

## The syllable in Old Chinese: sub-syllabic processes, syllable structure, and the status of medial glides

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**Abstract** How to represent a syllable is by no means a settled question in generative grammar. This paper employs the diagnostic tool Replace (X) to examine the sub-syllabic constituency in Old Chinese (OC) by virtue of two types of directional reduplication data: progressive and retrogressive reduplication. This paper finds that the OC syllable is comprised of onset, nucleus, and rhyme, which have different representations in the syllable structure. This paper also argues that the OC tone should be represented in terms of another independent plane, i.e., adjoining to the whole syllable rather than the rhyme sub-syllabic constituent, on the basis of the rhyming in *Shijing* ‘Book of Odes’. The OC medial glides *-j-* and *-w-* show an asymmetric status in syllable structure. The former tends to be aligned with the rhyme, while the latter tends to be aligned with onset. Comparing with other OC syllable structures, it is found that theoretical analyses reveal certain aspects of sub-syllabic processes, such as the placements of medial glides, and help us to examine syllabic representations such as tone representation, all of which may not be detected by direct observation of a maximal syllable in OC. Furthermore, a comparison of syllable structures in OC and Middle Chinese suggests that syllable structure, as well as other phonological phenomena, underwent great changes from OC to Middle Chinese or *Guangyun* phonology.

**Keywords** Syllable structure · Old Chinese · Medial glides · Tone

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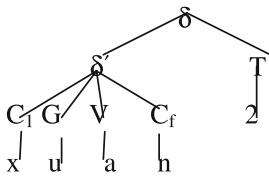
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**1 Introduction**

1.1 Modern standard Chinese syllables and their representations

In standard (or Mandarin) Chinese (SC), generally speaking, phonologists agree that the full syllable is composed of an initial consonant ( $C_1$ ), a medial glide (G), a nucleus (N) or vowel (V), a final consonant ( $C_f$ ), and a tone (T). The point of disagreement lies in how to represent an SC syllable. Proponents of CV models represent the syllable in terms of a flat structure, e.g., a word *xuan*<sup>1</sup> ‘spiral’ can be represented as follows:

(1)

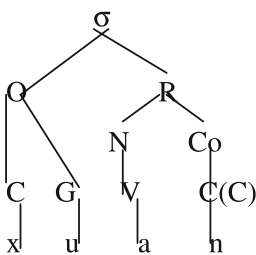


(Yip 1982; Chan 1985)<sup>2</sup>

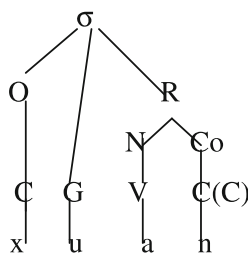
Proponents of this model do not recognize the internal structure of a syllable and consider that a syllable is syllabified from a sequence of sounds on the basis of well-formed syllabification principles and language specific rules.

Others in support of the X-slot theory argue for a representation that recognizes the syllabic internal structures in (2) and (3). Although these phonologists agree that syllables should be represented in a way that recognizes their internal structures, they have less agreement on which position a medial glide should take. In addition, some of them have different arguments on the representations of SC tones in (4). What should a tone be adjoined to—the whole syllable or the intermediate constituents?

(2) a.



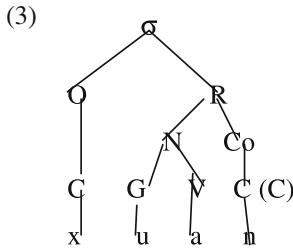
b.



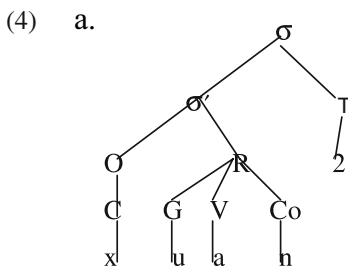
(Bao 1990a; Chiang 1992; Shu and Carstairs-McCarthy 1992)

<sup>1</sup> The *Pinyin* system is used here, and the number ‘2’ represents the second tone. In SC, there are four tones plus one neutral tone.

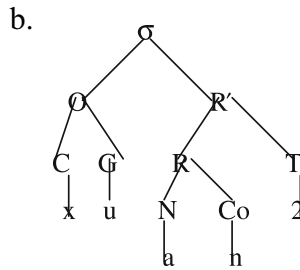
<sup>2</sup> They do not seem to represent the tone explicitly. Thus, I used the original assumption regarding tone in the CV model to formulate SC tones.



(Lin 1989; Chiang 1992; Wan 1999<sup>3</sup>)

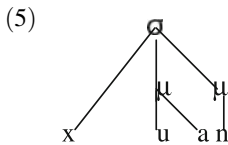


(Cheng 1973; Ting 1979; Lin 1989)



(Bao 1990a, b, 1995, 2001)

Some of the phonologists in question are in support of the moraic theory. Lin (1993) argues that medial and rhyme comprise the final part in a traditional analysis.<sup>4</sup> The representation is given below:



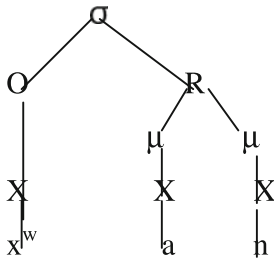
Still others have argued for mixed models (Chung 1989;<sup>5</sup> Duanmu 2000, 2001). They share an identical claim about the representation of the prenuclear glide, i.e., they claim that it is a secondary articulation that belongs to the onset.

<sup>3</sup> Wan (1999) discovered that when a prenuclear glide belongs to the rhyme, it often correlates with an onset that has a posterior feature (i.e., palatals, velars), while the prenuclear onset is aligned with the onset when it has an anterior feature (i.e., labials, dentals, retro-flexes).

<sup>4</sup> In the traditional syllabic analysis, a syllable consists of the initial part and the final part. The final part is subdivided into three subparts, i.e., the medial, rhyme and coda. Prenuclear glides, that are considered medial belong to the final rather than the initial part.

<sup>5</sup> Chung does not necessarily adopt the mixed representation perspective. Instead he adopted the X-slot theory. Due to the fact that his claim about the prenuclear glide is similar to Duanmu's, we put his and Duanmu's claims together.

(6)



On the basis of the representation from (1) to (6), an issue arises. That is, SC phonologists agree on the maximal syllable structure of  $C_1GVC_f + T$ . However, they do not agree on the representations of the prenuclear glides. Some argue that it belongs to the onset, while others claim that the prenuclear glide belongs to the rhyme. Yet, Chung (1989) and Duanmu (2000, 2001) claim that the prenuclear glide should be considered a secondary articulation feature. Still others support the claim that the position of the prenuclear glide in the syllable structure is indeterminate. Wan (1999) tried to discover the correlation between the prenuclear glide and the acoustic features in the onset because the features in the onset will determine the placement of the prenuclear glide, namely in domain of the onset or the rhyme. This paper aims to investigate these issues within the context of OC phonology, *Shijing* phonology, from which I will demonstrate that OC syllable structure, tone representation, and placements of medial glides are very different from those of Middle Chinese and even from those of modern standard Chinese.

## 1.2 Organization

After the overview of this paper, I discuss the sub-syllabic processes in OC, investigate the syllabic constituency, construct OC syllable structure, discuss tone representation, and examine placements of OC medial glides accordingly. In Sect. 2, the periods of history regarding phonological studies are defined. Then, generative studies in historical Chinese, such as Bao's (1995) proposal and argumentation regarding syllable structure and the syllabic status of medial glides in Middle Chinese or in *Guangyun* phonology, are introduced in more detail. In addition, Sun's (1999) reconstruction of directional partially reduplicated words in OC and his argumentations and verifications for these words are introduced. In Sect. 3, Replace (X) (Bao 1990a) as a diagnostic tool for sub-syllabic processes and syllabic constituency is employed to investigate the sub-syllabic constituency of onset, nucleus, and rhyme in OC based on partially reduplicated words and pronoun weakening. In Sect. 4, tone representation and its relation with rhyme are discussed on the basis of rhyming in the *Shijing* 'Book of Odes'. In Sect. 5, the syllabic status, or placement, of OC medial glides *-j-* and *-w-* in partially reduplicated words is investigated. In Sect. 6, I compare and contrast the reconstructed syllable structure in OC with Pan's (2000) OC syllable structure and with Bao's (1995) proposed syllable structure for Middle Chinese.

In Sect. 7, I conclude the article, discuss some controversies in this paper, and suggest future direction.

## 2 Generative studies in Chinese historical phonology

In studying Chinese historical phonology, researchers tend to periodize Chinese into the stages given in (7) (Baxter 1992; Lin and Geng 2001; Sun 1999; Zhu 2007). This periodization of Chinese is more linguistic than dynastic (cf. Qien 1969) and fits into the issues of syllable structure discussed in this paper that will unfold subsequently.

- (7) Periodization of Chinese
- a. Old Chinese (c. 1300 BC–220 AD)
    - (a) Early Old Chinese (c. 1300–771 BC; later Shang dynasty–Western Zhou)
    - (b) Classical Chinese (770–221 BC; The Spring and Autumn–Warring States)
    - (c) Later Old Chinese (220 BC–220 AD; Qin–Eastern Han)
  - b. Middle Chinese (220–1279)
    - (a) Early Middle Chinese (the 3rd century–the 7th century; Wei and Jin–Early Tang)
    - (b) Later Middle Chinese (the 8th century–the 10th century; Middle Tang–Southern Song)
  - c. Neo-Chinese (1279–present)
    - (a) Early Neo-Chinese (1279–1644; Yuan–Ming)
    - (b) Modern Chinese (1644–now; Qing–now)

The occurrence of the compilations of rhyme books enables Chinese historical phonologists to study sound patterns more systematically and efficiently. For example, researchers know that syllable structure in the stage of Neo-Chinese is similar to modern Chinese, having studied the classifications of the onset, rhyme, and tones in the rhyme books compiled during the *Yuan* dynasty, e.g., the well-known *Zhongyuan Yinyun*. For example, there are no voiced stops and voiced affricates found in this rhyme book. *Ru* tone or ‘entering tone’, has been lost and has been integrated into *yin* rhymes. These sound patterns parallel modern Chinese. Evidence in these rhyme books allows historical phonologists to reconstruct the phonetic value for each onset, rhyme, and tone.

