A Theoretical exploration of Prosodic Syntax

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Abstract : The study investigates prosody-constrained syntax and its implications. The striking facts revealed here lead naturally to some theoretical considerations: How can we capture the implication exhibited from the facts that prosodic features may be syntactic as well, and how can we accommodate them into contemporary linguistic theories? Furthermore, what will the architecture of the grammatical system look like with respect to prosodically constrained syntax? This study attempts to investigate these questions.

Keywords : prosodic syntax, filter model, prosodically triggered verb reduplication, prosodically triggered resultative verb raising, bidirectional hypothesis

In previous studies we have seen a variety of structures that are strictly constrained by prosody. The striking facts revealed here lead naturally to some theoretical considerations: How can we capture the implication exhibited from the facts that prosodic features may be syntactic as well, and how can we accommodate them into contemporary linguistic theories? Furthermore, what will the architecture of the grammatical system look like with respect to prosodically constrained syntax? This chapter attempts to investigate these questions.

1 Stress-Based Account

The earliest and most commonly assumed model for the interface between prosody and syntax developed in the past decades is the so-called **Non-Head Stress Rule** (**NHSR** Duanmu 2000:131), stated as follows:

(1) **Non-Head Stress Rule** (**NHSR** Duanmu 2000:131)

Nonhead Stress : A syntactic non-head must have stress.

The NHSR works powerfully in both the morphology and syntax of Chinese and it captures a variety of facts. For example:

(2) a. VVO * zhongzhi shu
plant trees

b. VVR * tie gongchang
iron factory

c. N-NN * xie shangdian
shoe store

All the above ungrammatical examples can be ruled out by assuming that the non-head is somehow weaker (one syllable) than the head (two syllables), and thus, is in violation of the non-head stress rule.

While there is no doubt that the NHSR works not only in the morphology (2c) but also in the syntax (2a-b) of Chinese and that it captures a wide range of prosodically constrained grammatical phenomena, it is, however, not sufficient to accommodate the facts of prosodically constrained syntax documented in previous studies. To take one of the examples discussed before (and repeated here as (3)).

(3) a. Zuijin, Meiguo xuezhe jiang xue Bei Shida,

Recent, America scholar talk academic Bei Shida,
yinqi le guangfan de zhuyi.
cause ASP.widely POSS attention.
'Recently, American scholars delivered academic lectures at Beijing Normal University and that gained widespread attention.'

b. *Zuijin, Meiguo xuezhe jiang kexue Bei Shida,
Recent, America scholar talk science Bei Shida,
yinqi le guangfan de zhuyi.
cause ASP.widely DE attention.
'Recently, American Scholars lectured on science at Beijing Normal University which gained widespread attention.'

In (3a) and (3b), neither *jiang xue* 'give lectures' nor *jiang kexue* 'lecture on science' is in violation of Non-Head Stress Rule, because in both cases, the non-heads have at least equal the number of syllables as their head (the monosyllable verb *jiang*), thus in both (3a) and (3b) the non-heads are (or can be) stressed. This is especially so for the ungrammatical case where the verb is monosyllabic (*jiang*) and the object is disyllabic (*kexue*). As a result, (3b) would be perfectly grammatical according to the non-head stress rule, but contrary to its prediction, this type of sentences is not acceptable in Chinese grammar. Obviously, the non-head stress rule can neither predict correctly all the time nor explain the prosodic effect exhibited here.

Instead of adopting the non-head stress mechanism, Feng (1991, 1995) proposed that prosodic syntactic phenomena like the ones in (3b) involve a prosodic constraint of the Nuclear Stress Rule (NSR) which is formulated as (4) (see Feng 2006).

(4) **Government-based Nuclear Stress Rule** (GNSR, Feng 1995/2003)

Given two sister nodes C1 and C2, if C1 and C2 are selectionally ordered (see Zubizarreta 1998), the one lower in selectional ordering and containing an element governed by the selector is more prominent.

In considering how prosody constrains syntax, the NSR given above has certain advantages over the NHSR. First, NSR specifies what exact syntactic information is accessible to the prosodic operation of NS assignment, namely, a selected constituent directly governed by its selector (i.e. the verb). Obviously, this type of syntactic information cannot be characterized in terms of a head and a non-head, because there can be multiple non-heads within a VP (such as double objects or complement plus adjunct). What seems to be crucial in Chinese prosodic syntax, however, is a strict locality condition for NR assignment (see Feng 2006). Thus, the NSR may have captured the most important prosodic effect on Chinese syntax.

Though prosodic syntax in Chinese may indeed be controlled by nuclear stress assignment under government, the NSR alone cannot account for the fact given in (3). Like the deficiency of NHSR, the NSR applies also to a head and a non-head, and it also requires that the non-head be stressed. However, the fact exemplified in (3) is not accounted for only by stress, because it is the size of the [V-N] (i.e., [*jiang xue*] vs. [*jiang kexue*]) that is at issue here. As a result, NSR is also not sufficient to accommodate the fact of interaction between syntax and prosody in Chinese.

2 Length-Based Account

In considering the fact that the prosodic syntactic phenomena in Chinese concern the size of certain grammatical units in both morphology (compounding) and syntax (the selector of NSR), Feng (2003) proposes the following condition for Chinese prosodic morphology, as introduced in previous chapters and repeated here in (5).

(5) **Minimal-word Condition** (Feng 2003)

a. A minimal word is a foot formed by two syllables, i.e.

MinWd = foot([σσ])

c. Any syntactic organization of the form [X + Y] cannot be an X^0

category unless it is a MinWd, i.e., [X + Y] → [X + Y]$_{X0}$ / [_]$_{MinWd}$.

The MinWd Condition captures a wide range of phenomena in Chinese morphosyntax as we have seen in Chapter 2, and it is crucial in accounting systematically for the reason why the trisyllabic verb + complement ([V-NN], [VRR]) combinations cannot be an X^0 category, but must, instead, be analyzed as phrasal constituents. Though the MinWd is indispensable, it cannot, by itself, explain why [V-NN] in [S + [V-N] NP] and [VRR] in [S [VRR] NP] are ungrammatical. For example:

(6) a. V-NN NP * shou tudi Shaolin Si
take disciple Shaolin Temple
* jiang xueshu Beishida
lecture academic Beijing Normal University

b. V-RR NP * Xie-tongshun wenzhang
write smooth article
* jiang-touche daoli
talk thoroughly reason

In order to rule out ungrammatical expressions like those above, one may be tempted to say that the VNN and VRR forms function like intransitive verb and thus cannot take an object (or an outer object, in the sense of Huang 1997). However, this is not true. Examples given below show that the trisyllabic VRR forms are in deed able to take an object.

(7) Ta xianzai xie wenzhang xie- tongshun le.
he now write article write smooth Asp.
'He now writes article with ease.'
Ni yao jiang daoli jiang-touche.
you should talk reason talk thorough.
'You should explain the reasons thoroughly.'

