a (see section 2.2).

To see how this model of FLF works, consider the definition of substitution for a hypothetical fanqie language in (22):

\[(22) \text{Substitution} \]
\[(22a) \text{a. In the first syllable, replace the rime with } [v]\text{.} \]
\[(22b) \text{b. In the second syllable, replace the onset with } [c].\]

Notice that the new constituent corresponds in structure to the constituent being replaced (rime or onset).

Given the string cgvs, which has the structure in (23),

\[(23) \]
\[c \quad \text{g} \quad v \quad s \]
\[\text{\quad x \quad x \quad x} \]
\[o \quad n \quad \text{\quad r} \]

we generate the fanqie language counterpart cg.v-c.vsj (where a dot separates the onset from the rime). (24) is the derivation:

\[(24) \text{Source syllable } \]
\[\text{Copying } \]
\[\text{cg.v-c.vsj} \]
\[(22a) \text{a. Total copying of the source syllable} \]
\[(22b) \text{b. Substitution operation on resultant string} \]

The Substitution operation as understood here preserves the structure of the original syllable up to the affected constituent. If Substitution involves the rime, the source rime is replaced with a new rime. Although the source rime and the new rime may or may not have the same internal structure, the structure of the source syllable is preserved in the sense that the rime is still part of the o-syllable. In (24) the source rime (vs) and the rime in the o-syllable (v) are different in their internal structure since the latter lacks a coda. However, the structure of the o-syllable up to the rime is preserved.

The structure-preserving property of Substitution is not sufficient to account for the formal patterns of fanqie languages that have been reported in the literature (mainly Chao (1931) and Li (1985)). Consider the nonexistent fanqie language of the form (25), where x or y is any segment:

\[(25) \text{Source syllable } cg.vx \]
\[\text{Fanqie word } cg.v-c.vy \]

In (25) the source rime vx is replaced by v in the first syllable; in the second syllable the onset is replaced by c, and the coda x is replaced by y. The second syllable of this fanqie word cannot be derived by a single operation of Substitution, because c and y do not form a structural constituent. But it can be generated by applying Substitution twice to the second syllable, as in (26):

\[(26) \]
\[\begin{array}{|c|}
\hline
\text{cg.vx} & \text{copy} \\
\hline
\text{cg.vx-c.vx} & \text{replace rime} \\
\text{cg.v-c.vx} & \text{replace onset} \\
\text{cg.v-c.vy} & \text{replace coda} \\
\hline
\end{array} \]

To prevent (26) from being generated, Substitution needs to be constrained. We stipulate (27):\footnote{I am grateful to an anonymous LI reviewer for making me aware of the need for a constraint like (27).}

\[(27) \text{Substitution can operate only once on a given syllable.} \]

The model of FLF being proposed here is summarized in (28):

\[(28) \text{Fanqie Language Formation} \]
\[a. \text{Total copying of the source syllable} \]
\[b. \text{Substitution operation on resultant string} \]
\[c. \text{ (27)} \]

Additional phonological rules are also needed, which will be formulated as we go along. Let us now see how (28) accounts for the facts of fanqie languages.

2.2. Mandarin Syllable Structure and May-ka, Mey-ka, and Man-t’a

Consider the data in (29):

\[(29) \]
\[a. \text{May-ka pay-key ‘north’} \]
\[\text{ta > tay-ka ‘big’} \]
\[\text{pan > pay-kan ‘book’} \]

[329]
b. Mey-ka pey > pey-key
ta > tey-ka
pan > pey-kon

c. Man-t’a pey > pan-t’ey
ta > tan-t’a
pan > pan-t’on

As noted in section 1.2, the rimes in the o-syllable in May-ka and Mey-ka are ay (May-ka) and ey (Mey-ka), regardless of the vowel quality of the source rime. For instance, the source syllables pey and ta have a [-low] vowel and [+low] vowel, respectively, but the o-syllables of their May-ka equivalents have the same rime ay. This contrasts with Man-t’a, where the nucleus of the source syllable is preserved in the o-syllable of its Man-t’a equivalent. In pey the nuclear vowel is [-low], and the o-syllable in pan-t’ey has a [-low] nucleus. In ta, by contrast, the vowel is [+low]; the o-syllable in tan-t’a also has a [+low] vowel. Assuming that syllables such as pey, ta, and pan have the structure in (30),

the Substitution rules for the three fangie languages are defined in (31) through (33):

(31) May-ka

a. In the first syllable, replace the rime with [ay 15]...
b. In the second syllable, replace the onset-initial with k.

As a consequence of the i-mutation, their o-syllables in May-ka and Mey-ka are ay (May-ka) and ey (Mey-ka), regardless of the vowel quality of the source rime. For instance, the source syllables pey and ta have a [-low] vowel and [+low] vowel, respectively, but the o-syllables of their May-ka equivalents have the same rime ay. This contrasts with Man-t’a, where the nucleus of the source syllable is preserved in the o-syllable of its Man-t’a equivalent. In pey the nuclear vowel is [-low], and the o-syllable in pan-t’ey has a [-low] nucleus. In ta, by contrast, the vowel is [+low]; the o-syllable in tan-t’a also has a [+low] vowel. Assuming that syllables such as pey, ta, and pan have the structure in (30),

(30) c v s
    \______________/
    | x x x |
    | o n |
\______________/
   | r |
   |
\_____ s

Now consider the cases in (36), involving medial glides:

(36) a. May-ka
    lya > lye-lya
    (*lyay-)
    tcyow > tcy-lyow
    (*tcyay-)
    cye > cye-tye
    (*cyay-)
    ‘two (persons)’

b. Mey-ka
    lya > ley-lyya
    (*ley-)
    tcyow > tcy-kyow
    (*tcyey-)
    ‘two (persons)’

(32) Mey-ka

a. In the first syllable, replace the rime with [ey 51].
b. In the second syllable, replace the onset-initial with k.