*Qieyun* (601 AD) plays a pivotal role in all these rhyme books for the following reasons. First, it was compiled at a time that allows researchers to trace back sound patterns 1,000 years earlier, i.e., to study OC phonology. Second, it laid the foundations for the classifications of onsets, rhyme, and tones for later rhyme books. Third, it ambitiously attempted to collect the sound patterns of dialects as well as the sound patterns of *yayian* ‘sounds for academia/scholars’ at that time. Researchers (Pan 2000; Zhu 2007) believe that *Lufayian*, the main author of *Qieyun*, compiled this rhyme book on the basis of the sound patterns spoken by the people who lived in *Louyan* at that time. Chinese historical phonologists, therefore, can reconstruct the sound patterns and phonetic values in *Shijing* ‘Book of Odes’ on the basis of

*Qieyun*. OC reconstruction was achievable with *Qieyun* after researchers figured out the corresponding phonological rules between OC and Middle Chinese and reconstructed the phonetic values for OC characters, after the comparison of sound patterns among other dialects within China and other Sino-Tibetan languages. In other words, the availability of *Shijing* and other works from the same time period, along with the compilations of the rhyme books, e.g., *Qieyun*, allows present-day Chinese historical phonologists to reconstruct the syllable structure in OC.

Interestingly, traditional Chinese phonologists, in contrast with generative phonologists, studied Chinese phonology from the reverse direction. Traditional Chinese phonologists laid their emphases on Middle Chinese and Old Chinese phonology because of nostalgia for ancient times, while generative phonologists employ generative theories to study modern Chinese, with less attention to Middle or Old Chinese. This discrepancy is disappearing in recent generative studies. Two of the representative studies, one in Middle Chinese (Bao 1995) and the other in Old Chinese (Sun 1999), are introduced as follows to motivate this study.

### 2.1 Bao's proposal on syllabic representation in Middle Chinese<sup>6</sup>

One of the representative studies in classical/Middle Chinese phonology is Bao's construction of syllable structure on the basis of *Guangyun*, which is based on *Qieyun* and is the representative rhyme book from *Sui* to *Song* dynasty. Bao argued that tone should be adjoined to the rhyme as in (4b), contrary to the traditional assumption that tone is adjoined to the whole syllable, as in (4a). Bao was the first to analyze the representation of the Early Middle Chinese syllable structure, as well as the tone and syllabic placements of the Middle Chinese medial glides, on the basis of reconstruction data from Wang (1968), Fu (1960), Ju (1960), and Chou (1962).

Bao cited the *lianmianzi* data, i.e., partially reduplicated words consisting of two syllables such as *buk T4-suk T4* 'small trees', which were mainly reconstructed by Wang (1958, 1968) from *Guangyun* with the Early Middle Chinese phonological patterns, to proceed to his analysis and argumentation. Bao argued that the maximal syllable in the *Guangyun* was  $C_1GVC_2$  plus tone, which is highly similar to what we saw in SC. Bao called the reduplicated words (*lianmianzi*) p-words, which are divided into two types: i-words and r-words. For example, with *p'aj T1-p'at T4*, '(of rain) heavy', the *shuansheng* words that were identical in the initial parts are called i-words, and with *buk T4-suk T4*, 'small trees' and *dieyun* words that were identical in the rhyming parts are called r-words. From these data, he found that when the two component syllables in a p-word differed in one segment, they kept the same tone, as in (8), while when the two component syllables in a p-word have more than one segment different from each other, their tones may be identical or different, as in (9). Some of his examples are cited as follows.

<sup>6</sup> The title of his 1995 paper is 'syllable structure and partial reduplication in classic Chinese'. As mentioned, classical Chinese can be periodized into several stages, each of which has its own phonological and phonetic characteristics. It seems inappropriate to define a title like this. Since he based his argumentation on *Guangyun* system, the period of his study is characterized as Middle Chinese instead of classical Chinese.

- |     |    |                              |                  |   |
|-----|----|------------------------------|------------------|---|
| (8) | a. | tian T2 – tyan T2            | ‘toss and turn’  | differ only by G                                      |
|     | b. | siəu T1 – siau T1            | ‘red spider’     | differ by V   |
|     | c. | buk T4 – suk T4 <sup>7</sup> | ‘small trees’    | differ by C <sub>1</sub>                              |
| (9) | a. | dau 1 – du 1                 | ‘wild horse’     | differ by two segments but<br>with the same tone      |
|     | b. | kai 2 – kəu 1                | ‘water-chestnut’ | differ by two segments with<br>different tones        |
|     | c. | kiem 1 – ka 1                | ‘reed’           | differ by three segments but<br>with the same tone    |
|     | d. | kəu 2 – kiei 2               | ‘Lyceum Chinese’ | differ more than two segments<br>with different tones |

He used the interactions between tones and the number of segment differences to argue against the flat syllable structure in (1) because this structure needed more stipulation to account for the phenomena in (8) and (9). That is, in the CV model, one has to stipulate that when two syllables differ in a p-word, then tone may be changed or may not be changed. He thought that this stipulation was ad hoc. This type of relationship between tone and the segment should be displayed directly from the syllabic representation rather than adding more stipulation, which is the course taken by the CV model. In addition, he also argued that since only rhymes of the two component syllables in a p-word differ, the tones may be changed. In other words, tones covariate with rhymes when rhymes are different. Therefore, the tone should be adjoined to the rhyme directly as shown in (4b), but not (4a). He did not agree with the traditional analysis of the syllable structure in classical Chinese (Cheng 1973; Ting 1979; Lin 1989).

At the end of his paper, he used p-words to discuss the syllabic position of the medial glides in the *Guangyun* system by Ju (1960) and Chou (1962), and found that when the medial glides were in the so-called strict r-words, they were consistently aligned with the rhyme, as in (10). However, when they were in the so-called loose r-words, they belonged to the onset, as in (11). From these, he concluded that the syllabic status of medial glides was ‘indeterminate’ in Middle Chinese.

- |      |                |                 |                           |
|------|----------------|-----------------|---------------------------|
| (10) | Strict r-words |                 |                           |
|      | a.             | daŋ 1 – dieu 1  | ‘cicada’                  |
|      | b.             | daŋ 1 – diei 3  | ‘aspen’                   |
|      | c.             | kəu 2 – kiei 3  | ‘lyceum Chinese’          |
| (11) | Loose r-words  |                 |                           |
|      | a.             | vuon 1 – lɔn 1  | ‘a kind of fragrant herb’ |
|      | b.             | baŋ 1 – ywaŋ 1  | ‘a kind of grain’         |
|      | c.             | bwæt 4 – k’æt 4 | ‘a kind of weed’          |

Classical Chinese can be periodized into several stages, and so can the syllable structure and the issues proposed so far. Comparing syllable structure in Middle

<sup>7</sup> There was a gap in his data, i.e., he could not find a p-word that differs by C<sub>f</sub>.

Chinese and modern Chinese, no codas except nasals exist in standard Beijing Chinese. Furthermore, *ru* ‘entering’ tone is incorporated into other tones and does not exist in SC anymore. In the same vein, OC is very different from the EMC that Bao (1995) studied. The reconstruction of the phonetic values of OC is one of the major achievements after 1920 due to enlightenment of phonetic sciences and the introduction of comparative historical linguistics from Indian scholars. The achievements in OC reconstruction of phonetic values are mature enough to enable us to investigate these issues: syllable structure, tone representation, and the placement of medial glides. In the following sections, I introduce a generative study that provides evidence and argumentation for the OC reduplication, which is crucial for us to construct the OC syllable and investigate the placements of medial glides in OC. The derivation regarding the placement of the medial glides in partially reduplicated words compensates for the inadequacies of the speculation of their behavior from direct observation of a maximal syllable in OC.

## 2.2 The period and characteristics of Old Chinese

The definition of OC in this study is based on the period of the classics compiled or composed, e.g., *Shijing*<sup>8</sup> ‘Book of Odes’ and other books around this period, which provide the source for the subsequent rhyme books. The OC refers to the language spoken in old China, and it is the acceptable norm of pronunciation among educated speakers in that period. From the perspective of classics, *Shijing*, in which the poems generally display consistent rhyming, and *Qieyun*,<sup>9</sup> which can be regarded as a rhyme dictionary, provide us with valuable material for OC reconstruction. Researchers first listed the words that rhyme with each other in each poem/chapter in *Shijing*. For example, they found that words A, B, C, D rhyme with each other in Poem 1, words B, F, G rhyme with each other in Poem 2, words F, Q, J rhyme with each other in Poem 3, and so on. Researchers can classify A, B, C, D, F, G, Q, and J into the same rhyme part because they must be able to rhyme with each other. Rhyme classifications can be achieved using this method. Therefore, rhyming in OC is solved.

One may accept that maybe the rhyming problem of OC is solved using *Shijing*, but what about the initial parts of the reconstructed words? Historical linguists employ various methods to define the initials in OC, such as *Xinsheng* (or *Xiensheng*) ‘harmonizing sound’, *Shengxun* and the correspondences between OC and living dialects such as the Min dialects. These are supposed to be isolated from the linguistic development of central China, and between OC and other Sino-Tibetan languages such as Tibetan, Burmese, and Sino-Annamese (Old Vietnamese). Researchers (Pan 2000; Zhu 2007, and many *Qing* scholars) have argued that *Xinsheng* (or *Xiensheng*) ‘harmonizing

<sup>8</sup> *Shijing* is a collection of 305 anonymous poems compiled from the sixth century BC. The poems in this collection display a consistent pattern of rhyming.

<sup>9</sup> It is said that it was the earliest rhyme book completed by *Lufayian* around 600 AD. In fact, there existed several rhyme books before it. *Shenglei* ‘Classes of Sounds’ might be the earliest one, and several rhyme books followed *Shenglei*, and they all preceded *Qieyun*. However, once *Qieyun* appeared in history, all of these books preceding it could no longer be found. Furthermore, what we call *Qieyun* today is not a true version of that completed during the *Sui* dynasty. It is the *Guangyun* of the Song dynasty that reflects the sound patterns of *Qieyun* and allows us to investigate the sound patterns of these works (Zhu 1993).



sound' is one of the major principles or criteria to reconstruct OC onsets on the basis of Duan Yuc'ai's claim that *Tongsheng bi tongbu*, 'words with the same sound part must belong to the same rhyme part'. For example, 果 and 裸 have an identical sound part, 果, so they must belong to the same rhyme part in OC. Furthermore, it is highly likely that these two words have identical pronunciation in OC.<sup>10</sup> Nevertheless, rhyme classifications and onset classifications based on *Shijing*, discussed above do not reflect the actual phonetic values for these OC classifications, which must rely on the values of the living dialects or languages that are isolated but closely related to OC, e.g., Tibetan and Proto-Tibetan. Sound patterns from these dialects and languages can also shed light on the sound patterns of OC.

The OC reconstruction data and evidence we have today are based on the efforts of Qing scholars, e.g., Gu Yanwu, Duan Yuc'ai, and Dai Zhen, and modern historical phonologists such as Karlgren (1960), Li (1971, 1976), Baxter (1992), Pulleyblank (1963, 1973, 1989, 2000), Pan (2000, 2002), Zhu (2007), and many others.

