Wordhood in Chinese[*]

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1. Introduction

While <u>zi</u> 'character' has figured prominently throughout the long history of Chinese linguistics, <u>ci</u> 'word' was hardly a topic prior to the twentieth century. According to Lü (1990: 367, note 3), the first Chinese scholar to talk about <u>ci</u> 'word', as in contrast to <u>zi</u> 'character', was Shizhao Zhang (1907). Real discussion did not occur until the 1950s, when, prompted by the desire to introduce an alphabetic writing system, wordhood became an issue of urgency and many studies ensued. It was soon realized, however, that the task at hand was harder than one had thought, since testing criteria often conflicted with each other (see, for example, Lu [1964], Ling 1956, Fan 1958, Chao 1968, Lü 1979, Huang 1984, H. Zhang 1992, Dai 1992). This has made some leading scholars doubt whether it is an attainable objective to define "word" in Chinese. For example, in his classic work on Chinese grammar, Y.R. Chao (1968: 136) states that "Not every language has a kind of unit which behaves in most (not to speak all) respects as does the unit called 'word' ... It is therefore a matter of fiat and not a question of fact whether to apply the word 'word' to a type of subunit in the Chinese sentence". Similarly, Shuxiang Lü (1981: 45) says, "The reason why one cannot find a satisfactory definition for the Chinese 'word' is that there is nothing as such in the first place. As a matter of fact, one does not need the notion 'word' in order to discuss Chinese grammar."

The distinction between words and phrases, however, is of vital importance to both morphology and phonology. Without knowing what a word is, one cannot meaningfully talk about morphology. Similarly, some phonological rules, such as stress assignment and the determination of tonal domains, apply differently at the word level from the phrase

level (cf. for example, Selkirk and Shen 1990; Duanmu 1992, 1993; H. Zhang 1992; and section 5 below). Without a distinction between words and phrases, such rules would appear ad hoc.

In this paper I discuss the distinctions between word and phrase in Chinese with regard to their morpho-syntactic, semantic, and phonological properties. The term "word" as used here refers to an X^0 in the X-bar theory, and the term "phrase" refers to an XP in the X-bar theory. A "phrase" therefore can be either a phrase or a clause in the ordinary sense, which I will not distinguish. For example, da de shu[i] 'big DE tree' will simply be called a phrase, whether one analyzes it as 'a big tree' or 'a tree that is big' (cf. Sproat — Shih 1991 for the latter position) . Note also that for a word that contains two or more morphemes, such as gao-xing 'glad' (literally 'high-mood'), I will not be concerned with whether it should better be called a compound or something else, although I will use the term "compound" when there is no possibility of confusion.[ii] I will also assume that a word can be made of words, departing from Lu's [1964] position that a word can only be made of morphemes. Finally, for reasons of space, I will not discuss all forms of word structures. Instead, I will focus on nominal structures, and even here the discussion will not be exhaustive.

In section 2 I review previous morpho-syntactic and semantic criteria for testing wordhood and show the conflicts among them. In section 3 I suggest which criteria should be abandoned, which modified, and which adopted. Unlike the popular view, represented by Chao (1968) and Lü (1981), I conclude that wordhood in Chinese is clearly definable. In particular, a modifier-noun [M N] nominal without the particle de is a compound, so are its derivatives, such as [M [M N]], [[M N] N], [[M N] [M N]], etc., as proposed by Fan (1958) and Dai (1992). In section 4 I discuss some background in metrical and tonal phonology, as a preamble to section 5, where I give phonological evidence for wordhood in Chinese,

which has been discussed very little previously. I show that phonological evidence and morpho-syntactic and semantic evidence support each other, and when one is missing the other can often fill the gap. In section 6, I discuss some remaining problems.

2. Previous criteria

In this section I review morpho-syntactic and semantic criteria that have previously been proposed for testing wordhood in Chinese. The list is probably not exhaustive but contains the important ones, I hope.

2.1. The Lexical Integrity Hypothesis (LIH)

Huang (1984) suggests that most differences between a word and a phrase in Chinese can be attributed to the Lexical Integrity Hypothesis, which "is the single most important hypothesis underlying much work on Chinese compounds" (1984: 64). Similarly, in a comprehensive study on Chinese morphology, Dai (1992: 80) suggests that "the LIH is a theoretical universal, slight variants of which underlie most current linguistic theories." Following Jackendoff (1972) and Selkirk (1984), Huang (1984: 60) states the Lexical Integrity Hypothesis as follows:

(1)   The Lexical Integrity Hypothesis

        No phrase-level rule may affect a proper subpart of a word.

Intuitively, the Lexical Integrity Hypothesis makes good sense. For phrasal rules, words are usually the minimal units whose internal structures are no longer accessible. In practice, however, it is not always easy to decide which operation is a phrasal rule, and different test criteria often give conflicting results. In the following, therefore, I will review

various test criteria separately.

2.2. Conjunction Reduction

   Huang (1984) suggests that in both Chinese and English Conjunction Reduction

can be applied to coordinated phrases but not to coordinated words. For example, consider

the following (the latter two are taken from Huang 1984: 61):

(2) a. [jiu de shu] gen [xin de   shu]

      old DE book and new DE book

      'old books and new books'

  b. [jiu de gen xin   de] shu

      old DE and new DE book

      'old and new books'

(3) a. [huo-che] gen [qi-che]

      fire-car   and gas-car

      'train and automobile'

  b. *[huo gen qi] che

       fire and gas car

(4) a. [New York] and [New Orleans]

  b. *New [York and Orleans]

   (2a) is a conjunction of two phrases, so Conjunction Reduction can apply to delete

the first shu 'book', giving (2b). In contrast, (3a) is a conjunction of two compounds, so

Conjunction Reduction cannot apply, as shown by the ill-formed (3b). The same is true in

English. In (4a) there is a conjunction of two proper names, which behave like compounds

rather than phrases, therefore Conjunction Reduction cannot apply, as shown by the badness of (4b).

As Huang suggests, Conjunction Reduction is a phrase-level rule. By the Lexical Integrity Hypothesis, Conjunction Reduction cannot be applied to coordinated words. In other words, the Conjunction Reduction effect is a reflex of the Lexical Integrity Hypothesis.

The Conjunction Reduction effect has been observed before. For example, Fan (1958) suggests that there are two kinds of nominals in Chinese, as shown below (M = modifier, N = noun, de = a particle):

(5)   a.   [M de N]

         b.   [M N]

As Fan shows, these nominals behave quite differently in a number of ways. Among the differences, Fan notes (1958: 215) that Conjunction Reduction may apply to (5a) but not to (5b) as we saw in (1)—(3). Further examples are shown below:

(6)   a.   [xin de yi-fu] he [xin de xie]

                 new DE clothes and new DE shoe

                 'new clothes and new shoes'

         b.   xin de [yi-fu he xie]

                 new DE clothes and shoe

                 'new [clothes and shoes]'

(7)   a.   [yang mao] he [yang   rou]

              sheep wool and sheep meat

              'sheep wool and sheep meat'

       b.   *yang [mao he rou]

              sheep wool and meat

              'sheep [wool and meat]'

        (6a) is a conjunction of two [M de N] structures, so Conjunction Reduction may

apply to give (6b). In contrast, (7a) is a conjunction of two [M N] structures, so

Conjunction Reduction cannot apply to give the intended (7b).

        By the Conjunction Reduction criterion, all [M de N] nominals are phrases, and all

de-less [M N] nominals are words. This is what Fan (1958: 216) suggests. In addition, the

Conjunction Reduction criterion can be applied iteratively, so that [M [M N]], [[M N] N],

[[M N] [M N]], etc., are also words. For example, not only is xin shu 'new book' a

compound, but [xiao [xin shu]] 'small new book', [[da yan-jing] gu-niang] 'big-eyed girl',

[[chang mao] [xiao gou]] 'long-haired small dog' are also compounds, and so on.

        The Conjunction Reduction test is challenged by Dai (1992, Chapter 3), who

argues that coordination may appear inside a compound, therefore Conjunction Reduction

is not a phrase-level rule. For evidence, Dai cites compounds like television and VCR table

(1992: 65) and anti- and pro-democracy (1992: 123), which contain compound-internal

coordination. We will return to Dai's criticism in section 3. We will also see below that the

Conjunction Reduction test is in conflict with several other tests.

2.3. Freedom of Parts

        The Freedom of Parts criterion, termed after Chao (1968: 361), says that if an

immediate component of an expression is a "bound" form, such as an affix, then this expression is a word. The Freedom of Parts criterion has been proposed by earlier researchers such as Lu [1964] and Ling (1956). By Freedom of Parts, jin-zi 'gold' and gao-xing 'glad' (literally 'high-mood') are both words, since in the former both parts are bound forms, and in the latter the second part is a bound form. Huang (1984: 63) suggests that Freedom of Parts is derivable from the Lexical Integrity Hypothesis, presumably because a phrase consists of words, and all words are free; if an expression contains a bound form, then it cannot be a phrase.

Lü (1979: 21) points out that the Freedom of Parts test may lead to wrong results, a problem that was also noted by Lu [1964]. For example, the Chinese question marker ma is not a free form, but it does not make sense to consider a whole question sentence to which ma is attached a compound. In addition, it will be noted that the reverse of Freedom of Parts does not hold, that is, one cannot assume that if all parts of an expression are free forms, then the expression is a phrase. In English, for example, both black and bird are free forms, yet blackbird is a compound. Similarly, consider the Chinese examples below:

(8)   a.   Free-Free   b.   Bound-Free

              ji dan   ya dan

              'chicken egg'   'duck egg'

It happens that ji 'chicken' is a free form, but ya 'duck' usually has to be used with a meaningless suffix zi. As Lü points out, if the reverse of Freedom of Parts is true, one arrives at the rather absurd conclusion that ji dan 'chicken egg' is a phrase but ya dan 'duck egg' a word.

It is generally true, however, that if one part of an expression is bound, and if the

other part is not a phrase, then the expression must be a word. If both parts are free, then one has to use additional criteria. This is the approach of Lü (1979) and Chao (1968), among others.

2.4. Semantic Composition

    Chao (1968: 363) proposes that for an expression whose parts are free, we can check whether the meaning of the expression is compositional from its parts. If the meaning is not compositional, then the expression is usually a word. If the meaning is compositional, then the expression is usually a phrase. Let us call this criterion Semantic Composition . For example, consider an example from Chao (1968: 363)

(9)   da yi

        big garment

        'overcoat' (*'big garment')

    Since the meaning of (9) is not a composition of its parts, (9) is a compound. Similarly, consider the following

(10)   a. da che   b. huang jiu

            big car   yellow wine

            'cart'   '(yellow) rice-wine'

(11)   a. da shu   b. bai   zhi

            big tree   white paper

            'big tree'   'white paper'

The meanings of (10a, b) are not compositional, so they are words. The meanings of (11a, b) are compositional, so they are phrases.

Since the meaning of a compound need not be compositional, an [A N] (Adjective—Noun) compound can take an additional A whose meaning may otherwise contradict that of the original A, as noted by Huang (1984: 61) and Dai (1992: 108), among others. This is shown below

(12) a. *<u>bai de hei de ban</u>

          white DE black DE board

          'white black board'

      b. <u>bai   de hei-ban</u>

          white DE black-board

          'white blackboard'

      c. <u>bai   hei-ban</u>

          white black-board

          'white blackboard'

In (12a), <u>hei de ban</u> 'black board' is a phrase, so it cannot take the additional adjective <u>bai</u> 'white', whose meaning contradicts that of the original adjective <u>hei</u> 'black'. In contrast, in (12b, c) <u>hei-ban</u> 'blackboard' is a compound, so adding the additional <u>bai</u> 'white' (with or without the particle <u>de</u>) is possible, even though <u>bai</u> 'white' contradicts <u>hei</u> 'black'.

Huang (1984: 61) suggests that semantic interpretation rules are phrasal rules, which cannot see the internal semantics of a word. Therefore Semantic Composition follows from the Lexical Integrity Hypothesis.

