A corpus study of Chinese Regulated Verse: Phrasal stress and the Analysis of Variability*

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Abstract

I introduce 1460 lines of Chinese regulated verse and offer an analysis of the data. I also compare Chinese with English and discuss two approaches to variability in linguistic patterns (such as regular vs. exceptional forms, or perfect verse lines vs. lines with metrical tension).

I argue that, whereas word stress is often more important than phrasal stress in English, it is crucial to understand the latter in Chinese. Other than that, stress maxima play a central role in both languages. This suggests that meter is probably less variable cross-linguistically than previously thought. Moreover, while a correlation is thought to exist between metrical tension and frequency, it is difficult to see it in the present corpus. I argue that non-phonological factors can influence frequency patterns and that the presence of variable patterns does not necessarily imply the presence of marked forms. Rather, even fully well-formed patterns may occur rarely.

1 Introduction

In generative phonology there have been several approaches to the analysis of English verse (Halle & Keyser 1971, Kiparsky 1975, 1977, Hayes 1989, Golston 1998, Fabb 2002, and others), but there is also substantial agreement. All analyses are based on stress and all assume an ideal form for a given verse style, to which verse lines can be compared with or mapped onto.

For illustration, consider the iambic pentameter. According to Halle & Keyser (1971: 169), the ideal form (or template) is as in (1), where W is a weak position, S a strong position, x an unstressed syllable, and X a stressed syllable (optional positions are ignored).

(1) Template: WSWSWSWSWS
Example: The curfew tolls the knell of parting day (xXxXxXxXxX)

The example shows an ideal line, where W and S are filled with unstressed and stressed syllables respectively. However, many lines depart from the ideal form. For example, in (2), some S positions are filled with an unstressed syllable and some W positions are filled with a stressed one. For ease of reading, such positions are underlined.

(2) Batter my heart, three-person'd God, for you (<u>Xx</u>xX<u>X</u>XxXx<u>x</u>)
Prison my heart in thy steel bosom's ward (<u>Xx</u>xXx<u>xX</u>XxX)

It is generally assumed that whether a line is metrical (or well formed) cannot be judged simply by the reader's intuition. Instead, if a pattern is frequently used, it must be metrical (for the given poet). The job of the linguist is to find an analysis in which such lines are metrical. Halle & Keyser propose that lines are not mapped to the template directly, but via a set of correspondence rules (also called metrical rules in later works).

Lines that can be so mapped are metrical. Lines that cannot are unmetrical. The correspondence rules are defined in (3) and (4), from Halle & Keyser (1971: 169)

(3) Correspondence Rules (CR)
- CR1 a. A position corresponds to a single syllable
  - b. Or to a sonorant sequence incorporating at most two vowels (immediately adjoining or separated by a sonorant consonant)
- CR2 a. Fully stressed syllables occur in S positions only and in all S positions
  - b. Or fully stressed syllables occur in S positions only but not in all S positions
  - c. Or stress maxima occur in S positions only but not in all S positions

(4) Stress Maximum (Halle & Keyser 1971: 169)
When a fully stressed syllable occurs between two unstressed syllables in the same syntactic constituent within a line of verse, this syllable is called a "stress maximum"

CR1a is the ideal case. CR1b allows two syllables to count as one in certain cases, which need not concern us. CR2a is the ideal case. CR2b allows an unstressed syllable to fill S, and CR2c allows a stressed syllable (but not a stress maximum) to fill W. A syllable is fully stressed if it carries the stress of a polysyllabic word or if it is a monosyllabic lexical word (instead of a functional or grammatical word). Given the correspondence rules, both lines in (2) can be mapped to the metrical template, as shown in (5) and (6).

(5) Batter my heart, three-person'd God, for you (<u>Xx</u>xX<u>X</u>XxXx<u>x</u>)
CR2c, CR2b, CR2c, CR2b (Complexity = 4)

(6) Prison my heart in thy steel bosom's ward (<u>Xx</u>xXx<u>xX</u>XxX)
CR2c, CR2b, CR2b, CR2c (Complexity = 4)

In (5), there are four positions that depart from those of the ideal line (departing from CR2a); each departure is related to a clause in CR2. For example, the first syllable has stress but is not a stress maximum (it is not 'between two unstressed syllables'), and according to CR2c it can fill W. Similarly, the second syllable in (5) is unstressed, but by CR2b it can fill S. Other deviant positions are accounted for in the same way.

The number of departures from the ideal line (from CR2a) provides a measure of metrical tension (or complexity). Thus, while both (5) and (6) are metrical, they are both complex, with a tension of degree 4. It is believed that lines with more tension occur less frequently than lines with less tension.

Several ideas in Halle & Keyser's proposal have subsequently been revised or reinterpreted. For example, Kiparsky (1975, 1977) proposes further conditions on stress maxima. Hayes (1989) argues that the stress maximum (or 'peak') should be defined in terms of prosodic categories. Hanson & Kiparsky (1996) use the term strength instead of stress maxima. The template has also been re-conceptualized. In Golston (1998), the template is represented by ranked constraints, following Optimality Theory (Prince & Smolensky 1993). In Fabb (2002), the template is replaced with a metrical grid that is built directly on a verse line, following the Bracketed Grid Theory of Idsardi (1992) and Halle & Idsardi (1995). The grid for the iambic pentameter is shown in (7).

(7) Metrical grid for the iambic pentameter (Fabb 2002: 16)

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                                  *        gridline 3
)         *                       *)       gridline 2
    *     *)    *     *           *)       gridline 1
)*  *)  *  *)  *  *)  *  *)  *  *)          gridline 0
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There is disagreement on metricality, too. Some researchers (such as Halle & Keyser 1971 and Fabb 2002) believe that the distinction between metrical and unmetrical lines is clear cut, but others believe that it is gradient (such as Youmans 1989 and Golston 1998). Opinions also differ with regard to metrical tension. Most researchers believe that tension can be specified in terms of rules or constraint violations, and that a relation exists between metrical tension and frequency (Halle & Keyser 1971, Kiparsky 1975, 1977, Golston 1998). On the other hand, Fabb (2002) suggests that metrical tension belongs not to phonology but to pragmatics.

Despite the differences, all the analyses agree that (a) there is a relation between the stress pattern of a verse line and an ideal template, and (b) a stress maximum in a verse line should correspond to a strong position in the template.

Against this background, Chinese verse presents an interesting case. First, it is often reported that Chinese speakers do not have a clear intuition for stress in their language (Chao 1968: 38), and some linguists believe that Chinese has no stress (Hyman 1977, Selkirk & Shen 1990). If so, what is Chinese meter based on? Second, perhaps because of the lack of agreement on stress, there is also a lack of agreement on the ideal template in Chinese verse (see below).

A possible response is that languages have different verse conventions, whereby stress is relevant for English verse but tone is relevant for Chinese verse. Thus, Wang (1958) provides a comprehensive discussion of tone in Chinese verse, but stress and feet are discussed only under western poetry and westernized Chinese poetry, where Chinese poets are thought to imitate European feet. Jakobson (1979b) holds the same view.

In a seminal study, Chen (1979) proposes that Chinese regulated verse also has feet. But unlike English feet, which are based on stress, Chinese feet are based on tone. In addition, syntax plays a major role in Chinese. Specifically, the syntactic tree of an ideal line should match the prosodic tree. The prosodic tree of a seven-syllable line is shown in (8a), and the ideal syntactic tree is shown in (8b).

(8) Tree-matching theory (Chen 1979)

a. Prosodic tree for a seven-syllable verse line in Chinese

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Line:       [                    ]
Half-lines: [            ][      ]
Feet:       [M M][M M][M M M]        M = monosyllable
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b. Syntactic tree for a seven-syllable verse line in Chinese

[[[M M][M M]][M M M]] M = monosyllable

As in English, many lines that deviate from the ideal one are found. Following Halle & Keyser (1971), Chen predicts that the more deviant a tree is, the less frequently it occurs (although unlike Halle & Keyser, Chen does not make a distinction between a line that is

deviant but metrical and a line that is unmetrical). The deviation (or tension) of a tree is measured in terms of the number of nodes that differ between it and the ideal tree, to which we return below.

Chen's work suggests that there is more in common between English verse and Chinese verse. However, Chen's work is based on just 100 verse lines and so some claims remain hypothetical. For example, the tree-matching proposal remains to be verified, so is the relation between the deviation of a tree and its frequency of use.

In this study I introduce a corpus of 1460 lines of Chinese regulated verse in order to find out what governs metricality in Chinese. In section 2 I describe the corpus. In section 3 I evaluate the proposal of Chen (1979). In section 4 I offer an analysis based on phrasal stress and the stress maximum. In section 5 I discuss further issues, including a comparison between Chinese verse and English verse, and approaches to variability in linguistic patterns. In section 6 I offer concluding remarks.

2 The corpus

The corpus is selected from an anthology of poems composed in the Tang Dynasty (618-907 AD). The anthology is known as *The 300 Tang Poems*, originally compiled in 1763 under the pen name Heng-Tang Tui-Shi[1] 'Hermit of the Heng Pond'. There are many editions of the anthology. I use the one by Qiu (1976), which is the same edition used by Chen (1979). There are a total of 320 poems, which are serially numbered and divided into six categories, shown in (9).

(9)

Category	Serial #	Syllables per line	Lines per poem
5-Gu	1-45	5	variable
7-Gu	46-89	variable	variable
5-Lü	90-169	5	4
7-Lü	170-223	7	4
5-Jue	224-260	5	8
7-Jue	261-320	7	8

(Category terms: Gu 'old', Lü 'regulated', Jue 'abrupt/short')

Each category may also contain a subcategory called Yuefu 'Music Academy (style)', which means the poems were in imitation of folk songs collected by the Music Academy in the Han dynasty. For example, 5-Gu includes 45 poems, of which 10 are 5-Gu Yuefu. Similarly, 7-Jue includes 60 poems, of which 9 are 7-Jue Yuefu.

