

Word Length Variations in Chinese¹
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1. Introduction Many Chinese words² have two synonymous forms, one bisyllabic and one monosyllabic. For example,

(1) BISYLLABIC	MONOSYLLABIC	GLOSS
deng-deng	deng	and so on
di-fang	di	place
ji-shu	ji	skill
gong-ren	gong	worker
gong-chang	chang	factory
shang-dian	dian	shop
yi-fu	yi	clothes
bu-zhuo	bu/zhuo	to catch
xue-xi	xue	to study
...		

The monosyllabic form comes from deleting either the first or the second syllable from the bisyllabic form.³ For example, in ji-shu, the second syllable may be deleted. In gong-chang, the first syllable may be deleted. In bu-zhou, either syllable may be deleted.⁴

The problem this paper addresses is this. If a construction is made of several words, with each word varying between monosyllabic and bisyllabic, there will be many synonymous expressions (i.e. 2ⁿ expressions, where n is the number of words in the construction); however, not all possible expressions are good. For example, in a two-word construction, there are four expressions, of which only three are good, as the following examples show

- (2) a. xue-xi hui-hua
 b. *xue-xi hua
 c. xue hui-hua
 d. xue hua
 study painting 'to study painting'

¹. We would like to thank ...

². In this paper we will not try to define 'word' as against 'morpheme'.

³. We do not want to assert that the bisyllabic form is the original one, nor vice versa. In fact, both cases seem to exist (cf. Lü 1963). As we will mention later, some bisyllabic forms come from adding a monosyllable to another monosyllable.

⁴. The question of which syllable to delete is an independent issue, to which we will have more to say later in the paper.

- (3) a. ji-shu gong-ren
 b. ji-shu gong
 c. *ji gong-ren
 d. ji gong
 skill worker 'skilled worker'

In each of (2) and (3), the four expressions are synonymous. However, (2b) and (3c) are bad. (2) and (3) raise two questions. First, why should word length matter for the well-formedness of an expression? Second, if word length matters, what is the preferred word length pattern? In particular, why is [2+1] (bisyllabic + monosyllabic) bad in (2b) but good in (3b), and why is [1+2] (monosyllabic + bisyllabic) good in (2c) but bad in (3c)?

In his pioneering paper, Lü (1963:423) remarks that [2+1] is disfavored in [V N] structures, such as (2), and [1+2] is disfavored in [A N] (or [Modifier Head]) structures, such as (3). However, Lü's remark only states the problem. Although there have been some recent attempts (e.g. Lu 1989), the problem has not been satisfactorily solved.

This paper suggests that cases like (2) and (3) are explicable in terms of stress. Specifically, we make the following proposal

- (4) a. For words with changing lengths, stressed ones cannot be shorter than unstressed ones.
 b. In a syntactic head-nonhead relation, the syntactic nonhead is assigned greater stress than the syntactic head.

We argue that (4a) agrees with the general tendency that lack of stress may lead to syllable deletion, and that (4b) is related to Nonhead Stress (NHS), which has independent motivations (Duanmu 1990). We also show that in addition to [A N] and [V N], our analysis accounts for many other two-word structures.⁵

2. Previous Analyses The pattern in (2) has been discussed a number of recent papers (e.g. Wu 1986, 1987; Li 1987; Lu 1989, Li 1990). Similar examples abound. Below are further cases (cf. Wu 1986, Lu 1989)

- (5) a. ... deng-deng di-fang
 b. ... *deng-deng di
 c. ... deng di-fang
 d. ... deng di
 so-on place '... and other places'
- (6) a. bian-xie xi-jü
 b. *bian-xie xi
 c. xie xi-jü
 d. xie xi
 write play 'to write plays'

⁵ The present discussion will largely be restricted to two-word phrases. We intend to discuss three-word phrases in a separate paper.

- (7) a. bu-zhuo tu-zi
 b. *bu-zhuo tu
 c. bu tu-zi (or zhuo tu-zi)
 d. bu tu (or zuo tu)
 catch rabbit 'to catch rabbits'

Like (2b), the bad expressions (5b), (6b) and (7b) are all [2+1], while [2+2], [1+2] and [1+1] are all good.⁶ To exclude [2+1], Wu (1986) and Lu (1989) propose the following constraint

- (8) The Rhythmic Constraint (Wu 1986, Lu 1989):
 Chinese phonology prefers [1+2] to [2+1] in two-word constructions.

There is, however, no explanation for the rhythmic constraint, nor is there

⁶ There are some apparent exceptions to such a generalization. Consider

- (i) a. mai-zang bei-tong
 b. *mai bei-tong
 bury sorrow 'to bury (one's) sorrow'

Like (2), (i) is [V N], and we expect [1+2] to be good. Yet (i.b) is bad, contrary to our expectation. The badness of (i.b), we suggest, are due to independent reasons. First, bei-tong and mai-zang are formal words, while mai is informal. Stylistically, it is inappropriate to mix words of different formality. Second, mai-zang and mai are not synonymous. In particular, mai refers to a concrete physical action, while mai-zang usually refers to an abstract action. The following example is further support (noted in Li 1990:251)

- (ii) a. mai-zang jiu she-hui
 b. *mai jiu she-hui
 bury old society 'to bury the old society'

Here the object is abstract, and so mai-zang must be used. In contrast, when the object is concrete, we see the reverse situation. Consider

- (iii)a. *mai-zang guan-dao
 mai guan-dao
 bury pipe-line

Here guan-dao is a concrete noun, so we must use mai and not mai-zang. An interesting case is seen in the following example (from Li 1990:251)

- (iv) a. mai-zang qin-ren
 b. mai qin-ren
 bury dear-kin 'to bury one's dear kin'

The fact that both mai and mai-zang can be used suggests that qin-ren must be both concrete and abstract.

independent motivation. In addition, (8) has no cross-linguistic generality. Thus, (8) at best is a stipulation.