The Semantic Composition test has limitations, however. First, as noted by Chao

(1968: 364) and Huang (1984: 63), the meaning of an idiomatic expression is not compositional, yet many idioms are not compounds. For example, neither <u>kick the bucket</u> nor <u>let the cat out of the bag</u> is a compound. Secondly, even when idioms are excluded, and when Semantic Composition is used together with the Freedom of Parts criterion, <u>ji dan</u> 'chicken egg' will still be seen as a phrase while <u>ya dan</u> 'duck egg' will be seen as a word, which is a rather odd conclusion. Finally, the results of Semantic Composition conflict with those of the Conjunction Reduction criterion; the latter considers both <u>ji dan</u> and <u>ya dan</u> as well as (10a, b) and (11a, b) to be compounds.

2.5. Syllable Count

Lü (1979: 21—22) suggests that in deciding whether an expression is a word or a phrase, one should consider the length of the expression. As Lü puts it (1979: 21), "The word in the mind of the average speaker is a sound-meaning unit that is not too long and not too complicated, about the size of a word in the dictionary entry."

Specifically, Lü suggests that disyllabic [M N] nominals should be considered words, while quadri-syllabic or longer nominals should be considered phrases. In this analysis, both <u>ji dan</u> 'chicken egg', <u>ya dan</u> 'duck egg', (10a, b) and (11a, b) are compounds. On the other hand, all the following are phrases ((13c) from Chao 1968: 481; (13e) from Chao 1968: 365)

(13)   a.   <u>ren-zao   xian-wei</u>

             man-make fiber

             'man-made fiber'

b.   <u>xiu-zhen ci-dian</u>

pocket   dictionary

'pocket dictionary'

c.   <u>luo-xuan tui-jin-qi</u>

snail-turn push-advance-instrument

'screw propeller'

d.   <u>Beijing shi-fan da-xue</u>

Peking Normal University

'Peking Normal University'

e.   <u>lian-he guo   jiao-yu   ke-xue wen-hua zu-zhi</u>

united   nation education science culture   organization

'United Nations Education Science Culture Organization'

It will be noted that in each of (13a-c), the first immediate component is not a free form. In (13d, e), the expressions are proper names. According to Chao (1968), all these expressions are compounds. According to Lü, however, they are too long to be compounds.

It is not hard to see that the Syllable Count criterion is in conflict with most other criteria. We have already seen in (13) that it conflicts with Freedom of Parts, as well as with the general assumption that a proper name is not a phrase. On the other hand, for disyllabic [M N] nominals, the Syllable Count criterion gives the same results as the Conjunction Reduction criterion in that both consider <u>ji dan</u> 'chicken egg', <u>ya dan</u> 'duck egg', (10a, b) and (11a, b) as compounds. Yet for longer expressions, the Syllable Count criterion again gives different results from the Conjunction Reduction criterion, as the following examples show (taken from Fan 1958: 215; judgments are Fan's)

(14)   a.   [zheng-que yi-jian] he [zheng-que tai-du]

                correct   opinion and correct   attitude

                'correct opinion and correct attitude'

       b.   *zheng-que [yi-jian he   tai-du]

                 correct   opinion and attitude

                'correct opinion and attitude]'

(15)   a.   [zheng-que si-xiang] he [cuo-wu si-xiang]

                 correct   thought and wrong   thought

                'correct thought and wrong thought'

       b.   *[zheng-que he   cuo-wu] si-xiang

                  correct   and wrong   thought

                '[correct and wrong] thoughts'

       (14a) is a conjunction of two [M N]s, therefore Conjunction Reduction cannot

apply, as shown by the badness of (14b). Similarly, (15a) is a conjunction of two [M N]s

and Conjunction Reduction again cannot apply. By the Conjunction Reduction criterion,

therefore, a quadri-syllabic [M N] is a compound, but by the Syllable Count criterion, it is

a phrase. If Syllable Count is accepted, a range of facts will remain unexplained.

       A different version of Syllable Count is proposed earlier in Lu ([1964]: 22-27), who

suggests that whether an [N N] nominal is a word or a phrase depends on the length of each

N. In particular, [1 1], [1 2], [1 3], [2 1] and [3 1] (where the digits indicate the number of

syllables in each N) are words regardless of other criteria (such as the Insertion test

discussed immediately below), while [2 2] could be a word or a phrase depending on other

criteria.

2.6. Insertion

The Insertion test was proposed as early as Wang (1944: 16). Lu [1964] considers
Insertion (what he calls "expansion") to be the most important test for wordhood. The
Insertion test says that if an expression allows an item to be inserted between its parts, then
it is a phrase; otherwise it is a word. The Insertion test is adopted by many others. For
nominals, the typical item to be inserted is the particle de, so that [M N] is converted to [M
de N]; in fact, according to Lu ([1964]: 21), de-insertion is the only workable test for [M N]
nominals. For illustration, let us consider two cases from H. Zhang (1992: 33).

(16)   a.   bai   zhi   b.   bai   de zhi

              white paper   white DE paper

              'white paper'   'white paper'

(17)   a.   xin   zhi   b.   *xin   de   zhi

              letter paper   letter DE paper

              'letter paper'   'letter paper'

(16a) allows de-insertion, but (17a) does not (for the intended meaning). Therefore,
following Lu, H. Zhang considers bai zhi 'white paper' a phrase and xin zhi 'letter paper' a
compound.

Lu ([1964]: 8) points out that for the Insertion test to work, it is necessary that the
inserted material should not change the structure of the original expression. To what extent
two expressions have the same structure is not explained in detail, but a few illustrations
are given. For example, Lu considers pairs like (16a, b) to have the same structures, both
being [modifier noun], and the particle de apparently having no significance. On the other

hand, the expressions below, from Lu ([1964]: 8), do not have the same structures:

(18)   a.   <u>yang   rou</u>

                 sheep meat

                 'mutton'

        b.   <u>yang   DE SHEN-SHANG YOU   rou</u>

                 sheep DE body   have meat

                 'The sheep's body has meat.'

        Although (18a) can be converted into (18b) by inserting the capitalized materials,
the original structure has changed from a nominal in (18a) to a sentence in (18b). Therefore
(18) should not be considered a genuine case of insertion.

        A further restriction on the Insertion test is that the inserted material should not
change the meaning of the original expression (cf. Lu [1964]: 32 and Chao 1968: 362). For
example, consider the following:

(19)   a.   <u>you zui</u>   b.   <u>you de   zui</u>

                 oil   mouth   oil   DE mouth

                 'glib talker'   'greasy mouth' (*'glib talker')

        Although <u>de</u> can be inserted into (19a) to give (19b), the meaning has changed
substantially. Therefore we should consider (19a) to have failed the Insertion test.

        Let us then state the two conditions on the Insertion test below:

(20)   Conditions on the Insertion Test

    a.   The resulting expression should have the same structure as the original.

    b.   The resulting expression should have the same meaning as the original.

       Proponents of de-insertion must have assumed that it is possible, at least in some cases, that de-insertion will not change either the meaning or the structure of the original expression. But this assumption is not shared by others, since significant semantic and structural differences between [M N] and [M de N] have been well documented (e.g., Zhu [1980], Fan 1958, Lü 1979, Sproat — Shih 1991, Dai 1992). We will return to this point.

       Lu ([1964]: 8) notes a further problem with the Insertion test. Sometimes the results of de-insertion conflict with each other depending on whether the host expression occurs alone or in a larger structure. Consider the following examples (from Lu [1964]: 8):

(21)   a.   yang rou   b.   yang de rou

            sheep meat   sheep DE meat

            'mutton'   'sheep's meat (mutton)'

(22)   a.   mai yi-jin   yang rou

            buy one-jin sheep meat

            'to buy a jin of mutton'   (a jin is 500 grams)

    b.   ??mai yi-jin   yang de rou

             buy one-jin sheep DE meat

            'to buy a jin of sheep's meat (mutton)'

       In (21a, b), both expressions are good (although one may argue whether the meanings are really the same). In (22), however, de-insertion makes (22b) odd. (21)-(22)

show that passing de-insertion in one environment does not guarantee passing it in another environment. To solve the problem, H. Zhang (1992: 52) suggests the following condition on where to apply de-insertion:

(23)   An [M N] nominal is a phrase iff it can be changed into [M de N] in the accusative position.

In other words, the proper place to apply de-insertion is a situation like (22), but not a situation like (21). According to (23), therefore, yang rou 'mutton' fails the de-insertion test, so it is a compound. Similarly, both ji dan 'chicken egg' and ya dan 'duck egg' are compounds. On the other hand, xin shu 'new book' is a phrase, as the following sentences show (H. Zhang 1992: 52):

(24)   a.   wo mai-le   yi-ben   xin shu
                   I   bought one-copy new book
                   'I bought a new book.'
          b.   wo mai-le yi-ben   xin de   shu
                   I   bought one-copy new DE book
                   'I bought a new book.'

For H. Zhang, the meanings of (24a, b) are identical, therefore xin shu 'new book' passes the de-insertion test and is a phrase. Similarly, da shu 'big tree', bai zhi 'white paper', hei mao 'black cat', etc., are considered phrases.

But why is the accusative position, and the accusative position alone, selected for de-insertion? Although H. Zhang does not explain, it is probably because it is hardest to

apply the de-insertion in that position. In any case, some problems remain. For example, whether the meanings of (21a, b) and (24a, b), and pairs like them, are really identical is perhaps not so easy to tell. Zhu [1980], for example, argues that xin shu and xin de shu have different meanings, as do [M N] and [M de N] in general. Similarly, according to Sproat — Shih (1991), xin shu means 'new book' but xin de shu means '(a) book which is new'. Moreover, the Insertion test is in conflict with the Conjunction Reduction test, as the following example shows:

(25)   xin shu he jiu shu

        new book and old book

        'new book and old book'

(26)   *[xin he jiu] shu

          new and old book

        'new and old books'

        Since (25) cannot be reduced to (26), the Conjunction Reduction criterion regards both xin shu and jiu shu as compounds. Hence, the Conjunction Reduction criterion and the de-insertion criterion provide conflicting results.

        There is a another problem with the de-insertion test. Recall that for Lu and H. Zhang, both da shu 'big tree' and da de shu 'big tree' are phrases; presumably the presence or absence of de does not matter. Now consider the following examples:

(27)   *da [tie de shi-zi]

          big iron DE lion

        'big iron lion'

(28)   da   de [tie   de   shi-zi]

         big DE iron DE lion

         'big iron lion'

Like da shu 'big tree', da [tie de shi-zi] 'big iron lion' must also be a phrase. Yet (27) is bad. For (27) to be good, there must be a de after da, as shown in (28). This effect has been noted by Fan (1958), Chao (1968: 288), Sproat — Shih (1992), and Dai (1992). For proponents of de-insertion there is no explanation why (27) is bad. For others, however, the reason is simple. According to Zhu [1980], Fan (1958), Lü (1979), Sproat — Shih (1992), and Dai (1992), among others, [M de N] and [M N] are very different structures; [M de N] is a phrase and [M N] a compound. Even if there is no apparent semantic difference, de-insertion will change the structure of an [M N] nominal. In particular, in (27), [tie de shi-zi] is a phrase but it occurs inside a compound structure [A N], making the expression ill-formed.[iii]

A further problem with the Insertion test is that even if insertion applies, an inserted item does not necessarily change a compound into a phrase. For example, according to Chao (1968: 362), a compound verb may take de while still remaining a compound, as shown below:[iv]

(29)   wo neng kan-jian ta.

         I   can   look-see him

         'I can see him'

(30)   wo neng kan-de-jian   ta.

         I   can   look-DE-see him

         'I can see him'

In (29), <u>kan-jian</u> is a compound verb, which can take an object. In (30), <u>kan-de-jian</u> is also a compound verb, even though <u>de</u> is added. One can also cite apparent cases in English, for example <u>evening class</u> is a compound and <u>evening chemistry class</u> is also a compound (Halle — Vergnaud 1987).

In summary, the Insertion test can at most be used in a limited way. If the Insertion test cannot apply to an expression, then the expression is probably a word. If the test does apply, nothing can be inferred, and one has to turn to other evidence.