The prefixes 5 and 7 refer to the number of syllables per line (except 7-Gu, see below). Gu (literally 'old') poems belong to *Gu Ti Shi* 'Old Style Verse'. Lü (literally 'regulated') and Jue (literally 'abrupt' or 'short') belong to *Jin Ti Shi* 'Recent Style Verse'. The difference is that Old Style Verse has no requirements for tonal alternations, whereas Recent Style Verse does (see section 5 on tonal requirements). In addition, Gu poems do not have a fixed number of lines per poem or a fixed number of syllables per line. In 5-Gu, each line has five syllables, but some poems have more lines than others. A few examples are shown in (10).

(10)

Poem No.	1	2	5	7	9	11
Total lines	10	8	14	6	24	16

Similarly, 7-Gu poems usually have seven syllables per line, but not always. In addition, some 7-Gu poems are longer than others. Some examples are shown in (11).

(11)

Poem No.	Total lines	Syllables per line
46	4	5, 5, 7, 7
47	8	5, 5, 5, 5, 7, 7, 7, 7
79	47	3, 4, 9, 5, 5, 7, 7, 7, 7, 7, 9, 9, 9, 7, 7…

Poem 46 has four lines, two of which have five syllables each and two have seven each. On the other hand, poem 79 has forty-seven lines, divided into four stanzas. The first stanza has fifteen lines, whose syllable counts are 3, 4, 9, 5, 5, 7, 7, 7, 7, 7, 9, 9, 9, 7, and 7 respectively.

Jue and Lü are both regulated verse and have a more consistent style, with a fixed number of syllables per line and a fixed number of lines per poem. Therefore, only they are included in the corpus. There are a total of 231 poems and 1460 lines, detailed in (12).

(12)

Category	# of Poems (serial #)	Total # of Lines
5-Lü	80 (90-169)	640
7-Lü	54 (170-223)	432
5-Jue	37 (224-260)	148
7-Jue	60 (261-320)	240
Total	231	1460

Next consider what features to code in the corpus. Based on discussions in the literature, the following items have been labeled. Tonal considerations have been discussed extensively in previous works and are not included here (I return to tonal requirements in section 5).

(13) Properties examined in the corpus
  a. Syllable count of each line
  b. Word categories
  c. Syntactic tree
  d. Simplified syntactic tree

Syllables are the basic counting units in all analyses. Word categories are relevant for stress in English in that lexical words are stressed and grammatical words are often not. They are labeled for Chinese in order to see whether the same is true. The syntactic tree is included because it is used in both English and Chinese. For example, the definition of the stress maximum in Halle & Keyser (1971) refers to the notion of a 'syntactic constituent'. Similarly, the metrical rules of Kiparsky (1977) refer to 'c-command' relations and a difference between compounds and phrases. In Hayes (1989), the stress maximum (or peak) is defined in terms of prosodic categories, which in turn are derived from syntax. In Chen's (1979) analysis of Chinese verse, the syntactic tree is matched with a prosodic tree. The simplified tree is included for convenience, where word categories are omitted. A sample poem is shown in (14).

(14)

Line	Syntax	Tree
170-1	[NN [A [[V NN] V]]]	[2 [1 [[1 2] 1]]]
170-2	[NN [A [V [NN N]]]]	[2 [1 [1 [2 1]]]]
170-3	[NN [[A V][B VV]]]	[2 [2 [1 2]]]
170-4	[[NN NN][A VV]]	[[2 2][1 2]]
170-5	[[NN VV][NN N]]	[[2 2][2 1]]
170-6	[[NN VV][NN N]]	[[2 2][2 1]]
170-7	[[NN NN][AA V]]	[[2 2][2 1]]
170-8	[[NN NN][V [N V]]]	[[2 2][1 2]]

The first column shows the serial number of a poem and the line. For example, 170-5 means the fifth line of poem 170. The second column shows the syntax and word categories, where NN is a disyllabic compound noun (or occasionally, a disyllabic noun), N a monosyllabic noun, B a monosyllabic negation word, A a monosyllabic adjective or adverb, and so on. The third column shows the simplified tree, where 1 is a monosyllabic word and 2 a disyllabic word, compound, or phrase.

Some comments are in order. First, since Chinese lacks inflection, the category of a word is not always clear. For example, *hong* can be an adjective 'red' or a noun 'red color', 'redness', or 'red thing'. Similarly, *dui* can be a preposition 'towards' or a verb 'to face'. The category B (negation) also contains several kinds of words, such as *bu* 'not', *wei* 'not yet', *wu* 'without' or 'not have', and *xiu* 'don't (do)'. The category W (wh-word) is also mixed, such as *shei* 'who', *he* 'what', and *ji* 'how many'. Sometimes a nominal wh-word is simply coded as N, such as *he nian* 'which year' (line 162-8), which is coded as NN. Overall, the number of B or W is rather small.

Second, syntactic distinctions that are irrelevant are not made. For example, since [A N] (such as 'yellow crane') and [N N] (such as 'smoke wave') are both compounds in Chinese (similar to *blackboard* and *rice wine* in English, see Dai 1992 and Duanmu 1998), they are both coded as NN (because a disyllabic compound behaves the same as a disyllabic word). The decision avoids the problem of deciding whether the modifier is A or N. For example, *jin* can mean 'gold' or 'metal'. Now is *jin jia* 'golden armor' [A N], 'gold armor' [N N], or 'metal armor' [N N]? Coding [A N] and [N N] as NN also means that in the Tree-column there is no [1 1] for nominals; it is always represented as 2. When a disyllabic noun or compound had a modifier, I tried to make a distinction between [A NN] and [N NN]. When in doubt, I favored [N NN] over [A NN]. However, since both A and N are content words, the decision turns out not to be crucial. Similarly, adverbials are mostly coded as A or AA whether they are adverbs (such as *yi* 'already'), adjectives (such as *kong* 'empty/in vain'), or nouns (such as *zhao* 'morning/in the morning'). I made no distinction between different kinds of adverbs (such as the distinction between *often* and *very* in English, as pointed out by a reviewer). The reason is that all adverbs appear to be content words in Chinese. Also, adjective predicates are coded as verbs. An example is shown in (15), where 170-6 refers to poem 170, line 6. The compound 'fragrant grass' is coded as a single word NN (omitting a pair of brackets), and '(is) thick' is coded as VV.

(15) [[[fang cao] qiqi][yingwu zhou]] 170-6
[[[fragrant grass] thick][parrot island]]
[[NN VV][NN N]]
'The fragrant grass is thick, on the parrot island'

Third, except [N N], which is coded as NN, internal structures of compounds are kept, such as [N NN] vs. [NN N]. Another point of interest is that a verb pair can be either a phrase [V V] or a compound VV. The difference is exemplified in (16).

(16)	[V V] phrase, 171-3	VV compound, 109-5
	yu san	fen-san
	want disperse	split-disperse
	'want to disperse'	'separate'

When an object (O) follows, there is also a difference between [V [V O]] and [VV O], such as *[jiao [chui xiao]]* 'teach play flute' (292-4) and *[juan-shang zhu-lian]* 'roll-raise bead-curtain' (295-4).

Fourth, sometimes the syntax is either fragmented or not fully clear. For example, the line in (15) can be interpreted as 'the fragrant grass on the parrot island is thick' (a sentence), or 'thick fragrant grass; parrot island' (syntactic fragments). However, higher-level syntactic relations are often inconsequential; in (15), the syntax [[NN VV][NN N]] is sufficient to determine the foot structure (see below). Another example of fragmented syntax is shown in (17), where it is hard to determine the relation among the three parts, so they are coded with a flat structure.

(17) [[feng ji][tian gao][[yuan xiao] ai]] 186-1
[[wind fast][sky high][[ape cry] sad]]
[[N V][N V][NN V]]
'The wind is fast; the sky is high; the ape cries are sad'

Fifth, [Numeral Classifier Noun] structure is coded as [NN N]. The reason is that the numeral-classifier part forms a foot, similar to NN. Since the Chinese foot is trochaic (see below), the second syllables in NN and [Numeral Classifier] are both unstressed. Therefore, coding both as NN does not affect the analysis.

Finally, sometimes an expression has two (or more) interpretations. An example is shown in (18).

(18) [[jing xi][zi [bei qiu]]] 163-8
[[whole night][self [mourn autumn]]]
[NN [N [V N]]] or [AA [A [V N]]]
'All night, I myself mourn the autumn'

Here the word 'self' can either serve as the subject noun or as an adverbial (to mean 'by oneself'). Also, 'all night' can be viewed as a separate fragment NN or as an adverbial AA. Since such differences often do not affect the resulting foot structure, an arbitrary choice is made (usually according to Qiu's 1976 translation).

Despite some uncertainties, most cases seem to be uncontroversial, and the overall results are unlikely to be affected strongly by the choices made here. A summary of tree frequencies and syntax frequencies is given in the Appendices. The data show a wide range of syntactic trees. Any analysis that assumes a relation between syntax and metrics, directly or indirectly, must account for the variation.

3 Evaluation of Chen (1979)

Chen (1979) focuses on seven-syllable lines. His proposal is that the syntactic tree should match the prosodic tree. A seven-syllable line has two possible prosodic trees, abbreviated in (19) as [[2 2][2 1]] and [[2 2][1 2]], where M is a monosyllable.

(19)

	[[2 2][2 1]]	[[2 2][1 2]]
Line:	[ ]	[ ]
Half-lines:	[ ] [ ]	[ ] [ ]
Feet:	[M M] [M M] [M M] [M]	[M M] [M M] [M] [M M]

The trees differ in the last three syllables ([2 1] vs. [1 2]). Chen proposes that the lines of a poem are divided into couplet pairs, where each pair should have the same prosodic tree and adjacent pairs should have different prosodic trees. Therefore, four-line poems have two patterns of alternation, shown in (20). In eight-line poems, the four-line pattern is repeated one more time.

(20)

Alternation A	Alternation B
[[2 2][2 1]]	[[2 2][1 2]]
[[2 2][2 1]]	[[2 2][1 2]]
[[2 2][1 2]]	[[2 2][2 1]]
[[2 2][1 2]]	[[2 2][2 1]]

A prediction is that in seven-syllable lines [[2 2][2 1]] and [[2 2][1 2]] are the most common trees. In addition, the two trees should be equally frequent. Now consider the four most frequent trees in seven-syllable lines, shown in (21).

