Stress and Syntax-Phonology Mismatches:
Tonal Domains in Danyang and Shanghai

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Abstract

This paper analyzes tonal domains in Danyang and Shanghai by applying stress rules cyclically through syntactic bracketing. Section 1 presents the data, followed by the analysis in section 2. In section 3, I discuss how Danyang and Shanghai relate to recent debates on the relation between prosodic rules and syntax, in particular how independent the former are from the latter, and how syntax-phonology mismatches may arise.[1]

1. The Data

Both Danyang (Danyang) and Shanghai (Shanghai) are members of the Wu family, a major dialect family of Chinese. Data on Danyang are from Lü (1980). Data on Shanghai are mainly from Xu et al (1981-1983) and Selkirk & Shen (1990), as well as from my own informants.

Many Wu languages exhibit 'phrasal sandhi', whereby the tonal pattern of a phrasal (or compound) domain is determined by the underlying tones of the initial syllable. We show this in (1)-(2) with Shanghai.[2]

(1) Word tones

fu 'fire'	tso 'car'	lo 'old'
MH	HL	LH

(2) Phrasal sandhi

a.	fu	tso →	fu	tso →	fu tso 'fire-car (train)'
	MH	HL	MH		M H
b.	lo fu	tso →	lo fu	tso →	lo fu tso 'old train'
	LH MH	HL	LH		L H (L)

The underlying tones of each syllable are given in (1). (2) shows phrasal sandhi: first, tones on noninitial syllables are deleted; then the second tone of the initial syllable is shifted to the second syllable; finally, a toneless syllable gets L as default.

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[1] I would like to t hank M. Halle, M. Kenstowicz, A. Marantz, Y.F. Li, B.F. Lu, S.Y. Luo, H.J. Wang, Y.W. Wu, X.Y. Zhou and the audience at WCCFL X, in particular Lisa Selkirk, for discussions.

[2] This variety of Shanghai is spoken by younger people. Older people speak a different variety, sometimes called 'Old Shanghai', described by Sherard (1972) and Shen (1981).

The phrasal sandhi in Danyang is, in essence, the same as that in Shanghai, in that, first, the underlying tones of noninitial syllables are deleted, and then the underlying tones of the initial syllable spread over the entire phrase in some way.[3] However, we will not discuss the underlying tones and the ways of spreading in Danyang. Instead, we will focus on how a tonal domain is determined.

Tonal domains in Danyang and Shanghai are sensitive to two factors, namely, syntactic relations and word length. In syntactic [Head Nonhead] relations, there is always a domain break between the two constituents, while in syntactic [Nonhead Head] relations, there is not always a domain break. For example, [V N] *tsʰo ve* '(to) fry rice' always forms two domains, but [A N] *lã ve* 'cold rice' always forms one. Some syntactic [Nonhead Head] structures can form two domains, and this depends on the word lengths of the constituents. For example, in [A N] structures, [l 2] (monosyllabic + bisyllabic) and [1 1] (monosyllabic + monosyllabic) always form one domain, as in *tʰieʔ si-tsz* 'iron lion' and *lã ve* 'cold rice', but [2 l] and (2 2] may form either one or two, as in *ɲeʔ-sz bin* 'hot-water bottle' and *zã-he tsʰo-ze* 'Shanghai Station'. For reason of space, we will only discuss syntactic [Nonhead Head] structures in this paper.

Below we summarize the domain patterns in bisyllabic through quadrisyllabic phrases, shown in (3)-(12), where parentheses indicate tone sandhi domains. The data are in Danyang, whose author does not discuss longer phrases.[4] Data in Shanghai will be noted when they differs from those in Danyang, or when a certain pattern is missing from Danyang. Transcription is given in the Pinyin system. In all examples, the word order in Danyang and Shanghai is the same as that in English. The syllable sign 'σ' is used for convenience only; nothing is implied for the view that metrical structures are constructed on syllables (cf. Halle & Vergnaud (1987), who argue that metrical and syllabic structures lie on separate plane).

(3) Multisyllabic morphemes form one domain (σσ…)

[piao-liang]	(σσ)	漂亮	'pretty'
[ka-fei]	(σσ)	咖啡	'coffee'
[bai-lan-di]	(σσσ)	白兰地	'brandy'
[a-si-pi-lin]	(σσσσ)	阿司匹林	'aspirin'

(4) [l l] forms one domain (σσ)

[re shui]	(σσ)	热水	'hot water'
[hong hua]	(σσ)	红花	'red flower'
[tao hua]	(σσ)	桃花	'peach flower'

[3] Danyang has two styles of speech, literary and colloquial. 'Phrasal sandhi' occurs only in colloquial speech.