(33) Man-t’a

a. In the first syllable, insert n in the rime.
b. In the second syllable, replace the onset-initial with t’.

Note that Substitution replaces the entire rime in the o-syllable in May-ka as well as Mey-ka. In Man-t’a n is inserted into the source rime, which is not replaced in its entirety.

Derivations of May-ka, Mey-ka, and Man-t’a equivalents of pey are given in (34):

(34) a. May-ka
    pey > p.ey
    (*p.ey)
    p.ey-p.ey
    p.ey-k.ey
    p.ey-p.ey
    p.ey-k.ey
    p.ey-p.ey
    p.ey-k.ey
    p.ey-p.ey
    p.ey-k.ey
    p.ey-p.ey
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    p.ey-p.ey
    p.ey-k.ey
    p.ey-p.ey
    p.ey-k.ey
    p.ey-p.ey
    p.ey-k.ey
A few phonological changes are obvious in the *fanqie* words in (35) and (36). In May-ka *k* palatalizes before *y*, and the rime *ay* is raised and monophthongized into *e*; in Mey-ka the onset is reduced with the deletion of *y*;¹¹ and in Man-t’a the [+ low] vowel is raised to *e* after *y* and before *n*, and *y* vocalizes by spreading to the following [- low] vowel.

These changes are motivated by the phonology of Mandarin, the source language. In Mandarin the [+ low] vowel raises to *e* between *y* and a coronal coda. It is therefore expected to raise in May-ka and Man-t’a in identical environments. Furthermore, syllables such as *tyay*, *nyay*, and *swaw* do not occur in Mandarin. In the derivation of May-ka and Mey-ka, we will generate strings of the forms CjVy and CyVy (C is any consonant; *y* never occurs in the coda position), which do not exist in the source language. In May-ka the [+ low] vowel raises, and the coda *y* is deleted; in Mey-ka the onset *y* is deleted. The two *fanqie* languages employ different strategies to remedy the illicit syllables that are generated.

In (35) and (36) the glides appear in the o-syllable of the *fanqie* words as well as in the r-syllable. I have shown that the o-syllable of a *fanqie* word in May-ka and Mey-ka is derived by replacing the entire rime of the second syllable (see (31a) and (32a)). The presence of the medial glides in the o-syllable entails that they are in the onset, rather than the rime, of the source syllable. In other words, the syllable structure of strings of the form cgvs is cg vs. rather than cg vs.

A sample derivation of *lya* is given in (37):

(37) a. May-ka

<table>
<thead>
<tr>
<th>ly.a</th>
</tr>
</thead>
<tbody>
<tr>
<td>ly-a-ly.a</td>
</tr>
<tr>
<td>ly.ay-ky.a</td>
</tr>
<tr>
<td>ly.e-ky.a</td>
</tr>
</tbody>
</table>

b. Mey-ka

<table>
<thead>
<tr>
<th>ly.a</th>
</tr>
</thead>
<tbody>
<tr>
<td>ly.a-ly.a</td>
</tr>
<tr>
<td>ly.e-ky.a</td>
</tr>
<tr>
<td>ly.e-ky.a</td>
</tr>
</tbody>
</table>

In the derivation *R&P* refers to the various phonological changes, such as onset or rime reduction, vowel raising, and palatalization. I will not formulate the exact rules for these changes, as they are of peripheral interest for our purpose.

2.3. Further Properties of Glides

We have seen that the medial glides must be in the onset in order to derive the May-ka, Mey-ka, and Man-t’a facts correctly. We now turn our attention to the behavior of glides in May-ka, Mey-ka, and Man-t’a. Consider the facts in (38):

(38) a. May-ka  yan > ye-tyan  ‘sun’

Mey-ka  yan > yey-kyan

Man-t’a  yan > yen-tyan

b. Mey-ka  ye > u-kye  ‘moon’

Man-t’a  ye > un-tye

c. May-ka  wan > way-kan  ‘curved’

(*-kwan)

May-ka  wa > way-ka  ‘sock’

(*-kwa)

Here the contrast is between the front glides and the back glide in the r-syllable. We observe that the r-syllable loses the back glide (as in (38c)) but keeps the front glides (as in (38a) and (38b)). The explanation crucially depends on the syllabic properties of the two kinds of glides.

As noted earlier, in the traditional analysis of Mandarin phonology, syllables are divided into two parts, an initial and a final. The medial glides are considered as part of the final; see Chao (1908) and Hockett (1947). The initial consists of single consonants, including what Chao (1968) calls the zero initial. Syllables such as ya ‘crow’ and wa ‘frog’ have the syllable structure shown in (39),

(39) a. ya

b. wa

where # represents the zero initial.