(21)

	Tree	Frequency	%
1	[[2 2][1 2]]	215	31.99%
2	[[2 2][2 1]]	119	17.71%
3	[2 [1 [1 [2 1]]]]	63	9.38%
4	[2 [2 [1 2]]]	47	6.99%

While [[2 2][2 1]] and [[2 2][1 2]] are indeed the two most common trees, they differ sharply in frequency. This means that there is no systematic couplet alternation in the last three syllables. Perhaps because of this problem, Chen (1979: 396) suggests that the last three syllables can be treated as one foot. The same view is expressed in Chen (1980: 17, 37), although no evidence is provided for the trisyllabic foot.

Next consider the deviation of a tree and its frequency. Chen (1979) proposes that the more deviant a tree is, the less frequently it is. The deviation of a tree is measured in terms of how many nodes (or pairs of brackets) differ between it and the ideal tree (for the sake of argument, we ignore [1 2] vs. [2 1] in the last three syllables between the two ideal trees). An example is shown in (22).

(22) Ideal tree Deviant tree (two bad nodes)

```
[                 ]        [                 ]
                                [            ]     A
                                   [         ]     B
[       ][      ]                    [      ]
[   ][   ][   ]            [   ]      [   ]
 MM   MM   MM   M           MM   M M   MM   M
```

[[2 2][2 1]] [2 /1 /1 [2 1]//]

The deviant tree has two bad nodes, labeled A and B. The domain of A should be over the first four syllables and that of B should be over the third and fourth syllables. Similarly, consider (23).

(23) Ideal tree Deviant tree (two bad nodes)

```
[                 ]        [                   ]
                               [               ]    A
                                   [           ]    B
[       ][      ]                     [      ]
[   ][   ]    [   ]                [   ]    [   ]
 MM   MM   M   MM           M   M   MM   M   MM
```

[[2 2][1 2]] [1 /1 /2 [1 2]//]

The deviant tree again has two bad nodes. The domain of A should be over the first four syllables and that of B should be over the first two syllables.

Having discussed how to measure deviation, let us consider the frequency data. Several patterns are shown in (24), where deviant brackets are italicized.

(24)

Pattern	Tree	Frequency	%	Bad nodes
1	[[2 2][1 2]]	215	31.99%	0
2	[[2 2][2 1]]	119	17.71%	0
3	[2 /1 /1 [2 1]//]	63	9.38%	2
4	[2 /2 [1 2]/]	47	6.99%	1
5	[[1 [1 2]][1 2]]	43	6.40%	1
6	[1 /1 /2 [1 2]//]	26	3.87%	2
18	[/[2 2] 1/ 2]	2	0.30%	1
19	[/[2 2] 2/ 1]	2	0.30%	1
26	[2 /[2 2/ 1/]	2	0.30%	2

The results are hard to account for in Chen's analysis. For example, patterns 1 and 2 have no bad node and are indeed the two most common trees, yet their frequencies differ widely. Pattern 3 has two deviant nodes, yet it is more frequent than patterns 4, 5, 18, and 19, which have only one deviant node. Moreover, patterns 3 and 26 both have two deviant nodes, yet one occurs sixty-three times while the other just two.

Although the correlation between the deviation of a tree and its frequency is not fully supported, it is striking that some patterns are far more frequent others. I return to this issue in section 4.3.

In summary, the bigger database reveals a number of empirical effects that are missed under Chen's account. Such findings cannot be understood unless we re-conceptualize the entire approach. Given the wide range of syntactic trees, one might wonder if syntax is relevant at all, a point raised by Schlepp (1980a, b). However, I will argue that syntax does play a role in Chinese verse, as it does in English.

4 The present analysis

In this section I argue that, with minor modifications, the basic model for English verse can be applied to Chinese verse. I outline the proposal in section 4.1, followed by an illustration of the analysis in section 4.2. In section 4.3 I discuss whether there is a relation between metrical tension and frequency of occurrence.

4.1 Outline of the analysis

Following the analysis of English verse, I discuss the following issues.

(25) Metrical requirements
- a. Templates for five-syllable lines and seven-syllable lines
- b. The stress maximum
- c. The relation between the stress pattern of a line and the template

(26) Stress considerations
- a. Word stress
- b. Compound and phrasal stress
- c. The effect of the empty beat

The templates I propose for Chinese verse are given in (27), where Ø is W occupied by an empty beat, or rest, which has been proposed before for both Chinese (Liu 1927 and Schlepp 1980a) and English (Burling 1964, Liberman 1975, and Hayes 1995).[2]

(27) Templates for Chinese verse (Ø = W occupied by an empty beat)
- a. Five-syllable lines: SWSWSØ
- b. Seven-syllable lines: SWSWSWSØ

There are several arguments for the templates. First, stress maxima occur in odd-numbered positions (see below), which should be S positions. Second, many lines start with a compound noun [N N] (coded as NN). Since [N N] strongly favors SW in English (Kiparsky 1977: 191), the null hypothesis is that they favor SW in Chinese, too. Third, the final (non-empty) syllable is S, in agreement with the fact that it is the rhyming syllable, which should be stressed. Fourth, with the empty beat, both templates contain binary feet only: the five-syllable line has three binary feet (SW)(SW)(SØ) and the seven-syllable line has four (SW)(SW)(SW)(SØ). In addition, the empty beat helps the analysis of the final three syllables, to be seen below. I have not included higher structures for the template, such as constituents for half-lines (Chen 1979, Golston 1998) or higher gridlines (Fabb 2002), because they do not seem to play a role in the present corpus.

The templates are similar to those proposed by Liu (1927) and Schlepp (1980a, b), whose arguments are based on recitation, where strong beats are said to fall on odd-

numbered syllables. However, since generative metrics usually avoids reference to recitation (Halle & Keyser 1971: 177, Kiparsky 1975: 585), I avoid it here, too.

Chen (1979) and Yip (1980) propose that the Chinese foot is iambic, so that the template is WSWS…. They offer two arguments, shown in (28).

(28) Arguments for WSWS… template (Chen 1979, Yip 1980)
  a. In recitation, even-numbered syllables are read with a longer duration.
  b. In Chinese regulated verse, even-numbered syllables have fewer choices for tone than odd-numbered positions.

The first argument is based on recitation, which should be avoided. The second argument assumes that syllables have fewer choices for tone in S positions than in W positions. But as a reviewer points out, syllables with more stress usually show more contrasts (such as allowing more vowels), and it is more natural to assume that positions that allow more tones are S positions. Thus, there is no clear evidence for the iambic analysis.[3]

Next consider stress. Since there is no literature on stress in classic Chinese, I will make two assumptions.[4] First, I assume that, as in English, grammatical words in Chinese have less stress than content words. Second, I assume the null hypothesis that, in the absence of counter-evidence, classic Chinese has the same compound and phrasal stress rules as modern Chinese or English.

Now consider word stress. Chinese has a small number of simple disyllabic words, such as *manao* 'amber' and *luobo* 'raddish'. In some of them the second syllable is completely unstressed (characterized by shorter duration, vowel reduction, and loss of underlying tones; see Lin & Yan 1988), such as *luobo* in Standard Chinese, but there is no case where the first syllable is unstressed. This suggests that main stress in disyllabic words is on the first syllable. This is reminiscent of disyllabic nouns in English, where stress generally falls on the first syllable.[5]

Next consider compound and phrasal stress. We begin with the case in English. Chomsky & Halle (1968) propose two rules, the Nuclear Stress Rule and the Compound Stress Rule, illustrated in (29) and (30).

(29) Nuclear Stress Rule: stress on the right

[V O]	buy CARS
[P N]	in SCHOOL
[N's N]	John's FRIEND
[A N]	red CARS

(30) Compound Stress Rule: stress on the left[6]

[N N]	OIL lamp

There are some shortcomings in the proposal. First, one would like to see a connection between the two rules. Second, some subtle stress differences are not captured. For example, (29) gives the same stress pattern to VO and AN, but traditional descriptions give them different stress patterns. For example, according to Kenyon & Knott (1944) and Jones (1950), main stress in VO is indeed on O, but in AN (such as *important aid*, *practical study*, *Red Cross*, and *real pleasure*) the two words have equal stress.

Duanmu (1990a, 2000) and Cinque (1993) argue that the two stress rules can be unified. According to Duanmu (1990a, 2000), compound and phrasal stress goes to the

syntactic non-head. According to Cinque (1993), compound and phrasal stress goes to the branch that has a deeper sub-branch. The two proposals are similar in several ways. First, there is a single rule for both compound and phrasal stress. Second, since the syntactic head is an X^0 and a syntactic non-head is an XP, the latter always has a deeper sub-tree. Thus, the two proposals assign stress to the same branch. Third, both proposals assume that syntactic heads are usually functional elements, following Abney (1987), Pollock (1989), and others. This explain why grammatical words are generally unstressed, a fact that requires a stipulation in other models. In what follows I ignore the difference between Duanmu (1990a, 2000) and Cinque (1993) and call both the Nonhead Stress model. In (31) I compare Chomsky & Halle's proposal with Nonhead Stress. For clarity syntactic heads are underlined and relative stress among stressed elements is ignored.