The examples in (7) show that although the MinWd Condition demands that the VRR forms not be an X^0 category, it does not disable the VRR forms from taking an object, thus the object can appear in preverbal positions. The examples in (7) also show that the VRR (and VNN as well) are grammatical, thus they cannot be eliminated on the grounds that they are ungrammatical expressions. As a result, the MinWd Condition is insufficient as a means of ruling out the ungrammatical sentences in (6) and (7). Given this, the real question we are considering here is why the legitimate VRR (and VNN) can only take an object elsewhere but not in the postverbal position. Obviously, the MinWd alone offers no reason why it is so.

3 Interaction between MinWd Condition and NSR

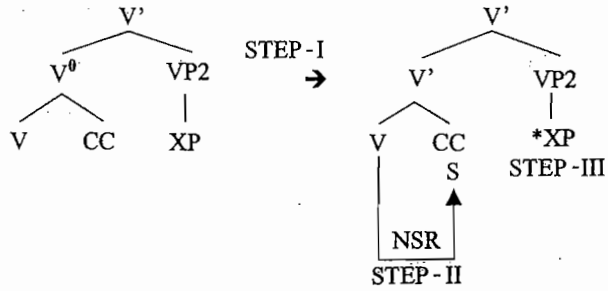
The incapability of accounting for the prosodic-syntactic phenomena by NSR and MinWd alone leads naturally to the idea that the prosodically constrained syntax in Chinese results from interactions of prosodic morphology (i.e., MinWd Condition) with prosodic syntax (i.e., the NSR). The application of the two prosodic rules operating under other conditions (see (9) and (10)) can be summarized as follows:

(i) MinWd applies first, resulting in a reanalysis of $[V\ CC]_V$ as $[V\ CC]_{V'}$ (where 'CC' stands for disyllabic complement); and then,

(ii) NSR comes in to play within the $[V\ CC]_{V'}$ structure, where the NS is assigned to the CC; and, finally,

(iii) the *XP is marked uninterpretable/ineffable as diagrammed in (8).

(8)



According to the interaction model given above, the grammatical one (3a) and the ungrammatical one (3b) are successfully ruled in and out, respectively. Note especially that the MinWd Condition functions to decompose a V^0 into a V' through a process of reanalysis. The decomposition process proposed in Feng (2003) can actually be traced back to what Chao (1968) has called a process

of ionization , which is informally stated in (9) below:

(9) **Prosodic ionization of a syntactic unit (Chao 1968)**

Prosody can ionize a syntactic unit/word into a (prosodic/syntactic) phrase.

Furthermore, in the tree structure (8), an Invisibility Condition (IC), together with a Structural Removing Condition (SRC) as introduced in previous chapters, are necessarily applied in order to derive the prosodically relevant structures. These conditions are repeated below for convenience.

(10) **Invisibility Condition (IC)**

In Chinese, anaphoric elements are prosodically invisible constituents that have no bearing on prosodic analysis.

(11) **Structural Removing Condition (SRC)**

When the NSR applies, remove all the prosodically invisible elements (with their syntactic branches) from the tree structure.

Notice further that the third step (i.e., marking * XP as uninterpretable/ineffable constituents in the structure) is enforced by the Lower Edge Constraint introduced before and repeated here to complete the whole picture.

(12) **The Lower Edge Constraint** (Feng, 2003)

Any (non-destressable) constituent beyond the NSR domain is prosodically uninterpretable.

The Lower Edge Constraint says simply that NSR functions to mark the lower edge of a sentence and the right edge of a sentence is therefore margined with a head and its (non-destressable) complement. As a result of the joint impact on syntax (i.e., Min-Wd Condition plus NSR), the surface structures of sentences in

Chinese all look like this: only one (stressed) constituent is favored after the main verb.

4 The Filter Model and its Deficiency

In previous sections we have seen that some syntactic phenomena can be accounted for by a stress-based mechanism, some must be analyzed in terms of a length-based approach, and still others must be explained by a joint enterprise. More importantly, we have seen that the prosodic syntax has brought some new thoughts to current syntactic theories, i. e., prosody does constrain syntax. Given this, the question we would like to ask is this: what is the architecture of the grammatical system?

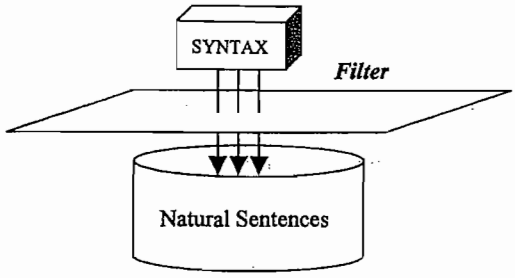
Let us start with the traditional model first. The standard explanation for obvious phonological influence on syntax is known as the Filtering Model (Ross 1967), which implies that both components (the phonology and syntax) operate independently. The 'filter' serves as a model that can capture the influence of a 'later' component on an 'earlier' one, as stated and diagrammed below:

(13) **Filtering Model**

Prosody functions as a filter for syntactic output and it applies after spell-out.

The Filtering Model says, essentially, that (a) Syntax produces all sentences according to the UG system parameterized in a specific language; and (b) The prosodic filter rules out all prosodically ill-formed ones, as shown in (14).

(14)



Examples given in (15) (repeated from section 1) show exactly how a prosodic filter works on syntactic output.

(15) a. VVO * zhongzhi shu
plant tree
'plant trees'

b. VVR * da laogu jichu
hit-solid foundation
'make a solid foundation'

Based on the prosodic and syntactic properties of the ungrammatical expressions, a prosodic filter can be formulated according to the Non-Head Stress Rule, as follows:

(16) **Prosodic Filter for * [VV+C]** ①
No disyllabic verb is allowed to take a monosyllabic complement.

The prosodic constraint of * [VVC] can function as a prosodic filter after spell-out and all sentences generated with a [VVC] form in syntax will be filtered out in the prosodic component.

The prosodic filter accounts not only for the examples given above, but also for the following examples:

(17) a. [V-R Object]$_{V'}$
da-lao jichu
hit-solid foundation
'make a solid foundation'

b. [V-O Object]$_{V'}$
jiang-xue Beishida
talk-academics Beijing Normal University
'give lectures at BNU'

a'. *da-laogu jichu
hit-solid foundation
'make a solid foundation'

b'. *jiang-yuyanxue Beishida
talk-linguistics Beijing Normal University
'give linguistic lectures at BNU'

We have seen before that disyllabic VR and VO forms can take an outer object, while trisyllabic VRR and VOO cannot generally do so. This prosodic effect is a result of two prosodic constraints: NSR and MinWd Condition. The former says that NS is assigned by a selector to a selected element which is characterized in terms of stress assigned in a structure; and the later states that only a disyllabic VO/VR can be an X^0 category which determines the size of stress assigner. Combining the two prosodic requirements, a filter constraint can be formulated as in (18):

(18) **Prosodic Filter for *[VCC NP]**

NSR applies to a MinWd selector only.