The zero initial is by no means zero in phonetic content. It shows considerable allophonic variation, ranging from a frictionless velar or uvular continuant to a glottal stop or a velar nasal. The exact articulatory nature of the zero consonant need not concern us here, since our analysis of the *fanqie* language facts does not hinge on that. There is evidence suggesting that the back glide *w* is an initial. In actual speech, a glottal stop can freely precede *y* in words such as yi ‘coat’, but not w.¹² Unlike the front glides, *y* is not deleted when it is preceded by the zero consonant (see section 2.3):

(i) Mey-ka

<table>
<thead>
<tr>
<th>yi &gt; yey-ki  ‘one’</th>
</tr>
</thead>
<tbody>
<tr>
<td>yan &gt; yey-kyan  ‘sun’</td>
</tr>
</tbody>
</table>

¹¹ *y* is not deleted when it is preceded by the zero consonant (see section 2.3):

¹² Yafer Li (personal communication) informs me that he can say ya with or without a preceding glottal stop. When the glottal stop is present, the glide *y* is more vocalic, closer to i. In his speech, the glottal stop is not possible with wa. Pulleyblank (1983, 2-7) actually classifies the glides as initials.
the back glide w behaves differently in different positions. It shows no phonetic variation when it is not syllable-initial. But in syllable-initial position it has several free variants, ranging from w to v; see Shen (1987). This is comparable to the range of allophonic variation of the zero initial. In contrast, y is phonetically stable, due perhaps to the presence of the initial zero consonant. In view of these facts, I will treat w as an initial, but not y or ū.Fully specified (minus the tone), ya ‘crow’, ūe ‘moon’, and wa ‘frog’ have different structures:

\[
\begin{align*}
&\text{(40) a.} \quad \# y a \quad b. \quad \# y \vline c. \quad \# w a \\
&\quad x x x \quad x x x \quad x x x
\end{align*}
\]

Given this analysis of the glides of Mandarin, the contrast between the front glides and the back glide in (38) can be explained easily. The derivations are shown in (41):

\[
\begin{align*}
\text{(41) May-ka} & \text{ #y.a} \quad \text{#y.y.a} \quad \text{#y.ay-ky.a} \\
& \quad \text{ye-tek.y.a} \quad \text{w.an} \quad \text{w.an-w.an} \quad \text{w.ay-k.an}
\end{align*}
\]

13 Alternatively, we can adopt the traditional analysis of treating the glides as medials—namely, they must be preceded by an initial, whether zero or not. w has the same structure as ya in (38a).

We can then posit a rule similar to the one proposed by Pulleyblank (1983) that deletes the zero initial when followed by w. The rule is given in (ii).

\[
\begin{align*}
&\text{(ii) } \# w \quad \# w a \\
&\quad x x x \quad x x x
\end{align*}
\]

The next property of the glides we will consider is vocalization. Relevant data are listed in (42):

\[
\begin{align*}
\text{(42) a.} & \quad \text{May-ka} \quad \text{liŋ > lye-tɕiŋ} \quad \text{‘order’} \\
& \quad i > ye-tɕi \quad \text{‘one’} \\
\text{Mey-ka} & \quad \text{liŋ > ley-kĭŋ} \quad \text{‘other’} \\
& \quad i > yey-ki \quad \text{‘one’} \\
\text{Man-t’a} & \quad \text{ɕîŋ > cîn-t’iŋ} \quad \text{a surname} \\
& \quad i > in-t’i \quad \text{‘one’} \\
& \quad tɕ’în > tɕ’in-t’iŋ \quad \text{a surname} \\
\text{b.} & \quad \text{May-ka} \quad \text{ɕû > ceye-tɕû} \quad \text{a surname} \\
\text{Mey-ka} & \quad \text{tɕ’û > tɕ’u-kû} \quad \text{‘go’} \\
& \quad ūe > ū-k’êc \quad \text{‘moon’} \\
\text{Man-t’a} & \quad \text{cûn > cûn-t’un} \quad \text{‘honor’} \\
& \quad ūc > ūn-t’êc \quad \text{‘moon’} \\
\text{c.} & \quad \text{May-ka} \quad u > way-ku \quad \text{‘black’} \\
& \quad k’uŋ > k’way-kuŋ \quad \text{‘empty’} \\
& \quad (∗k’ay-) \\
\text{Mey-ka} & \quad tuŋ > tway-kuŋ \quad \text{‘east’} \\
& \quad (∗tey-) \\
\text{Man-t’a} & \quad tuŋ > twan-t’un \quad \text{‘east’} \\
& \quad (∗tan-)
\end{align*}
\]

How to treat the high vowels is not as easy as it appears. For instance, i ‘one’ and u ‘black’ are often represented with an on-glide, as yi and wu. Chao (1931) uses the same symbols for vowels and for glides. In any case, i and yi or u and wu are not phonologically distinct in Chinese; hence, both transcriptions are attested. The fanqie facts suggest, however, that all three high vowels a, u, ū are preceded by the glides /y, w, ū/, respectively. To see this, consider how the May-ka equivalent of liŋ ‘order’ is derived. If the source syllable has the structure 늳, the derivation will be (43a), which results in the ill-formed ∗lay-tɕiŋ. The correct derivation is (43b), which results in lye-tɕiŋ, with y in the onset:

\[
\begin{align*}
\text{(43) a.} & \quad \text{May-ka} \quad \text{liŋ} \quad \text{lin-ŋ} \quad \text{‘order’} \\
& \quad \text{lin-ŋ-Lin} \quad \text{‘one’} \\
\text{Mey-ka} & \quad \text{liŋ} \quad \text{lay-k.ŋ} \quad \text{‘one’} \\
& \quad ∗\text{lay-tɕ.ŋ}
\end{align*}
\]

14 The rime yı is deleted when it follows the front rounded glide ū in Mey-ka. The glide vocalizes to become the nucleus of the o-syllable.
In Mandarin, like yi and i, tsiiy and tsiiy are not phonologically distinct. The same is true of the other two glides.