2.7. Exocentric Structure

Another test suggested by Chao (1968: 362) is whether the structure of an expression is exocentric. If it is, then the expression is a compound. Below are some examples:

(31)   SV—>N

    <u>huo shao</u>

    fire burn

    'baked wheaten cake'

(32)   VO—>N

    <u>tian fang</u>

    fill room

    'second wife (to a widower)'

(33)   VV—>N

        <u>kai   guan</u>

        open close

        'switch'

Huang (1984: 63) attributes this criterion to the Lexical Integrity Hypothesis. This is because general principles require that all well-formed phrase structures be endocentric. In order for exocentric expressions to appear, they must be converted to compounds so that their internal structures are no longer visible to phrasal rules. Further examples of exocentric compounds include the following:

(34)   a.   SV—>A   b.   VO—>A

                <u>shou-ti   shi</u>   <u>wa-tu   ji</u>

                hand-carry style   dig-soil machine

                'portable style'   'soil-digging machine (excavator)'

Note that VO and SV in (34) cannot be analyzed as relative clauses, since in Chinese, the particle <u>de</u> is required between a relative clause and the noun:

(35)   a.   [VO <u>de</u> N]

                <u>dai   mao-zi de   ren</u>   (*<u>dai mao-zi ren</u>)

                wear hat   DE person

                'the person who wears a hat'

b.   [SV <u>de</u> N]

        <u>wo mai de shu</u>   (*<u>wo mai shu</u>)

        I   buy DE book

        'the book I bought'

As far as I can see, the Exocentric Structure criterion works very well.

2.8. Adverbial Modification

        Fan (1958: 214) notes that [A <u>de</u> N] may take an adverb (typically an adverb of

degree) that modifies A, but [A N] cannot take such an adverb. Let us call this Adverbial

Modification (although I leave it open whether all such modifiers are adverbials). The

contrast between [A <u>de</u> N] and [A N] under Adverbial Modification is shown below:

(36)   a.   <u>xin de shu</u>   b.   <u>hen xin de shu</u>

                new DE book   very new DE book

                'a new book'   'a very new book'

        c.   <u>geng xin de shu</u>   d.   <u>zui   xin de shu</u>

                more new DE book   most new DE book

                'a newer book'   'the newest book'

        e.   <u>zheme xin de shu</u>   f.   <u>bu xin de shu</u>

                so   new DE book   not new DE book

                'such a new book'   'a book that is not new'

(37)   a.   <u>xin shu</u>   b.   *<u>hen xin shu</u>

                new book   very new book

                'a new book'   'a very new book'

c.   *geng xin shu   d.   *zui   xin shu

   more new book   most new book

   'a newer book'   'the newest book'

e.   *zheme xin shu   f.   *bu xin   shu

    so   new book   not new book

   'such a new book'   'a book that is not new'

(36)-(37) show that [A de N] can take any adverbial that modifies A but [A N] cannot take such adverbials.

Dai (1992: 108) suggests that the badness of (37b-f) is due to the Lexical Integrity Hypothesis, in that A in [A N] is protected by Lexical Integrity and is not accessible to an external modifier. In contrast, A in [A de N] is not protected by Lexical Integrity and is accessible to an external modifier. But why should the adverbial be considered external rather than internal? We know, for example, that (37b) hen xin shu is not 'a [very [new book]]' but 'a [[very new] book]', that is, hen is an internal modifier. Perhaps M in [M N] cannot be expanded? But this is not true either. The examples below show that [M N] can expand into [[X M] N]:

(38)   [N N]   —>   [[A N] N]

       bu   shou-tao   [lan   bu]   shou-tao

       cloth glove   blue cloth glove

       'cloth glove'   'blue-cloth glove'

(39)   [A N]   —>   [[N A] N]

        hong shou-tao   [tao   hong] shou-tao

        red   glove   peach red   glove

        'red glove'   'peach-red glove'

        (38)-(39) show that M in [M N] is expandable at least in some cases. What is the

explanation then that M cannot be expanded in (37)? The reason, I suggest, is that the

[adverb adjective] structure is always a phrase,[v] and because it is a phrase, it cannot occur

inside a compound. In contrast, the [A N] in (38) and the [N A] in (39) are compounds, so

they may occur inside a compound to give [[X M] N]. The same seems to be true in English,

too. For example, most A, more A, so A, best A, very A, etc., where A is an adjective, are

always phrases. On the other hand, there are numerous [A N] compounds, such as

blackbird, redwood, and White House, and numerous [N A] compounds, such as peach-red,

pitch-dark and snow-white.

2.9. XP Substitution

        Fan (1958: 214) notes that N in [M de N] can be substituted by [X N], where X is a

numeral-classifier unit or a demonstrative unit, but N in [M N] cannot be substituted this

way. Since there is in my view little question that both [Numeral-Classifier N] and

[Demonstrative N] are phrases (or XPs), I will call this process XP Substitution. (40) gives

the schematic forms of XP Substitution and (41)-(42) show some examples:

(40)   a.   [M de N]—>[M de XP]

        b.   [M N]-/->*[M XP]

(41)   [M de XP]

    a.   xin de [san ben shu]

          new DE three copy book

          'three books that are new'

    b.   xin de [nei ben shu]

          new DE that copy book

          'that book which is new'

(42)   *[M XP]

    a.   *xin [san ben shu]

          new three copy book

    b.   *xin [nei ben shu]

          new that copy book

(41) shows that N in [M de N] can be replaced by an XP. (42) shows that N in [M N] cannot be replaced by an XP. Recall that in section 2.8 we have seen that M in [M de N] can be replaced by a phrase but M in [M N] cannot. In other words, both M and N in [M de N] can be replaced by a phrase, while neither M or N in [M N] can. Similar effects are observed by Sproat — Shih (1991, 1992) and Dai (1992), who note that a de-phrase cannot occur inside a compound. For example, consider the following:[vi]

(43)   a.   [[M de N] de N]

        [xin-xian de dou-sha]   de yue-bing

        fresh   DE bean-paste DE moon-cake

        'mooncake with fresh bean-paste filling'

b.   [M de [M de N]]

xiao   de [xin   de shu]

small DE new DE book

'small new book'

(44)   a.   *[[M de N] N]

*[xin-xian de dou-sha]   yue-bing

 fresh   DE bean-paste moon-cake

'mooncake with fresh bean-paste filling'

b.   *[M [M de N]]

*xiao [xin de   shu]

 small new DE book

'small new book'

(43) shows that both M and N in [M de N] can be substituted by a de-phrase. (44)

shows that neither M nor N in [M N] can be replaced by a de-phrase.

The contrast between [M de N] and [M N] under XP Substitution is compatible

with the assumption that [M N] is a compound and [M de N] is a phrase. Since a phrase

cannot occur inside a compound, the badness of (42a, b) and (44a, b) are expected. If [M de

N] and [M N] had the same structures, as proponents of de-insertion assume, then the

contrast between (41) and (42) would need an explanation.

2.10. Productivity

It is reasonable to assume that phrasal rules are productive. For example, if a

language has the rule NP—>[A N], by which a noun phrase can be made of an adjective

plus a noun,[vii] one expects most [A N] combinations to be possible. On the other hand, if

most [A N] combinations are not possible, one would conclude that [A N] is not a phrase.

In English, [A N] is productive. In Chinese, many adjectives, such as <u>da</u> 'big', <u>xiao</u> 'small', <u>xin</u> 'new', <u>jiu</u> 'old', <u>bai</u> 'white', <u>hong</u> 'red', <u>chang</u> 'long', <u>duan</u> 'short', etc., are quite productive in that they can form [A N] with many nouns. If all [A N] structures are compounds in Chinese, as proposed by Fan (1958) and Dai (1992), one would wonder whether the criteria have been too loose. Why, for example, are all the expressions below (mostly from Zhu [1980]: 9-10) compounds in Chinese, while their structures, their meanings, and their English translations seem patently phrasal?

(45) a. <u>gui   dong-xi</u>   b. <u>bao zhi</u>
          expensive article   thin paper
          'expensive article'   'thin paper'

      c. <u>cong-ming hai-zi</u>   d. <u>hua-ji dian-ying</u>
          clever   child   funny movie
          'clever child'   'funny movie'

      e. <u>huang   zhi-fu</u>   f. <u>shen shui</u>
          yellow uniform   deep water
          'yellow uniform'   'deep water'

      g. <u>duan xiu-zi</u>   h. <u>bai   zhi</u>
          short sleeve   white paper
          'short sleeve'   'white paper'

The picture in (45) is deceptive, however. In his insightful study on Chinese adjectives, Zhu [1980] points out that Chinese [A N] is not fully productive and many gaps remain. For example, all the expressions in (46) are unnatural, even though they are exactly

parallel in structure to those in (45) and their English translations are perfectly well-formed (from Zhu [1980]: 9-10; judgments are Zhu's):

(46) a. *<u>gui   shou-juar</u>   b. *<u>bao hui-chen</u>
            expensive handkerchief   thin dust
            'expensive handkerchief'   'thin dust'

      c. *<u>cong-ming dong-wu</u>   d. *<u>hua-ji ren</u>
            clever   animal   funny person
            'clever animal'   'funny person'

      e. *<u>huang qi-chuan</u>   f. *<u>shen shu</u>
            yellow steam-boat   deep book
            'yellow steam-boat'   'difficult book'

      g. *<u>duan cheng-mo</u>   h. *<u>bai   shou</u>
            short silence   white hand
            'short silence'   'white hand'

One may wonder if Chinese has language-particular constraints on the collocation between certain adjectives and nouns, such as those in (46). But this is not the case. All of (46a-h) will become good if <u>de</u> is added between the adjective and the noun, as shown below:[viii]

(47) a. <u>gui   de shou-juar</u>   b. <u>bao de hui-chen</u>
            expensive DE handkerchief   thin DE dust
            'expensive handkerchief'   'thin dust'

c. cong-ming de   dong-wu   d. hua-ji de ren

    clever   DE animal   funny DE person

    'clever animal'   'funny person'

e. huang de qi-chuan   f. shen de   shu

    yellow DE steam-boat   deep DE book

    'yellow steam-boat'   'difficult book'

g. duan de cheng-mo   h. bai   de   shou

    short DE silence   white DE hand

    'short silence'   'white hand'

Examples like the above strongly indicate that while [A de N] is fully productive in Chinese, [A N] is not. It should be pointed out that the distributional gaps in (46) are not exceptions but the norm. To appreciate how defective the [A N] distribution is, consider the following:

(48) a.   gao shan   b.   gao lou

        tall mountain   tall building

        'tall mountain'   'tall building'

(49) a.   *gao shu   b.   *gao ren

         tall tree   tall person

        'tall tree'   'tall person'

In (48), gao 'tall' appears productive. But (49a, b), perfectly normal [A N] structures from an English point of view, are simply bad. One may suspect that, in parallel to English, which has two words for 'highness', high (which goes with standard, speed, and mountain)

and <u>tall</u> (which goes with <u>building</u>, <u>tree</u>, and <u>person</u>), perhaps there is another Chinese word for 'highness' which can go with <u>shu</u> 'tree' and <u>ren</u> 'person'? Unfortunately, this is not the case; <u>gao</u> is the only word in Chinese for 'highness' and covers the meanings of both <u>high</u> and <u>tall</u> in English. To express 'tall tree' and 'tall person' in Chinese, <u>gao</u> must be followed by <u>de</u>.

(50)   a.   <u>gao de shu</u>   b.   <u>gao de ren</u>

                tall DE tree   tall DE person

                'tall tree'   'tall person'

In other words, there is simply no way of forming plain daily expressions like 'tall tree' and 'tall person' in Chinese with an [A N] structure. If [A N] is a productive Chinese construction, such gaps are very striking indeed.

The following words from Zhu ([1980]: 11) nicely summarize the facts we examined in this section: "Evidence shows that ([A N]) is a structure that tends to be tightly frozen. Its structure is not determined by productive phrasal rules. When compared with other languages, this property is especially striking. When foreigners learn Chinese, they often cannot understand why expressions like <u>bai shou</u> 'white hand' and <u>gui shou-juar</u> 'expensive handkerchief' are not natural."

Since [N N] is less productive than [A N] (cf. Lu [1964]), by similar arguments [N N] cannot be a phrase either. In short, productivity evidence supports the view that [M <u>de</u> N] is a phrase but [M N] a word.