According to (18), the ungrammatical sentences exemplified in (17) are ruled out simply because the NSR is inoperable due to the oversized [VCC] which serves as the selector in the structure.

As seen above, the filtering hypothesis is an important model that accounts for most of the data discussed in previous Chapters; it is, however, not the only model for interface between prosody and syntax (see Feng 2002). Though the filter model is capable of capturing prosodic constraint on syntactic outputs it is incapable

of capturing prosodically motivated syntactic operations. In fact, the most salient question about P-syntax, as Kager and Zonneveld (1999) put it, is: Is there a bidirectionality of information passed back and forth between syntax and phonology through the interface? Although it is still too early to proffer a complete answer to this question, the argument for Bidirectional Interface (BI) can be established if there are syntactic structures that meet the following conditions:

19. (a) the ungrammaticality of the structures is accounted for by prosody,
    (b) the prosodic process is operated in syntax, and
    (c) the relevant syntactic process would not be activated without a prosodic motivation.

In other words, if there are facts that can only be accounted for by prosodically motivated syntactic operations, it becomes a corollary that syntax must have access to prosody and hence a theory of bidirectional interface between syntax and phonology is called for. As seen in section 5 below, there is synchronic as well as diachronic evidence suggesting strongly that this is, in fact, the case.

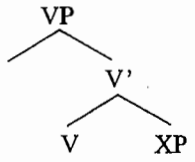
5 Prosodically Triggered Syntactic Operations

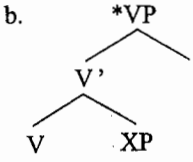
5.1 Prosodically triggered verb reduplication

Previous studies have shown that the application of NSR affects Chinese syntax so pervasively that only one (stressed) constituent is favored after the main verb. This surface pattern is what Huang (1984) identified as a Phrase Structure Constraint in Chinese syntax, as stated in (20) and diagrammed in (21):

(20) **Phrase Structure Constraint**

Within a given sentence in Chinese, the head (the verb or VP) may branch to the left only once, and only on the lowest level of expansion.

(21) a. 

b. 

The VP in (21a) is perfect while that in (21b) is not allowed because the VP in (21b) branches to the left twice (at the VP level and the V' level), thus violating the PSC. An actual syntactic effect of the PSC is thus: only one constituent is allowed after the main verb. Given the PSC, sentences like the following are automatically ruled out:

(22) a. * Zhang San meitian da dianhua sanci.
(VO Frequency P)
Zhang San everyday call telephone three time
'Zhang San makes phone calls three times a day.'

b. * Zhang San meitian da dianhua liangge zhongtou. (VO Duration P)
Zhang San everyday call telephone two hour
'Zhang San makes phone calls for two hours everyday.'

c. * Zhang San chi fan de hen kuai.
(Resultative de-clause)
Zhang San eat food POSS very fast
'Zhang San eats fast.'

d. * Zhang San tie huar zai qiang shang. (VO PP)
Zhang San paste pictureon wall top

'Zhang San pastes the picture on the wall.'

Based on the syntactic restriction demanded by the PSC, so-called V(erb)-reduplication in Chinese can be considered a rescue strategy to avoid the violation. For example:

(23) a. Ta tie huar tie zai ren lian shang le.
He paste picture paste on person face top Asp.
'He pastes a picture onto a person's face.'

b. *Ta tie zai ren lian shang huar le.
He paste on person face top picture Asp.
'He pastes a picture onto a person's face.'

c. *Ta tie huar zai ren lian shang le.
He paste picture on person face top Asp.
'He pastes a picture onto a person's face.'

However, the rescue strategy, together with the PSC, runs into difficulties where the following sentences are concerned:

(24) a. Zhangsan meitian da ta san ci.
Zhangsan everyday hit him three time
'Zhang San hits him three times everyday.'

b. Zhangsan fang zai nar liang ben shu.
Zhangsan put at there two CL book
'Zhangsan puts two books there.'

In both (24a) and (24b), there are two constituents after the verb (or the VP branches to the left twice), however, in neither case is verb reduplication obligatory. Why is this so? It is not difficult to note that in (24a) the object of the verb *da* 'hit' is a pronoun and in (24b) the object of the preposition *nar* 'there' is also a pronoun. As seen in previous chapters, pronouns (and definite NPs as well) are invisible to prosodic operations. According to the **Invisibility Condition** (10) and the **Government based NSR** (4),

what the PSC has captured can be automatically rendered into the prosodic constraint on Chinese VP-syntax in an across-the-aboard fashion, as seen in previous chapters. In other words, the GNSR (together with the Invisibility Condition) accommodates not only what the PSC has captured (e.g. (22a-b)), but also what it has left unexplained (e.g. (24a-b)). Furthermore, the condition in which no two constituents are allowed after the verb (i.e., why there is a PSC) in Chinese, is no longer as unusual, simply because PSC is understood to be a not purely syntactic constraint but, rather, one of the prosodic effects resulting from interactions between syntax and prosody.

Based on the prosodic interpretation of the PSC, it becomes a corollary then that the rescue strategy of V-reduplication is motivated by prosody. That is, it is prosody that forces V-reduplication in (23a); and no V-reduplication is necessary if there is no prosodic violation as in (24 a-b). On the other hand, there seems to be no purely syntactic reasons for why the verbs need to be reduplicated when there is an extra constituent after the object.

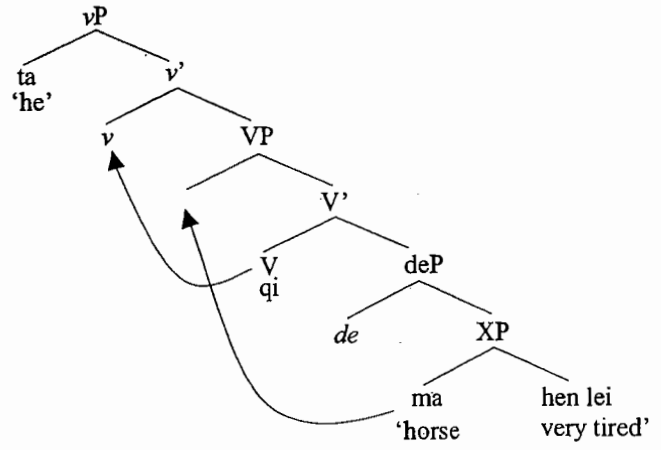
Cheng (2006) has developed a purely syntactic account for V-reduplication in Chinese. However, as we will see below, although the syntactic analysis proposed by Cheng might explain why V-reduplication is obligatory within the NSR domain, it does not explain why V-reduplication is not obligatory outside the NSR domain in the same syntactic environment.