[4] Some patterns may have a few exceptions. We will focus on the dominant cases. For example, in Danyang most multisyllabic morphemes form one domain, but some form two domains, with the final syllable being a separate domain, e.g., *(gao-er)-(fu)* 'golf'. We may assume that in these morphemes the last syllable is marked extrametrical. When another syllable is added to such words, the extrametricality disappears. Thus, in *(gao-er-fu) (qiu)* 'golf ball', *fu* is no longer extrametrical, and *gao-er-fu* forms one domain. In addition, we will not discuss idiomatic phrases, nor what L Lü calls 'flat structures', such as *cai mi you yan* 'firewood, rice, oil, salt (daily necessities)' and *dong nan xi bei* 'east, south, west, north (everywhere)'.

(5) [l 2] forms one domain (σσσ)

[tie shi-zi]	(σσσ)	铁狮子	‘iron lion’
[ni pu-sa]	(σσσ)	泥菩萨	‘clay Buddha’
[ye [kuai che]]	(σσσ)	夜快车	‘night fast-car (express)’
[xin [bei men]]	(σσσ)	新北门	‘new north gate’

(6) [2 1] forms (σσ)(σ) or (σσσ)

[[ci-gu] pian]	(σσ)(σ)	慈姑片	‘arrowhead slice’
[[re shui] ping]	(σσ)(σ)	热水瓶	‘hot water bottle’
[[jin shi] yan]	(σσσ)	近视眼	‘short-sighted eye’
[Shang-hai ren]	(σσσ)	上海人	‘Shanghai person’
[[yang mao] shan]	(σσσ)	羊毛衫	‘sheep -wool sweater’
[[xiao zi] bao]	(σσσ)	小字报	‘small-character poster’

(7) [l [1 2]] forms (σσσσ)

[ye [bai ju-hua]]	(σσσσ)	野白菊花	‘wild white daisy’
[zhen [jin jie-zhi]]	(σσσσ)	真金戒指	‘real gold ring’
[fu [zhong zhi-hui]]	(σσσσ)	副总指挥	‘vice general director’

(8) [l [21]] forms (σσσσ) or (σσσ)(σ)

[lao [huo-che zhan]]	(σσσσ) or (σσσ)(σ)	老火车站	‘old train station’
[jiu [jao-ta che]]	(σσσσ) or (σσσ)(σ)	旧脚踏车	‘old foot-pedal car’
[xin [ti-yu guan]]	(σσσσ) or (σσσ)(σ)	新体育馆	‘new phys.-ed. hall (gym)’

(9) [[1 2] l] forms (σσσ)(σ) or (σσσσ)

[[qing gong-ye] ju]	(σσσσ) or (σσσ)(σ)	轻工业局	‘light industry bureau’
[[hu luo-bo] si]	(σσσ)(σ)	胡萝卜丝	‘foreign radish (carrot) shred’
[[qiu hai-tang] hua]	(σσσ)(σ)	秋海棠花	‘fall crabapple flower’

(10) [[2 l] l] forms (σσ)(σ)(σ) or (σσσ)(σ)

[[re-shui ping] dan]	(σσ)(σ)(σ)	热水瓶胆	‘hot-water bottle liner’
[[yu-gan you] wan]	(σσ)(σ)(σ)	鱼肝油丸	‘fish-liver oil ball’
[[zi-lai shui] bi]	(σσσ)(σ)	自来水笔	‘fountain water pen’

(11) [2 2] forms (σσσσ) or (σσ)(σσ)

[Shanghai che-zhan]	(σσσσ) or (σσ)(σσ)	上海车站	‘Shanghai Station’
[Kailuan mei-kuang]	(σσσσ) or (σσ)(σσ)	开滦煤矿	‘Kailuan coal-mine’
[zi-ran ke-xue]	(σσσσ)	自然科学	‘natural science’

[be-jing da-xue]	(σσσσ)	北京大学	‘Peking University’
[wei-xin zhu-yi]	(σσσσ)	唯心主义	‘ideal-ism’
[dian-deng kai-guan]	(σσ)(σσ)	电灯开关	‘lamp switch’
[she-hui ke-xue]	(σσ)(σσ)	社会科学	‘social science’
[wei-wu zhu-yi]	(σσ)(σσ)	唯物主义	‘material-ism’