Empirically, the rhythmic constraint (8) fails to account for [A N] structures like (3), or [Modifier Head] structures in general, such as (9) and (10)

- (3) a. ji-shu gong-ren
 b. ji-shu gong
 c. *ji gong-ren
 d. ji gong
 skill worker 'skilled worker'
- (9) a. zhuo-zi shang-mian
 b. zhuo-zi shang
 c. *zhuo shang-mian
 d. zhuo shang
 table up-side 'top of the table'
- (10) a. yi-fu shang-dian
 b. yi-fu dian
 c. *yi shang-dian
 d. yi dian
 clothing store 'clothing store'

Here, (3b) is [2+1], and so is predicted to be bad by (8), yet it is in fact good. On the other hand, (3c) is [1+2] and so is predicted to be good by (8), yet it is in fact bad. The same is true for (9) and (10). In other words, although the rhythmic constraint (8) accounts for cases like (2), (5), (6) and (7), it goes directly against cases like (3), (9) and (10).

There is, however, a syntactic difference between cases like (2), (5), (6) and (7) on the one hand, and cases like (3), (9) and (10) on the other. In the former, the syntactic relation is [head nonhead], while in the latter the syntactic relation is [nonhead head]. The question is, how does syntactic relations affect the phonological well-formedness of an expression? Lu (1989) suggests the following

- (11) The Closeness Condition (Lu 1989):
- a. The syntactic relation [nonhead head] is 'close' and the syntactic relation [head nonhead] is 'loose'.
 - b. The rhythmic constraint (8) applies to 'loose' structures (i.e. [head nonhead]), and not to 'close' structures (i.e. [nonhead head]).

Lu argues that cross-linguistically [nonhead head] structures are more common than [head nonhead] structures, therefore the constituents in the former must be 'closer' to each other than those in the latter. However, even if [nonhead head] is indeed more common, it is not clear why constituents should be closer to each other in a common structure than in a less common one. Indeed, it is not clear what 'closeness' means in formal terms. Moreover, there is no reason why the rhythmic constraint (8) should apply to 'close' structures only, rather than to 'loose' structures only.

Lu's analysis has a yet more serious problem. If, as (11) states, the rhythmic constraint does not apply to [nonhead head], then all four expressions in (3) should be good. There is no reason, therefore, why (3c) should be bad. Similarly, one cannot explain why (9c) and (10c) are bad.

It is clear that both word lengths and syntactic relations affect the well-formedness of an expression. Although previous analyses have noted both factors, they have not succeeded in determining how each factor contributes to the well-formedness of an expression.

3. The Present Analysis Before we present our analysis, let us look at further data. Apart from words like those in (1), which have changing lengths, many Chinese words have just a fixed length, either monosyllabic or bisyllabic. For example

(12) a.	Monosyllabic		b.	Bisyllabic	
	nan	'male'		yan-jiu	'to study'
	gui	'ghost'		si-ji	'driver'
	xin	'new'		sha-fa	'sofa'
	ta	'it/he/her'		xi-huan	'to like'

Since these words do not vary in length, in a two-word construction there is just one expression; there are no synonymous alternatives. For example

(13) a.	nan	si-ji	'male driver'	
	b.	xin	sha-fa	'new sofa'
(14) a.	yan-jiu	gui	'to study ghosts'	
	b.	xi-huan	ta	'to like her'

Both (13) and (14) are good. However, (13) and (14) present a problem for Lu's rhythmic constraint (8). To see it, consider the following

(3c)	*ji	gong-ren	'skilled worker'	
(13) a.	nan	si-ji	'male driver'	
	b.	xin	sha-fa	'new sofa'
		[nonhead	head]	
(2b)	*xue-xi	hua	'to study painting'	
(14) a.	yan-jiu	gui	'to study ghosts'	
	b.	xi-huan	ta	'to like her'
		[head	nonhead]	

Both (3c) and (13a,b) are [1+2] and [nonhead head], yet (3c) is bad but (13a,b) are good. Similarly, both (2b) and (14a,b) are [2+1] and [head nonhead], yet (2c) is bad but (14a,b) are good. In other words, constructions that are made of words with fixed lengths, such as (13) and (14), are free from the rhythmic constraint (8). Why should this be the case? In Lu's (1989) analysis, there is no explanation. In particular, (14a,b) are [head nonhead], and by (11) they are 'loose' structures, so they are subject to the rhythmic constraint (8), which rules out [2+1] and hence deems (14a,b) bad. The goodness of (14a,b) shows that

Lu's predictions are wrong. In other words, in Lu's analysis, there is no explanation why (8) applies only to words of changing lengths, and has no effect on words of fixed lengths.