The representations of these issues, i.e., the syllable structure and tone representation, in OC are very different from the EMC that has been discussed so far. First, OC syllable structure allows complex onsets (Pan 2000; Zhu 1981; 2007; and many others). Second, Bao (1995) argued for the stance that tone in classical Chinese is adjoined to the rhyme part or is inseparable from rhyme on the basis of the co-variation of the tone and rhyme in the partially reduplicated words, p-words. He merely laid his emphasis on the cases in which the rhymes are *different*, whereas tones may be identical or different. However, he ignored the cases when the rhymes are *identical*. In such cases, what would happen to the tone in the syllable? In other words, he did not deal with the data thoroughly before he claimed that the representation of tones in classical Chinese is adjoined to the rhyme instead of to the whole syllable. When one is dealing with OC data, this aspect should be paid attention to as well. Also, placements of medial glides are very different in EMC and OC. Pan (2000) even argued against medial glides in OC, but he agreed that medial glides did exhibit indeterminate behaviors of their placement in the syllable structure in EMC or Middle Chinese.

The representations of onset, rhyme, and tone are the foundations for studies in both generative and historical phonology. Since there exist such differences in the EMC or *Guangyun* phonology and OC in this respect, it seems necessary to study these issues from a perspective of generative phonology in order to provide historical Chinese phonology with generalizations and representations of these foundations in OC.

To achieve this goal, another study on partially reduplicated words in OC from the generative phonology perspective (Sun 1999) is introduced for the following section. There are motivations and argumentations for two types of partially reduplicated words: (a) progressive reduplication, which consists of two syllables within which the base syllable precedes the reduplicant syllable; (b) retrogressive reduplication, which consists of two syllables within which the base syllable follows the reduplicant syllable. The partially reduplicated words allow us to target the sub-syllabic constituency of a syllable and provides us with evidence to investigate syllable structure in OC. The analytical tool Replace (X) is employed to target the sub-syllabic constituency (Bao 1990a, 2000; Lin 1989) in OC.

<sup>10</sup> This is major evidence for the existence of complex onsets in OC, as detailed in Sect. 3.2.1.

Section 2.3 introduces the two types of partially reduplicated words in OC, and Sect. 3.1 introduces the diagnostic tool for syllabic constituency. These are highly relevant when I am constructing OC syllable structure in the subsequent sections.

### 2.3 Progressive reduplication and retrogressive reduplication in OC<sup>11</sup>

Reconstruction data of progressive reduplication and retrogressive reduplication in OC play a central role in constructing syllable structure, as seen in Sect. 3, and in positioning of the medial glides in OC, as seen in Sect. 5. The following sections illustrate these two types of reduplications and provide evidence for argumentation in constructing syllable structure and investigating the positioning of the medial glides in OC.

#### 2.3.1 Progressive reduplication in OC

OC has the following initials and rhymes based on Pulleyblank's system, (Sun 1999).

(12) (a) Initials of the OC

Laryngeals	ʔ
Velars	k k <sup>h</sup> g x ŋ
Labial verlar	w
Dentals	t t <sup>h</sup> d n
	r
	ʃ (< ʒ ʃ)
	l (ld)
Sibilants	ts ts <sup>h</sup> dz s
Labials	p p <sup>h</sup> b m

(b) Rhymes of the OC

	(a) yin1 陰	(b) yang2 陽	(c) ru4 入
I		qin1 侵 əm	ji1 緝 əp
II		tan2 談 am	he2 盍(葉) ap
III	wei1 微 əl	zhun1 諄(文) əŋ	shu4 術 ət
IV (i)	ji4 祭 ats	yuan2 元 aŋ	yue4 月 at
	(ii) ge1 歌 al		
V	zhi3 脂 əj	zhen1 真 əŋ <sup>j</sup>	zhi4 質 ək <sup>j</sup>
VI	zhi1 支(佳) aj	geng1 耕 aŋ <sup>j</sup>	xi2 錫 ak <sup>j</sup>
VII	zhi1 之 əy	zheng1 蒸 əŋ	zhi2 職 ək
VIII	yu2 魚 ay	yang2 陽 aŋ	duo2 鐸 ak
IX	you2 幽 əw	dong1 冬(中) əŋ <sup>w</sup>	du2 毒(覺) ək <sup>w</sup>
X	hou2 候 a <sup>ɥ</sup>	dong1 東 aŋ <sup>ɥ</sup>	wu1 屋 ak <sup>ɥ</sup>
XI	xiao1 宵 aw		yao4 藥 ak <sup>w</sup>

<sup>11</sup> According to Sun (1999), OC progressive reduplication and retrogressive reduplication denote different semantics. The former denotes smallness/diminutiveness or vividness, while the latter denotes repetition of verbal actions or nouns. One hundred progressive reduplications were found and 79 retrogressive reduplications were found. For the sake of argument and illustration, only relevant examples were extracted for discussion.

In addition to these simple onsets, OC has initial clusters that are formed by the combination of the single consonants above with \*-r-, \*-s-, and ʒ. There are two post-coda that were responsible for the EMC tones \*-ʔ and \*-s. Although OC phonologists do not all agree with the details listed above, they do agree that OC has complex onsets, unlike SC today.

Progressive reduplication refers to one type of directional reduplication where a base syllable precedes a reduplicant syllable. The distinction between base and reduplicant syllables is determined by their meanings with respect to the whole binomial words. Before proceeding to exhibit the criteria in determining the base of the progressive partially reduplicated word, Sun emphasized that these words are not normal compound words. He argued that the meanings of the reduplicated words are not simply the composition of the component parts, namely the base and the reduplicant, which is created by phonological modifications to denote the specific semantics in OC. These points can be illustrated by the examples in (13).

- (13) Progressive reduplication for diminutive senses with liquid onset in reduplicant
- a. fuyou 浮游 \*bəw ləw > EMC buw juw, ‘larval mayfly’ (*Shijing*)
  - b. tanglang 螳螂 \*daŋ raŋ > EMC daŋ laŋ ‘mantis’ (*Zhuangzi*)
  - c. mingling 螟蛉 \*maŋ<sup>j</sup> raŋ<sup>j</sup> > EMC məŋ ləŋ, ‘caterpillar’, (*Shijing*)
  - d. rulu 茹蘆 \*naŋ raŋ > EMC ŋiə liə, ‘madder (a kind of grass)’, (*Shijing*)

Since speakers of Chinese are unable to get a sense from the composition of the two component parts in the partially reduplicated words, these words are not the normal compounds but the reduplicated words. Furthermore, the component that should be the base depends on its meaning with respect to the whole binom. The meaning of the base is more closely related to the whole binom, while the meaning of the reduplicant is less closely related to the whole binom or even irrelevant to it. In the progressive partially reduplicated words, sometimes even the meaning of the base is only loosely related to the whole binom. (13a) illustrates this point. We know that *fu* 浮 is the base and *you* 游 is the reduplicant. The characteristic of the larval mayfly, ‘floating’, is chosen as the base for the reduplication plus the reduplicant of *you* 游 to denote the SMALLNESS (diminutive) sense. However this is only loosely related in meaning with respect to the whole binom, and therefore it is considered a quasi-base.<sup>12</sup> Then the base syllable is copied, and then the reduplicant syllable is created through phonological modifications to denote some aspect of semantics.

<sup>12</sup> For detailed discussion about why the word *you* 游 cannot be the base, interested readers may refer to Sun’s dissertation (1999, pp. 54–55).

According to Sun (1999), there are primarily two types of progressive reduplication in OC on the basis of the aspects of semantics they denote. They are created to express diminutive meaning, namely SMALLNESS as in (13), and to express vivid meaning, namely VIVIDNESS as in (14). On the other hand, based on the phonological modifications these two types have undergone in OC, they can be classified into three types. The first type of phonological modifications represents the major type in which the base and reduplicant syllables have identical finals, but the onset of the second/reduplicant syllable is replaced with a liquid, *l-* or *r-*, as in (13) and (14). The other minor types of phonological modifications will be introduced in later parts of this section.

The demonstration of lexical entries for the OC reduplicated words follow this order: the modern pronunciation of the words;<sup>13</sup> OC phonetic value reconstruction with an asterisk ‘\*’; an EMC phonetic value, which begins with EMC and then is followed by its phonetic values; the English translation; and then the name, in parentheses, in the final position of the source of this item.

- (14) Progressive reduplication for vivid senses with liquid onset in reduplicant
- a. congong 從容 \*ts<sup>h</sup>aŋ<sup>u</sup> laŋ<sup>u</sup> > EMC ts<sup>h</sup>uawŋ juawŋ, ‘at leisure, casually’, (*Shangshu*, *Liji*)
  - b. weiyi 委蛇 \*ʔwal lal > EMCʔ wiä jia, ‘winding, roundabout’, (*Shijing*)
  - c. xiaoyao 逍遙 \*saw law > EMC siaw jiauw, ‘free and unfettered’, (*Zhuangzi*)
  - d. youyou 優游 \*ʔəw ləw > EMC ʔuw juw, ‘at leisure’ (*Shijing*)

On the other hand, progressive reduplication in OC has two other minor types in terms of their phonological shapes. For one type, different modifications occur when the onset of the base syllable is liquid *r-* or *l-*. The liquid onset of the base syllable triggers the change of vowel quality in (15). The following examples illustrate the point: when the component syllables share the same onset, vowel quality changes, i.e., a lowering process from *ə* to *a* occurs.

- (15) Progressive reduplication with identical onset in two component syllables
- a. liuli 流離 \*rəw ral > EMC luw lia, ‘kind of bird’ (*Shijing*)
  - b. lilu 藜蘆 \*rəj rax > EMC li lo, ‘a kind of grass’, (*Guangya*)
  - c. youyu 由余 \*ləw lax > EMC juw jia, ‘name of a person in Pre-Qin’, (*Shijing*)
  - d. laolu 鏘鏘 \*rəw rax > EMC law lo, ‘kind of arrowhead’, (*Guangya*)

For the other type, there are a minority of examples whose onsets are not replaced with liquids, but rather are replaced with other sounds such as nasals as in (16).

<sup>13</sup> Tone is ignored across the board unless it is the focus of my discussion.

- (16) Progressive reduplication with non-liquid onset in the reduplicant
- chenren 蹑蹑 \*tʰəmʔ nəmʔ > EMC tʰimʔ ɲimʔ, ‘slow and unhurried’, (*Dongxiao fu*)
  - zhimo 蟻螺 \*tək mək > EMC tək mək, ‘bat’ (*Fangyan*)
  - koumao 恠塉 \*khaʊs maʊs > EMC kʰəwʰ məwʰ, ‘fool’, (*Chuci*)
  - suimi 藪靡 \*swalʔ malʔ > EMC swiɑ̃ʔ miɑ̃ʔ ‘description of soft grass’, (*Zhaoyinshi*)

Although the majority of the onsets of the reduplicant of progressive reduplication are replaced with liquids, a minority of them can be replaced with nasals.