First, she argues that V-reduplication is a result of the realization of multiple copies and it is obligatory when Chain Reduction fails to apply, due to modification of word structure (e.g., fusion, as in distributed Morphology). More specifically, she claims that after the verb raises (i.e., copies and merges) to v, in

the morphological component, the lower copy of the verb is fused with an adjacent morphological element such as *DE* (the resultative marker). The morphological fusion of the verb with *DE*, for example, causes the L(inear) C(orrespondence) A(xiom) to be blind to the inner elements in [$_v$ V-*DE*] and therefore the Chain Reduction will not apply. As a result, both copies are allowed to be phonologically realized as shown in (25) (taken from Cheng 2006):

(25) Ta qi nei- pi ma qi de hen lei
He ride that CL horse ride DE very tired
'He rode the horse and the horse got very tired.'
'He rode the horse until it got tired.'

(26)



Since it is crucial for the lower copy of the verb to fuse with a morphological element in order to motivate the V-reduplication (i.e., to escape from Chain Reduction), Cheng (2006) proposes the following analysis (27a) for V-reduplication without extra morphological material (27b):

(27) a. Ta kan nei-ben shu kan san ci
He read that-CL book read three times

'He read THAT BOOK three times (... and this book twice, etc.).'

b. [$_{vP}$...[$_{vp}$ that book read [HAVE three times]]]

Although the covert morphology HAVE may obligatorily give rise to V-reduplication in Cheng's system[2], it is difficult to account for the fact that no V-reduplication is necessary if there is no NSR requirement. For example:

(28) a. Ta du shu san tian zhi du le LIANG ye
He read book three day only read Asp.two page
'He only read two pages in three days (or It took him three days to read two pages).'

b. Ta du shu du san tian cai du le LIANG ye
He read book read three day only read Asp. two page
'He only read two pages in three days(or It took him three days to read two pages).'

c. Ta du shu zhi du le LIANG ye / SAN tian
He read book only read Asp.two page / three day
'He only read two pages [in] three days.'

d. * Ta du shu zhi du le LIANG ye SAN tian
He read book only read Asp.two page three day
/SAN tian LIANG ye
/three day two page
'He only read two pages in three days.'

Consider the reduplicated phrase *du shu san tian* 'read books three days' first. According to Huang (1982, 1992), the reduplicated phrase is an adjunct, thus the NS, according to the GNSR, will not fall in the reduplicated phrase, but, instead, on the last

verb du 'read', leaving the reduplicated phrase (*du shu san tian*) outside of the NS-domain. As expected, V-reduplication is not obligatory within the reduplicated phrase even if there are two constituents ('book' and 'three days') after the verb 'read' in the adjunctive phrase, and the sentence is grammatical. However, according to the hypothesis given in (27b), (28a) should be ungrammatical because there is a covert 'HAVE' before 'three days' and hence V-reduplication must take place. But this did not occur, contrary to what was expected. WHY?

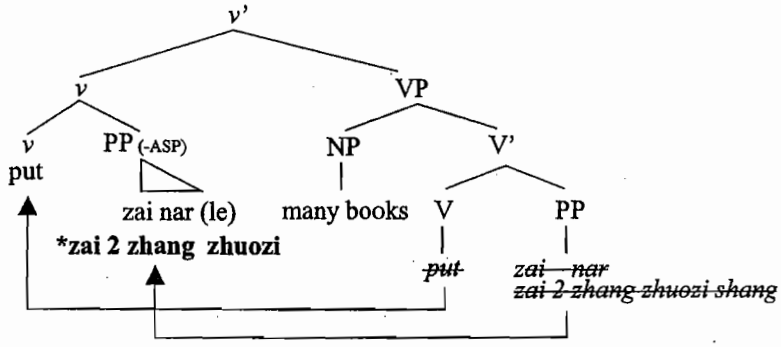
Furthermore, as the verb in (28b) can be triduplicated, it is even more difficult for the fusion hypothesis to postulate two covert HAVEs in the sentence in order to get double reduplications. Nevertheless, (28a) shows that two constituents are indeed allowed after a verb if the verb is not a selector for NSR in that sentence. This indicates that it is indeed the NSR (not syntax) that controls the structure of [V NP D/FP]. Furthermore, there is hardly any syntactic principle (in the GB theory) or feature (in the Minimalist Program) that triggers the verb to be reduplicated SEE ABOVE in a sentence, as in (28b). Given this, it is highly plausible that the only motivation for the verb reduplication in the above examples is the NSR which allows only one governed complement to receive the NS, forcing the others (if any) to move away through possible syntactic operations (if there are any). That is to say, the V-reduplication is permissible by syntax, but the reason for what it does here is due to prosody[3].

The following example (repeated from [24b]) also casts a doubt on the hypothesis that V-reduplication is motivated and licensed by the fusion of a verb with a morphologic element, so that it can escape from constraints of Chain Reduction. For in-

stance:

(29) Zhang San fang zai nar liang ben shu.
Zhang San put at there two CL book
'Zhang San put two books there.'

(30)



As seen in (30), the PP must have been fused with (or cliticized onto) the verb *fang* 'put' otherwise the verbal suffix *le* (perfective aspectual marker) would not have appeared after the PP. However, there is no V-reduplication taking place, which is unexpected according to the fusion hypothesis. The example given in (29) shows that V-reduplication is not motivated by the syntactically required fusion of the verb with a morphological element simply because the verb *fang* 'put' is unquestionably fused with the PP, though no V-reduplication takes place.

What we have seen from example (24a) is this: on the one hand, V-reduplication must take place if the [V $NP_{indefinite}$ D/F] structure falls within the NSR domain; on the other hand, the otherwise ungrammatical structure (28a) is acceptable without V-reduplication if it is located outside the NSR domain. Example (29) shows that no V-reduplication is necessary if the [(P+) NP] in [V $PP_{definite}$ NP] structure is definite or cliticized onto the verb,

even if it occurs in the NSR domain (because it is invisible). As a result, it can be concluded that verb reduplication in Chinese is essentially a prosodically triggered syntactic process.

The prosodically licensed V-reduplication can further be seen from the fact that without the D/FP (or a postverbal constituent), there is no V-reduplication allowed in the language.

(31) a. Laoshi piping Zhang San piping le SANge
Teacher criticize Zhang San criticize Asp.three
zhongtou.
hours
'The teacher has criticized Zhang San for three hours.'

b. *Laoshi piping Zhang San PIPING le ta.
Teacher criticize Zhang San criticize Asp.him
'The teacher has criticized Zhang San.'

c. *Laoshi piping Zhang San PIPING le.
Teacher criticize Zhang San criticize Asp.
'The teacher has criticized Zhang San.'

d. Laoshi piping le Zhang San
Teacher criticize Asp.Zhang San
'The teacher has criticized Zhang San.'