We will now present our analysis, which will account for both words with changing lengths, and words with fixed lengths. We propose the following

- (15) a. If a word has a bisyllabic form and a monosyllabic form, then when sufficiently stressed,⁷ the bisyllabic form must be used.^a
 b. In a syntactic head-nonhead relation, the syntactic nonhead is assigned greater stress than the syntactic head.

We may view (15a) as follows. We assume that words like those in (1) are underlyingly bisyllabic, which, when unstressed, may be shortened to monosyllabic.^a

7. We are using 'stress' as an abstract notion. It is represented in the system of Halle & Vergnaud by an asterisk, which is assigned to the head of a metrical constituent to indicate its prominence. This prominence of the metrical head may be, and often is, phonetically realized as stress (e.g. longer duration and/or greater acoustic energy), as is the case in Chengdu and Shanghai. In Mandarin, however, the major manifestation of the metrical head is the longer word length.

^a. Alternatively, we may say that bisyllabic words are 'heavy' and monosyllabic words are 'light', and that the degree of stress must match with the intrinsic heaviness of words, i.e. stressed words must be heavy and unstressed ones be light. Thanks to Moira Yip for making this suggestion.

^a. It seems, however, that many words like those in (1) are originally monosyllabic, and later become bisyllabic under sufficient stress. This view agrees with two facts. First, it is commonly held that historical Chinese had more monosyllabic words than modern Chinese. Second, the bisyllabic form is usually made of two monosyllabic morphemes of related meanings, such as in (i), or is made by affixing an almost meaningless syllable (such as prefixing *lao* 'old' or suffixing *zi* 'son') to a monosyllabic morpheme, such as in (ii) (cf. Lü 1963)

(i)	Bisyllabic	Monosyllabic	
a.	<i>gong-chang</i> work-factory	<i>chang</i>	'factory'
b.	<i>ji-shu</i> skill-technique	<i>ji</i>	'skill'
c.	<i>bu-zhuo</i> catch-grasp	<i>zhuo/bu</i>	'to catch'
d.	<i>xue-xi</i> study-practice	<i>xue</i>	'(to) study'
(ii)	Bisyllabic	Monosyllabic	

This is a natural assumption, since it is generally true that lack of stress may lead to syllable shortening or deletion. For example, in English we find

- (16) a. have --> [v]
 b. and --> [n]
 c. police --> [pli:s]

In (16a), [hæv] becomes [v], dropping [h] and [æ]. In (16b), there is a deletion of [æ] and [d]. In (16c), the vowel is deleted. As a consequence, (16a,c) lose a syllable, although [n] in (16b) may still retain its syllabicity.^{10,11}

Let us now turn to (15b). Duanmu (1990) argues that in some Chinese languages, there is a stress assignment by which, in a syntactic relation of [head nonhead] or [nonhead head], the nonhead gets greater stress. Duanmu calls this stress assignment the 'Nonhead Stress' (NHS), and is formalized as follows

(17) The Nonhead Stress (NHS) (Duanmu 1990):

- a. In the syntactic relation X^{n+1} or X^{n+1} (mirror-image),
- $$\begin{array}{ccc} & \wedge & \wedge \\ & Y & X^n \\ & \wedge & \wedge \\ & X^n & Y \end{array}$$

Y (= any projection) is the syntactic nonhead and X^n is the syntactic head.

- b. In a syntactic [head nonhead] or [nonhead head] structure, stress the syntactic nonhead.

The NHS is an different stress mechanism from those proposed in Halle & Vergnaud (1987). According to Halle & Vergnaud, given a phonological domain, the stress is either assigned to the leftmost element (e.g. syllable or mora), or to the

a.	lao-shu old mouse	shu	'mouse'
b.	lao-hu old tiger	hu	'tiger'
c.	tao-zi peach son	tao	'peach'
d.	fang-zi house son	fang	'house'

For our purpose, it suffices to assume that the bisyllabic form is associated with greater stress than the monosyllabic one.

10. We note, however, that although the English word to is always unstressed, it usually does not drop either of its segment.

11. The converse case, namely syllable insertion due to stress, is less common, but the following may serve as one example (from the TV program 'The Family Feud'): [flɒs] --> [fɛlɒs] 'flush'

rightmost element, or, in a three-element domain, to the middle element. The three ways of stress assignment are determined, respectively, by the parameters [+HT, left], [+HT, right] and [-HT] (cf. Halle & Vergnaud for details). In other words, the directionality of the stress is specified in the parameters. For example, the Nuclear Stress Rule (NSR) of English (Chomsky & Halle 1968, Halle & Vergnaud 1987) has the parameters [+HT, right], and assigns the nuclear stress to the rightmost stressed word.