### 2.3.2 Retrogressive reduplication in OC

Retrogressive reduplication refers to the type of reduplication where reduplicant syllables precede base syllables. Likewise, the determination of base and reduplicant syllables depends on their meanings with respect to the whole binom. The one relevant to the meaning of the whole binom is considered to be the base. Retrogressive reduplication in OC is motivated by the semantics of REPETITION. This type of retrogressive denotes repetition of verbal activities as in (17) (Sun 1999, 2003) or repetition of nouns as in (18), and it undergoes three types of phonological modifications: (a) [−round] in the reduplicant syllable and [+round] in the base syllable, i.e., roundness contrast as in (17) and (18); (b) an exceptional case to the case of (a), the base syllable bears a [−round] feature but the corresponding reduplicant syllable does not bear a [+round] feature, as in (19); (c) the final part of the reduplicant syllable is replaced with fixed elements, -aŋ, as in (20).

- (17) Retrogressive reduplication of verbal activities with roundness contrast
- zhangzhuān 輾轉 \*tranʔ trwanʔ > EMC trianʔ trwianʔ ‘toss and turn endlessly (in bed)’ (*Shijing*)
  - qianquan 纏綿 \*kʰjanʔ kʰwanʔ > EMC kʰjianʔ kʰuanʔ ‘keep on chopping and changing; get tangled; deeply attached’ (*Shijing*, *Zuozhuan*)
  - qingkong 磬控 \*kʰanʔs kʰanʔs > EMC kʰejŋʰ kʰəwŋʰ, ‘to control a horse in various ways’ (*Shijing*)
  - Chichu 踟躕 \*draj draʊ > EMC dri draʊ, ‘pace up and down’ (*Shijing*)
- (18) Retrogressive reduplication of repetition of nouns with roundness contrast
- pifu 虬蟬 \*pəj bəw > EMC bi buw, ‘ant’ (*Erya*)
  - qicao 齧齧 \*dzəj dzəw > EMC dzej dzaw, ‘grub’ (*Zhuangzi*)
  - jiejue 子叉 \*kat kwat > EMC kiat kuat, ‘wiggler, wriggler’ (*Huainanzi*)
  - dingdong 葦董 \*taŋʔ taŋʔ > EMC tɛŋʔ təwŋʔ, ‘kind of grass’ (*Erya*)

- (19) Retrogressive reduplication with [–round] in the base syllable
- a. pufu 匍匐 \*baj bək > EMC bə bək, ‘crawl’ (*Shijing*)
  - b. ziju 次且 \*tsəj tsay > EMC tsi tsinjə, ‘walk with difficulty’ (*Yijing*)
- (20) Retrogressive reduplication with fixed element -aŋ
- a. kangkai 慷慨 \*k<sup>h</sup>aŋ k<sup>h</sup>əls > EMC k<sup>h</sup>aŋ k<sup>h</sup>əj<sup>h</sup>, ‘vehement, fervent’ (*Aiyiŋ*)
  - b. langli 狼戾 \*raŋ rək<sup>s</sup> > EMC laŋ ləj<sup>h</sup>, ‘scattered about in a mess’ (*Mengzi, Huainanzi*)
  - c. huanghu 恍惚 \*xwaŋ<sup>?</sup> xwət > EMC xwaŋ<sup>?</sup> xwət, ‘in a trance’ (*Laozi, Hanfeizi*)
  - d. hangxie 沆瀣 \*gaŋ<sup>?</sup> grjats > EMC ɣaŋ<sup>?</sup> ɣəijh, ‘dew’ (*Yuanyou*)

The sound [j] is used as [–round] to contrast with [w], e.g., (17a) and (17b) and [ɥ], e.g., (17c) and (17d) with [+round] feature because [–round] usually implies [–back]. Therefore, [j] is utilized to contrast with [w] and [ɥ] in roundness.

These directional partially reduplicated words in Sun’s dissertation (1999) provide us with valuable data to construct the syllable structure, to discuss the sub-syllabic processes, and to target the positioning of the medial glides in OC. These data, along with the diagnostic tools introduced in the following section, help us understand the hierarchical organization of an OC syllable.

### 3 Diagnostic tools and syllable structure in OC

Three methodological issues raised by Bao (1995) should be addressed before I proceed to the analyses and diagnoses of syllable structure in OC. First, a number of theorists of reduplication (Marantz 1982; Yip 1982; McCarthy and Prince 1986; Steriade 1988; Bao 1990a, 1995, 2000; Sun 1999) assume some base copying procedures for reduplication. Therefore, when using partially reduplicated words, one needs to know the base of these reduplicated words to ensure the directionality of the reduplication. Second, since we are studying syllable structure using reconstructed data in the historical phonology context, we need to appeal to a set of well-justified data with ample morphological and phonological evidence. Third, the collection of this set of data must also originate within the period of time our interest focuses on. In other words, the interest for this study is OC phonology, so the data should originate from the OC time period, i.e., between 1300 BC and 220 AD, or during the time of *Shijing*.

Sun’s (1999) data are the ideal data set which eliminates the methodological concerns raised by Bao (1995). The base and reduplicant of the partially reduplicated words in OC are well justified with morphological, semantic, and phonological evidence and motivations. The data set is also limited to the reconstruction period in *Shijing* or classics around that period of time, representative pieces of work for OC phonology reconstruction. The data introduced earlier provide us with solid ground to study OC syllable structure with the diagnostic tools introduced below.

### 3.1 Diagnostic tools for syllable structure in OC

As a diagnostic tool, Replace (X) is used in Bao (1990a) as a test of syllable constituency (see also Lin 1989; Bao 1995, 1996, 2000; Chan 1990, 1997; Chung 1997; Hsu 2006). Replace (X) refers to a rule that targets a string of *xyz* segments by which two component syllables differ. In other words, Replace (X) refers to an X string of segments to be replaced in the derived syllables in the partially reduplicated words. This X string of segments replaced in the derived syllables is considered a constituent in the syllable structure. Consider a hypothetical example below.

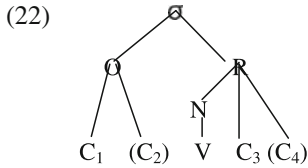
(21)  $bəw \rightarrow ba\ ləw$

For the derivation of partially reduplicated words, I adopt the assumption that all the phonological modifications follow the total copying of the original syllable. Then a shape of  $bəw\ bəw$  is created, before any phonological modifications are applied. The example in (21) can be derived in two steps. First, the rhyme of the first syllable is replaced with *a*. Second, the onset of the second syllable is replaced with *l*. Therefore, two Replace (X) rules are applied to this reduplicated word: Replace (R) and Replace (O). Replace (X) expresses the relation between the source syllable and derived syllable(s) in the partially reduplicated words. We may also infer that the replaced rhyme and onset constitute a constituent in the syllable structure. Furthermore, this rule says nothing about segments in different syllabic positions, e.g., the replaced rhyme in the first syllable has nothing to do with the onset in the first syllable. Using the property with which the two component syllables minimally differ in the partially reduplicated words, I am able to provide evidence for the internal organization of a syllable.

### 3.2 OC syllabic constituency and sub-syllabic processes

Historical Chinese phonologists like to analyze onset, rhyme, and tone when discussing a syllable structure. In this section, I will make a minor violation to this tradition. In this section, I mainly discuss onsets and rhymes in OC, articulate its syllabic constituency on the basis of the partially reduplicated words reconstructed by Sun (1999), and leave the discussion of OC tone for a later section.

In recent years, Chinese phonologists have been drawing on data from phonological processes that target sub-syllabic constituents, such as speech errors (Bao 1990a, 1996, 2000, 2001; Wan 1999, 2001), languages games (Bao 1996; Yip 1982), and partial reduplication (Bao 1995, 1996, 2000; Hsu 2006). From these studies, an underlying assumption for them to test the sub-syllabic constituency is that when a phonological process targets *xyz* segments, then the *xyz* segments become a constituent, as introduced in Sect. 3.1. In this section, I am going to use the partial reduplication data to argue for the following syllable structure.



### 3.2.1 OC syllable permits complex onsets as a constituent

When studying OC syllable structure, researchers are usually fascinated by the fact that the OC syllable permits complex onsets as English does, e.g., in *clock* and *cream*. A syllable structure permitting complex onsets is quite different from syllable structure in Middle Chinese or Chinese after the Han dynasty, as well as from present-day Chinese. Middle Chinese and contemporary Chinese only allow a one-segment onset if the medial glides *-j-*, *-w-*, and *-ʃ-* are excluded.

The confirmation of complex onsets in OC primarily undergoes three stages, starting in the late 19th century. Although scholars in Qing dynasty realized great achievements in OC-related studies, they did not discover the possibility that the OC syllable might permit complex onsets. A fundamental reason may have led to this oversight, i.e., Chinese is not an alphabetically based language. That is, the sound of a character cannot be produced by only looking at it, as is the case with other alphabetically based languages such as Romance or Germanic languages. In addition, we did not have sophisticated phonetic knowledge then. Therefore, the western scholar Edkins (1874, 1876, 1897) became the first person to propose that OC syllable structure might allow complex onsets. However, he did not devote himself to the systematic data collection and verification of the existence of complex onsets in OC. This proposal that OC syllable structure permitted complex onsets had raised numerous debates and incurred plenty of suspicion (Tang 1937) before the first half of the 20th century was over. Nowadays, researchers (Benedict 1976; Bodman 1954; Chen 1937; Du 1970; Hsu 1974; Li 1971, 1976; Lin 1967; Lu 1971; Mei 1971; Pan 2000; Pulleyblank 1962; Ting 1978; Tong 1944; Yen 1981; Wei 1932; Wu 1932; Zhou 1970; Zhu 1981, 1993, 2007; and others) have reached the consensus that OC syllable structure permits complex onsets. What they disagree about is the exact types of the complex onsets.