(12) [3 l] forms (σσσ)(σ) or (σσσσ)

[a-er-tai shan]	(σσσ)(σ)	阿尔泰山	‘Altai Mountain’
[qiao-ke-li tang]	(σσσ)(σ)	巧克力糖	‘chocolate candy’
[gao-er-fu qiu]	(σσσ)(σ)	高尔夫球	‘golf ball’
[e-mi-tuo fu]	(σσσσ)	阿弥陀佛	‘Amitabha Buddha’

The only quadrisyllabic pattern not given by Lü is [l 3]. From his remark that [l 3] forms one domain (p.109), and the fact that [l 3] forms one domain in Shanghai, we add this pattern in (13).

(13) [l 3] forms (σσσσ)

[bei ai-er-lan]	(σσσσ)	北爱尔兰	‘Northern Ireland’
[da tuo-la-si]	(σσσσ)	大托拉斯	‘big trust’
[bai fan-shi-lin]	(σσσσ)	白凡士林	‘white Vaseline’

(6) and (8)-(12) each has two domain patterns. In (6), some phrases prefer one pattern, and some prefer the other. In (11), some prefer one, some prefer the other, and some prefer both. In (8) both patterns are equally preferred. One may ask why, in each of these structures, not both patterns are equally preferred by all phrases. I have no good explanation for this, except pointing that in Shanghai, all expressions in (6) and (8)-(12) may occur in either pattern. I will therefore consider all domain patterns in (6) and (8)-(12) to be proper ones.

2. The Analysis

In this section, I propose an analysis of the data in section 1. For reason of space, I give the proposal directly. I discuss alternative analyses only briefly in section 3.

My analysis is based on stress metrics. There are three reasons for taking this approach. First, as Lü points out (p. 89), in each domain, the initial syllable is stressed. Initial stress is also noted in Shanghai (Xu et al.). Second, it often happens that lack of stress may lead to tone 1oss. For example, in the Mandarin words *di(HL) fang(H)* → *di(HL) fang* ‘place’, *huang(MH) gua(H)* → *huang(MH) gua* ‘cucumber’, and *xiao(HL) hua(HL)* → *xiao(HL) hua* ‘joke’, the second syllable in each word is unstressed and loses its underlying tone, to become the so-called ‘neutral tone’. The fact that the lack of stress may lead to tone loss is easy to understand: if stressless vowels may lose height and frontness and reduce to schwa, they may also lose their tonal features. The fact that in Danyang and Shanghai, noninitial syllables lose their underlying tones

may thus be attributed to their lack of stress. Third, tonal domains can be changed if one puts additional stress on certain words, such as happens in contrastive speech. Consider a case in Shanghai, shown in (14).

(14) a. (poʔ-tɕin da-ɦoʔ)
Peking big school
'Peking University'

b. (poʔ-tɕin tsõ-ɦoʔ)
Peking middle school
'Peking Middle School'

c. (poʔ-tɕin) (**da**-ɦoʔ), (veʔ-zi) (poʔ-tɕin) (**tsõ**-ɦoʔ)
Peking BIG school not Peking MIDDLE school
'Peking UNIVERSITY, not Peking MIDDLE school'

Normally, 'Peking University' and 'Peking Middle School' each forms one domain, as in (14a, b). However, when *da* and *tsõ* are in contrast, as in (14c), they receive extra stress, and each starts a new tonal domain.

The present proposal includes three general assumptions, given in (15), and three rules for Danyang and Shanghai, given in (16)

(15) a. Stress Equalization Convention (SEC): On each cycle, add asterisks to the newly introduced element, so that it has the same number of asterisks as the highest column of the previous cycle.
b. Clash Rule: On each cycle, if a column of asterisks is adjacent to a higher column, remove the lower column.
c. Column Lowering: On each cycle, if there is only one column of asterisks, delete all the asterisks except the top one.

(16) In Danyang and Shanghai:
a. Assign left-headed stress to each morpheme and then to each syntactic [Nonhead Head] unit.[5]
b. Stress Reduction (noncyclic): optionally delete the lowest line of asterisks.
c. The tonal domain starts from a stressed syllable and includes all stressless syllables to the right, up to just before the next stressed syllable.