Examples in (31) indicate a sharp contrast between the grammatical (31a) and the ungrammatical (31b-c), which shows clearly that V-reduplication takes place only when there is a D/FP (or more generally, a post-V' constituent after all syntactic operations). Notice that the D/FP in (31a) is the NS-target and all the ungrammatical ones (31b-c) lack a postverbal constituent that serves as the NS-target. On the other hand, all the examples in (22) contain two postverbal constituents but only one of them can

be assigned a NS. This is why the sentences in (22) are all ungrammatical without V-reduplication and those in (32) are ungrammatical even with V-reduplication. Given this, a condition on the V-reduplications can be formulated as follows:

(32) **Condition on Verb Reduplication (CVR)** [4]

In Chinese, verbs cannot be reduplicated unless there is a D/FP (or post-V' constituent) that serves as the NS-target.

The CVR says, essentially, that the application of V-reduplication depends on whether or not there is a post-V' NS-target. Thus, the D/FP (NS target) is a necessary condition for V-reduplication to take place[5]. If this is so, it follows that the V-reduplication process is built upon the prosodic property of that sentence. There is no doubt that V-reduplication is a syntactic operation while the NS-target licenser is a prosodic factor. Given this, it follows logically that the syntactic process operates on the basis of the prosodic property of that sentence. Put differently, without the prosodic requirement (NS on a post-V' constituent) there can be no such syntactic operation (V-reduplication). It follows, again, that syntax must collaborate with prosody before engaging the syntactic operation. Obviously, the V-reduplication provides further evidence that syntax must make reference or have access to prosody first before it can activate a potential (or unused) syntactic operation.

At this point, one may wonder if the V-reduplication might also be accounted for by the agency of a filter application, assuming that syntax generates all possible forms such as:

(33) a. * V_i O V_i

b. V_i O V_i D/FP

c. V_i O V_i-R

d. V_i O V_i PP

.....

If we take the CVR (32) as a prosodic filter, then the grammatical structures will pass through the filter while the ungrammatical ones will be filtered out. The problem with this proposal, however, is this: a Filter Condition like (32) for verb reduplication lacks sufficient evidence to explain why a syntactic operation of V-reduplication would appear in (22) and not in (31b-c). Based on Minimalist Syntax, every syntactic operation must have a proper triggering feature for its engagement. The V-reduplication is a legitimate syntactic process, but it could just be a potential or unused operation in the language until there is a need (a kind of triggering factor) to activate it. A filter treatment may look simple and straightforward, but it explains nothing about why there should be such an operation and how it comes about.

Contrary to the filter hypothesis, the present analysis addresses this question in this way: syntax never generates phrases like *[V_i O V_i]. The impossible string is accounted for in terms of a bidirectional interaction between syntax and prosody. That is, some syntactic operations are activated only as a result of prosodic requirements. Thus, if there is no such enforcement from prosody, there would be no corresponding operation in syntax. In other words, the ungrammatical *[V_i O V_i] phrases are not ruled out by a filter later on, but instead are never generated in the first place.

Given this analysis, we are able to explain not only why there is V-reduplication in the language (NSR assigns only one NS to a governed constituent, V-reduplication is therefore activated to

move others away from the NSR-domain when more than one constituent populates that domain) and why the V-reduplication is conditioned on the presence of a post-V' constituent (there would have been no triggering factor for V-Reduplication if there were no extra constituent within the NSR domain). In addition, it also explains why V-reduplication is optional when the object is a pronoun as in (24a) (a pronoun is invisible to the NSR hence V-reduplication is not obligatory). All of the results can be accommodated if we assume that syntax has access to prosody which then calls for a model of a bidirectional interface between prosody and syntax.

5.2 Prosodically Triggered Resultative Verb Raising

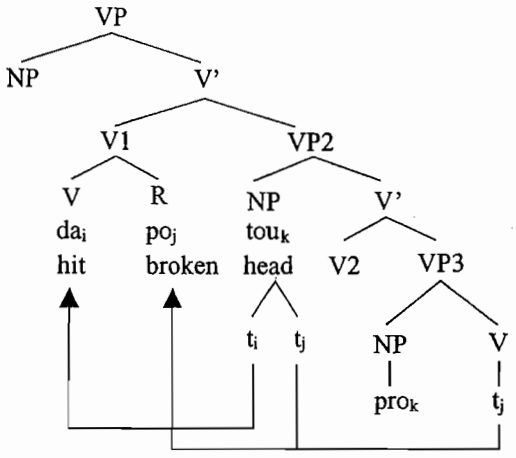
It has commonly agreed that the VR structures in classical Chinese appeared around the time of the Six Dynasties (400 A. D.). A striking phenomenon connected with the development of VR construction is the fact that two surface VR structures co-existed in the beginning of VR evolution, as shown in (34) below:

(34) a. da tou po
hit head broken
'hit the head and, as a result of the hitting, the head was broken'

b. da po tou
hit broken head
'hit the head and, as a result of the hitting, the head was broken'

Following Larson (1998), Feng (2002) proposes the syntactic structure for the two alternative VR constructions as follows (see also Sybesma, 1999):

(35)



Syntactically, the head movement of R-to-V must be optional in order to capture the two alternative results. That is, when the R-to-V movement applies, *da-po tou* 'hit-broken head' is derived, otherwise the R will stay in situ giving rise to the *da tou po* 'hit head broken' structure. However, the options of syntactic movement are somewhat problematic in recent (minimalist) syntactic theories, which imposes a principle for movement that is impossible without proper syntactic motivation (i.e., feature checking in the Minimalist Program, Chomsky 1995, 2006). However, in the structure given in (35) we can hardly posit any syntactic features (syntactically or morphologically) that would trigger the movement. Syntactically, if the R-to-V operation is explained in terms of a trigger of some kind, then it will be difficult to explain why the same trigger would not work in R-in-situ structures. On the other hand, if we assume that there may actually not syntactic features that could trigger R to move and therefore that the R is generated in situ without movement as in (34a), then it is difficult to explain why the R in (34b) has to move. In either case a problem remains. Of course, one may simply say that the trigge-

ring feature (if there is one) may be optional in nature, thus there are two surface structures derived from the optional property of that feature. If this is so, it is still difficult to explain what the trigger is and why it is optional.

Actually, the difficulty in explaining the optional movement using syntax becomes even more apparent when the following examples are examined:

(36) a. [V R O R]

打 破 烦恼 碎

da po fannao sui

Hit broken vexation crushed

To get rid of the vexation

b. *[V RR O]

*打 破碎 烦恼

*da posui fannao

Hit broken-crushed vexation

To get rid of the vexation

c. *[V O RR]

*打 烦恼 破碎

*da fannao po-sui

Hit vexation broken-crushed

To get rid of the vexation

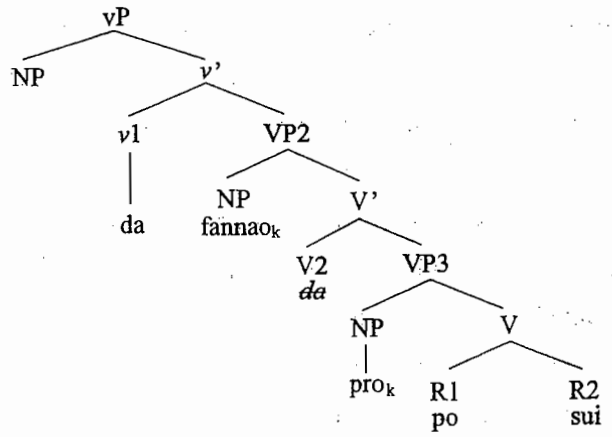
As we can see from the above examples, there are two syntactic positions simultaneously occupied by a R: one (in pre-object position) attaches to V, and the other (in post-object position) stands alone. Apparently, the positions for Rs seem not to be syntactically optional. Examples in (36) also show that, although there are two positions available for R syntactically, the appearance of R is restricted prosodically, that is: no disyllabic Rs (resultative

verbs) are allowed in either position, as evidenced by the fact that no such case has been found throughout history (Feng 2002).