When discussing and verifying the existence of OC complex onsets, Pan (2000) argued that it is necessary to distinguish sesqui-syllables and complex onsets.<sup>14</sup> Pan (2000, p. 105) pointed out that sesqui-syllables, which consist of a bound/half syllable and a full syllable, should not be considered complex onsets. It usually has the form of C(V)CV or CCV. The latter one may confuse the scholar into treating it as a complex onset. In fact, it is a half syllable or sesqui-syllable, which is pervasively seen in southern dialects. The main principle Pan proposed to distinguish complex onsets from sesqui-syllables is the sonority peak. In addition, Pan argued that not only vowels but also syllabified consonants can constitute a syllable. Then, we may proceed to how Pan distinguished these two. Since it is a sesqui-syllable, it

<sup>14</sup> I owe a debt of gratitude to one of the reviewers for pointing out this concern.



has two sonority peaks in contrast with a syllable with complex onsets. How can the two sonority peaks be detected? The Sonority Sequencing Principle (SSP) (Kens-towicz 1994) states that, generally speaking, there is a sonority scale for sounds: vowels > glides > liquids > fricatives > obstruents > stops. Consonant sonority becomes greater when it gets closer to the nucleus/vowel. If this sonority sequence is violated in a syllable, we may consider it a sesqui-syllable. For example, *s* or fricatives have greater sonority than obstruents, and therefore fricative + obstruents + V violates the sonority sequence. The sonority of complex onsets becomes weaker when it gets closer to the vowel. Pan argued that we should treat this type of sequence of two sonority peaks in the following way: one for the syllabified fricative and the other for obstruent + V, i.e., a sesqui-syllable + a full syllable. When encountering this kind of sequence in OC, we would do better to treat them as a sesqui-syllable plus a full syllable instead of a complex onset.<sup>15</sup>

Several types of evidence help us identify the existence of complex onsets in OC. The primary evidence is *xingsheng* or *xiesheng* words. In OC times, if words share the same sound character, they must have identical or similar sounds, because it provides a cue for speakers to pronounce that word, e.g., native speakers today know that 分 and 芬 have identical pronunciation, *fen*, because they share the same sound symbol/character 分. Although many words nowadays that share the same sound symbol do not have the same pronunciation because of sound change in history, historical phonologists believe that words of this type must have had identical or similar pronunciation in OC (see Duan Yucai's claim mentioned in Sect. 2.2). Therefore, when we find words with similar sound symbols that are consistently pronounced as two types of single onsets nowadays, we may infer that they indeed share the same onset types. On the other hand, if a group of words share the identical sound symbol but have two consistently different pronunciations, we may infer that these words may have had some proto-pronunciation in earlier times. The reconstruction of the complex onset is based on such an assumption. For example, when we see words like, 各 *k-*, 路 *l-*, 果 *k-*, 裸 *l-*, and other examples that share identical sound symbols but one of them has *k-* and the other has *l-* as an onset, we have reason to believe that they have a common onset in OC, i.e., [kl]. The loss of a complex onset leads to the divergence of these two types of simple onsets after the Han dynasty. In addition, other Sino-Tibetan languages, such as Tibetan and Burmese, which have rich complex onsets nowadays, are also exhibiting losses of complex onsets. The loss of complex onsets in these languages allows us to conjecture that OC syllable permitted complex onsets but that these complex onsets were lost later in history.

Zhu (2007) argued that when reconstructing OC complex onsets, we need to be able to find parallel examples that can exhibit similar patterns mentioned above independently in other sources, such as ancient literature and dictionaries, to explain the change of the sounds, and to reconstruct them on the basis of the phonotactic

<sup>15</sup> Sesqui-syllables have the characteristics of a weak syllable plus a full syllable. In terms of this criterion, reduplicated words in OC should not be considered one type of sesqui-syllable because they always consist of two full syllables with onset + rhyme and many have codas.

constraints in that language and consider language-specific rules and universal constraints on syllables.

The types of complex onsets synthesized in Zhu (1981, 2007) are extracted for exposition. Interested readers can refer to these references. The demonstration of the following examples follows this order: the OC reconstructed complex onset of the sound symbol is preceded by an asterisk '\*', then followed by its sound change or complex onset loss in Early Middle Chinese. The two words that share identical symbols but have different pronunciations in Middle Chinese are listed for the construction of the OC complex onset. The sounds following the two illustrated words indicate the possible onset construction at the time between OC and EMC. As mentioned, the underlying assumption is that when words have identical sound symbols but have different onset pronunciations at a later time, this comparison suggests that there once existed a common complex onset for the two. Due to the phonological change, part of the complex onset was lost, leading to the simple onset at a later time.

- (23) C + l/r (C denotes consonants and l/r means liquids)
- \*pl- > p 泉 l-/l- vs. 剝 pr-/p- (> means 'change into')
  - \*kl- > k- 呂 l-/l- vs. 茗 kl-/k-
  - \*gl- > g- 兼 k-/k- vs. 廉 gl-/l-
  - \*ŋl- > ŋ- 魚 ŋl-/ŋ- vs. 魯 l-/l-
- (24) ? + C (glottal stop + consonants; C could be any stop)
- \*?t- > t- 合 g-/ɣ- vs. 答 ?t-/t-
  - \*?d- > d- 公 k-/k- vs. 松頌 ?d-/d-/z-
  - \*?p- > p- 爻 g-/ɣ- vs. 駁 ?p-/p-
  - \*?n- > n- 今 k-/k- vs. 念 ?n-/n-
- (25) t-/d- + C<sup>16</sup>
- \*tk- > k- 羊 r-/∅- vs. 姜 tk-/k- vs. 詳 d-/z-
  - \*dg- > g- 佳 t-/tɕ- vs. 帷 dg-/g-
  - \*tʔ- > ?- 多 t-/t- vs. 黠 tʔ-/ʔ- vs. 爹 t-/t-
  - \*tp- > p- 勻 t-/tɕ- vs. 杓 d'/z-

The general rules for the loss of the complex onsets after OC are illustrated as follows (Ting 1978; Pan, 2000; Zhu 2007).

- (26) a. voiceless stops/affricates + l/r → l or r (loss of voiceless stops and affricatives). Elsewhere (consonants other than voiceless stops or affricatives), l or r was lost.
- b. ?loss in Middle Chinese.

<sup>16</sup> Examples illustrated here apparently violate the sonority sequencing principle. However, they may also be considered consonants with equal sonority.

For other types such as N (m, n, ŋ) + C (obstruents), S<sup>17</sup>+ (C)C(obstruents), Pan (2000) argued that these sequences should be treated as sesqui-syllables in OC, which also underwent sound changes, e.g., SC type lost C and only S left in later period. Based on the distinction between sesqui-syllable and complex onsets, the probability that the OC syllable permitted three consecutive consonants in onset position is low. In sum, researchers agree that OC syllable structure permits complex onsets that disappeared after the Han dynasty. Simple onset became an important feature after Early Middle Chinese or the *Qieyun* period.

To target the syllabic constituency of a complex onset, recall that one of the characterizing features of the major types of progressive reduplication in OC is that the consonant(s) before the vowel are replaced with a liquid, namely *l*, *r*, or a nasal, in a reduplicant syllable as in (13), (14), and (16) in Sect. 2.

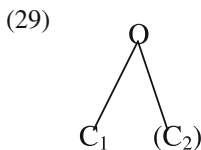
The source syllable is the base and is copied to yield a string of two copies. The reduplicant can be derived by a rule such as Replace (O), defined as follows.<sup>18</sup>

(27) Replace (O): Replace O-onset with *l*, *r*, or a nasal in the reduplicant

This rule only targets the consonant(s) preceding the vowel without affecting any segments included in the rhyme. The derivation of this type of reduplication can be formulated as follows.

(28) Base:	ts <sup>h</sup> aŋ <sup>q</sup>	bəw
Copy:	ts <sup>h</sup> aŋ <sup>q</sup>	ts <sup>h</sup> aŋ <sup>q</sup> bəw bəw
Replace (O)	ts <sup>h</sup> aŋ <sup>q</sup>	laŋ <sup>q</sup> bəw ləw
Output	ts <sup>h</sup> aŋ <sup>q</sup>	laŋ <sup>q</sup> bəw ləw
	‘at leisure’	‘larval mayfly’

From the derivation above, it is not difficult for one to discover that the onset is an independent constituent in a syllable. Therefore, we can formulate our schema as follows.



<sup>17</sup> S refers to fricative [s]. Zhu (2007) provided the following examples of complex onsets that have the form of SC(C).

- i. st- > ts- 左 st-/ ts- : 隋 t'-, d'-
- ii. stn- > n- 如 stn-/ n-/ nz: 絮 stn-/s-

<sup>18</sup> At this moment, medial glides *-j-* and *-w-* are temporarily put aside. I will discuss their behavior later.

### 3.2.2. *V as a constituent in OC*

Two types of evidence in OC proposed by Sun (1999) and Pan (2000) are put forth to argue for the independence of V as a syllabic constituent in OC.

First, Pan (2000, 2002) reported that OC pronouns have two patterns, and both of them are interchangeable. One is called the regular pattern (30a), and the other is referred to as the weakened pattern (30b). (30b) is the corresponding weakened pattern of (30a). The sounds for  $w$  and  $\emptyset$  are interchangeable for these cases.

- (30) a. 余 la 汝 na 女 na 者 kja 居 ka 是 gje 彼 pal  
 b. 台 lu 而 nu 乃 nu 之 kjw 其 gw 時 gjw 匪 pu

A weakening rule can be formulated as follows.

- (31)  $a \rightarrow w(\emptyset)$  Replace (V): replace V/a with  $w(\emptyset)$  in the weakened pronouns.

This rule also suggests that onset(s) and vowels constitute different syllabic constituents.

Second, recall the progressive reduplication examples in (16). When the onset of the base syllable is a liquid and the onset of the reduplicant syllable is also replaced with a liquid, the identical onsets between two component syllables will trigger vowel lowering, from  $\emptyset$  to  $a$ . Hence, the rule can be formulated as in (32).

- (32)  $\emptyset \rightarrow a$ : Replace (V): replace V/ $\emptyset$  with  $a$  in the reduplicant syllable.

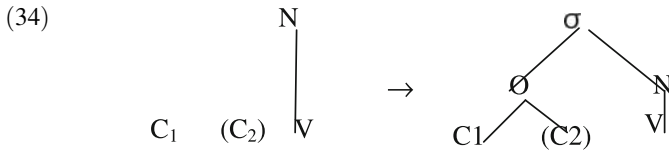
From these two types of phonological modifications that target the V, I can show the following derivation using the Replace (V).

(33)	Reduplicated words	Pronoun weakening
Base form	rəw	na
Copy	rəw rəw	N/A
Replace (O)	N/A <sup>19</sup>	N/A
Replace (V)	rəw raw	nu
Replace (Co) <sup>20</sup>	rəw ral	N/A
Output	rəw ral	nu
	'kind of bird'	'you'

Based on these types of evidence in OC, I am confident in arguing that V in OC forms a constituent in the syllable structure.

<sup>19</sup> I am not sure at this moment whether Replace (O) works in the derivation because the reduplicant syllable has the identical onset r-. If it does in the derivation, then Replace (O)  $\rightarrow$  Replace (r).

<sup>20</sup> This may be taken as evidence for the independent Co node. However, I need more evidence to verify this syllabic constituent in OC, and this step of the derivation is not our concern for the time being. Furthermore, because I am arguing for V as an independent constituent, I apply rules of Replace (V) and Replace (Co) separately, rather than apply a rule of Replace (VCo) once.