For (15a) and versions of (15b), I refer the reader to Halle & Vergnaud (1987). For (15c), we note that although many languages contrast stressed and stressless monosyllables, no language contrasts different degrees of stress on a monosyllable, such as <1> (highest stress), <2> (secondary stress) and <3> (ternary stress), in addition to <0> (no stress). Similarly, although on bisyllabic words, a language may contrast <l 2> (primary + secondary) with <l 0> (primary+ stressless), no language that contrasts <l 0> (primary + stressless) with <2 0>

[5] In fact, above the morpheme level, stress is assigned to every syntactic Nonhead. Thus, in a syntactic [Head Nonhead] unit, stress goes to the second constituent, and so there is always a domain break between the two constituents, as mentioned in section l. Since in this paper we only discuss syntactic [Nonhead Head] structures, left-headed stress is in effect assigned on all cycles.

(secondary + stressless). Such phenomena suggest that the degree of stress on a stressed syllable is relative, not absolute. (15c) reflects this fact, and will be shown to play an important role in Danyang and Shanghai. Finally, (16b) is a language particular rule that obliterates weaker stresses. Just as extrametricality does not apply to a monosyllable, (16b) does not apply when there is only one line of stress, otherwise there will be no stress left.

We are now ready to derive the patterns in (3)-(13). Consider multisyllabic morphemes first, which forms one domain, illustrated in (17).[6]

(17) (*)
[ka-fei] → (σσ) 'coffee'

The word *ka-fei* has no internal bracketing, so it undergoes just one cycle, on which (16a) assigns an asterisk to the initial syllable, and by (16c), the word forms one tonal domain. Next, consider [l l] in (4), shown by *re shui* 'hot water' in (18).

(18)	(*)	(*)	
	(*) (*)	(*)	(*)
	[re shui] →	[re shui] →	[re shui] → (σσ)
		Clash	C. L.

First, each morpheme gets an asterisk. Next, another asterisk is assigned to the Nonhead *re*. Now both syllables have stress, triggering the Clash Rule, which removes stress from *shui*. Finally, Column Lowering (C.L.) removed the lower asterisk from *re*. The result is one tonal domain.

(17) and (18) show that two monosyllabic morphemes [l l] give the same output as a bisyllabic morpheme. This is achieved by the Clash Rule and Column Lowering. Next we look at [1 2] in (5), which forms one domain, shown in (19).

(19)		(*)	(*)	
	(*)(*)	(*)(*)	(*)	(*)
	[σ [σ σ]] →	[σ [σ σ]] →	[σ [σ σ]] →	[σ [σ σ]] → (σσσ)
		Clash		C. L.

The first syllable gets an asterisk on its own cycle. Whether the innner [σσ] is a bisyllabic morpheme or two monosyllabic morphemes will give the same result, as seen in (17)-(18). Next, the first syllable, which is the syntactic Nonhead, gets another asterisk, followed by the Clash Rule, which removes stress from the second syllable. Finally, Column Lowering removes the lower asterisk from the first syllable. The result is one domain. Next we consider [2 l] in (6), which may form either (σσ)(σ) or (σσσ), shown in (20).

[6] For brevity, my metrical notation below differs slightly from that of Halle & Vergnaud. However, this is immaterial to the conclusion we draw.

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(20)  a.  (*      )                    b.  (*      )
          (*   )(*)                         (*   )(*)        (*      )
         [[σ σ] σ] → (σσ)(σ)               [[σ σ] σ] →    [[σ σ] σ] → (σσσ)
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The derivation of the inner [σ σ] is as in (17)-(18). The third syllable gets an asterisk on its own cycle. Next, the first syllable gets another asterisk. Now the Clash Rule cannot apply, since the two stresses are not adjacent. Nor can Column Lowering apply, since there are two columns of asterisks. However, since the highest column has more than one asterisk, Stress Reduction may apply. If it does, we get one domain, as in (20b) ; otherwise we get two domains, as in (20a). Next consider [l [l 2]] in (7), which forms one domain, shown in (21).

```
(21)  (*          )    (*          )
      (*)(*       )    (*)              (*          )
      [σ [σ [σ σ]] → [σ [σ [σ σ]] → [σ [σ [σ σ]] → (σσσ)
                     Clash          C.L.
```