In the NHS, however, there is no specification of directionality. Instead, whether stress goes to the left or right depends on the syntactic relation between the constituents. It will be noted that although the English NSR makes use of information on syntactic bracketing, no use is made of information on syntactic relations. In contrast, the NHS makes use of information on both syntactic bracketing and syntactic relation. The contrast between the NHS, as applied to Chengdu (cf. Duanmu 1990),¹² and the English NSR are shown in the following nuclear stress patterns (omitting secondary and lower stresses)

(18)	English NSR	Chengdu NHS
a.	*	*
	(to) buy books	mai shu buy book 'to buy books'
b.	*	*
	red books	hong shu red book 'red books'
c.	*	*
	little red book	xiao hong shu little red book 'little red book'
d.	*	*
	(to) buy red books	mai hong shu buy red book 'to buy red books'

In each of (18a-d), the English phrase has the same syntactic structure as the Chengdu construction. However, the locations of the nuclear stress differ in the two languages. In English, the nuclear stress uniformly falls on the rightmost word, while in Chengdu it varies. The English patterns may be derived by cyclically applying the NSR and the Stress Equalization Convention (SEC), rephrased below (cf. Halle & Vergnaud), and illustrated in the derivations in (21)

(19) The English NSR (Nuclear Stress Rule):
Stress the rightmost word in a domain.

¹² The words in Chengdu are given in Pingyin, a Romanized alphabetical system designed for Mandarin. The actual pronunciation of Chengdu differs somehow from Mandarin.

(20) The SEC (Stress Equalization Convention):

At every new cycle, bring the new words to the same stress level as the highest stress on the previous cycle.

(21) English NSR:

- | | |
|------------------------------------------------------------------|----------------------------------------------------------------|
| a. (*)
[buy books] | b. (*)
[red books] |
| c. (*)
* (*)
[little [red book]] | d. (*)
* (*)
[buy [red books]] |

The derivations of (21a,b) are straightforward. In (21c), on the first cycle, the domain is the inner brackets [red book], whereby the NSR puts an asterisk on [book]. On the second cycle, the domain is the outer brackets. The SEC first adds an asterisk to little, bringing it to the same stress level as book. Then the NSR applies again, giving [book] the ultimate nuclear stress. Finally, the derivation of (21d) is similar to that of (21c).

The Chengdu constructions in (18) may be derived by cyclically applying the NHS (17) and the SEC, as follows (shown in English words for convenience)

(22) Chengdu NHS:

- | | |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| a. (*)
[buy books]
H NH | b. (*)
[red books]
NH H |
| c. (*)
* (*)
[little [red book]]
NH__H
NH H | d. (*)
* (*)
[buy [red books]]
NH__H
H NH |

In (22a), the nonhead (NH) is [books], which gets the nuclear stress. In (22b), the NH is [red], which gets the nuclear stress. In (22c), there are two cycles. On the first cycle, the domain is [red book], whereby the NH [red] receives an asterisk. On the second cycle, the SEC first adds an asterisk to [little], bringing it to the same stress level as [red]; then the NHS applies again. Here the NH is [little], which gets the nuclear stress. Finally, in (22c), there are again two cycles. On the first cycle, the domain is [red book], whereby the NH [red] gets an asterisk. On the second cycle, the SEC first brings [buy] to the same stress level as [red]. Here the NH is the phrase [red book], which by NHS gets the nuclear stress, which is placed on [red], the phonological 'head' of the domain [red book] (cf. Halle & Vergnaud for details).¹³

¹³. By the definition of Halle & Vergnaud, the 'head' of a phonological domain is the element that receives the main stress in this domain. Under the NHS, therefore, the syntactic 'nonhead' (which gets stress) is the phonological 'head', and the syntactic 'head' (which does not get stress) is the phonological 'nonhead'. In other words, the headness switches from syntax to

One may suspect that in (22b), hong shu 'red book' is a compound, so the nuclear stress falls on hong for the same reason that in the English compound black-bird the nuclear stress falls on black. If this is correct, then Chengdu would be like English, where phrasal nuclear stress is assigned by the NSR, supplemented by the provision that in two-word compounds, the nuclear stress falls on the first word. This suspicion is dispelled by [xiao [hong shu]] 'little red book', where the nuclear stress falls on xiao. The reason is that if [xiao [hong shu]] is a compound, then the nuclear stress should fall on hong, in the same way that in the English compound [evening [chemistry class]], the nuclear stress falls on chemistry (cf. Chomsky & Halle 1968, Halle & Vergnaud 1987 for details). On the other hand, if [xiao [hong shu]] is not a compound, then the nuclear stress should also fall on hong (assuming that hong shu is a compound), in the same way that in the English phrase small evening class (where evening class is a compound) the nuclear stress falls on evening.

Having discussed independent motivations for (15a), i.e. lack of stress may lead to syllable deletion, and (15b), i.e. the NHS, we are now ready to account for the problem this paper addresses, namely, patterns like (2), (3), (13) and (14). We will first give an informal account, and then a more formal solution.

Let us look at (2) first, repeated below

- (2) a. xue-xi hui-hua
 b. *xue-xi hua
 c. xue hui-hua
 d. xue hua
 study painting 'to study painting'
 [H NH]

According to (15a), a word like those in (1) takes the monosyllabic form when it lacks sufficient stress (we will return to what is 'sufficient' shortly). According to (15b), the head cannot have greater stress than the nonhead. In (2a), both words are stressed, and the head [xue-xi] does not have stronger stress, so (2a) is good. In (2b), the head [xue-xi] is stressed, yet the nonhead [hua] is not, violating (15b), so (2b) is bad. In (2c), the nonhead has greater stress, and is good. Finally, in (2d), both words are unstressed, and the head does not have greater stress, so (2d) is good.