(31)	Syntax	Nonhead Stress	Chomsky & Halle
	[V N]	buy CARS	(same)
	[P N]	in SCHOOL	(same)
	[N N]	WRIST-watch	(same)
	[N [N N]]	GOLD WRIST-watch	(same)
	[[N N] N]	WRIST-watch store	WRIST-watch STORE
	[N [V N]]	COWS eat GRASS	(same)
	[N [A [V N]]	COWS OFTEN eat GRASS	(same)
	[D N]	the CAR	(same)
	[N's N]	JOHN 's FRIEND	John's FRIEND
	[A (F) N]	RED (F) CARS	red CARS

In some cases, such as [N [N N]] and [N [V N]], Chomsky & Halle assign stress to more than one word. This is due to the Stress Subordination Convention (Chomsky & Halle 1968: 16-17). A similar rule is used in Halle & Vergnaud (1987), which is called the Stress Equalization Convention. In the first seven structures, the syntactic heads are as traditionally understood. In [D N] the syntactic head is D, following Abney (1987). In [N's N] the syntactic head is the possessive {*s*}. The noun phrase [A N] is [A (F) N], where the syntactic head is the inflectional element {F}. This follows from the view that noun phrases are headed by a functional element, not always present in English (consider, however, {*ly*} in *lovely day*) but required in some other languages (Ritter 1991, Cinque 1993). For example, the Chinese counter-part to an English [A N] phrase is [A *de* N], where *de* is a functional element (Dai 1992, Duanmu 1998).

In most cases the two analyses predict similar stress assignments. Where they differ, the Nonhead Stress analysis seems to be more accurate. For example, in [N's N] and [A N], both words have stress in the Nonhead Stress analysis, in agreement with the traditional judgment (Kenyon & Knott 1944, Jones 1950). Similarly, as Hayes (1995: 373-382) argues, in structures like [[N N] N] and [[[N N] N] N], no stress should be assigned after the main stress (here the first N). Finally, the present analysis agrees with the observation that verbs are less likely to be stressed than nouns (Ladd 1980: 90-92, Hayes 1995: 376). This is because verbs often occur as syntactic heads.[7, 8]

I will return to theoretical motivations for Nonhead Stress in section 5. Meanwhile, I assume the null hypothesis that Nonhead Stress holds for classic Chinese, too. In (32) I summarize the stress rules for Chinese.

(32) Word stress:
In a disyllabic word, the first syllable has stress
Compound and phrasal stress (Nonhead Stress):
The syntactic non-head has stress.

The current definition of Nonhead Stress differs from the cyclic stress assignment of Chomsky & Halle (1968). Consider the example in (33).

(33)

Current	Cyclic	
	(x)	Second cycle
x	(x)	First cycle
[make [pan-cakes]]	[make [pan-cakes]]	

In the current analysis, *pan* gets stress on the first cycle. On the second cycle, the object should have stress, which is already true, and so no new stress is added. Under the cyclic assignment, *pan* gets a stress mark on the first cycle and another on the second cycle. The difference becomes bigger in longer expressions. Overall, the current analysis produces a limited number of stress levels, in agreement with Gussenhoven (1991).[9]

There are two additional arguments for the stress rules. First, they can explain the word order and word length variation in Chinese (Duanmu 2000). Second, in some Chinese dialects, such as Shanghai, the domains predicted by the above rules correspond to the domains of tone deletion and spreading (Duanmu 1999a).

The requirement for stress maxima is similar to that of Halle & Keyser (1971), shown in (34) and (35). Since most Chinese words are monosyllabic, the stress maximum mainly depends on compound and phrasal stress (see below). In (34) the term *unstressed* means without word or phrasal stress. Since most Chinese syllables are heavy, most Chinese syllables form a moraic trochee and have some stress (Duanmu 1999a).

(34) Stress maximum (preliminary):
A syllable is a stress maximum if it is stressed and is between two unstressed syllables.

(35) Restriction on the stress maximum:
A stress maximum must occur in S.

Next, consider the analysis of the final three syllables, which have been a problem for Chen (1979). In most cases, the final three syllables are [1 2] or [2 1]. It is easy to see why [2 1] is good, but it is hard to see why [1 2] is good. Consider the two most frequent final trisyllabic units in five-syllable lines, [V NN] and [NN N]. They are analyzed in (36), where x indicates stress.

(36)

```
 x                 x
[NN N]          [V NN]
 SW S           *S WS
```

In [NN N] the second syllable is not a stress maximum, so the unit can fill SWS. In [V NN] the second syllable is a stress maximum, so it should not fill W. In other words, the most common final trisyllabic unit [1 2] seems to violate the condition on stress maxima.

As a solution, I suggest that the final syllable is followed by an empty beat, which maps to the Ø position of the template. Phonetically, the empty beat is a real unit of time; it is realized either as a pause or as the lengthening of the final syllable (Klatt 1976). Given the empty beat, the final trisyllabic units are analyzed in (37).

(37)
```
 x   x                x   x
[NN  NØ]          [V  [N  [NØ]]]
 SW  SØ            S   W   SØ
```

In both structures, the final syllable and the empty beat form a binary unit [NØ], which is similar to a disyllabic word and has trochaic stress. Whether the second syllable has stress or not, it is not a stress maximum, and so it can fill W. Finally, there is no restriction for any syllable to fill S. In summary, because of the empty beat, the final syllable is always stressed, and the penultimate syllable is never a stress maximum, and so the final three syllables can always fill SWS.[10]

Next, consider lines that start with a monosyllabic word. For illustration, consider [1 [1 [2 1]], whose members are shown in (38).

(38)

Structure	Frequency
[A [V […]	40
[N [V […]	22
[V [V […]	15
[B [V […]	4
[N [A […]	2
[A [P […]	1
[M [V […]	1
[V [N […]	1
Total	86

As just discussed, the last three syllables can fill SWSØ, so our focus is on the first two syllables. In particular, because the second syllable corresponds to W, it should not be a stress maximum. In most cases, the second syllable is a verb (V) or a preposition (P), followed by its object. Since such V and P are syntactic heads and receive no phrasal stress, neither is a stress maximum. The remaining two cases are shown below.

(39) [N [A [AA V]]] (2 lines)

(40) [V [N [[V N] V]]] (1 line)
yan shi cai yao qu 249-2
say master gather herb go
'(He) said master went herb-gathering'

In (39), the second syllable precedes a disyllabic compound. Since the compound forms a trochee, the second syllable is not a stress maximum, and so it can occur in W. The line in (40) seems to have a problem. According to Nonhead Stress, the second syllable *shi* 'master' is a syntactic nonhead and so has stress, whereas the V's around it have no stress. If so, *shi* 'master' is a stress maximum and the line is unmetrical. On the other

hand, if [V N] forms a compound (and hence a trochee), which happens quite often for disyllabic words in Chinese, then *shi* is not a stress maximum and the line is metrical.

Since the restriction on stress maxima is only serious requirement, many structures are possible. However, there are also many structures that do not occur. For example, in five-syllable lines, the second most common structure within [2 [1 2]] is [[V N][V NN]], which occurs 34 times, yet a very similar structure [[V NN][V N]] is completely absent. Given the fact that Chinese sentences do not require an overt subject, both sentences should be equally good syntactically, as exemplified in (41) and (42).

(41) [[V N][V NN]] 34 examples
deng zhou wang qiu-yue 104-3
board boat watch autumn-moon
'(I) board the boat and watch the autumn moon.'

(42) [[V NN][V N]] (No example)
wang qiu-yue si jia
watch autumn-moon miss home
'(I) watch the autumn moon and miss home.'

The difference between the two is rather subtle. Consider the analysis in (43).

(43)
```
     x      x  x                 x       x
[[V N][V  [N  [NØ]]]]        [[V NN][V  [NØ]]]
  S W   S   W   SØ             S WS   W   SØ
```

In both structures the second syllable seems to be a stress maximum, so it should not fill W. Why then is [[V N][V NN]] so common? I suggest that the answer lies in the domain in which the stress maximum is defined. As the underline shows, in [[V NN][V N]] the domain of the stress maximum does not contain adjacent opposite brackets. In contrast, in [[V N][V NN]] the stress maximum is defined in a domain that contains adjacent opposite brackets. To capture the difference, I revise the stress maximum in (44).

(44) Stress maximum (final version):
A syllable is a stress maximum if it is stressed and is between two unstressed syllables within the same branching domain.

(45) Branching domain:
Two terminal notes A and B belong to separate branching domains if and only if neither c-commands the other.

Some examples of branching domains and stress maxima are shown in (46), where branching domain boundaries are indicated with a vertical line.

(46)
```
     x       x  x
[[V N]|[V  [N  [NØ]]]]        No stress maximum
  S W    S   W   SØ           Example found
```

```
     x         x
[[V NN]|[V [NØ]]]          Stress maxima
  S WS    W   SØ           Stress maximum in W;  no example

        x
[V [V [NN | NØ]]           Stress maximum
  S W  SW    SØ            Stress maximum in S;  example found

     x      x  x
[V [NN | [N [NØ]]]]        First N is a stress maximum
  S WS     W   SØ          Stress maximum in W;  no example
```

The branching domain is similar to the domain proposed by Liu (1980) and Kaisse (1985) for the Mandarin Tone 3 Sandhi rule. It also has some resemblance to Hayes's (1989: 208) idea of 'category membership'.

To conclude this section, I summarize the present analysis in (47) and (48).

(47) Stress rules

a. Word stress:
   In a disyllabic word, the first syllable has stress

b. Compound and phrasal stress:
   The syntactic non-head has stress.

(48) Metrical requirements

a. Templates (where Ø is W filled by an empty beat)
   Five-syllable lines: SWSWSØ
   Seven-syllable lines: SWSWSWSØ

b. A syllable is a stress maximum if it is stressed and is between two unstressed syllables within the same branching domain.[11]

c. A stress maximum must occur in S.

4.2 Illustration of the analysis

I now show how the proposal in section 4.1 accounts for the corpus. For reference, the number before each tree pattern is its frequency order (see Appendix 1).

4.2.1 Five-syllable lines

In five-syllable lines, there are 10 tree patterns. First, consider those in (49), where a vertical bar shows the boundary between branching domains.

(49)

	Tree	Frequency	%
1	[2 | [1 2]]	424	53.81%
2	[2 | [2 1]]	192	24.37%
6	[[2 | 2] 1]	12	1.52%

In all cases, there is a branching domain boundary after the second syllable. Therefore, whether the first two syllables are a compound or a phrase (such as [V N]), the second

syllable cannot be a stress maximum, and the first two syllables can fill SW. In addition, since the last syllable has stress (forming a trochee with an empty beat), the second final syllable cannot be a stress maximum, and so the last three syllables can fill SWS.