### 3.2.3 Rhyme as a constituent in OC

Before the discussion of ‘rhyme as a constituent in syllable structure’, some notions regarding the definition of rhymes in Chinese phonology are introduced. Rhyme generally consists of three parts, namely a medial glide (rhyme head), a nucleus (rhyme body), and a coda (rhyme tail). As for tone, whether it is included in rhyme depends on the context for rhyming. Chinese historical phonologists like to discuss rhymes in terms of several technical terms, *yunlei* ‘rhyme class’, *yun* ‘rhyme’, and *yunbu* ‘rhyme part’. *Yunlei* ‘rhyme class’ is the smallest unit for the classification of *yunmu* ‘mother of rhyme’, which categorizes those groupings with identical medial glide, nucleus, coda, and tone as one *yunlei* ‘rhyme class’. *Yun* ‘rhyme’ refers to the case when the words have identical nucleus, coda, and tone (medial glides excluded). *Yunbu* ‘rhyme part’ refers to the case when the words have an identical nucleus and coda (medial glides and tone being excluded). Chinese historical phonologists like to discuss OC rhymes in terms of *yunbu* ‘rhyme part’ rather than the other two. The main reason results from the fact that medial glides and tones arouse complex issues and exhibit interesting properties different from those in Early Middle Chinese. Tone will be discussed in Sect. 4 and medial glides in Sect. 5. In this section, my concern is whether a rhyme forms a syllabic constituent in OC.

Generally speaking, there are three types of rhymes in traditional Chinese phonology: *yinsheng yun* ‘open syllables’, *yangsheng yun* ‘closed syllables with nasal codas *-m, -n*, or *-ŋ*’, and *rusheng yun* ‘closed syllables with *-p, -t*, or *-k*’. Gu (1966a, b) found that OC rhymes exhibit a particular phenomenon that is incompatible with the rhyming in Middle Chinese, i.e., OC *yinsheng yun* ‘open syllables’ rhyme with *rusheng yun* ‘closed syllables with *-p, -t*, or *-k*’. This discovery leads to numerous debates in OC reconstruction. This implies that OC *yinsheng yun* ‘open syllables’ may end with codas and may not be open syllables as we conjecture in OC. They became open syllables because of the vowel length, i.e., long vowels tend to allow their following codas to be dropped (Wang 1975). Interested readers can refer to the debates regarding whether OC *yinsheng yun* should be reconstructed as open syllables (Wang 1975; Chen 1972) or closed syllables (Li 1986; Pulleyblank 1963; Ting 1979). My concern here is whether OC rhyme can constitute a syllabic constituent.

From the examples in (20) where the rhyme part of the reduplicant syllable in the retrogressive reduplication is replaced with fixed element *-aŋ*, I have evidence to argue that OC rhymes constitute a syllabic constituent.

With this alternation in mind, I can now analyze this type of retrogressive reduplication with the help of the rule schema Replace (X). The source of the syllable is regarded as the base, and the reduplicant can be regarded as the copied

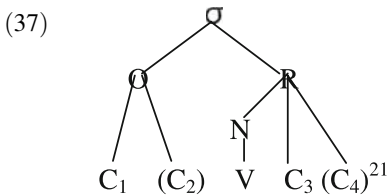
syllable that undergoes phonological modification. Thus, the reduplicant may be derived by a rule such as Replace (R), defined in (35).

(35) Replace (R): Replace R with -aŋ in the reduplicant

This rule only targets the segment from the nucleus plus coda, i.e., rhyme, leaving the consonants before the nucleus unaffected. The consonants before the nucleus and the nucleus + coda, i.e., rhyme, are different constituents in the syllable structure. The derivations of this type of reduplicated words are given below.

(36)	Base	khəls		bak	
	Copy:	khəls	khəls	bak	bak
	Replace (R):	khəŋ	khəls	baŋ	bak
	Output:	khəŋ	khəls	baŋ	bak
		‘vehement, fervent’		‘vast, boundless’	

After the demonstration of the derivation of this type of reduplication, I argue that rhyme forms a constituent in OC. The syllable structure of OC so far can be formed as in (37). As a consequence, the OC syllable I have constructed so far is the representation of (37).



#### 4 The representation of tone

Chinese historical phonologists like to use *yunbu* ‘rhyme part’ which excludes tones, rather than *yunlei* ‘rhyme class’ or *yun* ‘rhyme’, both of which require that tones must be included, to discuss tone-related phenomena in OC. This is because rhyming in *Shijing*, namely OC, is very different from that in subsequent periods in history. Rhyming in *Shijing* also follows strict rules requiring that in order for two words to rhyme, their nuclei have to be identical and the coda must come from the same

<sup>21</sup> Whether there should be an intermediate Co-node in the syllable structure in OC is not clear because I did not find sufficient evidence to argue for its constituency. What is certain is that, at least, it is part of the rhyme as we saw in (37). However, in one of the types in the progressive reduplications, i.e., when both components share the same liquid onset, there is a vowel quality change. This may suggest that nucleus and coda constitute different syllabic status. As for the number of coda that the OC syllable permits, it is still unclear. It seems that phonologists are concerned with the reconstruction of the *yinsheng yun*, and have placed less emphasis on this issue. Since Li (1986) argued that there existed two types of codas in *rusheng yun* ‘codas with -p, -t, -k’, i.e., the other type is that velars such as -k, -g, -ŋ can co-occur with another off-glide w. I suggest that there might be complex codas as well in OC. However, I leave this problem open for more evidence.

category. However, there existed the so-called *duizhuang* ‘rhyme with different tones’, such that tone is not an obligatory part in *Shijing* rhyming, in contrast to what is found during the Tang dynasty. This phenomenon triggered debates about whether OC has four tones. This is because some tones that are supposed to be *ping* ‘leveling’ tones can rhyme with the other three tones, *shang* ‘rising’, *qu* ‘departing’, and *ru* ‘entering’ tones, in addition to *ping* ‘leveling’ tones. This suggests that tone classification can be heavily reduced, and therefore, the fact that different tones can rhyme with each other can be explained. However, we may investigate this issue from other perspectives.

It is certain that there were four tones, i.e., *ping*, *shang*, *qu*, and *ru*, in Early Middle Chinese. However, not all Chinese historical phonologists agree that there were four tones in OC. For example, Duan Yucai thought that OC had no departing tone, which appeared in the dynasty of Wei-jin (220AD–589AD). Furthermore, Huang Kan argued that the *shang* tone occurred after *Shijing*. *Shang* tone did not exist in OC. Thus, OC had only the *ping* tone and *ru* tone. The *shang* tone was derived from the leveling tone, while the departing tone came from the entering tone. Wang (1975) followed Duan Yucai’s claim and classified OC tones into two types, *shu* ‘relaxed’ and *cu* ‘quick and short’, because in *Shijing*, the *ping* tone rhymed with the *shang* tone in addition to the *ping* tone, and the *qu* tone with the *ru* tone in addition to the *qu* tone. The subsequent four tones were derived by the interaction between vowel lengths and tones of *shu* and *cu* (with *-p*, *-t*, *-k* codas). Wang argued that if a long vowel has a *shu* tone in OC, it becomes a *ping* tone in the subsequent period. If a long vowel has a *cu* tone in OC, it becomes a *qu* tone later in history. On the other hand, if a short vowel has a *shu* tone in OC, it becomes a *shang* tone later, and if a short vowel has a *cu* tone in OC, it becomes a *ru* tone later. The derivation of these four tones after OC, using the interaction between tones of *shu* and *cu* and vowel length, is given in Table 1.

**Table 1** Derivation of four tones after OC by Wang (1975)

OC Tones	Shu	Cu (with <i>-p</i> , <i>-t</i> , <i>-k</i> codas)
Vowel length		
Long vowel	Ping	Qu
Short vowel	Shang	Ru

Wang argued that long vowels allow losses of codas of *-p*, *-t*, *-k*, and therefore *cu* tones with long vowels become *qu* tones in the subsequent period. This classification also accounts for the fact that *ping* can rhyme with *shang* and *qu* can rhyme with *ru*, because they are derived from the same tone in OC, as shown in Table 1.<sup>22</sup>

Even so, many phonologists still think that OC had four tones (Li 1971; Zhou 1970; Ting 1981, 1986; Zhu 2007). Nevertheless, Pulleyblank did not think that there existed any tones in OC and thought that tones in subsequent periods were derived from codas.

<sup>22</sup> Another account for the rhyming phenomena is given below.

**Table 2** Rhyming distribution across four tones in *Shijing* (Zhang 1968, cited from Ting 1986)

	Leveling	Rising	Departing	Entering
Leveling	2,186	203	159	5
Rising	158	882	99	18
Leveling	134	67	316	64
Leveling	5	21	97	732

Zhang (1968, cited from Ting 1986) investigated the distribution of rhyming in *Shijing*, and the results are represented as in Table 2. This table indicates the distribution of the rhyming in *Shijing*, where the leftmost tone marking indicates the tone of the words to rhyme and the uppermost tone marking indicates the tone of the words to be rhymed. The number in Table 2 indicates the number of words of the rhyming distribution, e.g., 2,186 indicates the number of words with leveling tone rhyming with another leveling tone, and 203 displays the number of words with leveling tone rhyming with a rising tone in *Shijing*.

Zhang (1968) ran a statistical analysis on the distribution of rhyming among the four tones and found a reliable effect on the distribution. That is, rhyming usually occurs when the two words have the identical rhymes and tones. The rhyme with the first tone tends to rhyme with another first tone, not the second tone, and so on. This reliable effect supports the existence of the four-tone system in OC. The rhyme for these four tones should be randomly distributed. On the other hand, Table 2 provides another important clue, i.e., the relationship between tone and rhyme is not inseparable. If we suppose that it is inseparable or that tone is attached to rhyme, then as long as rhyme is identical, tone must be an obligatory and crucial part in OC rhyme. This contradicts what Chinese historical phonologists have found in *Shijing* rhyming.

In Bao's (1995) paper, the syllabic position of a tone co-varied with the rhyme alternation. On the basis of the reconstruction data he had examined, he found that when the disyllabic p-words (reduplicated words) differed only in one segment, i.e.,  $C_1$ , G, V, or  $C_F$ , the tones of these two syllables would be identical. However, when the disyllabic p-words differed in two or more segments, the tones of these two syllables could be identical or different. The only place where the disyllabic words could differ in two or more segments was the rhyme. He thus concluded, contrary to the traditional analysis, that tone should not be adjoined to the whole syllable, but rather adjoined to rhyme.

The main point for his analysis of Middle Chinese tone in the partially reduplicated words relies on the fact that when rhymes are *different*, tone can be identical or different. However, he ignored the other side of argument, i.e., what would happen to tone if rhymes are *identical*?<sup>23</sup> Rhyming in OC is the very case that

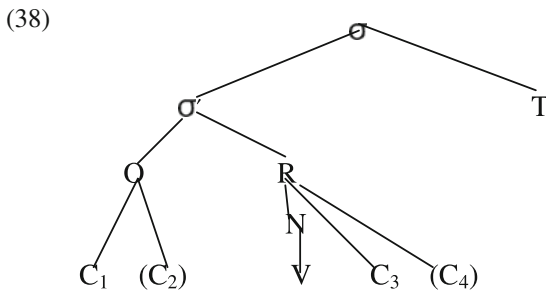
<sup>23</sup> In fact Sun (1999) reported that when two component syllables in a p-word have identical rhymes, but these two syllables differ in onsets and medial glides, their tones can be different, as given below.