I have said that the Mandarin vowel system consists of two vowels, [+ low] and [-low]. Both have several surface variants. Not only does the [-low] vowel have several surface variants, listed in footnote 9; the [+ low] vowel also undergoes considerable phonological alternations. We have seen one variant of the [+ low] vowel in our treatment of the three Mandarin-based fangie languages. When preceded by a front glide y or i and followed by the coronal nasal n (as in Man-t'a) or y (as in May-ka), the [+ low] vowel is raised to e. The high vowels are not included in the two-vowel system of Mandarin. The surface high vowels are derived from the glides through vocalization. The glides and their corresponding high vowels do not differ by having different values for the feature [syllabic], the glides being [-syllabic] and the vowels being [+syllabic]. Such specification is not necessary, since the syllabic location of a segment provides sufficient information about whether the segment is a glide or a vowel. Specifically, given the underlying segment [-consonantal, + high, - back, -round], if it is syllabified as (part of) an onset, it surfaces as a glide, namely, y; if it is syllabified as the nucleus, it is a vowel, namely, i. The same is true of the other two pairs, y versus u and w versus u.

The so-called glides are specified as [-consonantal, + high], which can be syllabified as (part of) the onset or the nucleus of a syllable. In cases involving medial glides, the glides are first syllabified as the onset, along with the initial segments. They then vocalize to be the nucleus. One corollary of this analysis is that surface high vowels in Mandarin are preceded by their corresponding glides, unless ruled out by specific phonotactic rules. This is the result we want in order to derive the correct fangie words from source syllables with medial glides. (44) shows the syllable structure of liy 'order'; ciu (a surname), and k'ui 'empty':

\[
\begin{align*}
\text{a. May-ka} & \quad \text{ly}.\text{iy} \quad \text{cy}.\text{uy} \\
\text{ly}.\text{iy} & \quad \text{cy}.\text{uy} \\
\text{ly}.\text{ay}.\text{kiy}.\text{iy} & \quad \text{cy}.\text{ay}.\text{kiy}.\text{uy} \\
\text{ly}.\text{e}.\text{tyiy}.\text{iy} & \quad \text{cy}.\text{e}.\text{tyi}.\text{uy} \\
\end{align*}
\]

Given the syllable structure in (44), the May-ka equivalents of ciu and k'ui are easily derived:

\[
\begin{align*}
\text{(45) a. May-ka} & \quad \text{ciu} \quad \text{cy}.\text{uy} \quad \underline{\text{cy}.\text{uy}} \quad \underline{\text{cy}.\text{ay}.\text{kiy}.\text{uy}} \quad \underline{\text{cy}.\text{e}.\text{tyi}.\text{uy}} \\
\text{b. May-ka} & \quad \text{k'ui} \quad \underline{\text{k'ui}} \quad \underline{\text{k'ui} \quad \text{k'ui} \quad \text{k'ui} \quad \text{k'ui}} \\
\end{align*}
\]

Not only do the glides vocalize in the absence of a vowel; they also vocalize when they precede a rime with the [-low] vowel in the nucleus and a coronal nasal (n) in the coda. We have seen this phenomenon in Man-t'a in (35e) and (38b). Take, for instance, the Man-t'a word tsiiy-n-yow (see (35e)). It is derived from tsiyow, which has a [-low] nucleus o. The Substitution rules as defined in (33) generate tsiiy-[low]n-t-yow, where the glide vocalizes in the o-syllable, yielding tsiiy-n-yow.

Finally, consider the data in (46):

\[
\begin{align*}
\text{(46) a. May-ka} & \quad \text{pu} > \text{pay-ku} \quad \text{fu} > \text{fay-ku} \quad \text{mu} > \text{may-ku} \\
& \quad \text{"cloth"} \quad \text{"husband"} \quad \text{"mother"} \\
& \quad \text{(*pway-)} \quad \text{(*fway-)} \quad \text{(*mway-)} \\
\text{b. Mey-ka} & \quad \text{pu} > \text{pewy-ku} \quad \text{fu} > \text{fey-ku} \quad \text{mu} > \text{mey-ku} \\
& \quad \text{"cloth"} \quad \text{"husband"} \quad \text{"mother"} \\
& \quad \text{(*pwayy-)} \quad \text{(*fwayy-)} \quad \text{(*mwayy-)} \\
\end{align*}
\]
c. Man-t’a pu > pen-ku
   (*pwan-)\(^{15}\)
   fu > fon-ku
   (*fwan-)
   mu > man-ku
   (*mwan-)

The assumption that the surface high vowels are derived from glides through vocalization enables us to explain the otherwise puzzling behavior of high glides (high vowels) in fanqie languages. However, it commits us to postulate pw as the onset in the underlying representation of pu ‘cloth’—in other words, it commits us to saying that the structure of pu is pw, u, from which we will derive the ill-formed May-ka counterpart *pw, ay-k, u]. The o-syllables in (46) do not have the glide w.