Next consider [1 [1 [2 1]]], which was discussed before. The final three syllables can fill SWSØ. In addition, except for one case (line 249-2), the second syllable is not a stress maximum, and so the first two syllables can fill SW. Next consider (50).

(50)	Tree	Frequency	%
4	[1 [1 [1 2]]]	32	4.06%
5	[1 [[1 2] 1]]	31	3.93%
7	[[1 [1 2]] 1]	5	0.63%

Here again, if the second syllable is not a stress maximum, the lines are good. In most cases, the second syllable is a syntactic head (V or P), which does not receive phrasal stress and so is not a stress maximum. There are five examples where the second syllable is not V or P, listed in (51).

(51)	Tree	Cases
	[A [A [B [V N]]]]	106-8, 109-8
	[A [A [V NN]]]	100-8, 154-8
	[N [A [V [A V]]]	104-5

In to our analysis, a stress maximum should be a syntactic nonhead that is between two syntactic heads. Here the second syllable is not between syntactic heads, so it is not a stress maximum (because one or both of its neighbors have stress). Finally, consider the remaining patterns, which cover six cases, detailed in (52).

(52)	Tree	Structure	Cases
8	[[2 1] 2]	[[NN V][A V]]	139-5, 139-6, 166-5, 166-6
9	[[[2 1] 1] 1]	[[[NN N] N] V]	125-7
10	[[1 2] 2]	[[A [V N]][B V]]	127-7

In none of the cases is the second syllable a stress maximum, and so all the lines are metrical. In summary, all five-syllable lines except one (line 249-2) are metrical.

4.2.2 Seven-syllable lines

Since the final SWS can be filled easily, our focus is on the first four syllables. First, consider the trees in (53). Vertical lines are branching domain boundaries.

(53)	Tree	Frequency	%
1	[[2 | 2] | [1 2]]	215	31.99%
2	[[2 | 2] | [2 1]]	119	17.71%
4	[2 | [2 | [1 2]]]	47	6.99%
13	[2 | [2 | [2 1]]]	13	1.93%
15	[2 | 2 | [2 1]]	4	0.60%
19	[[[2 | 2] | 2] 1]	2	0.30%
26	[2 | [[2 | 2] 1]]	2	0.30%
29	[[2 | [2 | 2]] 1]	1	0.15%

In the first four syllables, the branching domains are all disyllabic, so there is no stress maximum, and all the trees are good. Next consider the trees in (54)

(54)	Tree	Frequency	%
5	[[1 [1 2]] | [1 2]]	43	6.40%
6	[1 [1 [2 | [1 2]]]]	27	4.02%
7	[1 [1 [2 | [2 1]]]]	20	2.98%
8	[[1 [1 2]] | [2 1]]	18	2.68%
10	[1 [[1 2] | [1 2]]]	18	2.68%
16	[1 [1 [[2 | 2] 1]]]	3	0.45%
20	[1 [[1 2] | [2 1]]]	2	0.30%
32	[1 [[1 [2 | 2]] 1]]	1	0.15%

In all cases, the first four syllables are in the same branching domain. What we need to show then is that neither the second nor the fourth syllable is a stress maximum. The fourth syllable is not a stress maximum in the above cases, because it is the last syllable in the domain. The second syllable is not a stress maximum if it is V or P. This is true in most cases, except five lines, shown in (55).

(55)	
[[N [N NN]][V NN]]	174-1
[INT [[N NN][N VV]]]	176-1
[A [A [[P N][V NN]]]]	206-6
[[V [N [V N]]][V NN]]	205-3, 205-4

In the first three the second syllable is not a stress maximum, because it is not between syntactic heads. In the fourth case, the second syllable turns out to be a pronoun in both lines. Assuming that pronouns are not assigned phrasal stress (see section 5), they are not stress maxima either. Thus, all lines are metrical. Next consider lines in (56).

(56)	Tree	Frequency	%
3	[2 | [1 [1 [2 1]]]]	63	9.38%
11	[2 | [1 [1 [1 2]]]]	17	2.53%
14	[2 | [1 [[1 2] 1]]]	8	1.19%

The trees will be good if the fourth syllable is not a stress maximum. In other words, the fourth syllable should be V or P, or it should not be surrounded by V or P. This is true for all cases. Next consider the examples in (57).

(57)	Tree	Frequency	%
9	[[[2 1] 1] | [1 2]]	18	2.68%
12	[[[2 1] 1] | [2 1]]	13	1.93%
30	[[2 1] | [1 [2 1]]]	1	0.15%
31	[[2 1] | [1 [1 2]]]	1	0.15%

The trees will be good if the first two syllables form a compound, so that the second syllable is not a stress maximum. This is true for all cases except one, where the first four syllables are [[[A V] N] V]. Here the second syllable is a syntactic head and so it is not a

stress maximum either. Thus, all the lines are good. Next, consider the cases in (58).

(58)	Tree	Frequency	%
22	[1 [1 [1 [[1 2] 1]]]]	2	0.30%
23	[1 [1 [1 [1 [1 2]]]]]	2	0.30%
24	[1 [1 [1 [1 [2 1]]]]]	2	0.30%

These will be good if the second and fourth syllables are not stress maxima, which is the case for all of them. Next, consider the trees in (59).

(59)	Tree	Structure	Cases
18	[[[2 | 2] 1] | 2]	[[[NN NN] V][N V]]	2
21	[1 [1 [[[2 1] 1] 1]]]	[A [V [[[NN N] N] N]]]	1
		[A [B [[[NN N] N] V]]]	1
25	[2 | [[[2 1] 1] 1]]	[AA [[[NN N] N] N]]	1
		[NN [[[NN N] N] N]]	1
27	[[[1 2] 1] | [2 1]]	[[[A NN] N][NN V]]	1
33	[2 | [1 [2 | 2]]]	[NN [B [[P N][V N]]]]	1

In none of the cases is the second or fourth syllable a stress maximum. Finally, consider the remaining two trees, which cover three cases, shown in (60).

(60)	Tree	Structure	Cases
17	[[[1 2] 1] | [1 2]]	[[[P NN] N][N VV]]	311-1
		[[[P NN] N][N [V N]]]	311-2
28	[[1 2] | [1 [1 2]]]	[[P NN][V [A NN]]]	222-8

In these cases the second syllable is a stress maximum, and we predict the lines to be unmetrical. In summary, of the 672 seven-syllable lines, all except three are metrical.

4.3 Frequency, grammar, and metrical tension

Halle & Keyser (1971: 157) suggest that there is a correlation between the tension or complexity of a line and its frequency: 'The more complex the line…, the less frequently it occurs.' The idea is adopted by many others, such as Kiparsky (1975, 1977), Chen (1979), Youmans (1989), and Golston (1998).

In section 3 I argued that the correlation between frequency and tension is not statistically obvious. However, it is striking that some patterns are far more frequent others. For example, in both five- and seven-syllable lines the most common tree is twice as frequent as the second most common tree (see Appendix 1). If we follow Halle & Keyser, we might want to say that the second most common tree and all those below it contain tension, but it is not obvious that they indeed do (see below).

I believe that metrically poor structures should indeed be infrequent, as previously assumed. However, infrequent structures need not be metrically poor, because other factors may limit the frequency of metrically good lines. For example, if certain structures (such as active sentences) are independently more common than others (such as passive sentences), we expect the latter to be less frequent in verse, even if they do not contain tension. The influence of non-metrical factors makes it difficult to interpret frequency data. Indeed, I will show that non-metrical factors can have a greater impact on

frequency than tension. Consider the top two patterns in five-syllable lines, shown in (61).

(61)

Pattern	Tree	Frequency	% of total (788 lines)
1	[2 [1 2]]	424	53.81%
2	[2 [2 1]]	192	24.37%

If tension is the only factor that affects frequency, we expect pattern 2 to have more tension. However, as I will show, pattern 2 in fact has less tension than pattern 1. What makes pattern 1 most frequent then is not the lack of tension, but the fact that it is the most common sentence.

In SVO languages the most common sentence is presumably [S [VO]], where S is the subject, V the verb, and O the object. Now, if most nouns are disyllabic and most verbs monosyllabic, [2 [1 2]] will be the most common pattern, regardless of metricality. In Chinese it is indeed true that most nouns are disyllabic compounds and most verbs are monosyllabic. Consider the data in five-syllable verse, shown in (62).

(62) Nouns and verbs in five-syllable verse (788 lines)

	# of Words	%
NN	744	59.0%
N	356	28.2%
[NN N]	134	10.6%
[N NN]	17	1.3%
Other nouns	11	0.9%
V	955	95.5%
VV	45	4.5%

Disyllabic nouns constitute about 60% of all nouns and monosyllabic verbs constitute over 90% of all verbs. A similar pattern can be seen in non-verse Chinese. Consider the data in (63), based on 1230 commonly used colloquial Chinese words (Beijing University 1995). The original verb list includes some five NV compounds, such as *tian hei* ‘sky dark (it is getting dark)’, and eighty-three VN compounds, such as *he cha* ‘drink tea’; such compounds have been excluded here.

(63) Nouns and verbs in colloquial Chinese

NNN	8.4%	VVV	0.0%
NN	75.3%	VV	10.3%
N	16.4%	V	89.7%

Once again we see that most nouns are disyllabic and most verbs monosyllabic.[12]

Next consider sentence types in [2 [1 2]] and [2 [2 1]]. The five most frequent sentence types for each are shown in (64) and (65).

(64) Top five sentence types in [2 [1 2]] (total = 424 lines)

Sentence	Frequency
[NN [V NN]]	145
[[V N][V NN]]	34
[AA [V NN]]	24
[NN [A [V N]]]	20
[[A V][V NN]]	11

(65) Top five sentence types in [2 [2 1]] (total = 192 lines)

Sentence	Frequency
[NN [NN V]]	41
[NN [NN N]]	38
[NN [AA V]]	17
[AA [NN N]]	13
[[N V][NN V]]	10

The sentence type [NN [V NN]], which is [S [V O]], exceeds all others by far. Clearly, this is why [2 [1 2]] is the most common five-syllable pattern.