2.11. Intuition

A number of researchers have assumed that Chinese speakers, or educated linguists

at least, have an intuition of what a word is and that the predictions of one's theory should agree with it. For example, Lü (1979: 21-22) suggests that in the mind of the average speaker a "word" is something that is "not too long", and Lü proposes an upper limit of four syllables, beyond which an expression should be considered a phrase regardless of other criteria. Similarly, intuition is often appealed to when one is faced with conflicting criteria. For example, H. Zhang (1992: 39) notes that by the de-insertion test da shu 'big tree' and xiao shu 'small tree' are phrases, but by the Conjunction Reduction test (cf. section 2.2 above) they are compounds; since "(a)lmost all Chinese linguists are of the same view" that da shu 'big tree' and xiao shu 'small tree' are phrases, H. Zhang rejects the Conjunction Reduction test in favor of the de-insertion test.

Intuition is certainly an important factor to consider, and in many cases people's intuitions do agree. On the other hand, the fact that there is still no consensus on where to draw the line between word and phrase in Chinese, even though the discussions started since at least the 1950s, indicates that there are areas where people's intuitions either are not clear or do not agree. Specifically, while it is relatively easy to determine the wordhood of an expression that contains an affix, it is harder to analyze [M N] nominals that do not contain an affix. As Lu ([1964]: 5) puts it,

> When popular grammar books discuss (Chinese) word structures, they rarely focus on simple expressions like tie lu 'iron road (railroad)' and cai chuang 'vegetable beds' that are made of content forms only, apparently in order to avoid the greatest difficulty in Chinese morphology. In Chinese, expressions without functional forms are the hardest to analyze, because here one cannot rely on inflection to recognize wordhood, as one can in Indo-European languages.

Intuition, therefore, should be used with caution, especially with [M N] nominals. As far as one can, intuition should not be used alone to argue for one or another among conflicting criteria.

2.12. Summary

In this section I have reviewed a number of tests for wordhood in Chinese. I have focused on tests for nominals only, in particular [M N] nominals. The results are summarized below

(51)   TEST   WORD OR PHRASE

Conjunction Reduction   both

Freedom of Parts   both

Semantic Composition   both

Syllable Count   both

Insertion   both

Exocentric Structure   ??

Adverbial Modification   word

XP Substitution   word

Productivity   word

Intuition   ??

There is no question that [M de N] is always a phrase. For [M N], results differ. Three tests (Adverbial Modification, XP Substitution, and Productivity) consider all [M N]s as words. The Intuition test has no fixed answer, since people's intuitions do not always agree. The Exocentric Structure test considers exocentric [M N]s as words but say nothing

about other [M N]s. The remaining five tests (Conjunction Reduction, Freedom of Parts, Semantic Composition, Syllable Count, and Insertion) consider some [M N]s as words and some as phrases; however, they differ on which [M N]'s are words and which phrases. I will now offer my view on which tests should be adopted and which abandoned.

3. The present analysis

In this section I offer my view of which criteria should be rejected and which adopted.

3.1. Rejecting Syllable Count, Insertion, and Intuition

Consider Intuition first. There are two reasons for rejecting it. First, as noted by Lu [1964], people's intuitions do not always agree, especially with [M N] nominals, therefore it is hard to decide whose intuition to follow. Second, when intuitions do agree in certain cases, one can usually interpret these intuitions in concrete terms. For example, all people agree that you zui 'oil mouth —> glib talker' and tian fang 'fill room —> second wife (to a widower)' are compounds; the former can be explained by Semantic Composition and the latter by Exocentric Structure. Therefore, it is better to rely on concrete evidence than intuition.

Next, consider Syllable Count. The shortcoming with this criterion is its arbitrary nature and lack of motivation. Why, for example, should the threshold for phrasehood be set at four syllables, instead of three or five? And why is there no such condition in other languages?

Finally, consider Insertion. As discussed in section 2.6, the Insertion criterion crucially requires that the following conditions be both met

(52)   Conditions on the Insertion Test

      a.   The resulting expression should have the same structure as the original.

      b.   The resulting expression should have the same meaning as the original.

But the first condition is unlikely to be satisfiable in _de_-insertion. This is because inserting _de_ definitely makes a nominal into a phrase, whereas without _de_ a nominal could be a word. Besides, as Fan (1958) has extensively shown, [M N] and [M _de_ N] have very different syntactic behaviors, therefore they cannot be of the same structure. As for the second condition, it is often hard to tell when two expressions have the same meaning. For example, does 'a big tree' have the same meaning as 'a tree that is big'? The semantic judgment required here must be very refined. The same is true in Chinese. For some, such as Zhu [1980], [M N] and [M _de_ N] never have exactly the same meanings; for others, [M N] and [M _de_ N] can have the same meanings. But even if 'a big tree' and 'a tree that is big' have the same meaning, it does not follow that they have the same structure. Why then should one assume that _da shu_ 'big tree' and _da de shu_ 'big DE tree' have the same structure just because they have similar meanings?[ix]

A further reason to reject the above three criteria (Intuition, Syllable Count, and Insertion) is that not only do they conflict with each other, but they conflict with other criteria as well (cf. section 2). As we will see below, once these three criteria are rejected, all the remaining criteria give converging results.

3.2. Adopting Conjunction Reduction, Freedom of Parts, Semantic Composition, and Exocentric Structure with limitations

Let us now consider Conjunction Reduction, Freedom of Parts, Semantic Composition, and Exocentric Structure. The assumption here is that phrases should have

regular syntactic and semantic behavior; they should allow conjunction reduction, be made of free parts, be semantically compositional, and be structurally endocentric. If an expression fails any of these tests, it is not a phrase. This assumption is held by all analysts and will not be disputed here.

But what if an expression passes all these tests? Apparently one cannot conclude that the expression must be a phrase. If one does, one is assuming that no compound can allow conjunction reduction, be made of free parts, be semantically compositional, and be structurally endocentric. But this assumption is incorrect. As Dai (1992) points out, while some compounds may have peculiar syntactic and semantic behaviors, others have regular syntactic and semantic behaviors. Therefore, if an expression has peculiar behavior, it is likely a word, but if an expression does not have peculiar behavior, it may still be a word. Consider the following:

(53)   a.   meat-and-potato eater

        b.   apple pie

        c.   blackboard

(53a) is a compound which contains an internal conjunction (from Dai 1992: 112, citing Bates 1988: 228).[x] (53b) is a compound that is made of two free parts. (53c) is a compound whose structure is endocentric. Finally, the semantics of (53a, b) are quite compositional. (53) shows that the syntactic and semantic structures of a compound can be regular. Thus, even if an expression passes all of Conjunction Reduction, Freedom of Parts, Semantic Composition, and Exocentric Structure, it still could be a compound. In other words, Conjunction Reduction, Freedom of Parts, Semantic Composition, and Exocentric Structure can only be used to spot expressions that have peculiar syntactic and semantic

behavior, hence marking them as compounds, but they cannot be used for expressions with regular syntactic and semantic behavior, which may or may not be compounds.

3.3. Adopting Adverbial Modification, XP Substitution, and Productivity

Let us now consider the remaining three criteria, Adverbial Modification, XP Substitution, and Productivity. Adverbial Modification can probably be subsumed under XP Substitution, but it will not be our concern. These three criteria are based on reasonable assumptions, namely, that the A in an [A N] phrase (but not the A in an [A N] compound) should be modifiable by an adverb, that in a phrase made of two parts at least one should be an XP and so substitutable by an XP, and that all phrasal constructions should be productive. As we have seen in section 2, by these three criteria one arrives at the same conclusion that in Chinese, all [M de N]s are phrases and all [M N]s are words.

It will be noted that in this respect Chinese differs from English in an important way. In English, an [A N] nominal can be either a compound (e.g., black market) or a phrase (e.g., black dogs). This has lead many people to assume that the same is true for Chinese [A N] structures. But in English, [A N] is a fully productive construction, where the A readily accepts adverbial modifications (e.g., difficult discussions, more difficult discussions, most difficult discussions, very difficult discussions). In Chinese, however, [A N] is unproductive for most adjectives (e.g., *jian-ku tao-lun 'difficult discussions'), and the small number of adjectives, such as da 'big' and xiao 'small', which seem to be quite productive in [A N] structures, cannot take an adverbial modifier (e.g., *geng da gou 'more big dog -> a bigger dog', *zui da gou 'most big dog -> the biggest dog', *hen da gou 'very big dog -> a very big dog'; cf. geng da de gou 'more big DE dog -> a bigger dog', zui da de gou 'most big DE dog -> the biggest dog', hen da de gou 'very big DE dog -> a very big dog'). If the Chinese [A N] is equated with the English [A N], such facts will be very hard

to explain. The same applies to longer <u>de</u>-less nominals, such as <u>da-xing min-yong pen-qi-shi fei-ji</u> 'large civilian jet liner'. For many people, such nominals are too long to be a compound. But then in *<u>xiang-dang da-xing min-yong pen-qi-shi fei-ji</u> 'fairly large civilian jet liner', *<u>bi-jiao da-xing min-yong pen-qi-shi fei-ji</u> 'relatively large civilian jet liner', and *<u>gen da-xing min-yong pen-qi-shi fei-ji</u> '(more large) larger civilian jet liner', why are the Chinese expressions bad yet the English ones good? In the present analysis, this contrast is just what one expects.

3.4. Summary

I have shown that there are good reasons for rejecting Syllable Count, Insertion, and Intuition as tests for wordhood in Chinese. Once this is done, all the remaining criteria provide converging results. In particular, all [M N] nominals, as well as their iterative derivatives (e.g., [M [M N]], [[M N] N], etc.) are words. This conclusion differs from most previous analyses of Chinese wordhood, but is similar to the one proposed by Dai (1992) and in part to the one proposed by Fan (1958). I will now present independent phonological evidence that supports the present analysis.

4. Background in metrical phonology and tonal phonology

To facilitate our discussion of phonological evidence for wordhood in Chinese, let me first review relevant findings in metrical and tonal phonology.

4.1. Metrical phonology

Metrical phonology determines which speech elements are more prominent than others. Metrical rules are often called stress rules for the reason that in many languages metrically prominent elements surface as stressed elements. It is important to remember,

however, that phonetic stress (greater duration and/or intensity) is not the only possible

manifestation of metrical prominence. In Japanese, for example, a metrically prominent

syllable is assigned a H tone (which may spread to preceding syllables), without being

necessarily longer or louder than other syllables. A metrically prominent element need not

always bear a high pitch either. For example, while a stressed syllable in English usually

bears a high pitch, in certain speech styles it may bear a low pitch, while unstressed

syllables bear high pitches.

Having mentioned the above precaution, I will continue to refer to metrical

prominence as stress, with the understanding that stress may be realized in different ways.

The manifestations of stress in Chinese will be discussed below. For more discussion on

metrical phonology, see Halle — Vergnaud (1987) and Hayes (1995), among many others.

4.1.1. Foot, head, and degenerate foot

Metrical elements (moras, syllables, etc.) are grouped into constituents, or "feet".

In each foot one member is more prominent than others, and this member is called the head.

The head element is also called the stressed element. The process of constructing feet and

determining heads is therefore the process of stress assignment. As an example, consider

the stress pattern in a language with syllabic trochee ($ = syllable, ( ) = foot):

```
(54)     x     x     x
        ($ $)($ $)($ $)
```

A trochaic foot is one that has two elements, with the first being the head. (54)

shows a word with six syllables, which form three feet. In each foot, the head is marked by

the symbol "x" on top of it.

A foot usually consists of two or more elements. A foot that consists of just one

element is called a "degenerate foot". A degenerate foot is disfavored in all languages. One

solution is to merge it with a neighboring foot, as shown below:

```
(55)     x     x     x          x     x
       ($  $)($  $)($)    ->    ($  $)($  $  $)
```

(55) shows what may happen to a word with five syllables under trochaic stress.

The first four syllables form two full feet. The last syllable does not form a full foot, so it

merges with the second foot. An alternative way to avoid a degenerate foot is to create a

new member for it, such as lengthening the vowel (for moraic feet) or reduplicating the

syllable (for syllabic feet), so that it is no longer a degenerate foot.