The derivation of the last three syllables [σ [σ σ]] is as in (19), and the first syllable gets an asterisk on its own. Next, the first syllable gets another asterisk, followed by the Clash Rule and Column Lowering, giving one domain. Next consider [l [2 1]] in (8), which may form (σσσ)(σ) or (σσσσ), shown in (22).

```
(22)                        (*          )      (*          )
       (*      )             *  (*      )       *
      (*) (*   )(*)         (*) (*   )(* )     (*)      (*)
      [σ [[σ σ] σ]] →       [σ [[σ σ] σ]] →    [σ [[σ σ] σ]] →   a. (σσσ)(σ)  no S.R.
                            Clash                                b. (σσσσ)    after S.R.
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The derivation of the last three syllables [[σ σ] σ] is as in (20a); Stress Reduction does not apply here yet, but we shall consider it shortly. Next, the Stress Equalization Convention adds an asterisk to the first syllable (which already has one from its own cycle), followed by another asterisk assigned to the first syllable. Next, the Clash Rule applies, removing the column from the second syllable. Finally, Stress Reduction can optionally apply here; if it does not, we get (22a), otherwise we get (22b). Next we look at [[l 2] l] in (9), which may form (σσσ)(σ) or (σσσσ), shown in (23).

```
(23)   (*          )
       (*      ) (*)
       [[σ [σ σ]] σ] →   a. (σσσ)(σ)   without S. R.
                         b. (σσσσ)     after S.R.
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The derivation of the first three syllables [σ [σ σ]] is as in (19). Next, the first syllable gets another asterisk. If we apply Stress Reduction, we get (23b), otherwise (23a). Next consider [[2 l] l] in (10), shown in (24).

(24)

```
                          (*                  (*
   (*       )             (*       ) *        (*       ) *
   (*   )(*)(*)           (*   )(*)(*)         (*   )   (*)
[[[σ σ] σ] σ] →      [[[σ σ] σ] σ] →      [[[σ σ] σ] σ] →  (σσσ)(σ)
                     Clash
```

First, the derivation of the first three syllables [[σ σ] σ] is as in (20a) and the fourth syllable gets an asterisk on its own. Next, the Stress Equalization Convention adds an asterisk to the fourth syllable, before the first syllable gets another asterisk. Now the last two syllables are both stressed, triggering the Clash Rule (15b) to remove the lower column on the third syllable. At this point, the final syllable has two asterisks, while Stress Reduction (as stated) can only remove the lowest line of asterisks once. So, whether Stress Reduction applies or not, the result is still (σσσ)(σ).

Recall, however, that [[2 1] 1] has two sandhi patterns in Danyang, (σσσ)(σ) and (σσ)(σ)(σ), as seen in (10), yet our analysis cannot derive the latter. It is worth noting though that in Shanghai, (σσ)(σ)(σ) is not possible for [[2 1] 1] (or for any other structure). I leave it open whether the reported Danyang pattern (σσ)(σ)(σ) is influenced by the 'reading style', in which each syllable keeps its own tones, and no tone sandhi takes place.

Next we look at [2 2], seen in (11), which may form (σσ)(σσ) or (σσσσ). The analysis is shown in (25).

(25)

```
  (*          )
  (*   )(*   )
[[σ σ][σ σ]] →     a. (σσ)(σσ)     without S.R.
                   b. (σσσσ)       after S.R.
```

The derivation for each inner [σ σ] is as in (17)-(18). Next, the first syllable gets another asterisk. Without Stress Reduction, we get (25a), otherwise (25b). Next consider the analysis of [3 1] in (12), which forms (σσσ)(σ) or (σσσσ), shown in (26).

(26)

```
  (*          )
  (*      )(*)
[[σ σ σ] σ] →  a. (σσσ)(σ)     without S.R.
               b. (σσσσ)       after S.R.
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Again, the alternation comes from Stress Reduction; without it we get (σσσ)(σ), otherwise (σσσσ). Finally, let us consider [l 3] in (13), which forms (σσσσ), shown in (27).

(27)

```
(*          )      (*          )
(*)(*     )        (*)                (* )
[σ [σ σ σ]] →      [σ [σ σ σ]] →      [σ [σ σ σ]] → (σσσσ)
                   Clash              C.L.
```

The derivation is similar to that of [l 2] in (19), and we get (σσσσ) as predicted. This completes our analysis of (3)-(13).

To summarize, we have shown that tonal domains in Danyang and Shanghai can be derived by applying stress rules cyclically from the morpheme up through the entire phrase. Alternative patterns are due to Stress Reduction (16b), which optionally deletes the lowest line of asterisks. The asymmetry between [1 2] and [2 l) is attributed to the Clash Rule (15b). We also assumed Column Lowering (15c) to ensure that a bisyllabic morpheme gives the same result as two monosyllabic morphemes, that a trisyllabic morpheme gives the same result as [l 2], etc. Without Column Lowering, we cannot always derive alternative patterns. To see this, compare *[[re shui] ping]* 'hot-water bottle' and *[ci-gu pian]* 'arrowhead slice', shown in (28).