The explanation for the facts in (46) lies again in the phonology of Mandarin. A Mandarin syllable onset cannot contain two labial segments. Hence, syllables like *pwa, *fway, *mwa, *pya, *fyay, and *mya do not exist.\(^{16}\) We need a rule that deletes a labial glide after a labial segment, which is given in (47):

\[(47) \ [ + \text{lab}] \rightarrow [ + \text{lab}] \]

The contrast between tug ‘east’ and pu ‘cloth’ can be accounted for by (47). After vocalization, (48) and (49a) are the structures for tug and pu, respectively. (47) applies to (49a), yielding (49b):

\[(48) \]

\[(49) a. \quad p \quad u \quad b. \quad p \quad u \]

\[a. \quad \begin{array}{c}
\text{p} \\
\text{u} \\
\text{u}
\end{array}
\quad b. \quad \begin{array}{c}
\text{p} \\
\text{u} \\
\text{u}
\end{array}
\]

Other fanqie words in (46) can be derived in the same way.

3. Tone Patterns of Fanqie Languages

Let us now turn to the tone patterns of fanqie languages. In section 2.3 we noted a generalization concerning tone patterns of fanqie languages, namely, (18):

\[(18) \quad \text{If the vowel of the source syllable remains in the o-syllable, the o-syllable keeps the source tone.}\]

Within our theory of FLF, if the entire rime (including the tone) is replaced, none of the rime melodies of the source syllable will remain in the o-syllable (unless the source syllable coincidentally has the same melodies as the new rime that replaces it). This is true of May-ka and Mey-ka, the derivation of which, as we saw in section 2.2, requires replacing the entire rime of the source syllable. In Man-t’a, on the other hand, the vowel of the source syllable remains in the o-syllable; so does the source tone. The Substitution rule for Man-t’a inserts n into the coda, a subrime node. There is a direct correlation between the locus of the Substitution operation and the tone pattern of the resultant fanqie language.

This leads us to examine how tones and other components of the syllable are related structurally. Tones are assumed to be part of the rime, but on different tiers than rime melodies. One interpretation of this assumption is shown in (51), where the rime is represented as a branching node that dominates two tiers, one tonal (1), the other segmental (r):
I will call the node r segmental rime and the node R rime.

Given this representation of the rime, we expect that any Substitution operation on subrime (r node) segmental constituents will not affect the tone. We have seen that in May-ka and Mey-ka the entire rime (R node) of the o-syllable is replaced. In Man-t'a, by contrast, n is inserted into the position of S in the segmental rime; the tone node (t) is intact. Hence, the source tone is retained on the o-syllable. The tone patterns of May-ka, Mey-ka, and Man-t'a follow naturally from our analysis of FLF.

From the representation in (51) we can deduce five formally distinct types of o-syllable, which are enumerated in (52):

(52) a. Rime (R) is replaced; new tone is expected.
    b. Coda (S) is replaced; source tone is expected.
    c. Segmental rime (r) is replaced; source tone is expected.
    d. Nucleus (V) is replaced; source tone is expected.
    e. Tone (t) is replaced; new tone is expected.

All five types are attested in fanqie languages. May-ka and Mey-ka account for type (52a), with a new tone on the o-syllable. We have seen the second type (52b) in Man-t'a, where the Substitution operation on the o-syllable inserts n into the coda position (S). Mo-pa, which is based on a Wu dialect spoken in Kunshan (henceforth, Kunshan), is a fanqie language of type (52c). In Mo-pa the source tone remains on both the o-syllable and the r-syllable; the rime in the o-syllable is invariably o:

(53) a. pâ 33 > po 33-vâ 33 'country'
    b. ts'î 4 > ts'o 4-zl 4 'seven'

See section 4.2 for a detailed analysis of Mo-pa.

Yip (1982, 641) reports a fanqie language that has a fixed tone pattern [5-2]. Ma-sa, of type (52c), is based on Taiwanese, a Southern Min dialect. It is exemplified in (54):

(54) a. ma 3 > ma 5-sa 2
    b. ti 5 > ti 5-sî 2
    c. kun 31 > kun 5-sun 2

Yip (1982) gives only three examples. In the first syllable (the o-syllable) the tone is replaced; the segmental rime remains the same.\(^{17}\)

\(^{17}\) The second syllable of Ma-sa shows two changes: in the onset (s) and in the rime (the tone). Primarily, this is a counterexample to (27), which constrains the number of Substitution operations on each syllable to one. But it is possible that the tone on the second syllable is derived through some tone sandhi process, or that the fanqie word has one falling tone whose domain is the entire word. For lack of adequate data I leave this issue open.