4.1.2. Word stress, compound stress, and phrasal stress

Stress assignment may be applied at several levels.[xi] In general, it starts at the word

level, and then moves on to higher levels. Different levels may have different ways of

stress assignment. In English, for example, stress is assigned at the word level, the

compound level, and the phrase level. At the compound level, stress is usually (though not

always) left-headed, i.e., it is assigned to the first word of the compound. In contrast, at the

phrase level, stress is right-headed, i.e., it is assigned to the last word in a phrase. In

addition, both compound stress and phrasal stress are assigned cyclically.

4.1.3. Stress Clash

A very important finding in metrical phonology is that stresses should not occur too

close to each other. This is referred to as Stress Clash. When it happens, a number of things

may be triggered. Usually one of the stresses will be removed, so that there is no longer a

clash, or an unstressed element may be inserted between stressed elements, so that they are

farther apart. Below is an example of Stress Clash and the subsequent results

```
(56)    x                       x                       x
        x   x                   x                       x
        ($)($  $)    ->        ($)($  $)    ->        ($  $  $)
```

First, Stress Clash leads to the removal of the stress on the second syllable. This in turn leads to the loss of the second foot, since by a standard metrical assumption every foot must have a head. The result is therefore a single foot with three syllables. It will be noted that there is certain overlap between resolving Stress Clash and avoiding a degenerate foot. The Stress Clash in (56) is in part due to the fact that the first foot is degenerate. Removing the second stress not only resolves Stress Clash, but the output no longer has a degenerate foot. Whether resolving Stress Clash and avoiding degenerate feet are reducible to some higher principle will not be our concern here, however.

4.1.4. Stress Reduction

Stress Reduction is another important rule in metrical phonology. Its effect is to reduce the number of stress levels in a language through deleting a line of stress marks. Stress Reduction is also called "conflation". For example, in Khalkha Mongolian (cited in Hayes 1980: 63), stress falls on the first long vowel. The standard metrical analysis is as follows (v = short vowel, V = long vowel):

```
(57)    Line 2:    x
        Line 1:    x        x    x            x
                   v  V  v  v  V  v  V    -> v  V  v  v  V  v  V
```

The hypothetical word in (57) has three long vowels. First, all the long vowels are

assigned a stress mark on Line 1. Then on Line 2, left-headed stress is assigned, which falls

on the first long vowel. Next, Stress Reduction is applied, deleting the Line 1 stresses. This

leaves the second and third long vowels with no stress. For the first long vowel, its Line 2

stress falls onto Line 1, and this is the only surface stress in the word.

4.2. Tonal phonology

      We now review relevant points in tonal phonology, in particular the treatment of

contour tones, association rules, and association domains.

4.2.1. Contour tone, tiers, and mapping rules

      In African languages, contour tones (e.g., rise and fall) can usually be analyzed as a

sequence of level tones (e.g., H and L). For example a fall can be seen as HL and a rise as

LH. For illustration, consider an example from Margi (Williams 1976; tone markings: ˇ =

rise, ` = low, ´ = high):

(58)   a.   <u>věl</u>   b.   <u>ani</u>   c.   <u>vèlání</u>

          to jump   causative   to make jump

      The verb for 'to jump' has a rising tone when said alone, and the causative suffix has

no underlying tones. When the verb and the suffix are put together in (58c), the verb

appears with a low tone, and the suffix vowels with high tones. Williams suggests that a

rise should be analyzed as the sequence LH, and that tones be represented on a separate tier

from segments. In addition, he suggests that tones be mapped to syllables by the Mapping

Rules (or "association rules"), given in (59), along with the analysis of (58) in (60).

(59)   The Mapping Rules

a. Associate tones to syllables one-to-one, left to right.

b. If there are more syllables, spread the last tone to excess syllables.

c. If there are more tones, link excess tones to the last syllable.

(60)   a.   59a   59c
                    vel —> vel —> vel   : segmental tier
                          | |\
                    LH   LH   LH   : tonal tier

         b.   59a   59b
                    vel + ani —> velani —> velani   : segmental tier
                              | | | | /
                    LH   L H   L H   : tonal tier

While the essence of Williams' proposal has now become the standard practice in multi-tiered (or autosegmental) phonology, many people remain doubtful whether contour tones in Chinese are analyzable in exactly the same way as in Margi (cf. Yip 1989 and Bao 1990). There is no question, however, that in several Chinese dialects of the Wu family, contour tones behave exactly the same way as in Margi, although the mapping rules vary in some ways. For illustration, consider the following examples from Shanghai:[xii]

(61)   a.   du 'big'   b.   ŋ 'fish'   c.   çi 'fresh'

              rise   rise   fall

(62)   a.   du ŋ   b.   çi ŋ

              low high   high low

              'big fish'   'fresh fish'

(61) shows that when said alone, du 'big' and ŋ 'fish' have a rising tone, and çi 'fresh' has a falling tone. (62) shows the tones when these words are put together, where no

syllable bears the same tone as in isolation. The above data can be analyzed as follows (cf. Selkirk — Shen 1990, Duanmu 1993):[xiii]

(63)   Mapping Rules for Shanghai

a. Delete tones from non-initial syllables.

b. Associate tones to syllables one-to-one, left to right.

c. If there are more tones, link excess tones to the last syllable.

(64)   63b   63c
                     du —> du —> du
                               | | \
                     LH   LH   LH

(65)   a.   63a   63b
                     du ŋ —> du ŋ —> du ŋ   'big fish'
                                               | |
                     LH LH   LH   L   H

        b.   63a   63b
                     ɕi ŋ —> ɕi ŋ —> ɕi ŋ   'fresh fish'
                                               | |
                     HL LH   HL   H   L

Unlike Margi, Shanghai has an extra rule (63a) which deletes tones from non-initial syllables. We will return to the reason for it later. In addition, Shanghai does not spread the last tone to excess syllables; this, however, should not be of concern, since some African languages do not spread tones either (cf. Pulleyblank 1986). The remaining aspects of Shanghai are largely similar to those of Margi.

4.2.2. Association domains

Our discussions of Margi and Shanghai have focused on what happens to tones in a given domain. Let us call such a domain an "association domain", in which tones may shift

from one syllable to another. It is important to bear in mind that an association domain may differ from other kinds of tone-sandhi domains, such as those for the Mandarin Third-Tone sandhi or the tone sandhi in Min dialects, in which tones do not shift from one syllable to another (cf. Duanmu 1993).

A given expression may form one or more association domains. For example, the Shanghai sentence below forms four association domains ([] = association domain boundaries)

(66)   [lo wã]   [hø-çi] [tçʰe'] [ha' ŋ]

old Wang like   eat   black fish

'Old Wang likes to eat black fish.'

Within each domain, the same tonal rules in (63) apply. The tonal derivation of (66) is therefore as follows

(67)   Underlying: [lo wã]   [hø-çi] [tçʰe'] [ha' ŋ]

                              LH LH   HL LH   LH   LH LH

        After (63a):   [lo wã]   [hø-çi] [tçʰe'] [ha' ŋ]

                              LH   HL   LH   LH

        After (63b, c): [lo wã]   [hø-çi] [tçʰe'] [ha' ŋ]
                         | | | | ∧ | |
                         L   H   H   L   LH   L H

While the tonal processes within each association domain are now quite clear, the determination of association domains has been a thorny problem. As we will see below, the distinction between word and phrase plays a crucial role in this regard.

5. Phonological evidence for wordhood in Chinese

In English, phrases and compounds can often (though not always) be distinguished by stress. For example, the primary stress in the compound <u>blackbird</u> is on the first word, whereas the primary stress in the phrase <u>black bird</u> is on the second word. In Mandarin Chinese, however, such a cue is not readily available. Indeed, apart from the fact that some compounds may contain a syllable with a "neutral tone", many people do not think there is any other phonological distinction between words and phrases in Chinese (cf., however, Packard 1992, who proposes some phonological arguments for Mandarin morphology). For example, Chao (1968: 360-361) states that when the neutral tone is excluded, Mandarin "compounds do not differ from phrases" in regard to stress.

In this section I will argue that there is a rich body of phonological evidence, especially metrical and tonal evidence, for the distinction between words and phrases in both Mandarin and other Chinese dialects. In particular, I will heavily draw evidence from Shanghai, although similar evidence is available in many other Wu dialects.

In order to use evidence from beyond Mandarin, I will assume that, in general, if an expression is a compound in one dialect, it is also a compound in other dialects. This assumption is shared by other researchers, among them Chao (1968: viii), who says that "in terms of grammar, most of what is said ... about Mandarin is true of all Chinese".

5.1. Association domains as stress domains

We first ask what makes an association domain in Shanghai. In an extensive study, Selkirk — Shen (1990) propose that every lexical word forms an association domain. Higher syntactic levels have additional effects but do not concern us here. Duanmu (1992) points out that an association domain can be smaller than a word. Consider the following

data

(68)   (pa-li)   'Paris'

       (zã-he)   'Shanghai'

       (lu-mo)   'Rome'

(69)   (tsz-ka-ku)   'Chicago'

       (ko-r-fu)   'golf'

       (ka-na-da)   'Canada'

(70)   (ya-lu)(-sa-lẽ)   'Jerusalem'

       (de'-k^{h}e')(-sa-sz)   'Texas'

       (tu-mi)(-ɲi-ka)   'Dominica'

(71)   (ku-r)(-pa-tɕo-fu)   'Gorbachov'

       (ʔe-se')(-ŋu-pi-ya)   'Ethiopia'

       (ka-li)(-fo'-ɲi-ya)   'California'

(72)   (dJe'-k^{h}a')(-sz-lu)(-va'-k^{h}a')   'Czechoslovakia'

The above expressions are undoubtedly words, but they do not form a single association domain. In general, names of two and three syllables form one association domain, those with four and five syllables form two association domains, and those with six syllables form three association domains. This pattern is what one expects if Shanghai has trochaic footing at the word level, as shown below:

(73)   x
       ($ $)

(74)   x   x   x
       ($ $)($) –> ($ $ $)

```
(75)      x       x
          ($ $)($ $)

(76)      x     x     x        x     x
          ($ $)($ $)($) -> ($ $)($ $ $)

(77)      x     x      x
          ($ $)($ $)($ $)
```

For names with an odd number of syllables, the last cannot form a full foot, so it merges with the preceding foot. For names with an even number of syllables, all feet are disyllabic.

The fact that the length of a word affects how many association domains it forms needs to be accounted for in any analysis of Shanghai tone sandhi. On the other hand, if we assume that association domains are determined by stress, namely, an association domain is a stressed foot, then not only do we get association domains in multisyllabic names for free, but a number of other facts also come into light. Let us consider three of them.

First, why should the first syllable in an association domain keep its underlying tones while others lose their underlying tones? We know independently from Mandarin Chinese that an unstressed syllable may lose its tones. If association domains are determined by stress, it follows that only the domain-initial syllable is stressed, hence being able to keep its underlying tones, whereas other syllables are unstressed and so will lose their underlying tones.

Second, as Duanmu (1992) notes, contrastive stress may create a new association domain. Consider the data below (only relevant association domains are shown):

(78)   a.   (lo-fu dɤ)

                tiger   head

                'tiger's head'

b.   <u>ve' z   lo-fu ɲi-po, z (lo-fu)(dɣ:)</u>

        not be tiger tail   be tiger   head

        'It's not the tiger's tail, but the tiger's head.'

(78a) shows that <u>lo-fu dɣ</u> 'tiger's head' normally forms one association domain. (78b) shows that with a contrastive stress, <u>dɣ</u> 'head' forms a new association domain by itself. In addition, the syllable <u>dɣ</u> is lengthened. If the association domain is unrelated to stress, why should contrastive stress create a new association domain? On the other hand, if the association domain is determined by stress, the above effect is just what one expects. The contrastive stress on <u>dɣ</u> forces it to become a foot, and in order to avoid a degenerate foot, the vowel is lengthened to make a bi-moraic foot.