I have shown that there is a non-metrical reason for the most frequent sentence type. Let us now consider metrical tension. According to Halle & Keyser (1971), there is metrical tension if an S position is filled with an unstressed syllable or if a W position is filled with a stressed one. Now, consider the three most common sentence types in five-syllable verse, shown in (66), where positions that have tension are underlined.

(66) Tension in the three most frequent five-syllable lines

	Tension	Frequency
SW <u>S</u> <u>W</u> SØ x x x [NN [V [N NØ]]]	2	145
SW SW SØ x x x [NN [NN VØ]]	0	41
SW SW SØ x x x [NN [NN NØ]]	0	38

The most frequent sentence type [NN [V NN]] has more tension that the second and third most frequent types, which have no tension. The reason for the frequency difference, therefore, is not tension but because [S [V O]] is the most common sentence. It is also interesting to consider the sentence type in (67).

(67)

	Tension	Frequency
SW SW SØ x x x [NN [VV NØ]]	0	0

This structure does not occur at all, even though it has no tension and looks very similar to [NN [V NN]] (both being [S [V O]] sentences). It is easy to think of examples of (67), such as that in (68).

(68) wo-men yao-qing ni (not found in the corpus)
we invite you
'We invite you'

There is no obvious metrical reason why (67) is rare. On the other hand, there is a non-metrical reason. The percentage of disyllabic verbs is low, so is the percentage of monosyllabic nouns. Therefore, the probability of the combination of a disyllabic verb with a monosyllabic noun is even lower.

4.4 Summary

I have analyzed all the 1460 lines, of which just four are problematic. For reference they are listed in (69).

(69) [V [N [[V N] V]]]
yan shi cai yao qu 249-2
say master gather herb go
'(He) said master went herb-gathering'

[[P NN][V [A NN]]]
wei ta-ren zuo jia yi-shang 222-8
for other-people make wedding clothes
'(I) make wedding clothes for other people'

[[[P NN] N][N VV]]
jin han-shi yu cao qiqi 311-1
near Han-Shi rain grass thick
'Rain near the Han-Shi season; the grass is thick'

[[[P NN] N][N [V N]]]
zhao mai-miao feng liu qing ti 311-2
on wheat-seedling wind willow shine bank
'Wind blows over the wheat field; willow trees shine on the bank'

Since the poems were written in the past, it is perhaps difficult to verify the predictions. However, some evidence is available. First, the exceptional lines are rare, in agreement with the fact that Chinese regulated verse is technically strict. Second, the exceptional lines have prompted special comments in traditional literature. For example, Qiu (1976) found line 249-2 to be 'mysterious'. In lines 311-1 and 311-2, the initial P is said to be 'special'. The line 222-8 belongs to what is traditionally called '3-4 sentences', in which the first part has three syllables and the second has four, a pattern to be avoided (Li 1935: 16-17, Wang 1958, Tai 1974, volume III, p.1610). The present analysis has made it explicit why those lines appear to be devious. It is also worth moting that in three of the cases, [P NN] fills SWS, or (SW)(S…, where the NN is split between two feet. This violates what Chen (2000) calls No Straddling, to which I return in section 5.

I have also discussed the correlation between metrical tension and frequency. I have shown that it is statistically less obvious than previously thought, because non-metrical factors can have a greater influence on frequency than metrical factors. In particular, some sentence structures are inherently less common and they may either occur rarely in a corpus or not at all. If the present analysis is correct, a revision is needed for a central premise of generative metrics, namely, 'patterns found in the corpus are grammatical, while those absent from the corpus are ungrammatical' (Rice 2000: 330, where 'grammatical' means 'metrical'). The premise assumes that all good structures are equally common, a poet will use all good structures (equally) in his or her poems, and any corpus will contain all good structures. It is similar to saying that 'all sentences written by a novelist are grammatical for him or her and all sentences not written by a novelist are ungrammatical for him or her', or 'all sentences ever written are grammatical and all sentences not yet written are ungrammatical'. The claim is too strong and is inconsistent with the spirit of generative linguistics, which aims to account for not only old sentences but also possible new sentences (Chomsky 1957).

The present study offers a more cautious interpretation of frequency data. A comparison between previous assumptions and the present ones is shown in (70).

(70)

Assumptions	Previous	Present
Frequent means metrically good	yes	yes
Metrically good means frequent	yes	no
Metrically poor means infrequent	yes	yes
Infrequent means metrically poor	yes	no

I have shown that in the present corpus all frequent patters are metrically good, but not all metrically good patterns are frequent. In addition, I have shown that metrically poor patterns are infrequent, but not all infrequent patterns are metrically poor.

5 Further issues

Several issues arise from the present analysis and merit further discussion. They include tonal requirements in Chinese verse (section 5.1), the principle that underlies the default phrasal stress rule (section 5.2), modern judgment on classic verse (section 5.3), a comparison between Chinese verse and English verse (section 5.4), prosodic phonology (section 5.5), two approaches to variability in linguistic patterns (section 5.6), and the No Straddling constraint of Chen (1979, 2000) (section 5.7).

5.1 Tonal requirements in Chinese regulated verse

Classic Chinese verse is divided into Old Style Verse and Recent Style Verse. Old Style Verse originated from folk verse and has no tonal requirements. Recent Style Verse, or regulated verse, is subject to tonal requirements, according to which tones are divided into two categories, *Ping* 'even' and *Zhe* 'oblique'. In addition, the two categories should alternate in specific ways. The phonetic difference between the tonal categories remains somewhat unclear. Zhou (1948) suggests that Ping tones are long and Zhe tones are short. On the other hand, Mair & Mei (1991) argue that the tonal categories were invented to imitate heavy vs. light syllables in Sanskrit prosody.

Following Mair & Mei (1991), I denote the tonal categories as A and B. In seven-syllable lines there are four tonal alternations, shown in (71), along with Chen's foot analysis. The requirements on the sequencing of the lines need not concern us here.

(71)	Tonal Patterns	Chen's Feet
	AABBAAB	(AA)(BB)(AA)(B)
	BBAABBA	(BB)(AA)(BB)(A)
	AABBBAA	(AA)(BB)(B)(AA)
	BBAAABB	(BB)(AA)(A)(BB)

Chen argues that tonal alternations reflect foot structure: syllables in a foot have the same tones and tones of adjacent feet mostly differ. Both Chen and the present analysis agree that the first four syllables form two feet. The difference lies in (a) the analysis of the last three syllables, and (b) whether stress is on odd-numbered or even-numbered syllables.

It can be seen that Chen's analysis allows monosyllabic feet and stress clash. In particular, if the Chinese foot is iambic, as Chen assumes, either there is a stress clash, or the final syllable has to be unfooted, as shown with a seven-syllable line in (72).

(72)			
	a.	Final W:	(WS)(WS)(WS)W
	b.	tress clash:	(WS)(WS)(WS)(S)
	c.	Stress clash:	(WS)(WS)(S)(WS)

In the first case, the final syllable is unfooted and W, which is inconsistent with the fact that it is the rhyming syllable and should be stressed. In the other two cases, there is a monosyllabic foot. In addition, whether the monosyllabic foot is final or medial, it causes stress clash. Therefore, none of the options gives an ideal rhythmic template.

Next consider tone. Of interest is a rule known as the '1-3-5' rule, according to which the first, third, and fifth syllables can take any tone, regardless of the tonal requirement for a line. In other words, even-numbered positions have fewer tonal choices than odd-numbered positions.[13] Yip (1980) and Chen (1980) suggests that it is stressed syllables that have fewer tonal choices, and so stress is on even-numbered syllables. However, a problem is noted by Duanmu (1990b: 186). In (71) the fifth syllable of the last two lines should have stress, since it is the only syllable of the foot, yet this syllable is free to take any tone. Therefore, it is better to assume that it is stressed syllables that have more choices for tones (except the final syllable, which is the position for rhyming, required for even-numbered lines and optional for the first line).

Next consider the last three syllables. We have seen that their syntax is flexible, and Chen often grouped them into one foot. Under this consideration, along with the 1-3-5 rule, I compare Chen's analysis with the present one in (73), where O is a free position, R a riming position, and Ø an empty beat.

(73)	Tonal Patterns	Chen's Analysis	Present Analysis
	OAOBOAR	(OA)(OB)(OAR)	(OA)(OB)(OA)(RØ)
	OBOAOBR	(OB)(OA)(OBR)	(OB)(OA)(OB)(RØ)
	OAOBOAR	(OA)(OB)(OAR)	(OA)(OB)(OA)(RØ)
	OBOAOBR	(OB)(OA)(OBR)	(OB)(OA)(OB)(RØ)

As far as required tonal positions are concerned, Chen's analysis is identical to the present one.

According to Mair & Mei (1991), Shen Yue and his followers invented tonal requirements for Chinese regulated verse between 488 and 550, in imitation of Sanskrit

prosody. They conclude that prosody can be transmitted from one language to another. If the present analysis is correct, there is something more fundamental: the core of prosody, such as phrasal stress and the condition on the stress maximum, is probably inherent in all languages. It is true that Shen Yue and his followers regarded their invention to be superior to folk verse, and regulated verse gained official recognition in the Tang Dynasty (618-907). Still, it is possible that it is folk verse that better reflects native intuition. It is worth noting that neither Old Style Verse nor modern folk verse has tonal requirements. In addition, regardless of tonal requirements, regulated verse is still subject to metrical requirements, as I have argued.

5.2 Phrasal stress

In section 4 I proposed that the Nuclear Stress Rule and the Compound Stress Rule of Chomsky & Halle (1968) can be combined into one, which I call Nonhead Stress. In this section I discuss a more fundamental principle that underlies Nonhead Stress and can explain some other stress phenomena.

Let us begin with a familiar case, which is contrastive stress. An example is shown in (74), where uppercase indicates contrastive stress.

(74) This is a CAT, not a DOG.