A far more interesting type of o-syllable is (52d). Li (1985) and Lin (1988) report a fanqie language that has just this property. This fanqie language is also based on Taiwanese. I will call it La-pi, which is derived from pa 'father', since ma 'mother' is an illicit syllable in Taiwanese (nasals cooccur with nasalized vowels). Unlike May-ka and other Mandarin-based fanqie languages, the first syllable of a La-pi word is the r-syllable, and the second syllable is the o-syllable. The onset of the r-syllable is l, and the nucleus of the o-syllable is i (data from Li (1985)):

(55) a. hyaw 53 > lyaw 53 (55)-hi 53
    b. t'aw 13 > law 13 (33)-it' 13
    c. t'at 31 > lat 31 (53)-it 31

Notice that the source tone occurs on both syllables of the fanqie words. Furthermore, the o-syllable keeps the coda of the source syllable (55c). The rime structure of the source syllable is preserved in the La-pi word. If the source syllable contains a coda, its La-pi equivalent contains the coda in both syllables. To preserve the rime structure, the locus of Substitution must be the nucleus. Clearly, there is a correlation between the tone pattern and the presence of the source coda in the o-syllable. I express this correlation in (56):

(56) If the coda of the source syllable remains in the o-syllable, then the o-syllable keeps the source tone.

We will return to this fanqie language in section 4.1.

Recall that (18) expresses the relation between the nucleus of the source syllable and the tone pattern of the o-syllable. Generalizing, we can combine (18) and (56) as follows:\(^{18}\)

(57) If either segmental constituent of the source rime remains in the o-syllable, then the o-syllable keeps the source tone.

This generalization follows from the proposed analysis of FLF. If the o-syllable contains segmental information of the source rime, then the locus of Substitution must necessarily be a node dominated by the segmental rime node (r node). Hence, the source tone is retained on the o-syllable.

To my knowledge, there are only five types of tone patterns among the fanqie languages that have been reported. Thus, the proposed theory of FLF makes strong (and correct) predictions about the possible tone patterns of fanqie languages.

\(^{18}\) Mo-pa, of type (52c), prevents us from strengthening the generalization into a biconditional:

(i) A segmental constituent of the source rime remains in the o-syllable iff the o-syllable keeps the source tone.

This is so because in Mo-pa the o-syllable keeps the source tone, but there is no segmental constituent of the source rime (r node) in the o-syllable. Still, the tone pattern of Mo-pa follows from our analysis. The locus of substitution for this fanqie language is the segmental rime (r node), so there is no trace of the segmental information of the source rime in the o-syllable.
4. Other Properties of Fanqie Languages

In this section I extend my model of FLF to fanqie languages based on Chinese dialects other than Mandarin. Specifically, I will discuss nasality transfer, place feature transfer, and the behavior of nasal consonants in fanqie languages.

4.1. Nasality Transfer: The Case of La-pi

As mentioned earlier, the initial of the r-syllable in La-pi is l. The nucleus of the o-syllable is i. Both syllables of the fanqie word inherit the source tone and retain the rime structure of the source syllable. If the source rime contains a coda, the La-pi word contains a coda in both of its syllables; if the source rime does not have a coda, neither of the two syllables has a coda (compare Man-t’a). However, the coda of the o-syllable defaults to n or t (ts) is an unaspirated alveopalatal affricate):

(58) a. be > le-bi ‘buy’
   b. tsiaw > iyaw-tsi ‘bird’
   c. hwe > lwe-hi ‘flower’

(59) a. kaw > lam-kim ‘sweet’
   (‘-kim’)
   b. tsiw > lin-tsin ‘very’
   c. at > lat-in ‘red’
   (‘-in’)

(60) a. tsap > lapt-sit ‘ten’
   (‘-tsip’)
   b. t’at > lat-t’t ‘kick’
   c. pak > lap-pit ‘peel’
   (‘-pik’)

The syllable structure of Taiwanese differs from that of Mandarin. I assume that this dialect has the maximal syllable structures shown in (61):

(61) a. \[ \begin{array}{c}
   | & | & | \\
   o & x & x
   \end{array} \]

(62) a. \[ \begin{array}{c}
   | & | & | \\
   o & x & x
   \end{array} \]

The glides are optional in both structures, and the coda is either a voiceless stop or a nasal. In terms of segments, the maximum syllable length is four. A syllable with a postvocalic glide does not have a coda (61a), and a syllable with a coda does not have a postvocalic glide (61b).

In Taiwanese, nasals and voiced stops do not contrast (see Zhang (1983)), since the nasals occur only before nasalized vowels or in the coda. Thus, in the underlying representation, the nasals in (59) are voiced stops, which nasalize syllable-finally. Substitution is defined as follows:

(62) Substitution
   a. In the second syllable, replace the nucleus with [li].
   b. In the first syllable, replace the onset with [li].

So defined, Substitution operates on the nucleus of the o-syllable. The source tone is retained on both syllables, which confirms generalization (57). In addition to (62), we need rule (63),

(63) \[ \{ -continuant \} \rightarrow \{ + coronal \} / \_ \_ \_ \_ \_ [\_ \_] \]

where fw refers to fanqie words. The syllable-final stops become t or n in the o-syllable of a fanqie word. (64) is the derivation of (60c):

(64) p.ak \[ \begin{array}{c}
   \text{copy} \\
   \end{array} \]
   p.ak-p.ak \[ \begin{array}{c}
   \text{(62a)} \\
   \end{array} \]
   p.ak-p.ik \[ \begin{array}{c}
   \text{(62b)} \\
   \end{array} \]
   lak-p.ik \[ \begin{array}{c}
   \text{(63)} \\
   \end{array} \]
   lak-p.it