- i. Different onsets: xiyi 蜥蜴 \*sak<sup>l</sup> lak<sup>j</sup> 24 > EMC sejk jiajk, 'kind of lizard', (Shuowen; Fangyan)
- ii. Different medial glides: mianman 綿蠻 \*mjan mran 42 > EMC mjian mai n, 'in rich and bright colors' (Shijing)

These cases suggest that tones do not necessarily co-vary with rhyme.



rhymes are identical, but tone can be either identical or different, suggesting that OC tones may not be a critical and integrative part in rhyming to the people's perception and production in OC. As long as the *yunbu* 'rhyme part' sounds identical, tones may be ignored. In order to characterize OC people's perception and production and to account for the fact that tone is not a necessary part in rhyming, I have reasons to suggest that OC tones can be dissociable from rhymes, different from what we see in the rhyming in the Tang poems and *fanqie* system. Since tones are dissociable from rhyme, naturally when people at that time were making poems, they did not need to find a word with a strictly identical tone to rhyme. Therefore, I suggest the following representation for OC tone, which is independent of rhyme.



## 5 The syllabic status of the OC medial glides<sup>24</sup>

OC partially reduplicated words provide us with a good source to examine the behavior of medial glides *-j-* and *-w-*. In Sect. 5.1, their behavior in progressive reduplication is introduced, and in Sect. 5.2, their behavior in retrogressive reduplication is introduced.

### 5.1 Medial glides in the progressive reduplication

From Sect. 2, one of the characterizing features of the OC progressive reduplicant is that the onset of the reduplicant/second syllable in this type is replaced with the liquid *r-* or *l-* in the major types and replaced with other consonants in the minor types.

<sup>24</sup> There is a well-known OC glide, *r*, which was lost in EMC. It is not included in our discussion at this point. As for the modern medial glide  $\varphi$ , which is a consequence of labialization of *-iu-*, it was not formed until modern Chinese. I am not concerned with this glide  $\varphi$  at this time, either.

5.1.1 Medial glide *-j-*<sup>25</sup>

- (39) a. diaoliao 鴟鵂 \*tjaw rjaw > EMC tɛw lɛw, ‘kind of bird which eats worms inside of reeds’ (*Erya*)  
 b. jiaoliao 校釘 \*kjawʔ rjawʔ > EMC kɛw’ lɛw’ ‘kind of small leggings’, (*Fangyan*)  
 c. yaotiao 窈窕 \*ʔjawʔ ljawʔ > EMC ʔɛw’dɛw’, ‘reticent, modest’ (*Shijing*)  
 d. yaorao 萋繞 \*ʔjawʔ njawʔ > EMC ʔjaw’ ŋjaw’ ‘the root of the marrow leaved polygala’ (*Erya*)

The behavior of the medial glide *-j-* can be observed through the following derivation. If it is replaced with the Replace (O) rule, it is aligned with onset. On the other hand, if it is not replaced with this rule, it is aligned with rhyme.

(40) Placement of medial glide *-j-* in the progressive reduplication

Base	tjaw		ʔjawʔ		ʔjawʔ	
Copy	tjaw	tjaw	ʔjawʔ	ʔjawʔ	ʔjawʔ	ʔjawʔ
Replace (O)	tjaw	rjaw	ʔjawʔ	ljawʔ	ʔjawʔ	njawʔ

<sup>25</sup> Pan (2002) argued that the OC medial glide *-j-* has been intimately correlated with three problems in Chinese historical phonology: (a) the *kai* ‘open; no [u] sound follows’ and *he* ‘closed; followed by [u] sound’ problems of labials sounds, namely p, b, m; (b) problems of *chongniu* ‘repetition of onset; rhyme classifications based on the medial glides’ and third grade medial glide *-j-*; (c) phonological condition for the *zhongchunyin* ‘bilabial’ and *qingchunyin* ‘labio-dental’. For the first problem of labial sounds *kai* and *he*, Pan (2002) followed Li’s (1973) and Shao (1991) argument that no *kai* ‘open; no [u] sound follows’ and *he* ‘closed; followed by [u] sound’ problem exists in OC on the basis of the phonological system in *Qieyun*, i.e., the classification of rhymes involving labial onsets have nothing to do with the existence (or not) of an [u] sound. Furthermore, he solved the problems that Li (1973) could not solve, i.e., what is the criterion for the rhyme classification of those words that are supposed to be classified on the basis of the contrast of *ka* ‘open; no [u] sound follows’ and *he* ‘closed; followed by [u] sound’. He argued that the *-j-* medial glide in OC plays a critical role for these rhyme classifications in Middle Chinese. Pan proposed numerous interesting inquiries and arguments to argue against such a contrast after the labial sounds. Interested readers may refer to Pan (2002, pp. 4–19). Second, *chongniu* ‘repetition of onset; rhyme classifications based on the medial glides’ refers to the fact that third grade rhymes can be divided into two types. Pan argued against the traditional analysis that they are distinguished on the basis of different nuclei, and for the argument that *chongniu* is distinguished by the medial glide *-j-*. Third, Qian (1992) found that only bilabial sounds but no labio-dental sounds existed before EMC. The phonological conditions for the development of labio-dental after EMC have not been satisfactorily addressed. Pan (2002) first refuted Wang’s claim on the phonological condition for the EMC labio-dental sounds. Wang claimed that as long as a sound is labio-dental after EMC, it must be a bilabial sound followed by [u], i.e., it is *hekou* in OC. On the other hand, if it keeps the bilabial status after EMC, it must be a bilabial sound that is not followed by any [u] sound, i.e., it is a *kaikou* in OC. Pan argued that the phonological condition for the labio-dental after EMC that occurs when the OC bilabial sounds are followed by a medial glide *-j-* or central or back vowels, i.e., the phonological context excludes [i] and [ɛ] and words belonging to *Tong* and *Liu* that are included in *Ming* rhyme and that become labio-dental after EMC. It can be formulated as follows.

Bilabial (p, b) → labio-dental (f, v) / \_\_\_j or (vowels excluding i and ɛ).

This paper also discusses the relationship between the medial glide *-j-* and the development of palatalized sounds in Old Vietnamese. Interested readers can refer to Pan (2002) for more discussion.

Output	tjaw rjaw	ʔjawʔ ljawʔ	ʔjawʔ njawʔ
	‘kind of bird which eats worms inside of reeds’	‘reticent, modest’	‘the root of the marrow leaved polygala’

By investigating the derivation above, medial glide *-j-* survives after Replace (O), suggesting that it belongs to the rhyme in the progressive reduplication.

5.1.2 Medial glide *-w-*

- (41) a. jingling 鼯 鼯 \*kwanʔ ranʔ > EMC kwɛŋ liaŋ, ‘kind of mouse’, (*Guangya*)
- b. weiyi 委蛇 \*ʔwal lal > EMC ʔwiɑ̄ jiɑ̄, ‘winding, roundabout’, (*Shijing*)
- c. kuanglang 壙 垠 \*kʰwanʃ ranʃ > EMC kʰwanʰ lanʰ, ‘spacious and open all sides’ (*Zhuangzi*)
- d. suimi 藿靡 \*swalʔ malʔ > EMC swiɑ̄ miɑ̄ ‘description of soft grass’, (*Zhaoyinshi*)
- e. juewu 崛 岬 \*gwət mət > EMC gut mut, ‘towering’, (*Lulingguangdian fu*)

Following the same line of thinking in Sect. 5.1.1, if the medial glide *-w-* is replaced with other consonants in the derivation, the derivation suggests that it belongs to the onset. If it survives through derivation, it suggests that *-w-* is aligned with rhyme.

(42) Placement of medial glide *-w-* in the progressive reduplication

Base	kwanʔ		ʔwal		swalʔ	
Copy	kwanʔ	kwanʔ	ʔwal	ʔwal	swalʔ	swalʔ
Replace (O)	kwanʔ	ranʔ	ʔwal	lal	swalʔ	malʔ
Output	kwanʔ	ranʔ	ʔwal	lal	swalʔ	malʔ
	‘kind of mouse’		‘winding, roundabout’		‘description of soft grasses’	

From the derivation above, the medial glide *-w-* is replaced with the rule, Replace (O), suggesting that it is aligned with onset.

In sum, with progressive reduplication, the medial glide *-j-* belongs to the rhyme while *-w-* belongs to the onset, suggesting an asymmetrical status of the two medial glides in OC syllable structure.

5.2 Medial glides in the retrogressive reduplication

The characterizing feature of the major type of retrogressive reduplication is that when the [+round] feature appears in the base, then the opposite [−round] feature appears in the reduplicant. For example, with the second syllables in the data below, the base has the [+round] feature while the reduplicant, the first syllable, has the [−round]

feature. These examples are illustrated as (43a)–(43e). In addition, the examples involving *-j-* and *-w-* in the other type of retrogressive reduplication, whose rhyme in the reduplicant syllables is replaced with *-aŋ* are illustrated in (43f) and (43g).

- (43) a. qikuo 契闊 \*k<sup>h</sup>jat k<sup>h</sup>wat > EMC k<sup>h</sup>et k<sup>h</sup>wat ‘be separated far away’  
 b. tiantuan 叮囑 \*t<sup>h</sup>janʔ t<sup>h</sup>wanʔ (or t<sup>h</sup>janʔ2 t<sup>h</sup>wanʔ2) > EMC t<sup>h</sup>en’ t<sup>h</sup>wan’,  
 ‘to keep trampling down’  
 c. jianguan 間關 \*krjan krwan > EMC kəin kwain ‘(of chariot)  
 advancing endlessly’  
 d. yinyun 氳氳 \*ʔjəŋ ʔwəŋ > EMC ʔjin ʔun, ‘dense mist’ (*Yijing*)  
 e. yiwei 伊威 \*ʔjəl ʔwəl > EMC ʔji ʔuj, ‘kind of worm’ (*Maozhuan*)  
 f. huanghu 恍惚 \*xwaŋ xwət > EMC xwaŋ’ xwət, ‘in a trance’  
 (*Laozi*, *Hanfeizi*)  
 g. hangxie 沆瀣 \*gaŋ grjats > EMC ʔaŋ’ ʔəiŋh, ‘dew’ (*Yuanyou*)

The examples whose rhyme of the base is replaced with the fixed element *-aŋ* are considered first. The derivations of (43f) and (43g) are given below to manifest the syllabic status of medial glides in this subtype of retrogressive reduplication.