        Third, as Duanmu (1992) notes, contrastive stress does not always create a new association domain. Consider the example below

(79)   a.   <u>(kɣ dɣ)</u>

                dog head

                'dog's head'

        b.   <u>ve' z   kɣ   ɲi-po, z (kɣ   dɣ)</u>

                not be dog tail   be dog head

                'It's not the dog's tail, but the dog's head.'

(79a) shows that <u>kɣ dɣ</u> 'dog's head' normally forms one domain. However, (79b) shows that the contrastive stress on <u>dɣ</u> 'head' does not create a new association domain, unlike what we saw in (78b). This fact appears rather mysterious. But under a stress analysis of association domain, it is exactly what one expects. Consider the representations

below (X = contrastive stress):

(80)   a.   x   X   b.   x   X   x
               ($ $)($)   ($)($) —> ($ $)

(80a) shows the metrical structure of lo-fu dɤ 'tiger's head' with a contrastive stress

on dɤ, and (80b) shows that of kɤ dɤ 'dog's head', also with a contrastive stress on dɤ. It

can be seen that in (80b), but not in (80a), Stress Clash has occurred, namely, stresses fall

on two adjacent syllables. It is no surprise that the contrastive stress is removed from (80b),

hence no new association domain is created. In fact, dɤ in (79b) is no more prominent than

that in (79a), indicating that it no longer bears any stress.

5.2. Compound stress vs. phrasal stress

        Kennedy (1953) noted that in the Wu dialect Tangsic, [M N] and [V O] have

different tone patterns. Other studies have shown that this is a general tendency among Wu

dialects. Consider the following expressions in Shanghai (omitting association lines):

(81)   tsʰo ve   —>   (tsʰo ve)
        LH LH   L   H

        fry rice

        'fried rice'

(82)   tsʰo ve   —>   (tsʰo) (ve)
        LH LH   LH   LH

        fry rice

        'to fry rice'

        (81) is a nominal and (82) is a verb phrase. Both expressions have the same input

words, but their surface tone patterns differ. (81) forms one association domain and (82)

forms two association domains. For a long time, the contrast between (81) and (82) has

remained without explanation. Under a metrical analysis of association domain, however,

there is a simple answer.

Recall that in English, compound stress is left-headed, while phrasal stress is

right-headed. If this is also true in Chinese, then (81) and (82) follow. Let us look at the

process in detail:

(83) a.   [A   N]   b.   [V   N]

ts^ho ve   ts^ho ve

'fried rice'   'to fry rive'

| x x | x x | Word Stress (trochaic) |
| ($)($) | ($)($) | |

x		
x x		
($)($)		Compound Stress

	x	
	x x	
	($)($)	Phrasal Stress

x	x	
x	x	
($)($)	($)($)	Clash Resolution

x		
x		
($ $)		Foot Merging

	x	
	x x	
	($)($)	Exhaustive parsing

First, each word is assigned word stress, which, as discussed earlier, is trochaic in

Shanghai; although it does not show on a monosyllable, its effect will become clear

immediately. Next, Compound Stress (left-headed) applies. Since (83a) is a compound, an

additional stress is assigned to its first syllable. (83b) is not a compound, so it is unchanged.

Next, Phrasal Stress (right-headed) applies. This time a stress is put on the second syllable

in (83b). (83a) is not a phrase and nothing happens to it. Now both (83a, b) show Stress

Clash. As discussed earlier, there are several ways to resolve Stress Clash. Here I will

assume that the weaker stress is removed. Now stress removal leaves two headless feet,

which should merge with a neighboring foot if they can. This occurs in (83a), but cannot

occur in (83b). The reason is that the foot in Shanghai is trochaic, whose head is the first

syllable. Had the stressless first syllable in (83b) merged with the stressed second syllable,

the foot would no longer be trochaic. In the final step, the unstressed first syllable in (83b)

is re-assigned a stress; this is based on an assumption that all elements must be parsed into

one domain or another (cf. Halle — Vergnaud 1987).[xiv] A subsequent process will

lengthen both the syllables in (83b) to make them bi-moraic feet.[xv]

Let us now consider nominals. We discussed in sections 2 and 3 that [M N]s are

compounds and [M de N]s are phrases. Association domain formation supports this.

Consider the following examples:

(84)   (çĩ   sz)

```
        new book              x           x
                              x    x      x
        'new book'            ($)($)  ->  ($  $)
```

(85)   (çĩ   ge')(sz)

```
        new DE  book   x
                              x        x
        'new book'            ($  $)($)
```

(84) shows that a disyllabic [M N] will always form just one association domain. In (85), since the functional word <u>de</u> does not bear stress, it can always form a disyllabic foot with the first syllable. The third syllable forms an association domain by itself.[xvi]

Since association domain is determined by stress, it will be sensitive to word length. This is exactly the case. Consider [M N] nominals with the length pattern [1 2] and [2 2] (1 = monosyllabic, 2 = disyllabic):

(86)
```
    x                   x
    x   x               x
   ($)($  $)  ->  ($  $  $)
```

(87)
```
    x
    x       x                 x
   ($  $)($  $)  ->  ($  $  $  $)
```

For [1 2], there is always Stress Clash, and so it will always form just one association domain. For [2 2], there is no Stress Clash. Thus it may form two association domains. On the other hand, Stress Reduction may optionally apply, therefore [2 2] may also form just one association domain. The data below shows that the prediction is correct:

(88) a. (s<u>ã   Ho'-ÿü</u>)   b. *(<u>sã</u>)(<u>Ho'-ÿü</u>)

          business school

          'business school'

(89) a. (<u>ṉü-yi</u>) (<u>Ho'-ÿü</u>)   b. (<u>ṉü-yi   Ho'-ÿü</u>)

          language school   language school

          'language school'   'language school'

Sometimes, the association domains of an expression may seem to contradict its

morphological structure, as shown in the case below.

(90)   ço ka-li-fo'-ɲi-ya —> (ço ka-li-)(fo'-ɲi-ya)

'small California'

In (90), the first word forms an association domain with part of the second word. This fact is a mystery in previous analyses. But in a metrical analysis, it is again what we expect. Below is the metrical derivations.

(91)
```
                              x                         x
     x   x       x            x   x       x             x           x
  ($)($-$-)($-$-$)  ->  ($)($-$-)($-$-$)  ->  ($  $-$-)($-$-$)
  Word Stress (trochaic)      Compound Stress         Clash Resolution
```

First, each word is assigned trochaic stress. Then Compound Stress adds another stress to the first word. Next, Clash Resolution removes the stress from the second foot, which then merges with the first foot. The result is what we saw in (90).

The association domains in expanded [M N]s, such as [M [M N]], [[N A] N], and [[N A] [M N]], can be derived in the same way. Let us consider two more examples:

(92)   a. [M [M N]]   b. [M [M N]]

           (lã   tsʰo ve)   (çĩ-çi)(tsʰo ve)

           cold fry rice   fresh fry rice

           'cold fried rice'   'fresh fried rice'

(93)   a.
```
                                     x            x
                       x            x   x         x
      x    x  x        x   x  x     x   x  x       x
     [$  [$  $]] —> [$  [$  $]] —> [$  [$  $]] —> [$  [$  $]] —> ($ $ $)
```
Word   first cycle   second cycle   Clash   association domain

b.
```
                                     x            x
                       x    x        x    x       x
      x    x x        x    x x       x    x x      x    x
     [[$-$][$ $]] —> [[$-$][$ $]] —> [[$-$][$ $]] —> [[$-$][$ $]] —> ($-$)($ $)
```
Word   first cycle   second cycle Clash   association domain

Both (92a, b) are [M [M N]], with the difference that the first M in (92a) is monosyllabic, while that in (92b) is disyllabic.[xvii] This difference leads to their tonal differences: (92a) forms one association domain, but (92b) forms two. The metrical structures of (92a, b) are shown in (93a, b) respectively. In (93a), each word is first assigned a word stress. Then Compound Stress applies. Since Compound Stress is cyclic, it will first apply to the inner brackets (which include the last two syllables) and assign greater stress to the left member (which is the middle syllable). On the second cycle, Compound Stress assigns greater stress to the first syllable. Next Clash Resolution applies, removing stresses from the last two syllables. The output is one association domain. The metrical derivation in (92b) is similar, except that the first word is disyllabic, so the stress on the third syllable does not clash with the stress on the first. Thus, both stresses survive, giving two association domains.

Let us now look at non-nominal structures. First, consider [Adv A] structures, in which an adjective is modified by an adverb, such as very beautiful, more beautiful, most beautiful, so beautiful, etc. These expressions are phrases in English. In section 2, I suggested that they are also phrases in Chinese; that is why expressions like [[hen xin] shu] 'a [[very new] book]' are bad, since the phrase hen xin occurs inside an [M N] compound. If

I am correct, then [Adv A] should behave like [V O] and form two association domains, even if the first word is monosyllabic. This prediction is borne out.

(94)   (ka)(lo)   (lo)(lo)   (tsø)(lo)
        'so old'   'very old'   'most old—>oldest'

        (ka)(pʰʸo-lʸã)   (lo)(pʰʸo-lʸã)   (tsø)(pʰʸo-lʸã)
        'so pretty'   'very pretty'   'most pretty'

In previous studies of tonal domains, the fact that [Adv A] does not form a single association domain remains a stipulation. In a metrical analysis, it follows from the fact that [Adv A] is a phrase, so that A has greater stress, which cannot be removed by Clash Resolution.

In section 2, we also discussed that, in contrast to [Adv A], which is a phrase, [N A] and [Adj A] can be a compound; that is why [[N A] N] and [[Adj A] N] are possible, as shown in [[tao hong] se] 'peach-red color', [[zi hong] se] 'purple-red color', and [[da hong] se] 'big-red color—>bright-red color'. According to this analysis, [N A] and [Adj A] should be assigned Compound Stress, which is left-headed. When N, Adj and A are monosyllabic, [N A] and [Adj A] should form just one association domain. This is again correct, as the following Shanghai data show:

(95)   a.   (ka)(Hõ)   (lo)(Hõ)   (tsø)(Hõ)
                'so red'   'very red'   'most red—>reddest'
        b.   (do Hõ)   (tsz Hõ)   (du Hõ)
                'peach red'   'purple red'   'big red—>bright red'

In (95a), [Adv A] forms two association domains. In (95b), [N A] and [Adj A] form one association domain. This supports the analysis that [Adv A] is a phrase and [N A] and [Adj A] are compounds.

Let us now consider more [V O] structures. It has been noted that some [V O]s behave like a compound, such as <u>dan xin</u> 'to carry heart—>to worry', which may take another object. If <u>dan xin</u> is a compound, it should be assigned left-headed stress at the compound level, and so form one association domain. This prediction is borne out in Shanghai.

(96)   (nõ) (de-çĩ)   (sa)

        you carry-heart what

        'What do you worry about?'

Huang (1984) suggests that whether a [V O] is a compound or a phrase can be determined by whether it can take another object. But H. Zhang (1992) points out, correctly, that object-taking is an inadequate test. For example, an intransitive [V O] compound, such as <u>zou lu</u> 'walk road—>to walk', cannot take another object and so will be wrongly seen as a phrase in Huang's analysis. H. Zhang suggests instead that [V O] be tested on whether the O can be fronted in a <u>ba</u>-construction. But <u>ba</u>-fronting is itself an inadequate test, since not all objects accept <u>ba</u>-fronting, even if the object is a phrase. For example, *<u>wo ba ta xi-huan le</u> 'I BA-her like LE—>I liked her' is bad, but we cannot conclude that <u>xi-huan ta</u> 'like her' is a compound, just because <u>ta</u> cannot be <u>ba</u>-fronted.

Where syntactic tests fall short, phonological evidence turns out useful. In our analysis, if [V O] (with a monosyllabic V) is a compound, it should form one association

domain; if it is a phrase, it should form two association domains. Consider the following [V O] expressions in Shanghai:

(97)   a.   (tsɤ lu)   (ga   se-wu)

              walk road   saw mountain-river

              'to walk'   'to chat (on unimportant matters)'

        b.   (tsɤ) (kã-sz)   (ga) (mo'-dɤ)

              walk steel-wire   saw wood

              'to walk on tight-rope'   'to saw wood'

In (97a), both expressions form one association domain, indicating that they are compounds. In (97b), both expression forms two association domains, indicating that they are phrases.