Given the examples in (36), the hypothesized process of optional feature checking becomes inoperable when two Rs appear in the structure because one must be moved (onto the V) and the other must stay (in situ). It is hard to imagine a categorical syntactic process that could possibly accommodate such an arbitrary operation. However, the arbitrary operation (move to V and stay in-situ) becomes what is motivated under the hypothesis of prosodically triggered syntactic operations. That is, the movement is syntactically permitted but prosodically activated, thus, whether or not there is a movement depends on whether or not prosody requires or permits it to do so. Let us see how prosody triggers one R to move and another R to stay simultaneously when there are two Rs in a sentence.

First, let us look at (36c) where the resultative verbs *po* and *sui* are in situ, as shown in the structure given in (37):

(37)



Assuming that the light v is affixal it would trigger movement of the verb *da* 'hit' causing it to transfer from its original (italicized) position in V2 to a new position in v 1. Let us also assume,

for the moment, that there is no syntactic motivation (i.e., no feature to be checked) for the two resultative verbs, and so they will therefore stay in situ, giving rise to sentences like (36c). Now, when the NSR applies to it, the verb *da* will be picked up as a selector and in turn, the object *fannao* 'vexation,' directly C-commended by the verb *da*, will be the NS-target. This will leave *po-sui* prosodically uninterpretable; thus suggesting that sentences so generated are ungrammatical. This explains why there are no such sentences in the history of VR development.

The [V-RR O] sentences in (36b) are also prosodically ungrammatical. First, let us assume that the R2 is incorporated onto the R1 and then, that the conflated R1R2 together moves to v, forming a verb complex with *da*, giving rise to (36b): *da posui fannao*. When prosodic rules apply (after the syntactic movement), we have a sentence with the following structure:

(38) C_P[....v[da_i po-sui_j V_P[*$fannao_k$ v'[t_i V_{P3}[pro_k ~~*po-sui$_j$*~~]]]]]

W S

NSR

Since MinWd Condition does not allow trisyllabic expressions (i.e., [*da* -[*po-sui*]] in the present case) to be an X^0 category as we have seen before, the oversized verb complex is therefore re-analyzed as a phrasal category, exactly like [V OO] and [VRR] in modern Chinese as discussed in Chapters 4 and 5. If *da-posui* is (reanalyzed as) a phrasal category, the verb *da* will be structurally computed as the selector and *posui* the selected element directly governed by the verb. The structural analysis will warrant NSR to assign NS to *posui*, leaving *fannao* an uninterpretable constituent. This explains why (3b) is ungrammatical and why no such sentences can be found in the history of syntactic changes in classical Chinese.

Why, then, is [V R O R] grammatical? First, it is grammatical because when the monosyllabic R moves to V, it results in a disyllabic VR compound, which serves perfectly as a selector (allowed by the MinWd Condition to be a standard compound) and assigns NS to the object. This process will give rise to the grammatical sentences as seen in (34).

According to this analysis, the in-situ R in (36a) and (34a) will be ruled out because if NS is assigned to the object, the post-object R will be prosodically uninterpretable, just like the post-object RR in (36b). Why, then, is the in-situ R allowed? First, if the analysis given above is correct, then, the in-situ R should not be allowed. This prediction is actually borne out by the fact that the majority of VR structures is formed as [V R O] in medieval Chinese and was standardized in pre-modern and modern Chinese as generally observed in the literature. On the other hand, the [V O R] structures are restricted to certain environments and to certain Rs as we will see below. Actually, as argued in Feng (2002) the disallowance of the in-situ R by prosody has served as a trigger for the head-movement of R to V. In other words, the very reason why the in-situ R must be moved out of the post-object position is because the in-situ R will otherwise receive no prosodic interpretation, and cause an ungrammatical result.

What about the Rs actually in-situ? As argued in Feng (2002), the Rs that are in-situ are prosodically invisible in the sense that they have been phonetically reduced into a neutralized syllable. There is evidence for this analysis.

First, all of the in-situ Rs we have found in our data have an alternative structure of [VR O], as exemplified in (34) and repeated here as (39).

(39) da po tou da tou po
hit broken head hit head broken

It has also been observed (Mei, Wu) that the more frequently Rs are used in VR forms (originating from VV coordination compounds), the more bleached becomes their semantic content (or lexical properties). The co-occurrence of R in parallel structures shows that the Rs in these structures have been used for long periods of time with high frequency. It is also true that some frequently used Rs in VR forms have been morphologized as functional or semi-functional elements (cf. *sha* in classical Chinese and *wan* in modern Chinese). In the present case, *po* has not only lost its causative usage in the environment of [V O *po*] as pointed out by Mei (1991), but presumably has also lost its phonological quality so that it becomes a prosodically weaker form, hence invisible to prosodic operations. This is why it can remain in situ and escape from the prosodic restriction.

Furthermore, the fact that no disyllabic RR forms have occurred in-situ indicates, that, if an in-situ R is prosodically heavy, it is not allowed. This shows once again, that the in-situ position is a prosodically invisible position (hence no heavy forms are allowed).

The last piece of evidence concerns the disappearance of the [V O R] forms around the Tang Dynasty (600 A.D.). As the VR structure developed and matured, all adjectives (and some verbs) were able to be used in the structure. The new Rs in the VR structures in the Tang Dynasty were all lexical items and no longer simply weaker forms. It is commonly agreed that the VR forms were developed from the V1V2 coordination compounds (Pan 1989?, Zhicun 196?), and that the weakening of V2 is a precon-

dition for the birth of VR structures[6]. Given this, if the [VR O] structure is matured and the VR forms can be freely formed out of any Rs without depending on the weakening process of the V2 in V1V2, then there will be no [V O R] expressions produced in the language because the condition for generating weakening Rs (i. e., the process of historical change from VV to VR) no longer exists. These predictions are borne out as generally observed in the literature (Wang 1954).