I take it to be uncontroversial that all languages use contrastive stress. Even in languages where word stress seem to be absent, such as Chinese, contrastive stress works the same way. The reason for contrastive stress, it seems, is that words under contrast carry more information of interest, and the more information a word carries the more stress it receives. Let us state the generalization formally in (75).

(75) The Information-Stress Principle:
A syntactic constituent that carries more information than its neighbor(s) should be stressed.

The definition assumes a simple contrast between having and not having phrasal stress, in agreement with Gussenhoven (1991). (An alternative definition, which I do not pursue, is that the more information a word carries, the more stress it has.) I will now show that a range of stress phenomena that otherwise seem to be unrelated to one another can be derived from the Information-Stress Principle.

First, consider Nonhead Stress, stated in (76), from Duanmu (2000: 131). The linear order of the constituents is immaterial.

(76) Nonhead Stress: Syntactic nonheads should have stress.

```
  x       x
[[YP X] ZP]
```

In standard X-bar syntax, the head is an element at the word or affix level, and a nonhead is an element at the phrase level. Since there are more possible phrases than possible words or affixes, the occurrence of a nonhead (phrase) is less predictable than the occurrence of a head (word or affix). According to Information Theory (Shannon & Weaver 1949), the more predictable an expression is, the less information it carries. It

follows that a syntactic nonhead carries more information than its syntactic head, and by the Information-Stress Principle, the syntactic nonhead should be stressed.

The above case is the default situation, where no word carries special focus or emphasis. When a word does carry focus or emphasis, it can override Nonhead Stress (such as *the* in *this is THE story*), because its information now exceeds that on other words. Because of this, phrasal stress is flexible, or as Hayes (1995: 373) puts it, 'most rules of phrasal stress are optional'. In the present analysis, phrasal stress is flexible because the information load of each word is only partly dependent on syntax and the speaker can give extra information to any word at will.

An interesting mirror-image of emphasis is pronouns, which usually do not carry stress, even if they are in nonhead positions (such as the subject or the object position). This phenomenon also follows from the Information-Stress Principle: pronouns are used when its referent is contextually obvious or just mentioned, and so it does not carry new information.

As a final example, consider the difference between function words and content words. The former are often unstressed, whereas the latter are usually stressed. In the present analysis, there are two reasons. First, function words are closed-class words (small in number) and so high in probability of occurrence. By Information Theory they are low in information content, and by the Information-Stress Principle they do not carry stress. In contrast, content words are open-class words (large in number) and so low in probability of occurrence. By Information Theory they are high in information content, and by the Information-Stress Principle they should generally carry stress. Second, function words mostly occur in syntactic head positions, which do not have stress. In contrast, content words often occur in non-head positions, which have stress.

5.3 Modern judgment

According to Rice (2000: 329), generative metrics assumes that 'researchers cannot resort to their own intuitions' to judge the metricality of someone else's verse. It is worth noting, though, that the present analysis of Chinese regulated verse matches the intuition of modern Chinese speakers quite well. For example, as Liu (1927) and Schlepp (1980a, b) point out, in tapped recitation of regulated verse, stronger taps fall on odd-numbered syllables, which are S positions in the present analysis. In addition, the lines that are predicted to be unmetrical indeed sound bad to the modern ear, whereas other lines all sound good. This would be expected if (a) compound and phrasal stress is universal, so that it does not change over time, and (b) the requirement for the stress maximum to fill S is also universal.

5.4 Comparison between Chinese and English verse

There is a general agreement that English verse lines are often imperfect. For example, Golston (1998) argues that all the metrical rules of Halle & Keyser (1971) are violated in Shakespeare's poems. In addition, many native English speakers find it difficult to judge the metricality of English verse.[14] Indeed, even scholars can disagree on how to interpret a poet's meter (see Kiparsky 1989 for different interpretations of Hopkins's sprung rhythm).

There is also a common feeling among Chinese speakers that English verse is less metrical than Chinese verse, in the sense that the rhythm in English verse is less obvious. In contrast, it is often easy to get native agreement on whether a Chinese line is rhythmic or not, be it classic or modern verse, and regardless of the poet.

Let us take a closer look at standard English meter and that in Chinese regulated verse, shown in (77).

(77)

	English	Chinese
Stress maximum in S	yes	yes
Stress maximum in W	no	no
Stressed non-maximum in W	yes	yes
Stressed non-maximum in S	yes	yes
Extra syllables	yes	(no)
Completely unstressed syllable in S[15]	yes	no
Stress maxima mainly based on	word	phrase

In both languages, stress maxima are respected. In addition, both languages allow a stressed syllable that is not a stress maximum to fill either S or W positions (this is the case with most monosyllabic content words, as observed by Kiparsky 1975).

There are, however, three differences. First, English verse often allows extra syllables, but Chinese does so only in a limited way. Extra syllables do not occur in Chinese regulated verse, but they do in Chinese folk verse. An example is shown in (78), from an anonymous modern poem.

(78)

S	W	S	W	S	W	S	W
gan-	de	gan,	Ø	kan-	de	kan	Ø
kan-de	gei	gan-	de	ti	yi-	jian	Ø

‘Doers do, watchers watch,
Watchers against doers raise criticisms’

The template has eight positions that form four trochees. The second W is filled by an empty beat in the first line and the final W is filled by an empty beat in both lines. Of interest is the first S in the second line, which is filled with two syllables, one heavy and one light (a problem, perhaps, for the metrical parameters of Hanson & Kiparsky 1996). However, even in Chinese folk verse, extra syllables are not as common as in English verse. Second, English often allows completely unstressed syllables to fill S positions (such as for *charity* to fill SWS), which is rare in Chinese. Third, in English, word stress is often more important than phrasal stress. For example, *love-lacking*, *heartbroken*, and *pipe-bearer* can fill WSW but not SWS (Kiparsky 1977: 192, Hayes 1989: 227, Hanson & Kiparsky 1996: 291), which shows that it is less important to preserve compound stress (on the first syllable of the examples) than word stress (on the second syllable of the examples), even though the former is stronger. In contrast, stress maxima in Chinese are mainly determined by phrasal stress.

The differences between English and Chinese seem to derive from word length. English has many polysyllabic words that contain their own stress maxima, which must be respected regardless of phrasal stress. In addition, some words inherently trigger tension. For example, words like *charity* and *Canada* must fill SWS, where the unstressed final syllable fills an S position, and words like *fortification* usually fill SWSW, where the second and third syllables share one W position (Kiparsky 1977). In contrast, Chinese words are mostly monosyllables, which contain no word-level stress maxima or inherent tension. What matters then is phrasal stress. In addition, unlike word

stress, which cannot be altered easily, phrasal stress can be adjusted to produce stress maxima in the right places. One way to adjust phrasal stress is to change word order, such as topicalization or inversion. Another way, which is very common in Chinese, is to change word length through compounding. In particular, many Chinese words can occur either as a monosyllable or as a disyllable. The disyllable is a compound in structure but semantically the same as one of its components; we can call them pseudo-compounds. Some examples are shown in (79), where the redundant syllable in the pseudo-compound is italicized.

(79)	Pseudo-compounds	Literal	Gloss	Example
	li-bie	leave-depart	'to depart'	92-3
	fu-fan	repeat-return	'to return'	170-3
	yun-*xia*	cloud-rosy cloud	'cloud'	94-3
	jin-jia	metal-armor	'armor'	259-3

An examination of 100 lines shows that about a third of the disyllabic words are pseudo-compounds. According to Duanmu (1999b), pseudo-compounds have been created to satisfy foot binarity, a need that is acute in a language where most words are otherwise monosyllabic.

In summary, English verse and Chinese verse share much in common. Their differences seem to stem from a single reason, namely, English has many polysyllabic words but Chinese does not.

5.5 Prosodic phonology

Hayes (1989) and Golston (1998) argue that prosodic phonology (Selkirk 1981 and Nespor & Vogel 1986) plays an important role in the analysis of verse. A central assumption of prosodic phonology is that phonological rules should not refer to syntax directly; they can, however, refer to syntax indirectly. According to Hayes (1989: 205), direct reference to syntax means referring to syntactic categories, such as N, NP, V and VP, and indirect reference means referring to syntactic levels (such as X^0 and XP). In this regard, the phrasal stress rule (Nonhead Stress) that I proposed only makes indirect reference to syntax.

Prosodic phonology also assumes that phonological rules should refer to a hierarchy of prosodic categories. According to Golston (1998: 731-733), the verse template can be converted from metrical categories to prosodic categories. A seven-syllable line is exemplified in (80), where VF is a verse foot, M a metrical position, Int an intonational phrase, and S a syllable (same as a moraic foot in Chinese).

(80)

```
Metrical categories                          Prosodic categories
Line:  [                        ]            Int:    [                        ]
Half-L:                                      [            ] [          ]   Phrase:
[            ] [          ]
VF:    [     ] [     ] [     ] [  ]          Word:  [     ] [     ] [     ] [  ]
M:      M M   M M   M M   M                  S:      S  S   S  S   S  S   S
```

I have avoided the phonological word and the phonological phrase for two reasons. First, they seem to be redundant. Second, they are difficult to define. According to Selkirk

(1986) and Hayes (1989), a phonological word is a lexical word (plus adjacent function words), but compounds present a problem. If lexical words do not include compounds (Hanson & Kiparsky 1996: 291), phonological words will be too small in Chinese: they are mostly monosyllables. If lexical words include compounds, phonological words will often be more than a verse foot (disyllabic trochee), such as [N NN], [NN N], and [NN NN]. Similarly, according to Selkirk (1986) and Hayes (1989), phonological phrases are delimited by XP boundaries, and this again gives undesirable results. For example, line 186-1 is made of three clauses [[N V][N V][NN V]], which gives six phonological phrases (instead of two). Line 230-1 is made of one clause [[NN NN] V], which gives two phonological phrases, but not at the right places (the predicted phonological phrase break in a five-syllable line is after the second syllable). Given such difficulties, an analysis in prosodic phonology needs to solve two problems. First, it needs better definitions of the phonological word and the phonological phrase. Second, it needs to show that lines that do not conform to the predicted prosodic structures are indeed metrically poor. The solutions remain unclear to me.