Huang (1984) raised the possibility that a given [V O] may sometimes be a compound and sometimes a phrase. This again is confirmed by association domain formation:

(98)   a.   ŋu le'-le' (kʰø sz)   b.   ŋu le'-le' (kʰø)(sz)

              I Asp   read book   I Asp   read book

              'I am reading.'   'I am reading a book.'

When kʰø sz is used as a compound, it means 'reading' and forms one association domain; when it is used as a phrase, it means 'to read a book' and forms two association domains. A similar contrast can be obtained in a [S V] expression:

(99)   a.   <u>nõ</u> (dɤ   tʰõ va)   b.   <u>nõ</u> (dɤ) (tʰõ va)

           you head ache Q   you head ache Q

           'Do you have a headache?'   'Does your head ache?'

When <u>dɤ tʰõ</u> is used as a compound, it forms one association domain (together with the following unstressed particle); when it is used as a phrase, it forms two domains.

5.3. Compound stress and phrasal stress in Mandarin

Unlike in Shanghai, where stress is detectable by Stress Clash, Stress Reduction, and association domain formations, stress in Mandarin and most other Chinese dialects is less obvious. Yue-Hashimoto (1987) suggests that different dialects may have different prominence patterns, for example, the Wu family has left-dominance and the Min family has right-dominance. The Mandarin family presumably has no special dominance. A rather different proposal is made in Duanmu (1993), who argues that the difference between Shanghai and Mandarin lies in their syllabic weight. We have seen that in Shanghai, foot formations apply to syllables, and Stress Clash also occurs on neighboring syllables. This is because Shanghai syllables are generally mono-moraic, and what appears to be syllabic trochee is in fact moraic trochee. In contrast, Mandarin syllables are generally bi-moraic, therefore every full syllable will form a bi-moraic trochee and be inherently stressed by what is called the Weight to Stress Principle (Prince 1990). Higher levels of stress, such as Compound Stress and Phrasal Stress, will then no longer have obvious effects, nor will Stress Clash. To see why, let us assume that Mandarin has the same stress rules as Shanghai, and consider the metrical representations of two Mandarin expressions (m = mora):

(100) a.   Compound   b.   Phrase

```
       x                                    x
       x     x                            x     x
     (m m)(m m)                          (m m)(m m)

     chao fan                            chao fan

     fry   rice                          fry   rice

     'fried rice'                        'to fry rice'
```

Since every full syllable is bi-moraic, Stress Clash does not directly occur between two syllables. In addition, since every foot is bi-moraic, syllable lengthening is rarely necessary. Therefore, Compound Stress and Phrasal Stress cannot be detected easily, and both expressions in (100) sound similar in Mandarin. In particular, every full syllable is an association domain, thus it does not usually lose its tones or shift them to another syllable.

Nevertheless, I would like to point out two facts that suggest that Mandarin may have the same Compound Stress and Phrasal Stress as in English and Shanghai.

First, consider disyllabic compounds. There are three stress patterns, either both syllables are stressed, or the first syllable is stressed and the second unstressed, or the first syllable is stressed while the second is optionally unstressed. There is no Chinese compound in which the first syllable is unstressed while the second is stressed, even if the first syllable is a bound form. This fact is in agreement with the assumption that Mandarin Compound Stress is left-headed, as in English and Shanghai.[xviii]

Second, it has been noted that many Chinese words have elastic length, namely, they can be either disyllabic or monosyllabic, such as suan vs. da-suan 'garlic' and zhong vs. zhong-zhi 'to plant'. The popular explanation for this apparent redundancy is that modern Chinese lost many syllabic contrasts, giving too many monosyllabic homophones; consequently, disyllabic forms are created to avoid ambiguities (e.g., Lü 1963: 21, Wang

1944: 15). However, the popular view cannot explain why the elasticity of word length already existed in early history, as discussed by Guo (1938), or why Chinese is a monosyllabic language in the first place.

A more serious problem with the popular view is that the short and the long forms are not always interchangeable, even when they are completely synonymous. Consider the following examples:

(101)   [V   O   ]
    a. zhong-zhi   da-suan
    b. *zhong-zhi   suan
    c. zhong   da-suan
    d. zhong   suan
        plant   garlic   'to plant garlic'

(102)   [M   N   ]
    a. mei-tan   shang-dian
    b. mei-tan   dian
    c. *mei   shang-dian
    d. mei   dian
        coal   store   'coal store'

In (101), [2 1] (disyllabic monosyllabic) is bad, while in (102), [1 2] is bad. (101) and (102) represent a general tendency, namely, [2 1] is disfavored in [V O], and [1 2] is disfavored in [M N]. This asymmetry has been noted by Lü (1963) and Li (1990), among others, but has remained without good explanation. In particular, if the disyllabic form is created to avoid ambiguity, why should (101b) and (102c) be bad?

Guo (1938) offers a different view on this matter. He suggests that word length elasticity is due to the tempo of speech. The short forms are used at points where one speaks faster, and the long forms are used at points where one speaks slower. But exactly where should one speak faster and where slower? In particular, why is it possible for one to speak the V faster and the O slower in (101), but not the V slower and the O faster? And why is the pattern of tempo reversed in [M N]? These questions are left unanswered.

A more specific proposal is made by Duanmu — Lu (1990) and Lu — Duanmu (1991). They suggest that word length elasticity is due to metrical prominence. In particular, they suggest that a word with greater stress should not be shorter than a word with less stress. In addition, greater stress is assigned to the syntactic "non-head", namely, M in [M N] and O in [V O]. While a full account of the elasticity problem cannot be given here, the proposal of Duanmu — Lu is in agreement with the present analysis that [M N] is a word and [V O] a phrase, and that in Mandarin, Compound Stress is left-headed and Phrasal Stress is right-headed, just as they are in English and Shanghai.

6. Further issues

In the preceding discussions, I have shown that there is a convergence between phonological evidence and structural evidence in regard to wordhood in Chinese. In this section I explore some implications of our analysis.

6.1. Personal names and titles

It has not been clear whether personal names and titles should be considered phrases or compounds. In English, for example, personal names and titles behave like phrases in regard to stress. For example, the stress patterns of John Smith and Mr. Smith are similar to black bird rather than to blackbird. In Chinese, however, the reverse seems to

be true. Consider the following examples from Shanghai:

(103)   (wã çi-sã)   (lo wã)   (wã   li')

               Wang Mr   old Wang   Wang Li

               'Mr. Wang'   'Old Wang'   'Wang Li'

```
    x                    x                   x
    x   x                x   x               x   x
   ($)($  $)            ($)($)              ($)($)
```

        The association domain patterns of the above are similar to those of compounds. In

particular, the main stress is assigned to the first syllable, and the stress on the second

syllable is removed due to Stress Clash. The result is one association domain. A more

interesting case is as follows:

(104)   (dẽ ço) (bĩ)   or   (dẽ ço bĩ)

               Deng Xiao Ping

               'Deng Xiao-ping'

        In (104), dẽ is the family name, and ço bĩ the given names. As shown above, this

expression may form either two association domains or just one. In the former case, the

first two syllables form one association domain, and the third forms another. This means

that in the speaker's mind the three syllables have no internal structure, instead of being [$

[$-$]] as the spelling suggests. To see why, consider the metrical structures below:

```
(105)  a.     x                    b.     x                   x
              x      x                     x  x                x
             ($  $)($)                    ($)($-$)  ->  ($  $-$)
```

In (105a), the three syllables are treated as having no internal structure. Trochaic stress then groups the first two into one foot, and the third into another. Since the second foot is degenerate, it may merge with the first foot, giving one association domain. Alternatively, the third syllable may undergo lengthening to become a bimoraic foot, giving two association domains. In (105b), the three syllables are structured as [$ [$-$]], namely, the given names form an internal unit. In this case, the last two syllables will form a foot. At the compound level, another stress is added to the first syllable. Next, Stress Clash leads to the removal of the stress from the second syllable. This gives just one possible pattern for (105b), namely, ($ $-$). The fact that (104) has two association domain patterns shows that its metrical structure must be (105a) and not (105b).

Why should personal names behave differently in English and Chinese? The answer is not clear. We know, however, that not all compounds in English have left-headed stress. For example, in Madison Street the primary stress is on the first word, but in Madison Avenue it is on the second (Halle — Vergnaud 1987: 271-272). Perhaps personal names are also compounds in English but happen to have right-headed stress? An additional puzzle to note is that in English, the title (such as Mr or Professor) comes before the name, whereas in Chinese it comes after the name. But in both languages the title has less stress than the name.

6.2. A missing structure?

In English, there are three kinds of nominal structures, compound, phrase, and relative clause. In Chinese, however, there are just two nominal forms, [M N] and [M de N]. These are shown below:

(106) a. <u>blackbirds</u>   b. <u>black birds</u>   c. <u>birds that are black</u>

(107) a. <u>hei   niao</u>   b. <u>hei   de niao</u>

            black bird   black DE bird

It is not clear which English structure relates to which Chinese structure. Many people assume that (107a) relates to both (106a) and (106b), and (107b) relates to both (106b) and (106c). On the other hand, Sproat — Shih (1991) argue that (107b) exclusively relates to (106c), but whether (107a) relates to (106a) or (106b) or both is left unanswered. In the present analysis, all [M N] nominals are compounds, therefore (107a) exclusively relates to (106a). This again leaves an unanswered question as to how (107b) is related to (106b) and (106c).

If Sproat — Shih (1991) are right, then (107b) exclusively corresponds to (106c). And if the present analysis is also right, then (107a) exclusively corresponds to (106a). This leads to the unexpected conclusion that Chinese nominals are either words or relative clauses, with no "nominal phrases" in the traditional sense.

Another possibility, suggested by Bingfu Lu (personal communications), is that (107a) corresponds to (106a), both being compounds. (107b), however, can either be a phrase, as in <u>san zhi hei de niao</u> 'three black birds', or a relative clause, as in <u>hei de san zhi niao</u> 'three birds that are black'.

At this point, none of the analyses seems conclusive, and I leave the issue open.

6.3. <u>de</u>-omission

Our discussion has crucially depended on the presence and absence of <u>de</u> in a Chinese nominal. However, it seems possible that <u>de</u>-omission may occasionally occur. Consider the following (from Hashimoto 1969: 88):

(108)   wo shi ji   fan

       I   be   chicken rice

       'Mine is chicken rice.'

The literal meaning of (108) is 'I am chicken rice', but the actual meaning is 'Mine (my order) is chicken rice'. To get the actual meaning, it is reasonable to assume that after wo there is an underlying de, which is subsequently (and optionally) omitted. Similarly, personal pronouns like wo 'I' and ni 'you' usually cannot occur directly before a noun, but must be followed by the particle de, yet in some cases this de can be missing:

(109)   *wo shu   *wo shou   *ni   shu   *ni   shou

       I   book   I   hand   you book   you hand

      'my book'   'my hand'   'your book'   'your hand'

(110)   wo ba   wo ma ni   ba ni   ma

       I   dad   I   mom   you dad   you mom

      'my dad'   'my mom'   'your dad'   'your mom'

If de-omission occurs in (110), we ask if the expression will change into a compound. The answer seems to be no. Consider the following data in Shanghai (ge' in Shanghai corresponds to de in Mandarin):

(111)   (?a'-la' ge') (ya)   *(?a'-la' ge' ya)

       we   DE   father

      'our father'

(112)   (<u>?a'-la'</u>) (<u>ya</u>)   *(<u>?a'-la' ya</u>)

   we   father

'our father'

(111) is a phrase, whereby <u>ya</u> carries greater stress. Although <u>ya</u> is a monosyllabic foot, its primary stress makes it less likely to merge with the preceding foot. Instead, it remains a foot through lengthening. In (112), <u>ge'</u> = <u>de</u> is omitted. If (112) is now a compound, greater stress should be on the first syllable, and <u>ya</u> should optionally be able to merge with the first foot. On the other hand, if (112) remains a phrase, <u>ya</u> will carry the primary stress and remain a foot (through lengthening). The fact that (112) does not form one association domain shows that it is still a phrase, even without <u>ge'</u>.