In brief, the present analysis has answered the questions of why the majority of VR structures are formed with a [VR O] and why there are [V O R] forms as well. In addition, we have explained why [VR O R] forms are allowed and why neither [VRR O] nor [V O RR] existed. Most importantly, the [VR O] together with [V R O R] examples show that it is prosody that forces a R-to-V movement and it is also prosody that permits R in situ, without which the VR construction in Chinese would have remained as a [V O R] structure through later development. Obviously, the VR structure in medieval Chinese provides further evidence for prosodically triggered syntactic operations.

6 Bidirectional Hypothesis

Given all of the evidence in modern and classical Chinese above, it is evident that prosody does motivate syntactic operations in the sense that legitimate syntactic operations may not be triggered simply by purely syntactic factors, but also by prosodic requirements. If this is so, the grammatical system must operate through a bidirectionality of information passed back and forth between syntax and phonology through the interface. How can

this be? In this section, I would like to suggest a bidirectional interface model based on a theory recently developed by Chomsky (1999, 2001), namely, the Phase-based Theory, which, essentially, operates according to the following principles:

(40) a. Clause Structure is built up in phases (CP, vP, DP, PP; Redford 2004);

b. At the end of each phase, the domain of a phase is transferred to phonological and semantic components;

c. After the process of transfer, the domain is impenetrable to further syntactic operations.

Under the phase-based theory, syntactic structure is built up phase by phase and spelled out one domain at a time. This process opens up a possibility for a cyclic spellout operation under which a reaction of syntax to prosody (i.e., the check-back process as seen below) can be hypothesized within this system, before a further merging process takes place. More specifically, a **Check-Back Operation** is proposed as follows:

(41) **Check-Back Operation**

At the point of transfer (spellout), each domain of a phase is assigned a prosodic structure (stress/length...), and after the prosodic feature assignment, the domain will be checked back in syntax if, and only if, there is a prosodically uninterpretable factor, according to which a syntactic reactive feature is assigned to the P-ineffable factor in that domain, before operation by segmental phonology.

Within the system hypothesized above, the generation of sentences in the grammatical system will operate bidirectionally to

pass information back and forth between syntax and phonology through the interface. In order to restrict the bidirectional operation, the key notion of prosodically (un)interpretable factors is specified as a Syntactic Reactor (SR):

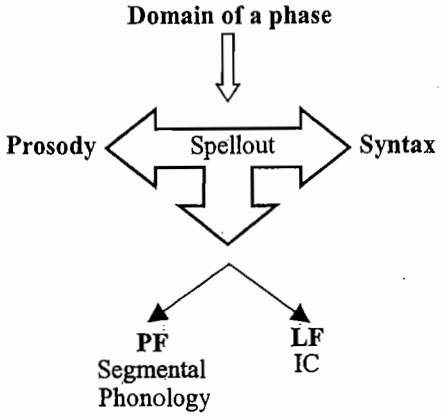
(42) **Syntactic Reactor**

Any constituent in a domain of a phase that is prosodically **uninterpretable** by NSR (incorporating with other prosodic rules) will be assigned a '*' feature, called a REACTOR.

Although the Reactor '*' feature is assigned by prosody, it is understood (and can be characterized) as a feature of functional category assigned to a constituent in the domain, designating that this constituent is misplaced in the position it occurs, (similar to the manner of a noun without a Case). In situations like this, the Reactor must probe every active matching position within its search space, thereby activating relevant syntactic operations in that domain. In this sense, we may consider the syntactic Reactor as a reactive feature for syntactic operations assigned by the prosodic computational system to a prosodically uninterpretable constituent. When the Reactor is assigned to a constituent, the grammatical feature of that constituent immediately percolates into the Reactor, activating it to probe for a potentially unused host within the domain. That is to say, after the prosodic feature assignment ⑦, a domain with a Reactor feature (projected from uninterpretable factors) will be **checked back** in syntax (though all syntactic operations have been completed at this point, the domain has not been sent to PF and processed by segmental phonology yet ⑧), thus, the Reactor '*' feature is able to reactivate the syntactic operative system, triggering relevant/available syntactic oper-

ations of different types (such as adjunction, movement, and probably other available operations), which may or may not be activated by existing syntactic triggers in that language, According to the hypothesis given above, the system of interface between syntax and prosody will look like this:

(43) **A Model of Interaction between Prosody and Syntax**

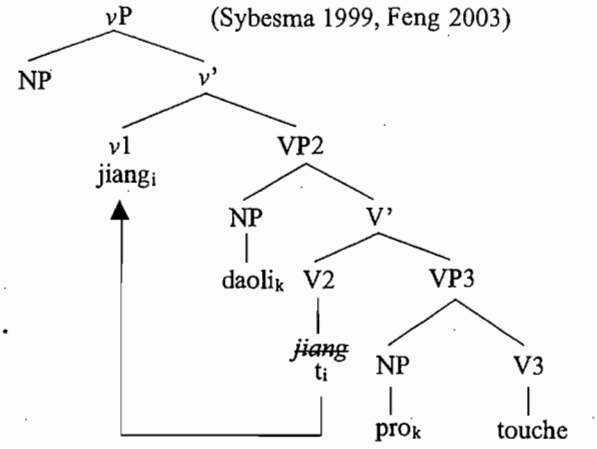


How does the system work? Let us now take one example given in (44) to see how the mechanisms operate.

(44) a. Ni yao jiang tou daoli.
You should talk thorough reason
'You should explain the reasons thoroughly.'

b. *Ni yao jiang touche daoli.
You should talk thorough reason
'You should explain the reasons thoroughly.'

c. Ni yao jiang daoli jiang touche.
You should talk reason talk thorough
'You should explain the reasons thoroughly.'

(45) 

(Sybesma 1999, Feng 2003)

Since the *v* P is transitive (thus a phase) and since the light verb is affixal, it triggers movement of the verb *jiang* 'explain' moving it from its original (italicized) position in V2 to *v* 1. Since there is no independent motivation for V3 to move at this moment (because the unmoved V3 is grammatical in classical Chinese and other languages) the domain of the phase head (*jiang* 'to lecture') is derived as the one given in (46) (Sybesma 1999; Feng 2000). At the point that the domain undergoes transfer (to PF), the NSR applies to it, resulting in the structure (47):

(46) Domain $[\ldots_{vP}[\text{daoli}_k\ v'[t_{i\ VP3}[\text{pro}_k\ \text{touche}]]]]$

(47) Spellout $_{vP}$ $[\text{daoli}_k\ v'[t_{i\ VP3}[\text{pro}_k\ \text{touche}]]]$

In (8), the NSR assigns a reactor feature '*' (resulting from an uninterpretable factor) to the whole domain simply because there is no seeable head (selector) in that domain and so there is no way to assign NS according to the Government-based NSR given before. As assumed above, the check back process will be activated accordingly, giving rise to next cycle of transfer, i.e., merging with a CP constituent. After that process, we have (9):

(48)

Domain: $_{CP}$[Ø...$_{TP}$[...$_{VP}$[... v[jiang$_i$ $_{VP}$[daoli$_k$ v'[t$_i$ $_{VP3}$[pro$_k$ touche3]]]]]]]

(49)

Spellout v[(jiang$_i$ $_{VP}$[daoli$_k$) v'[t$_i$ $_{VP3}$[pro$_k$ *touche3]]]]

W S

NSR

In (49), since there is a selector *jiang*, and the complement *daoli* is immediately c-commended by the selector *jiang*, *daoli* automatically receives a NS. Since every selector assigns only one NS, the last constituent *touche* will not receive a NS and hence is excluded from the NS domain. Given the Lower Edge Constraint by which the NSR functions to mark the right edge of a sentence (as seen in (4.4.3)) the last constituent, *touch*, *e* will receive no interpretation from the NSR. As a result, *touche* is assigned a Reactor '*' feature.