5.6 Two approaches to variability in linguistic patterns

The Chinese verse corpus contains a wide variety of lines, both in terms of syntax and in terms of the resulting stress patterns. In the preceding discussion I have illustrated two approaches to such data. It is interesting to compare them again, because they have implications for how to approach variability in linguistic patterns in general.

The first approach assumes that one of the patterns is the regular form and the rest are exceptions of various sorts. It is adopted in Halle & Keyser (1971) and Chen (1979), among others. Let us call it the *one-good-pattern* approach. Golston (1998), cast in Optimality Theory, also assumes this approach, although for him even the best pattern is not perfect.

The second approach assumes that many or most patterns can be good and that phonology only needs to specify truly phonological requirements. This approach is adopted by Fabb (2002) and the present analysis. Let us call it the *many-good-patterns* approach.

The one-good-pattern approach assumes that it is the job of phonology to account for all (or most) variability. Usually, the most common pattern is thought to be the normal form or the best, and less common patterns are thought to be exceptions or marked in various ways.

The many-good-patterns approach assumes that it is not always the job of phonology to account for pattern variability, because non-phonological factors often contribute to frequency effects. As a result, some phonologically good patterns can be infrequent. A phonological analysis should focus on those aspects that are truly phonological and leave the rest to non-phonological factors or statistics.

The one-good-pattern approach, originally demonstrated by Chomsky & Halle (1968) in their analysis of English word stress, has been the standard approach in generative phonology. I hope to have shown that the many-good-patterns approach is a possible alternative. To what extent the new approach can be applied to other areas of phonology, such as word stress and cross-linguistic comparisons, will be left open.

5.7 No Straddling

Chen (1979: 411; 2000: 358) suggests that a constraint on foot formation is No Straddling, given in (81), which rules out (82), where a disyllabic morphosyntactic unit stands astride two feet.

(81) No Straddling: Immediate constituents should be footmates.

(82)
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… [S   S] …        Morphosyntactic structure (S = syllable)
(      )(      )   Prosodic structure (feet)
```

In the present data, three of the four problematic lines start with [P NN] (see (69)), whose foot structure is (P N)(N…), where NN violates No Straddling. It seems No Straddling offers similar predictions as the present analysis, but there are some differences.

First, No Straddling cannot rule out the first problematic line in (69). Second, some lines are ruled out by No Straddling but not by the present analysis, such as tree 27 and tree 33 in seven-syllable lines (Appendix 1). Although both tree 27 and tree 33 are infrequent, it is easy to construct similar lines in modern folk verse. Third, if the final trisyllabic unit [1 2] fills (SW)(SØ), as I have argued, it violates No Straddling. Fourth, No Straddling does not apply to languages like English. For example, in *the curfew tolls…*, *curfew* violates No Straddling if the meter is iambic, and in *try today…*, *today* violates No Straddling if the meter is trochaic. In contrast, an analysis based on stress maxima applies to both Chinese and English.

In summary, No Straddling does not seem to be an independent constraint, nor does it have cross-linguistic application. Instead, it seems to be a consequence of stress assignment, whereby a disyllabic compound usually forms a foot.

6 Conclusions

I have introduced a corpus of 1460 lines of Chinese regulated verse and offered an analysis of the data. I have argued that, like English verse, Chinese verse is based on stress and that stress maxima must occur in S positions (section 4). In addition, I have argued for a default phrasal stress rule that applies to both English and Chinese, and probably universally (section 5.2).

There are also some differences between Chinese and English (section 5.4). English often allows completely unstressed syllables to fill S positions. In addition, English often allows extra syllables. Moreover, English word stress is often more important than phrasal stress. In contrast, Chinese verse does not allow completely unstressed syllables in S positions, and extra syllables are used much less. In addition, it is phrasal stress that plays the main role in determining stress maxima in Chinese. The differences can be attributed to an independent fact that many English words are polysyllabic and contain stress maxima themselves, which must be respected regardless of phrasal stress. In contrast, most Chinese words are monosyllabic, whereby word stress is mostly irrelevant.

Previous analyses often assume there to be a correlation between frequency and well-formedness, in that patterns with higher frequencies are phonologically better than those with lower frequencies. However, the correlation is difficult to demonstrate in the present corpus (section 4.4). The reason is that some frequency effects are due to non-phonological factors, and the presence of variable patterns does not necessarily imply the presence of exceptions. One should therefore not assume that all frequency problems

have a phonological explanation, or that less frequent patterns must be phonologically marked (the *one-good-pattern* approach, section 5.6). Instead, we should have a more moderate goal: all phonologically poor patterns should indeed be infrequent, but some phonologically good patterns may be just as rare or not occur in a corpus at all (the *many-good-patterns* approach, section 5.6).

Jakobson (1979a: 148) believes that 'the role that prosodic elements fulfill in a given linguistic system is decisive for verse.' Similarly, Kiparsky (1989: 338) suggests that 'the metrics of a language will tend to be built on prosodic categories that are distinctive in its (lexical) phonology.' Since tone is distinctive in Chinese but not in English, and stress is distinctive in English but rarely so in Chinese, one would expect the metrics of Chinese to be built on tone and that of English to be built on stress. But if the metrics of Chinese is also built on stress, as I have argued, then there is likely to be less variation in poetic meter cross-linguistically and fewer metrical parameters are needed than previously thought.

Notes

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[1] Chinese words are transcribed in Pinyin. Tones are omitted for two reasons. First, tonal values differ from classic Chinese to modern Chinese, as well as among modern Chinese dialects. Second, given the gloss, there is no ambiguity even without tones.

[2] The empty beat can also occur medially, which is realized as a pause. Thus, it is very common in both classical verse and modern folk verse for a line with 3+3 syllables SWSØSWSØ to match a line with seven syllables SWSWSWSØ, both being four feet.

[3] Because of the difficulty in deciding stress in the Chinese foot, Chen (2000) suggests that the Chinese foot has no stress—a disyllabic unit with two equal parts. To distinguish it from a regular foot (which has stress), Chen introduces a new prosodic category, the Minimal Rhythmic Unit.

[4] It has been shown that languages that appear to lack stress may still have foot structure. For example, both Japanese and Chinese appear to lack stress, but Poser (1990) has argued that Japanese has moraic feet, and Shih (1986) and Chen (2000) have argued that Chinese has syllabic feet. It is possible that some languages have stressless feet, as Chen (2000) suggests. For example, their metrical template may be made of equal positions, such as XX/XX/…, instead of S and W positions. However, I will argue that Chinese does have stress and that there is no need to assume stressless feet.

[5] When a Mandarin expression (made of full syllables) is read in isolation, the final syllable is longer and seems to have more stress (Chao 1968, Yan & Lin 1988). However, when the expression is read in a carrier sentence, its final syllable is no longer the longest, but its first syllable often is (Wang & Wang 1993). In the present analysis, the effect is due to a final empty beat, to be discussed below.

[6] Since it is not relevant for the present discussion, I have omitted the condition that the second part of a compound is not branching.

[7] Although V is the head of [V N], the head of a sentence is not V but probably an inflectional element (or elements) I, which could be empty. Thus, [N [V N]], such as *cows eat grass*, is [N [I [V N]], where I and V are both heads. Similarly, [N V], such as *horses run*, is [N [I V]], where V is now a syntactic nonhead in [I V] and has stress. In other words, verbs can get stress sometimes, especially when no object follows.

[8] As discussed in section 2, both [A N] and [N N] are coded as NN, because they are both compounds in modern Chinese. A reviewer points out that, if [A N] can be a phrase in English, it could be a phrase in classic Chinese. If so, a distinction should be made between [A N] and [N N]. However, even if classic Chinese is like English and unlike modern Chinese, there is little consequence. The stress pattern of NN is stressed-unstressed, which can fill SW. If [A N] is a phrase, its stress pattern is stressed-stressed, which can also fill SW.

[9] If the present analysis is correct, a revision is needed for the Faithfulness Condition of Hayes (1995: 380): the relation between a domain (a pair of parentheses) and a stress mark can be many to one, rather than one-to-one.

[10] Fabb (personal communications) suggests that, if I assume that the final syllable must have stress, I need not assume the empty beat. I prefer the present analysis for several reasons. First, the empty beat seems to be a phonological fact, even though it is not transcribed orthographically. Second, without the empty beat, the idea that the final syllable must have stress remains a stipulation. Third, without the empty beat, the final foot is monosyllabic, which violates the well-known constraint FOOT BINARITY.

[11] Hayes (1989: 227, 231) defines the stress maximum (or peak) as a position that has more stress than 'at least one of its neighbors' within a given domain. If so, the second syllable in [[V N][V NN]] is a stress maximum and the line should be bad. The high frequency of such lines presents a problem. One possibility is that a disyllabic constituent can form a foot regardless of its internal structure (Shih 1986, Chen 2000). Duanmu (2000) calls it the Foot Shelter effect, whereby the syntax inside a foot can be ignored. If so, the present definition of stress maxima should be revised. I leave this issue for a separate study, using data from modern folk verse.

[12] There is a metrical reason why nouns tend to be disyllabic and verbs tend to be monosyllabic (Duanmu 1999b). Verbs often occur as syntactic heads, which do not get phrasal stress. In contrast, nouns tend to occur as syntactic nonheads, which get phrasal stress, which then should be disyllabic in order to satisfy FOOT BINARITY. As a reviewer observes, most lines start with a disyllabic word or compound (see Appendices). In the present analysis, this is expected: the first two syllables correspond to SW and a disyllabic compound with trochaic stress is a perfect fit for it.

[13] As Wang (1958) points out, the 1-3-5 rule is a somewhat simplified statement. For example, a line is poor if there is just one even tone.

[14] Thanks to Anthony Brasher and Michael Marlo for pointing this out to me.

[15] This case can be further divided into two. One is an unstressed syllable between stressed syllables, which can be called a *stress minimum*. The other is an unstressed syllable next to an unstressed one. While the latter can fill S positions in English, the former does not seem to be able to in neither language.

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