As Chao (1968: 289) points out, <u>de</u>-omission is not a wide-spread rule; it usually occurs after a personal pronoun and before a personal relation. It does not, therefore, seriously affect the conclusions we have drawn so far.

6.4. Compound internal conjunction

In section 2, we discussed that phrases should allow Conjunction Reduction. Dai (1992) points out that conjunction may also occur inside a compound. Consider an example from Ling (1956: 13):

(113)   <u>xue-sheng he lao-shi men</u>

   student   and teacher Pl

'students and teachers'

The plural suffix <u>men</u> is a bound form, yet it is attached to a conjunction structure.

If men always attaches to a word, then xue-sheng he lao-shi 'student and teacher' should be a word. This is what Dai suggests. In addition, Dai argues that if [N and N] can be a word before a suffix, there is no reason why it cannot be a word without a suffix. Thus, Dai (1992: 119) considers the following sentence ambiguous:

(114)   [shu-cai he shui-guo] hen   you   ying-yang

       vegetable and fruit   much have nutrition

       a.   'Vegetables and fruits (as one of the food groups) are very nutritious.'

       b.   'Vegetables and fruits are very nutritious.'

According to Dai, (114a) is the reading when shu-cai he shui-guo is a compound, and (114b) is the reading when shu-cai he shui-guo is a conjunction of two phrases.

The fact that some compounds may contain an internal conjunction does not affect the assumption that phrases should permit Conjunction Reduction, and all the more so. In other words, if two conjoined expressions do not allow Conjunction Reduction, it is reasonable to assume that they are not phrases. Therefore, the conclusion that [M N] is a word and [M de N] a phrase remains unaffected.

6.5. [Neg V] and [Wh N] structures

     [Neg V] structures (where Neg = negation) are not often looked at in discussions on wordhood. If phonological evidence can provide independent tests, it may shed light on the structural properties of [Neg V]s. Consider the following cases in Shanghai:

(115)   a.   (va' tʰo-lẽ)   b.   (ma')(tʰo-lẽ)

        not discuss   not   discuss

        '(will) not discuss'   '(did) not discuss'

        Both va' (= bu in Mandarin) and ma' (= mei in Mandarin) are negation words. The

former forms one association domain with the verb, but the latter does not. In other words,

(115a) is a word but (115b) a phrase. What makes them different is not exactly clear to me.

But there is an additional difference between va' and ma' in Shanghai, namely, va' cannot

be used without the verb in answering a question, but m-ma', the disyllabic form of ma, can.

This is shown below:

(116)   Question   Answer

        a.   nõ tçʰi va   *va'   (va' tçʰi)

                you go   Q   not   (not go)

                'Will you go?' '(I) won't.'

        b.   nõ tçʰi ku va   m-ma'

                you go Asp Q not

                'Did you go?'   '(I) haven't.'

        In (116a), the answer cannot be va', but must be va' tçʰi. In (116b), the answer can

be just m-ma'.

        The wh-morpheme sa also has an interesting behavior. It sometimes acts as a prefix

and sometimes as a full word. Consider the following data in Shanghai:

(117) a. *<u>sa   mo</u>   *<u>sa   sz</u>

           which cat   which book

           'which cat?'   'which book?'

       b. <u>sa   ge' mo</u>   <u>sa   ge' sz</u>

           which DE cat   which DE book

           'which cat?'   'which book?'

(118) a. (<u>sa   ɲĩ</u>)   b. (<u>sa   me'-z</u>)   c. (<u>sa   di-fã</u>)   d. (<u>sa   zẽ-kʷã</u>)

           which person   which thing   which place   which time

           'who'   'what'   'where'   'when'

      (117) shows that <u>sa</u> usually cannot directly modify a noun; <u>ge'</u> (= Mandarin <u>de</u>) has

to be used between <u>sa</u> and the noun. However, (118) shows that <u>sa</u> can sometimes directly

modify a noun to give the meaning of a wh-word. It is therefore more appropriate to

consider (118a-d) as single words, rather than phrases. The fact that (118a-d) form one

tone domain supports this view.

6.6. Summary

      We have seen a few areas where wordhood raises interesting questions. There are

several other areas to which the present inquiry can be extended, such as verb-complement

constructions, resultative constructions, A-not-A constructions, wh-nominals, classifier

constructions, and V-V constructions. They will not be covered in this paper, however.

7. Conclusions

      I have argued that there is converging evidence from structural considerations that

a fairly clear distinction exists between words and phrases in Chinese. In particular, <u>de</u>-less

[M N] nominals, as well as their iterative derivatives, such as [M [M N]], [[M N] N], [[M N] [M N]], etc., are words, as argued by Fan (1958) and Dai (1992). In this view the Chinese word covers a significantly broader range of structures than has been assumed in most other works, such as Lu [1964], Lü (1979), and H. Zhang (1992). I have also shown that there is a rich body of metrical and tonal evidence for a distinction between words and phrases. Furthermore, I have shown that the phonological distinction is in agreement with the structural distinction. The fact that two independent lines of inquiry come to similar conclusions is encouraging news.

Notes:

[i].   Unless otherwise noted, the transcription of Mandarin Chinese will be in the standard Pinyin system, and the tone marking will often be omitted.

[ii].   Unlike in English, where it is easier to tell a compound (e.g., blackbird) from a noncompound (e.g., anti-pollution), in Chinese opinions often differ. For example, in xiao xing 'small-sized' the first morpheme is free but the second bound, and in fu-mu 'parents' (literally 'father-mother') both morphemes are bound. Some linguists call both expressions compounds since they do not contain affixes (e.g., Chao 1968: 359), others consider neither as a compound since they both contain bound morphemes (e.g., Dai 1992: 75).

[iii].   Chao (1968: 288) notes an apparent exception to the tendency that [M de N] cannot occur inside [M N]

(i)   zheng de cao-mei   gao
        whole DE strawberry cake

a.   'strawberry cake which is whole'

b.   'strawberry cake with whole strawberries'

        The reading (i.a) is what one expects, i.e. [A de [N N]]. However, (i.b), which seems to be [[A de N] N], was also heard. Chao suggests two reasons. First, there is a

reluctance to split the compound cao-mei gao 'strawberry cake' with de, so the expected

structure (ii) is not used:

(ii)   zheng cao-mei   de   gao

whole strawberry DE cake

'cake with whole strawberries'

Second, without splitting cao-mei gao 'strawberry cake', the next choice is to repeat

the word cao-mei, as in the following structure:

(iii)   zheng cao-mei   de cao-mei   gao

whole strawberry DE strawberry cake

'strawberry cake with whole strawberries'

(iii) is, however, rather wordy. If one omits the first cao-mei 'strawberry', the result

is (i.b). In other words, (i.b) is in fact not [[A de N] N] but [[A ø] de [N N]], where ø is the

omitted cao-mei.

[iv].   The de in a verb compound is different from the de in the nominal [M de N]. Cf.

Zhu (1961) for discussion on different de's.

[v].   Fan (1958: 214) notes a few exceptions, such as the following:

i.   zui   gao ji   ii.   zui   da   xian-du

most high level   most large limit

'the highest level'   'the top limit'

As Fan points out, these expressions are not productive and all involve the word

zui.

[vi].   In the examples below, only the intended meanings are shown. Other meanings

may be available but are irrelevant to our point.

vii.   Strictly speaking, in the X-bar theory, the rule should be NP—>[AP N], namely, the modifier is not an adjective but an adjective phrase. I simplify the matter for ease of discussion.

viii.   As Zhu points out, the expressions can be made more colloquial by reduplicating certain adjectives and/or adding some semantically empty elements.

ix.   The same may be said about the "transformability tests" of H.Zhang (1992: 46-47), who suggests that whether a [V N] is a compound or phrase should be determined by whether the N can be fronted with a <u>ba</u>-construction. For example (glosses are H.Zhang's):

(i)   <u>wo du shu</u>   —>   <u>wo ba shu du le</u>

        I read book   I BA book read LE

        'I read books.' 'I read books.'

(ii)   <u>wo sheng qi le</u> —>   *<u>wo ba qi sheng le</u>

        I bear gas LE   I BA gas bear LE

        'I am angry.'   'I am angry.'

        According to H. Zhang, (i) shows that <u>du shu</u> is a phrase, and (ii) shows that <u>sheng qi</u> is a compound. Two questions remain. First, does the transformed expression have the same meaning as the original? Second, does the transformed expression have the same structure as the original? Neither question can be given a positive answer.

        Besides, the transformability test has other limitations. It is applicable only to the so-called "disposable" verbs and not to other verbs. Consider:

(iii)   <u>ta pa gui</u>   —>   *<u>ta ba gui pa le</u>

he fear ghost   he BA ghost fear LE

'He fears ghost.'

(iv)   ta pa zhe-ge gui   —>   *ta ba zhe-ge gui   pa le

he fear this   ghost   he BA this   ghost fear LE

'He fears this ghost.'

In (iii) an (iv), the object cannot be fronted in a ba-construction. One cannot say that the VO part is a compound, since the demonstrative zhe-ge 'this' in (iv) shows that the object can be a phrase. Thus, the transformability test tells us nothing about whether pa gui is a compound or not. In fact, it is not clear whether the verb in (ii) is a "disposable" verb.

[x].   While (53a) contains a conjunction, it need not have come from Conjunction Reduction, since 'potato-and-meat eaters' does not mean 'potato eaters and meat eaters'. If this is the general case with compound internal conjunctions, then perhaps no compounds allow Conjunction Reduction. Thus, in addition to saying that if Conjunction Reduction fails to apply, the conjoined parts must be words, we may further say that if Conjunction Reduction applies, the conjoined parts must be phrases.

[xi].   See Gussenhoven (1991) for the view that stress is only assigned at the word level. At higher levels, stress deletion takes place, instead of further stress assignment.

[xii].   This variety is called New Shanghai by Xu et al. (1988). Like in other Wu dialects, onset voicing has certain effects on tone, but they are ignored. The transcription is in phonetic symbols.

According to Duanmu (1993), all Shanghai syllables are underlyingly CV, with one onset position and one rime position. In particular, ['] is used for glottalization of the vowel, replacing the traditional [?] coda, and traditional [VN] (vowel-nasal) is replaced

with a nasalized vowel. In addition, a syllabic consonant, such as [ŋ] 'fish', should strictly

speaking be written as [ŋŋ] or [ŋ:], or perhaps represented as follows:

(i)   CV
            \/
            ŋ

        With this cautionary note, and for typographic convenience, I continue to use a

single symbol for a syllabic consonant.

^{xiii}.   Strictly speaking, tones are not linked to syllables but to moraic segments.

However, in the Shanghai data we look at, all syllables are mono-moraic, so there is no

confusion. For more discussions, see Duanmu (1993).

^{xiv}.   Instead of deleting the stress on V in (83b) and re-assigning a stress to it later, one

may regard avoiding Stress Clash and exhaustive parsing as constraints on the output, and

different means can be used to satisfy them. For example, when Stress Clash occurs, one

may delete the weaker stress if the headless foot can merge with another foot, otherwise

one lengthens a foot so that the stresses are no longer adjacent.

^{xv}.   I suspect, however, that sometimes the monosyllabic verb before an object noun

may remain unfooted, in which case it will not surface with its full tones, nor will it be

lengthened. This agrees with the description of Xu et al. (1988) that the tone of the verb

before an object noun is much reduced.

^{xvi}.   Again, two things may happen to this monosyllabic foot. Either it will lengthen to a

bi-moraic foot, as is the usual case, or it may cease to be a foot and merge with the

preceding foot. The latter situation may happen when the first syllable ç̃ɪ has emphatic

stress, as suggested by Selkirk — Shen (1990).

^{xvii}.   It can be argued that ç̃ɪ -çi is a compound; even so, its output is the same.

[xviii].   Chao (1968: 35) says that in a compound with no unstressed syllables, the last syllable has greater stress than the rest. The phonetic study of Lin et al. (1984) shows that in disyllabic compounds read in isolation where both syllables are stressed, the second syllable is indeed longer (265 ms vs. 301 ms for one speaker, and 317 ms vs. 346 ms for another). This lengthening may have been due to the phrase-final effect, however.

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