We next look at (3), repeated below

- (3) a. ji-shu gong-ren
 b. ji-shu gong
 c. *ji gong-ren
 d. ji gong
 skill worker 'skilled worker'
 [NH H]

Here the nonhead is the first word. In (3a,b,d) the head does not have greater stress than the head, so the expressions are good. In (3c), however, the head [gong-ren] has greater stress than the nonhead [ji], giving a bad expression.

Finally, we look at (13) and (14), repeated below

- (13) a. nan si-ji 'male driver'
 b. xin sha-fa 'new sofa'
 [NH H]
- (14) a. yan-jiu gui 'to study ghosts'
 b. xi-huan ta 'to like her'
 [H NH]

In both (13) and (14), the head is bisyllabic and the nonhead monosyllabic. However, here, the greater word length of the head does not mean greater stress. The reason is that for words of fixed lengths, of which (13) and (14) are made of, the word length cannot change, with or without stress; so word lengths here are not an indication of stress. In fact, in both (13) and (14), the nonhead has greater stress than the head, even though the syntactic nonhead remains monosyllabic and the syntactic head bisyllabic.¹⁴

Let us return to the issue of how much stress is sufficient for a word to retain its bisyllabic forms. Consider (2d) and (3d) again, repeated below

- (2d) xue hua (3d) ji gong
 [H NH] [NH H]
 'to study painting' 'skilled worker'

In (2d), if the syntactic head xue 'study' has greater stress, why does it not become its bisyllabic form xue-xi? Similarly in (3d), why does ji not become ji-shu? Clearly, just to be stressed is not enough for retaining the bisyllabic form. We propose the following (cf. Halle & Vergnaud)¹⁵

- (23) a. Assign an asterisk to every word, if the whole construction is emphasized.¹⁵
 b. Assign an asterisk to the syntactic nonhead.
- (24) For a word like those in (1), if it has no asterisk, delete a

¹⁴. In fact, even for fixed monosyllabic words, such as xin 'new' and xiao 'small', there is a tendency to make them bisyllabic under sufficient stress, such as xin-bian 'newly compiled' and xiao-xing 'small-sized', even though the bisyllabic word is not quite synonymous to the monosyllabic one. Cf. Appendix for some examples.

¹⁵. We forgo the mechanism of how constituents are constructed during NHS.

¹⁶. We forgo word level stress assignment, since it is not directly related to our discussion.

syllable. If it has one asterisk, optionally delete a syllable.¹⁷

If a construction contains embedded bracketing, (23) will apply cyclically, supplemented by the SEC (20).

Let us now look at the derivations of (2), (3), (13) and (14) in detail. Take (2) first, whose derivations are shown in (25)

- (25) a.

(23a)	*	*	(23b)
xue-xi hui-hua	----->	xue-xi hui-hua	----->
[H NH]		[H NH]	
- *
* (24)
- * *
xue-xi hui-hua -----> i. xue-xi hui-hua (=2a)
[H NH] ii. xue hui-hua (=2c)
- b.

(23b)	*	(24)
xue-xi hui-hua	----->	xue-xi hui-hua ----->
[H NH]		[H NH]

 i. xue hui-hua (=2c)
ii. xue hua (=2d)

In (25a), the phrase is emphasized, and (23a) applies, giving each word an asterisk. After the application of (23b), the first word has one asterisk and the second word has two. (24) may then optionally delete a syllable from the first word, giving two possible patterns, equivalent to (2a,c). In (25b), the phrase is not emphasized, and (23a) does not apply. After the application of (23b), the first word has no asterisk and the second word has one. (24) then deletes a syllable from the first word, and optionally deletes a syllable from the second word, again giving two patterns, equivalent to (2c,d). Note that although (2c) is derived in two ways, i.e. (25a.ii) and (25b.i), the two derivations are not identical in stress assignment, although they are identical in word lengths, both being [1+2]. On the other hand, the bad pattern (2b) will not be derived.

We next look at (3), whose derivations are given in (26)

17. One may ask why in Chinese deletion applies to the whole syllable, and not to segments, such as the vowel. In English, for example, we find segment deletion, as in [hæv]-->[v] in have, and [-dei]-->[-di] in Sunday. There are two possible reasons. First, Chinese languages have a fixed syllabic structure (cf. Duanmu 1990). If in a CVC syllable, the vowel is deleted, then the remaining CC will no longer be a syllable, nor can they attach to the preceding or the following syllable. Thus, the deletion of the vowel in effect leads to the deletion of the syllable. Second, it is likely that the variation between the monosyllabic and the bisyllabic forms is not due to reduction but expansion, as we mentioned earlier. In other words, the bisyllabic form comes from adding a monosyllabic morpheme to another monosyllabic morpheme.

word lengths remain unchanged.¹⁸

4. Further Examples In this section we show that our analysis supported by a range of further evidence.

4.1. Statistical Evidence Lü (p423) notes that most modern Chinese words are bisyllabic; he counted the three thousand most commonly used modern Chinese words listed in WGH (1959), and came with the following statistics¹⁸

(29)	Nouns	Adjectives	Verbs
Multisyllabic	85%	69%	61%
Monosyllabic	15%	31%	39%

Most multisyllabic words are bisyllabic. If we follow the common view that most Chinese words were monosyllabic historically, we must explain why the increase of bisyllabicism is different among the word categories. In our analysis, there is a possible answer. If NHS is the trigger of bisyllabicism, then we expect words that can occur in syntactic nonhead positions to show greater bisyllabicism than those that rarely occur in such positions. In particular, since N may occur as the nonhead in VP and A as the nonhead in NP, both N and A should show greater bisyllabicism. This agrees with (29).