Once again, this domain with a '*' feature will be checked back in syntax and the Reactor (marked on *touche*) will locate every potentially active matching target within its search space.

At this point, I would like to argue that the movement of the resultative complement *touche* to a higher verb *jiang* in the VR construction is triggered by the reactor '*' (see Feng 2000). That is to say, the movement is a prosodically motivated syntactic operation, as shown in (50).

(50) Domain: $_{CP}$[.... v [jiang$_i$-touche$_j$ $_{VP}$ [daoli$_k$ v' [t$_i$ $_{VP3}$ [pro$_k$ ~~*touche*$_j$~~]]]]]

After the head-movement, prosodic features will, once again, be assigned to the domain (at the point of transfer/spellout), yielding the following result:

(51)

Spellout $_{CP}$[....$_{v}$[jiang$_i$-touche$_j$ $_{VP}$[*daoli$_k$ $_{v'}$[t$_i$ $_{VP3}$[pro$_k$ ~~touche$_j$~~]]]]]

W S

NSR

This structure is derived as follows: First, MinWd applies before NSR. Since MinWd demands that *jiang-touche* cannot be taken as a word category, it must be treated as a (**prosodic**) phrasal structure. If *jiang-touche* is a phrasal category with *jiang* as a head, then *touche* will receive a NS.

Given this computational result, the last NP * *daoli* will be assigned a reactor '*' feature at this time, due to its 'prosodic uninterpretability' by the NSR.

Once again, since the domain in (51) is assigned a reactor '*' feature, it must be checked-back one more time. This means that the '*' reactor will activate, again, a relevant syntactic operation that must be syntactically permissible by the UG system, if not available (or used) in the language of that time.

At this point, I would like to suggest that the so-called 'verb reduplication' process in Chinese might be, in fact, motivated by the prosodic reactor feature. If this is so, we now have a syntactic operation triggered by prosody.

(52)

Domain: $_{CP}$[... $_{v'}$[jiang daoli $_{v'}$[$_{v}$[jiang$_i$-touche$_j$ $_{VP}$[~~*daoli$_k$~~ $_{v'}$[t$_i$ $_{VP3}$[pro$_k$ ~~touche$_j$~~]]]]]]]

W S

NSR

The verb-reduplication can be analyzed as a copy of the verb through an adjunction of V' to V', by which it creates an ideal host for the * *daoli* to move to. In other words, the copy of the verb is forced to move out of its original place by the Reactor fea-

ture that needs a host for the *NP. Obviously, the operation of verb reduplication in Chinese is necessary and well-motivated prosodically, if not syntactically.

Once the reduplication process is complete, the domain will undergo transfer all over again and, at the point of Spellout, will receive prosodic computation, resulting in the structure given in (53):

(53)

Spellout $_{CP}$[... $_{v'}$[(jiang daoli) $_{v}$[v[(jiang$_i$-touche$_j$) $_{VP}$[~~*daoli*~~$_k$-V'[t$_i$ $_{VP3}$[pro$_k$ ~~*touche*~~$_j$]]]]]]]

(σ σσ) (σ σσ)

w s

NSR

Now, there is no uninterpretable factor, therefore, the prosodically well formed domain (with remaining well-formed constituents) will be sent to Segmental Phonology for further processing.

Notes

① This rule must be understood with the following exceptions as noted in previous chapters: 1. V.v where the second verb has a neutralized syllable (as seen in Chapter One) and 2. V.$_R$ where the R has a neutralized syllable as well (as seen in Chapter Four).

② This analysis cannot distinguish among the following grammatical contracts:

(i) a. *Zhang San xue yingwen san nian.
Zhang San study English three year
'Zhang San studied English for three years.'

b. Zhang San xue yingwen san nian le.
Zhang San study English three year Asp.
'Zhang San has been studying English for three years.'

(ii) a. Zhangs San xue yingwen xue le san nian.
Zhang San study English study Asp three year
'Zhang San studied English for three years.'

b. Zhang San xue yingwen xue le san nian le.

Zhang San study English study Asp. three year Asp.

'Zhang San has been studying English for three years.'

As argued in A. Li (1987), the structure of (i-a) is different from that of (i-b) and only in (i-b), is there an abstract YOU in the [[[V O] YOU D/FP]] structure. This is why (i-b) is grammatical while (i-a) is not, and when the verb is reduplicated the two types of structures have two different meanings. Obviously, the grammatical as well as semantic distinctions of these two structures will be lost if YOU appears in both structures under Cheng's analysis.

③ This does not mean that verb reduplication has no pragmatic function at all. What is important to note here is the fact that the [V NP D/FP] structure is perfectly acceptable without V-reduplication (36/58a), whereas sentences like (54d) and (55b-c) are ungrammatical even if the verb is reduplicated. This contrast shows that V-reduplication in (54a-c) is forced by prosody in the sense that a reorganization of the prosodically ill-formed structure is required either by making use of a syntactic or a pragmatic operation.

④ Though (18) is sufficient for the purpose of the current analysis, regarding the sentences given in (i), however, the CFVR must be redefined more accurately as in (ii).

i. Ni jintian he jiu he *(DUO) le.
You today drinkwine drink much Asp.
'You had too much wine today.'

ii. **Condition for Verb Reduplication (CFVR, revised)**
Verbs cannot be reduplicated unless there is a postverbal complement that serves as the NS-target.

⑤ Note that the opposite of CFVR may not be true: when there is D/FP (NS-target), there must be a V-reduplication. This, as seen in (58a) is actually predicted by the theory presented here.

⑥ The semantic bleaching resulted in HH > H+NH > VR.

⑦ Selkirk (2006) argued that prosodic major phrases are defined only with respect to constituents which are dominated by nodes in the extended verbal projection, namely arguments and adjuncts of the verb and its projections. She defines the generalization as follows: Prosodic *major phrases* correspond to *the highest constituent in the spellout domain of a phase*. (Selkirk, 2006) The present study is consistent, in spirit, with Selkirk's hypothesis.

⑧ The current model is also consistent with what Chomsky has proposed as a "deferred spell-out", discussed in his *Derivation by Phase* (2001: 13-14).

I would like to thank Dr. Feng-fan Hsieh for pointing this out to me.

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