```
(28)  a.  (*          )
          (*     )( * )
          [[ci-gu] pian] →  i.  (σσ)(σ)    without S.R.
                            ii. (σσσ)      after S.R.

      b.                                        ( *          )
          ( *     )          ( *     )          ( *     )  *
          ( *) ( * )  (*)    ( * )     ( * )    ( * )     ( * )
          [[re shui] ping] → [[re shui] ping] → [[re shui] ping] → (σσ)(σ)
```

In (28a), there are two morphemes, *ci-gu* and *pian*. On the morpheme level, the first and third syllables each get an asterisk. Next, *ci* gets another asterisk. Without Stress Reduction, we get (28a.i); with Stress Reduction, we get (28a.ii).

(28b) has three morphemes, each of which gets an asterisk on its own cycle. On the cycle for *[re shui]*, *re* gets another asterisk, followed by the Clash Rule, removing the asterisk from *shui*. On the final cycle, Stress Equalization Convention adds an asterisk to *ping*, and then *re* gets another asterisk. Now if Stress Reduction can only apply once, as it is stated in (16b), then (28b) will yield (σσ)(σ) regardless of whether Stress Reduction applies. In other words, although both (28a, b) are [2 l], without Column Lowering we may wrongly predict that (28a) and (28b) would yield different results. Thus, Column Lowering is not a trivial rule.

3. Discussion

There has been much recent debate as to how much syntactic information is available to prosodic phonology (see Inkelas & Zee 1990 for a review). At one extreme is the 'Prosodic Hierarchy' theory, advanced by Nespor & Vogel (1986) and earlier works of Selkirk, and summarized by the following words from Hayes

> 'A central claim of the (Prosodic Hierarchy) theory is that direct-syntax rules do not exist.' (Hayes 1990: 87)

> ‘…metrical rules NERVER refer to syntactic bracketing, only to prosodic bracketing. In other words, syntax has effects in metrics only insofar as it determines the phrasing of the Prosodic Hierarchy.’ (Hayes 1989: 224)

To see whether this position is correct, one must clarify what a ‘prosodic’ rule is, and how prosodic domains are determined. For example, English word stress rules do not constitute a counter-example. First, one can argue that word stress rules are not prosodic rules. Second, one can argue that word stress only looks at ‘morphological’ bracketing, not ‘syntactic’ bracketing.

Hayes (1990: 107) offers seven ‘Diagnostics for True Phrasal Phonology’, one of them being ‘spreading...over multiple syllables’. By this standard, phrasal sandhi in Danyang and Shanghai, shown in (1)-(2), must be a true phrasal process. But does phrasal sandhi in Danyang and Shanghai depend on syntax? In a sense, it does not, since one may say that it refers only to stress domains. But if stress domains refer to syntax, as we have proposed in section 2, then the independence of phrasal sandhi from syntax becomes trivial. In addition, the stress rule (16a) is, arguably, itself a ‘true phrasal rule’, since it operates on entire phrases.

There are two solutions to the problem. First, one may suggest a different way of forming tonal domains in Danyang and Shanghai, without using (15)-(16). One alternative is the ‘end-based’ analysis of Selkirk & Shen (1990), who suggest that tonal domains in Shanghai start from the left-end of every lexical word or compound, and the left-end of every lexical XP (NP, AP, and VP). However, their analysis cannot account for the ‘word length’ effect, such as the asymmetry between [1 2] and [2 l], in a simple way. For example, consider

(29)	a.	[tie [shi-zi	→ *(σ)(σσ)	‘iron lion’
	b.	[ci-gu [pian	→ (σσ)(σ)	‘arrowhead slice’

If (29a, b) each contains two words, then according to Selkirk & Shen, (29a, b) should each form two domains, since there are two left-ends of words. But (29a) forms just one domain. We achieved this by the Clash Rule, as shown in (19). Selkirk & Shen cannot readily employ the Clash Rule, since their analysis is not based on stress.

The second solution, suggested by Selkirk (personal communication 1991), is that all the examples in (4)-(13) are ‘compound words’, and so we are not discussing prosodic phonology after all, but merely word level phonology. The cost of this suggestion is that Selkirk & Shen must revise their analysis of Shanghai, because if all expressions in (4)-(13) are compounds, they should all form just one domain. The gain of the suggestion, though, is that the Prosodic Hierarchy theory still stands.

The distinction between a compound and a phrase in Chinese is controversial, and we cannot go into it here. Nonetheless, there are expressions that are clearly not compounds, yet they still show the word length effect. Consider a few cases in Shanghai, shown in (30).

(30)	a.	se pã	(σσ)	‘three pounds’
	b.	se ã-sz	(σσσ)	‘three ounces’
	c.	se-zeʔ pã	(σσσ) or (σσ)(σ)	‘thirty pounds’
	d.	se-zeʔ ã-sz	(σσσσ) or (σσ)(σσ)	‘thirty ounces’

In our analysis, (30a-d) are respectively [1 l], [1 2], [2 l], and [2 2], and their domains are derived in (18)-(20) and (25) respectively. According to Selkirk & Shen, each phrase in (30) contains two words, so (30a-d) should each form two domains, which is incorrect.

An important argument for Prosodic Hierarchy comes from ‘syntax-phonology mismatches’. Consider a case in Italian, shown in (31).

(31)

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        |
       _____
      |     |
      |  _____________
      |  |            |
      |  |        _____________
      |  |        |           |
      |  |        |  _________________
      |  |        |  |                 |
      |  |        |  |              _____
      |  |        |  |              |   |
     XP V       XP  N              XP   A
     Ho_visto | tre_colibri        | molto scuri
     I saw      three hummingbirds  very dark
     ‘I saw three very dark hummingbirds’
```