In contrast, V do not often occur as the nonhead of a construction, except for the intransitive verb, which is the nonhead of IP perhaps.²⁰ We predict, therefore, that V should show the least bisyllabicism. Although our prediction is correct in (29), the figure 61% is still too high. This is because intransi-

¹⁸. Again, cf. Appendix for cases where even 'fixed' monosyllables may be become bisyllabic when sufficiently stressed.

¹⁹. The word categories given in WGH (1959) is not without controversy. However, the overall ratio should still be a fair indication of the size of each word class.

²⁰. In [_r· Infl [vp V NP]], VP is the nonhead of I', and so should get greater stress. However, the NHS for I' does not go to V but to NP. This is shown below

(*)
* (*)
[Infl [V NP]]

In VP, NP is the syntactic nonhead, and so is the phonological head of VP. Since stress always falls on the phonological head, the NHS for I' falls on NP, and not on V. On the other hand, in [_r· Infl [vp V]], where V is intransitive, the NHS for IP does fall on V.

tive verbs only consist of about 10% of all verbs,²¹ so most verbs should, we predict, remain monosyllabic. The discrepancy, we suggest, is due to the fact that many so-called verbs are in fact [V N] structures. For example, *kai-hui* 'to hold a meeting', *shuo-hua* 'to talk' (lit. 'start meeting'), and *shuo-li* 'to reason' (lit. 'utter reason') are considered verbs, yet these expressions allow expansion, as in *kai liang ci hui* 'to hold two meetings', *shuo yidian hua* 'to utter some words' and *shuo yidian li* 'to utter some reason'. In addition, of the 280 most commonly used verbs, only 30% are bisyllabic (Wu 1986). If we further exclude [V N] structures from this 30%, then the ratio will be much closer to our prediction.²²

4.2. Compound Verbs Chinese has many compound verbs. Some are formed by suffixing a word to the verb stem, as in (30),²³ and some by prefixing a word to the verb stem, as in (31), with the primary stress shown

- | | | |
|------|--------------------|----------------------|
| (30) | * | * |
| | kao-gan | xi-bai |
| | bake-dry | wash-white |
| | 'to bake till dry' | 'to wash till white' |
| (31) | * | * |
| | hong-shao | shou-xie |
| | red cook | hand write |
| | 'to red-cook' | 'to hand-write' |

21. The estimate is based on counting all verbs on pages 1, 50, 100, ... in *Collins Dictionary of the English Language*, Collins, London, 1979, and *A New English-Chinese Dictionary*, Shanghai People's Press, Shanghai, 1976.

22. One may ask why N has greater bisyllabism than A, since N often occurs as the syntactic head in [A N] structures, while A rarely occurs as the syntactic head. An examination of WGH (1959) shows that many so-called Ns are in fact [A N] structures. For example

- | | | | | | |
|--------|----------------|----|-------------|----|---------------|
| (i) a. | kai shui | b. | kong jun | c. | ke ting |
| | boil water | | air army | | guest hall |
| | 'boiled water' | | 'air force' | | 'living-room' |

In a random sample of 28 Ns, 13 belong to this kind. If we exclude these 'nouns', then the bisyllabism of N will be closer to expectation.

23. Such words are considered compounds because they behave like a single verb, as in

- | | | |
|-----|------------------------------------------------|---------|
| (i) | ta xi-bai | le yifu |
| | he wash-white ASP clothes | |
| | 'He washed (his) clothes till they were white' | |

where both the object NP *yifu* and the aspect *le* follow the compound V.

Although (30) and (31) are not considered phrases, they nevertheless have a syntactic/morphological headness relation. We see that the stress falls on the affix of the compound, in agreement with NHS. Thus, if the two words of a compound verb have flexible lengths, we predict that, of the four possible expressions, one will be bad. Specifically, for compounds like (30), where the stem/head is initial, we expect [2+1] to be bad, and for compounds like (31), where the stem/head is final, we expect [1+2] to be bad. As the following examples show, the prediction is borne out

(32) a.	[H		NH]		b.	[NH		H]
	da-sao	gan-jing				shou-gong	qing-xi	
	*da-sao	jing				shou-gong	xi	
	sao	gan-jing				*shou	qing-xi	
	sao	jing				shou	xi	
	sweep	clean				hand	wash	
	'to sweep till clean'					'to hand-wash'		

The fact that the NHS applies not only to phrases but also to compounds should be no surprise. Recent treatments of incorporation as a syntactic phenomenon (Baker 1988) and the expansion of functional categories and their projections (e.g. TenseP, AgrP, NegP, cf. Pollock 1989) indicate that much of what used to be considered morphology/lexicon is now in the domain of syntax.²⁴

²⁴. English compound verbs show similar behavior. Consider

- (i) a. [NH H]: * * *
red-cook, hand-write, home-make, ...
- b. [H NH]: * * * *
dine out, live in, clean up, wash out, ...
- (ii) a. *
What did you put on?
- b. *
What did you walk with?
- c. *
I put on a hat.
- d. *
I put a hat on.