Given this analysis of La-pi, consider now the behavior of nasalized rimes in this fanqie language. The nasality of the source syllable is transferred onto the o-syllable in La-pi. The relevant data are listed in (65):

(65) a. swwi > lww-si > nww-si ‘mountain’
   b. pé > lé-pi > né-pi ‘sick’

The initial l nasalizes before nasalized rimes in the r-syllables, as does it in Taiwanese. One fact about nasalized rimes in Taiwanese is that they do not have an overt coda (*swāp), whereas their oral counterparts do (swap). I suggest that the nasalized rime contains a coda that is associated with what Trigo (1988) calls a nasal glide N lacking place and stricture features. Thus, syllables with nasalized rimes have the structure

19 Trigo (1988, 22–23) defines the nasal glide N as in (6),

\[ \begin{array}{c}
   \text{SOFT PALATE} \\
   \text{[−consonantal]} \\
   \end{array} \]

where s is the supralaryngeal node, r is the root node, and x is the time slot. SOFT PALATE is the articulator that controls nasality. Note that N, as a glide, is specified as [−consonantal].
The full representation of the source syllable in (65a) then is (66):

\[
\begin{array}{c}
\text{(66)}
\end{array}
\]

\[
\begin{array}{c}
\text{N}, \text{ lacking place features of its own, spreads its nasality onto the nucleus; hence, both the glide and the vowel are nasalized. Because of the presence of N, nasalized rimes do not have an overt coda.}^{20} \text{ The transfer of nasality in La-pi is completely predictable. To derive the } \text{fanqie} \text{ word from (66), for instance, the nucleus wa is replaced with i, but } N \text{ is not affected since it is outside the nucleus. Hence the transfer of nasality, (63) does not apply here since, by definition, } N \text{ has no stricture features. Here is the derivation of (66).}^{21}
\]

\[
\begin{array}{c}
\text{(67)}
\end{array}
\]

\[
\begin{array}{c}
\text{s.waN} \\
\text{s.waN} \text{-s.waN} \\
\text{l.waN} \text{-s.IN}
\end{array}
\]

\[
\begin{array}{c}
\text{n.waN} \text{-s.IN} = \text{nwâ-si}
\end{array}
\]

We have seen that two properties of La-pi follow naturally from the proposed analysis, namely, the tone pattern and nasality transfer. Since the Substitution operation involves the nucleus of the o-syllable, both the source tone and the coda are retained on the o-syllable. The nasal glide N is in the coda; therefore, nasality is transferred from source syllables to their La-pi counterparts.

The nasality transfer phenomenon in La-pi contrasts sharply with the lack of nasality transfer in Mo-pa, where Substitution involves the entire segmental rime, as we will see in the next section.

4.2. Place Feature Transfer: The Case of Mo-pa

Mo-pa, which is based on Kunshan, selects the initial segment of its r-syllable from the two rows of phonemes in (68) (for tone patterns in Mo-pa, see section 3):

\[
\begin{array}{c}
\text{(68) a: p, t, ts, tɕ, k}
\end{array}
\]

\[
\begin{array}{c}
\text{b: v, l, z, j, ŋ}
\end{array}
\]

In this list ŋ is the voiced velar fricative and j is the voiced palatal glide. Following Chao (1931), stops and affricates are [-continuant], and fricatives, glides, and nasals are [+continuant]. If the onset-initial is [-continuant], the initial of the r-syllable is [+continuant, +voice]; if [+continuant], the initial of the r-syllable is [-continuant, -voice]. In both cases the initial of the r-syllable is homorganic with the source onset. In other words, the place feature of the source onset is transferred. Here are some examples:

\[
\begin{array}{c}
\text{(69) a. pâ > po-vâ ‘country’}
\end{array}
\]

\[
\begin{array}{c}
\text{‘pol-}
\end{array}
\]

\[
\begin{array}{c}
\text{taw > to-law ‘many’}
\end{array}
\]

\[
\begin{array}{c}
\text{tso > tso-zo ‘as’}
\end{array}
\]

\[
\begin{array}{c}
\text{tɕɊ > tɕ oy-l ‘hill’}
\end{array}
\]

\[
\begin{array}{c}
\text{kwe > ko-rwe ‘close’}
\end{array}
\]

\[
\begin{array}{c}
\text{b. ma > mo-pa ‘mother’}
\end{array}
\]

\[
\begin{array}{c}
\text{vâ > yo-pâ ‘house’}
\end{array}
\]

\[
\begin{array}{c}
\text{‘vō-’}
\end{array}
\]

\[
\begin{array}{c}
\text{sa > so-tsa ‘what’}
\end{array}
\]

\[
\begin{array}{c}
\text{le > lo-te ‘come’}
\end{array}
\]

\[
\begin{array}{c}
\text{jɊ > jo-tɊ ‘have’}
\end{array}
\]

\[
\begin{array}{c}
\text{ho > ho-kə ‘flower’}
\end{array}
\]

\[
\begin{array}{c}
\text{twa > to-kwa ‘king’}
\end{array}
\]

From these data we can see that the o-syllable (the first syllable) has only two segments and it does not contain the nasality of the source syllable.