- (44) Replacement of medial glides *-j-* and *-w-* in the *-aŋ* subtype of retrogressive reduplication

Base	xwət	grjats
Copy	xwət xwət	grjats grjats
Replace (R)	xwaŋ xwət	gaŋ grjats
Output	xwaŋ xwət ‘in a trance’	gaŋ grjats ‘dew’

In (43f), the medial glide *-w-* does not undergo the rhyme alternation, implying that it belongs to the onset. By contrast, in (43g), the medial glide *-j-* does undergo the rhyme alternation, i.e., the *-aŋ* replaced the following rhyme *-rjats* in the base syllable. This suggests that *-j-* belongs to the rhyme. This type of alternation supports my previous conclusion, i.e., the medial glide *-j-* belongs to the rhyme while *-w-* belongs to the onset in OC syllable structure.<sup>26</sup>

However, the pattern demonstrated from (43a) to (43e) poses a problem to my current analysis on the asymmetric status of the two medial glides. The dissimilation process undermines this asymmetric conclusion because it seems to target the medial glides *-j-* and *-w-* simultaneously, suggesting that these two medial glides may occupy the same syllabic position. However, there is a way out of this

<sup>26</sup> This complicates the issue of whether there exist any medial glides in OC. That is, the medial glides *-w-* and *-j-* in OC are in fact a consonant and a vowel, respectively, in OC. Nonetheless, we have reasons to believe that the behavior of *-w-* and *-j-* in OC is different from that of Middle Chinese. See related discussion in Sect. 6.1 below.

predicament. On the basis of our Replace (X) rule, what are replaced are *a segment/segments* and not a *feature*, and nothing can prevent a feature from being assimilated from one sub-syllabic constituent to the other sub-syllabic constituent. Consider English assimilation cases such as in + possible. It is apparent that [n] is the coda of the prefixed syllable while [p] is the onset of the stem syllable. However, the labial feature of the onset bilabial [p] can assimilate another sub-syllabic constituent, namely coda alveolar [n] into bilabial [m], resulting in ‘impossible’. I have reasons to believe that feature assimilation or dissimilation does not change the status of the sub-syllabic constituency, but rather this (dis)assimilatory process can move across sub-syllabic constituents.

After examining the phonological modifications in progressive and retrogressive reduplication, I suggest the placements of the medial glides in OC show an asymmetric status. The medial glide *-j-* tends to alternate with rhyme while the medial glide *-w-* tends to alternate with the onset.

The result that the medial glide *-j-* belongs to the rhyme in OC suggests that *-j-* has more of a vowel property instead of the indeterminate status in Middle Chinese or in the *Qieyun* phonological system (Bao 1995). Pulleyblank (1962–1963) found that people tended to use *ŋ-* but did not use *-j-* to translate foreign words beginning with *Y-* and suggested that the medial glide *-j-* does not exist in the onset. Furthermore, researchers (Pan 2000; Zheng 1987) suggested that OC *-j-* is in fact a short vowel *ɪ*, or at least a majority of OC *js* are derived from short vowel *ɪ*. The medial glide *-j-* we find in Middle Chinese are derived from a vowel. Based on these discussions, if there is a medial glide *-j-* in OC, it bears more of a vowel property. Therefore, it is aligned with rhyme in OC.

As for the medial glide *-w-*, its alignment with the onset suggests that it has more of a consonant property in OC. On the basis of the *Qieyun* phonological system, Li (1976) found that the rounded vowel *u* only followed the velar sounds such as *k-*, *g-*, *x-*, and *ŋ-* and labials sounds. In addition, there existed no roundness contrast in the vowel after the labial sounds, but there existed such a contrast after the velars. That is, both rounded and unrounded vowels can follow velar sounds in Middle Chinese. This fact from Middle Chinese led him to believe that the roundedness contrast of the vowels after the velar sounds is derived from a labial consonant *w-*. If OC has the *kw-*, then it will become *k-u* in Middle Chinese. In his view, he believed that OC has only *-j-* and *-r-* glides, and *w-* is not a glide in OC but a consonant. From the evidence in the partially reduplicated words, it seems that his reconstruction of *w-* as onset is supported.<sup>27</sup>

<sup>27</sup> Another possibility that *-w-* is aligned with onset may result from the reconstruction assumption in Sun and Pulleyblank’s system. Footnote 10 implies that they treat *-w-* as a consonant instead of a glide. However, Sun (1999) argue that *-w-* in OC was [-consonantal] in Chap. 4. There exists disagreement regarding *-w-* within the same author/system. Regardless of any conscious effort in incorporating *-w-* as a consonant in reconstruction, the disagreement is suggestive of *-w-* as a medial glide in OC in their system.



he argued that there existed no segment for *w* in OC on the basis of Yahon (1960), Pulleyblank (1962–1963), and Li (1971). Second, he argued that since *-j-* only occurred in words of group of *Zhang* 章, other *j*-like segments are in fact the short vowel *ɪ*, and this *-j-* can be treated as a part of the complex onset without assuming it to be a medial glide. Furthermore, comparing his syllable structure and mine, I found that he assumed a syllabic constituency of E which may consist of two consonants, with no tone representation.

I agree that OC medial glides still involve complex issues. However, before making a claim like this, it seems that more evidence is necessary. First, as mentioned earlier, Li (1971) did not explicitly argue that *w* should be a secondary feature and could not be an independent segment. In order to claim or to argue that it is a secondary feature or articulation, one needs evidence and argumentation (see Duanmu 2000). OC *w-* may or may not be a glide, but the consensus we have so far is that it is aligned with the onset. This placement is quite different from that in Middle Chinese.

For the medial glide *-j-*, Pan and I disagree. On the basis of the analysis of Replace (X), *-j-* is aligned with rhyme and should not be treated as a part of the complex onset. I am conservative for the time being with respect to whether *-j-* belongs to the onset or the rhyme. However, in order to claim that it belongs to the onset, one needs to propose some analyses and argumentation for its placement. Therefore, I keep my position that medial glide *-j-* is aligned with rhyme but not with onset.

Concerning the syllabic constituency of E, I believe that there exists such an intermediate node in the representation of syllable structure, from both cross-linguistic evidence and examples from subsequent periods in Chinese phonology. Again, one needs more evidence to articulate its existence. OC tone and its representation are still a highly controversial issue. However, based on people's rhyming habits in OC times, I argue that OC tone is dissociable from rhyme or independent of OC rhyme, at least in their production and perception between the rhyming and rhymed words in *Shijing*.

Pan and I both reach the consensus that the OC syllable permits complex onsets (and maybe complex codas), which are very different from Middle Chinese, or *Guangyun* phonology, or SC or Beijing dialect.

## 6.2 Comparison and contrast with Bao's syllable structure

Bao (1995) argued for the syllable structure in (4a), which is very different from the OC syllable structure in (38). Syllable structure underwent great change from OC to Middle Chinese. Comparing these two syllable structures, we find three main differences. First, syllable structure does not permit any complex onsets in Middle Chinese, and therefore syllable structure in Middle Chinese permits only one segment if medial glides are excluded. Second, medial glides *-j-* and *-w-* behave differently in OC from Middle Chinese. In OC, the medial glide *-j-* is aligned with the rhyme, while *-w-* is associated with onset (though it is not completely sure whether this is a glide yet). In comparison, their placements are indeterminate in Middle Chinese, i.e., they can be aligned with both onsets and rhymes. Third, as for tone

representation, my position is in support of a traditional analysis, i.e., tone is adjoined to the whole syllable, but not to the rhyme (Cheng 1973; Ting 1979; Lin 1989; Lin and Geng 2001), which is different from Bao's (1995) analysis. However, I am still suspicious of the tone representation in Middle Chinese, because Bao provides us with evidence that tones and rhymes co-vary in the partially reduplicated words when rhymes are *different* in a p-word. He does not provide a thorough analysis dealing with the relationship between tones and rhymes in the partially reduplicated words when rhymes are identical. This aspect of analysis seems necessary for the tone representation in the syllable structure in Middle Chinese as well.

## 7 Concluding remarks

Although Chinese phonologists have been applying and employing different theoretical frameworks to investigate phonological alternation in SC syllable structure, how to represent a syllable is by no means a settled question. As mentioned earlier, three main types of syllable representations have their own proponents in accounting for the sub-syllabic processes in SC. These Chinese phonologists' efforts have yielded fruitful achievements in the representation of a syllable, though they have not reached mutual agreement on this issue. Theoretical or generative Chinese phonologists choose the opposite route in studying Chinese phonology. They lay their emphasis on the issues of modern Chinese, while descriptive or traditional Chinese phonologists prefer to study Chinese phonology in different periods other than modern Chinese. Thus, less research has been reported regarding syllable-related issues in historical Chinese, such as how to represent the OC syllable and the behavior of the medial glides in OC from the perspective of generative linguistics.

Bao (1995) employed Replace (X) as a diagnostic tool to investigate the sub-syllabic processes and syllable constituency in classical Chinese/Middle Chinese and constructed the syllable structure in *Guangyun* phonology. He found that syllable structure in Middle Chinese permits only one segment in the onset position, that there is a structural distinction between onset and rhyme, that tone is adjoined to the rhyme, and that the status of the medial glides *-j-* and *-w-* is indeterminate in this period.

Chinese is a living language and phonological changes throughout its entire history reflect its dynamics as a living language. Hence, phonological changes such as syllable structure change throughout the entire history are also reflections of dynamics. The main purpose of this paper is to investigate the sub-syllabic processes and syllabic constituency in OC and to discuss the issues that are of concern to both theoretical and historical Chinese phonologists as well, based on Sun's well-justified directional partially reduplicated words, Pan's pronoun weakening, Pulleyblank's *ə/a* ablaut, and rhyming in *Shijing*. The OC syllable structure permits complex onsets and has different syllabic constituencies among onset, nucleus, and rhyme. Tone forms its own plane independent of the whole syllable based on the rhyming facts in *Shijing* 'Book of Odes', in support of the traditional analysis. As for the syllabic status of the medial glides, the findings suggest that the two medial glides



-j- and -w- exhibit asymmetric behaviors across reduplication types, i.e., -j- tends to be aligned with the rhyme while -w- is generally associated with the onset. My analysis is in support of Bao's (1995, 1996, 2000, 2001) claim that a syllable has its own hierarchical internal structure that is necessary for the representations of the syllable in order to account for the sub-syllabic processes. After comparing and contrasting Pan's (2000) and Bao's (1995) syllable structures in OC and in Middle Chinese, I am concerned that direct observation from a possible maximal syllable in a language without theoretical analyses may result in some rash conclusions. Though the overall representation of the syllable structure can be crudely determined based on direct observation, theoretical analyses can reveal several aspects of phonological phenomena such as the status of medial glides and tone representation. These abstract behaviors of glides and tones can be captured by theoretical analyses.

Although OC studies have had great achievements since the 1920s, many controversies exist. One aspect of the controversies that cannot be completely resolved in this paper is whether OC *w* is a medial glide, an onset, or a secondary articulation. Modern phonologists also note this aspect of controversy in present-day Chinese. More evidence is needed in order to completely justify its property of a phonological unit and status in the syllable structure.

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