In (i) the nonhead carries greater stress, whether it is before or after the verb stem. In (iia,b) we see a minimal contrast. Although both on and with are sentence final, on carries the nuclear stress but with does not. The contrast is due, in our analysis, to the fact that on is a nonhead (of the verb put on) and so is stressable, but with is a head (of the PP) and so is not stressable. In (iic,d), the nonhead of the VP is hat, which takes the nuclear stress.

4.3. Prepositional Phrases Prepositions are not many, and most of them are monosyllabic in Chinese. However, the following example shows that NHS still applies

- (33) yi-zhao tu-yang
 *yi-zhao yang
 yi tu-yang
 yi yang
 according-to pattern 'according to the pattern'
 [H NH]

In (33), the head is initial. Consequently, [2+1] is bad, as expected.

4.4. Omissions Multisyllabic expressions can normally be shortened by omitting one (or more) syllable. Below are some typical examples (Lü, 422, 427)

- (34) a. [yang hao] bi --> yang hao 'goat-hair brush'
 goat hair brush
 b. mao-tai jiu --> mao-tai 'mao-tai liquor'
 mao-tai liquor
 c. da [xue xiao] --> da xue 'college'
 big study school
 d. xiao [xue xiao] --> xiao xue 'primary school'
 small study school

(34a-d) show that, when an expression is shortened, it is the syntactic head (with underline) that is often omitted. This agrees with our analysis that the syntactic head has less stress, and the general tendency that unstressed syllables are most likely to drop out.²⁵

Our analysis may be extended to quadrisyllabic [2+2] phrases. It has been noted that [2+2] phrases may often be shortened to [1+1]. In the normal case, the first and the third syllables stay, and the second and the fourth drop out (cf. Chao 1968, Chiang 1990). For example

- (35) bei-jing da-xue ---> bei da 'Peking University'
 North-Capital big-school
 [NH H] [NH H]

It can be seen that the first and the third syllables are syntactic nonheads, while the second and the fourth are syntactic heads. Since under NHS, syntactic heads have less stress, they are more likely to drop out. This is true for many

25. The following English examples seem to show the same phenomenon:
 William's High School --> William's High
 Stanford University --> Stanford

subject NP has the nuclear stress, and so longer length. Now consider²⁷

- | | | |
|-------------------|-----------------|----------------------|
| (37) wo ting-jian | lao-hu hou-jiao | |
| | lao-hu jiao | |
| | * hu hou-jiao | |
| | hu jiao | |
| I hear | tiger roar | 'I hear tigers roar' |

27. The reason to embed the clauses of interest (shown in box) in a matrix sentence is that, when being the main verb, many intransitive verbs require either negation or aspect, as seen below (from Li 1990:248)

- | | | | |
|----------------|----------------|---------------|------------------|
| (i) a. *ta zui | | b. ta zui le | |
| he drunk | 'He is drunk' | ASP | 'He is drunk' |
| c. ta zui guo | | d. ta mei zui | |
| ASP | 'He was drunk' | not | 'He isn't drunk' |

Similarly, when standing alone, hu jiao 'tigers roar' is odd, as in

- | | | | |
|------------------|------------------------|----------------|-----------------------|
| (ii) a. ?hu jiao | | b. hu jiao le | |
| tiger roar | 'Tigers roar' | ASP | 'Tigers (now) roared' |
| c. hu jiao guo | | b. hu mei jiao | |
| ASP | 'Tigers (once) roared' | not | 'Tigers didn't roar' |

However, the fact that verbs like zui and jiao require negation or aspect is not due to phonology, but due to syntax. That is, the badness of (i.a) is not due to the shortness of the verb. Without negation or aspect, a bisyllabic verb is also bad, as seen below

- | | | | |
|----------------------|----------------------|--------------------|---------------------|
| (iii)a. *ta chu-xian | | b. ta chu-xian le | |
| he appear | 'He appears' | ASP | 'He has appeared' |
| c. ta chu-xian guo | | d. ta mei chu-xian | |
| ASP | 'He (once) appeared' | not | 'He did not appear' |

Thus cases like (i)-(iii), where an intransitive main verb syntactically requires negation or aspect, should be distinguished from cases where word length is conditioned by phonology.