There is consonant gemination (Raddoppiamento Sintattico) between *Ho visto* and between *tre colibri* (shown by underline), but not between *visto tre*. According to Nespor & Vogel (1986, 170-172), (31) is evidence that phonological rules do not follow syntax, since neither *Ho visto* nor *tre colibri* forms a syntactic domain. Rather, *Ho visto* and *tre colibri* are ‘phonological phrases’, which exist independent of syntax.

However, not all syntax-phonology mismatches are evidence for Prosodic Hierarchy. For example, [[1 2] l] in (9) can form (σσσ)(σ), and [l [2 l]] in (8) can form (σσσ)(σ) as well. In [[1 2] 1] > (σσσ)(σ), there is no syntax-phonology mismatch; the first three syllables form a tonal domain as well as a syntactic domain. But in [1 [2 1]] > (σσσ)(σ), there is a mismatch; the first three syllables form a tonal domain but not a syntactic domain. Nevertheless, we already saw that such mismatch simply follow from the application of stress rules and the fact that tone sandhi domains depend on stress.

There is an alternative analysis for (31), too. Cinque (1990) argues that, universally, phrasal stress is assigned in such a way that the more deeply embedded constituents have greater stress than less deeply embedded ones.[7] In (31), *Ho* and *tre* are more deeply embedded (with higher X-bar levels) than *visco* and *colibri*, so *Ho* and *tre* have greater stress than *visto* and *colibri*. Now if the Italian consonant gemination occurs between a stressed word and an unstressed one, in that order, then the result in (31) simply follows. In other words, the ‘phonological phrases’ in (31) could be an artifact of a syntax-dependent stress assignment.

Prosodic rules evidently have their independence. For example, the Clash Rule and the Stress Equalization Convention do not, it seems to me, follow from clear syntactic motivation.

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[7] This stress assignment is very close co that proposed by Duanmu (1990), who suggests that in a syntactic [Nonhead Head] or [Head Nonhead] relation, stress is assigned to the syntactic Nonhead. Duanmu calls his stress assignment Nonhead Stress (NHS). Fort both Cinque and Duanmu, phrasal stress is assigned cyclically through syntactic bracketing, and the direction of stress on a certain cycle is determined solely by syntactic relations.

The interaction of such rules may thus lead to prosodic domains that differ from syntactic domains, or syntax-phonology mismatches. However, the independence of prosodic rules and their ability to refer to syntax need not mutually exclude each other.

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