I assume that in this dialect the onset does not branch, the glides being part of the rime. Thus, kwe ‘close’ has the structure shown in (70):

\[
\begin{array}{c}
\text{(70) k \text{[w e)}}
\end{array}
\]

\[
\begin{array}{c}
\text{x x x}
\end{array}
\]

\[
\begin{array}{c}
\text{O n}
\end{array}
\]

\[
\begin{array}{c}
\text{r}
\end{array}
\]

With this assumption, the facts can be readily explained. Substitution is defined as follows:
(71) Substitution
   a. In the first syllable, replace the rime with [o].
   b. (i) In the second syllable, replace the value of [continuant] in the onset
      with the opposite value.
      (ii) [continuant] → [voice]

   The fact that the o-syllable contains only two segments follows from replacing
   the source rime with o. As for the initial of the r-syllable, all we need to do is replace
   the value of [continuant] in the source onset with the opposite value, and perform the
   necessary operation on the feature [voice]. (72) is a sample derivation:

   (72) k.ō-r.ē
        o
        k.ō
        k.ō-r.ē
        k.ō-r.ē

   Our model of FLF offers an easy explanation for the homorganic correlation between
   the initial of the r-syllable and the source initial. The place feature transfer is explained
   by total copying of the source syllable and (71b). The loss of nasality in the o-syllable
   is expected because the entire segmental rime (the r node in (51)) is replaced. The
   derivation of pā ‘country’ is given in (73):

   (73) p.aN
        o
        p.aN-p.aN
        p.o-v.aN = po-vā

   In La-πi, by contrast, the nasality of the source syllable is not lost in the o-syllable.
   In that fanqie language, as we have seen, the locus of Substitution is the nucleus,
   rather than the entire segmental rime.

4.3. Syllabic Nasals

   Syllabic nasals undergo FLF in three distinct patterns, which are exemplified by La-πi,
   based on Fuzhou, Mo-πa, and Maŋ-la, which is based on Changzhou, a Wu dialect. In
   La-πi, nasals undergo FLF optionally. When they do, they surface as exact copies of
   the source syllable:

   (74) La-πi
        m > m-t
        n > n-t
        ŋ > ŋ-t

   The second pattern comes from Mo-πa. In this fanqie language syllabic nasals also
   undergo FLF optionally. When they do undergo FLF, they function as if they were
   syllabified as both the onset and the rime:

   (75) Mo-πa
        m > mo-pm
        n > no-tn
        ŋ > ŋo-ŋŋ

   The initial of the r-syllable is conditioned by the nasal in the source syllable; see section
   4.2.

   Maŋ-la furnishes the third pattern, in which only the initial of the r-syllable is missing:

   (76) Maŋ-la
        m > maŋ-m
        ŋ > ŋaŋ-ŋ

   (74) is clearly exceptional, and special provision has to be made for the syllabic
   nasals in La-πi. In Mo-πa and Maŋ-la syllabic nasals can be derived in the same way
   as other syllable types. Both fanqie languages treat syllabic nasals as if they have the
   structure in (77) (see also Yip (1982, 660)):

   (77) m
        o
        n
        r
        σ

   For instance, the word mo-pm, of Mo-πa, is derived from m in the following steps:

   (78) m
        o
        n
        r
        σ
        m
        o
        p
        m
        x
        x
        x
        x
        o
        n
        o
        n
        σ
        σ
According to Chao (1931), the syllabic pm is rather awkward. For this reason, the syllabic nasals often do not undergo FLF in Mo-pa at all.

The last case, (76), can be derived in the same fashion. In Mân-la, the rime of the r-syllable is ηγ, and the initial of the r-syllable is l. Thus, we expect a normal derivation of syllabic nasals:

(79)

\[
\begin{array}{c}
\text{m} \quad \text{m} \\
\text{o} \quad \text{n} \quad \text{o} \\
\sigma \quad \sigma
\end{array}
\]

Like Mo-pa’s pm, the r-syllable, lm, is awkward in Changzhou, the source language. Unlike Mo-pa, Mân-la avoids the awkwardness by deleting l. The rule can be formulated as follows:

(80)

\[
\text{1} \quad [\text{nasal}] \\
\text{f} \\
\text{x} \quad \text{x}
\]

This rule derives mang from mang-lm, enabling the syllabic nasals in Changzhou to undergo FLF freely.

5. Conclusion

The theory of FLF that emerges from the above discussion has three components, as listed in (28), repeated below:

(28) Fandie Language Formation
  a. Total copying of the source syllable
  b. Substitution operation on resultant string
  c. (27)

It gives a simple account of FLF. Although logically game languages can be constructed in any way imaginable, the fandie languages that have been reported in the literature form a highly restricted set. The theory I have proposed here predicts that features, segments, onsets, nuclei, codas, rimes, and tones are constituents on which Substitution operates. The structure-dependent and structure-preserving nature of Substitution and the constraint (27) on Substitution explain a range of facts that are associated with fandie languages. The tone pattern generalization (57), the behavior of glides in fandie languages, and nasality transfer, or lack of it, follow naturally from the proposed analysis of FLF. To the extent that this analysis successfully accounts for the phonological properties of fandie languages, it supports Steriadie’s (1988) theory of reduplication, which involves the total copying of the base, its prosodic structure as well as its melodic content. An affixational theory of reduplication, in which only the segmental material is copied under reduplication, is inadequate in accounting for the range of facts in fandie languages.

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