- (38)

lao-hu	hou-jiao
lao-hu	jiao
* hu	hou-jiao
hu	jiao

 le yi tian
- tiger roar ASP one day 'Tigers roared for a day'

We see that, for the clauses in box, when the verb is longer than the subject NP, the expression is bad. This is an indication that the subject is the NH of IP. Further examples of this kind are

- (39) a. niao-er ge-chang b. hua-er kai-fang
 niao-er chang hua-er kai
 *niao ge-chang *hua kai-fang
 niao chang hua kai
 bird sing 'Birds sing' flower blossom 'Flowers blossom'

5. Summary We have offered an analysis of why for constructions that are made of words of flexible lengths, not all possible combinations are good, as exemplified in (2) and (3). Our analysis, given in (23) and (24), are based on metrical structure. In particular, we make two proposals: first, the NHS (Nonhead Stress), stated in (17), takes the syntactic nonhead as the phonological head (which then is assigned greater metrical prominence, or 'stress') and second, for a word of flexible length, such as those in (1), the longer length is used when sufficiently stressed. On the other hand, for words of fixed lengths, such as those in (12), word lengths do not always reflect stress assignment (though sometimes they also do, cf. Appendix); thus, even if the syntactic nonhead has fewer syllables than the syntactic head, such as in (13) and (14), the nonhead may still carry greater stress, and so the expressions are good.

We have discussed few constructions longer than two words, where more complicated syntactic issues arise, such as negation phrases, relative constructions, modal constructions, classifier phrases, resultative constructions, etc. These topics are left for another paper.

Appendix

In our discussion, we said that for words of fixed lengths, such as those in (12), their lengths will not be affected by the degree of stress they carry. In particular, monosyllables will not become bisyllabic even when they carry NHS, as seen in

- | | | | |
|--------|----------------|----|------------------|
| (i) a. | (*) | b. | (*) |
| | xin cidian | | xiao cidian |
| | new dictionary | | small dictionary |

where xin has NHS, but does not become bisyllabic.

There are cases, though, that even for fixed monosyllabic words, such as xin 'new' and xiao 'small', there is a tendency to make them bisyllabic under sufficient stress, such as xin-bian 'newly compiled' and xiao-xing 'small-sized', even though the bisyllabic word is not quite synonymous with the monosyllabic one. Consider²⁸

- | | | |
|---------|---------------------------------------|--------------------------|
| (ii) a. | ??xin hanyu cidian | |
| | [new [Chinese dictionary]] | 'New Chinese Dictionary' |
| b. | hanyu xin cidian | |
| | [Chinese [new dictionary]] | 'New Chinese Dictionary' |
| c. | xin-bian hanyu cidian | |
| | [newly-compiled [Chinese dictionary]] | 'New Chinese Dictionary' |
| d. | *?hanyu xin-bian cidian | |
| | [Chinese [newly-compiled dictionary]] | 'New Chinese Dictionary' |

(ii.a) is quite bad.²⁹ The correct expression for (ii.a) is (ii.b), where the order of the modifiers is switched. The question is, is the badness of (ii.a) due to a bad order of modifiers, or due to a bad pattern of word length? As (ii.c,d) show, the preferred order of modifiers is (ii.a), not (ii.b). Thus, the badness of (ii.a) is not due to a bad order of modifiers, but due to a bad pattern of word length. In other words, to save (ii.a) phonologically, we may even sacrifice the preferred modifier order, as in (ii.b).

The next question to ask is, why is the word length pattern bad in (ii.a) and good in (i) and (ii.b)? The answer, we suggest, again lies in stress. Consider

²⁸. When discussing such sentences, Lu (1986) suggests that Chinese prefers 'small belly' expressions (i.e. the middle word is shorter than the words on both ends) to 'big belly' expressions (i.e. the middle word is longer than the words on both ends).

²⁹. If one really has to say this phrase, one must stress and lengthen xin, and leave a pause between xin and the rest of the phrase. This is in agreement with NHS.

- (iii) (*)
xin cidian
new dictionary
- (iv) a. (*)
* (*)
??xin hanyu cidian
[new [Chinese dictionary]]
- b. (*)
* (*)
hanyu xin cidian
[Chinese [new dictionary]]
- c. (*)
* (*)
xin-bian hanyu cidian
[newly-compiled [Chinese dictionary]]

In (iii)=(i.a) and (iv.b)=(ii.b), xin has one asterisk. In (iv.a)=(ii.a), however, xin has two. It seems, therefore, that the badness of (iv.a) is due to the fact that a monosyllable cannot bear too many asterisks. In (iv.c)=(ii.c), xin is lengthened by adding another syllable bian (of redundant meaning), so the expression is good again.

Similar pattern is seen in the following patterns

- (v) a. da mei-kuang
large coal-mine 'large coal-mine'
- b. ??da [lu-tian mei-kuang]
large open coal-mine 'large open coal-mine'
- c. lu-tian [da mei-kuang]
open large coal-mine 'large open coal-mine'
- d. da-xing [lu-tian mei-kuang]
large-scale open coal-mine 'large open coal-mine'
- e. ??lu-tian [da-xing mei-kuang]
open large-scale coal-mine 'large open coal-mine'

da has fixed length, as seen in (v.a), where it is not lengthened under NHS. Still, when too many asterisks fall on da, as in (v.b), the expression gets bad. (v.b) may be saved either by switching the order of the modifiers, as in (v.c), or by adding a syllable (of redundant meaning) to da, as in (v.d). The same is true for a longer title, as in

- (vi) a. xiandai hanyu da cidian
modern Chinese big dictionary
- b. ??xiandai hanyu da-xing cidian

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