KANSAS WORKING PAPERS
IN
LINGUISTICS

edited by

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Volume 27
2004

Cover Design by Nathan Poell and Stacey Stowers

Bi-directionality at the PF-Interface: Explaining Adjunction Stress Patterns in West Germanic

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Abstract: Theories regarding the connection between prosodic stress assignment and phrasal hierarchy abound in modern linguistic studies. The counter-cyclic behavior of adjunction structures (Late Adjunction Hypothesis – Lebeaux 1988) poses a problem for most accounts of prosodic mapping parasitically acting upon syntactic-generated structures. Feng's bi-directional model of prosody-syntax interaction (2003b) accounts for the intricate relationship between prosodic stress assignment and late adjunction structure in West Germanic in a parsimonious fashion unachieved by recent amendments to the Nuclear Stress Rule (Cinque 1993, Zubizarreta 1998). Furthermore, it is argued that *Nachfeld adjuncts*, i.e., adjunction structures that appear after the lowest VP in an SOV language, can be assigned prosodic prominence contra the Structural Removing Condition (Feng 2003a).

I. Introduction[1]

The connection between phrasal hierarchy and prosodic stress assignment has received much attention in recent studies (cf. Cinque 1993, Zubizarreta 1998). In particular, the active role of prosody in the narrow syntax has stimulated much controversy and discussion. Accumulating evidence in linguistics studies point to prosodic constraints interacting upon syntactic operations, especially within the field of Chinese linguistics (Lu and Duanmu 1991, Feng 1995/2000, Dong 1998, and many others). The most aggressive of these claims is forwarded by Feng (2003a) who promotes a syntactic model of bi-directionality with regards to the prosody-syntax interface. Feng argues that syntactic operations can actually make reference to phonological (prosodic) properties, so that structures generated in syntax must be altered by either movement or reanalysis as required by prosody. This stance is a significant departure from 'mainstream' Minimalism. In the Minimalist Program (hereafter MP) syntactic operations do not refer to phonological properties and thus the acceptability of the sentence is contingent only upon syntactic properties. Accordingly, at the PF-interface no structures are removed from the set of generated syntactic outputs. As a result, the phonology is only concerned with how sentences are pronounced at the successful completion of all syntactic operations.

Surprisingly with the sudden rise of interest in the prosody-syntax interface in the literature, Feng's bidirectional model has received little attention outside of Chinese linguistics. Most scholars who research scrambling/object shift and adjunction in Indo-European languages readily admit, at least to some extent, to the active participation of non-lexical triggers, i.e., discourse-linking, scopal/semantic or prosodic elements, at some point in the derivation. Concentrating on the introduction of adjuncts into syntax, focusing in particular on Dutch, German and Pennsylvania German, this article will show that the implementation of Feng's bi-directional model of syntactic computation sufficiently accounts for the various stress assignments that can be achieved on the basis of Lebeaux's (1988) Late Adjunction Hypothesis. Take, for example, the following sentences in Dutch (primary stress indicated in **boldface**):

(1)   ...dat ik op een bankje **wacht**
      ...that I on a bench wait ˎ
      '...that I wait, on a bench'

(2)   ...dat ik op een **bankje** wacht
      ...that I on˙ a bench wait
      '...that I wait on a bench'   (Van Gelderen 2003:175)

As pointed out by Neeleman and Reinhart (1998), in the first case, the PP is interpreted as an adjunct, in the second as an argument. This clearly shows that somehow, the active stress rules have to know about adjunct/argument distinctions, the burning question that remains however, is how this is possible. In other words, how can the relevant properties of adjuncts with regards to their interpretability at both LF and PF be derived? Lebeaux's Late Adjunction Hypothesis explains the counter-cyclic behavior of adjuncts, however, the current theoretical models regarding stress assignment operate under *cyclic* derivations, which serves as a shortcoming not addressed until now.

In this article we contend that Feng's bi-directional model achieves the most parsimonious account in explaining the various stress assignment patterns attributed to adjunct/argument distinctions within the framework of the MP. As a matter of fact, the presence of a 'Prosodic Filter' in the bi-directional model actually strengthens and unifies the role and function of previous theories of stress assignment contingent upon phrasal hierarchy (i.e., Cinque 1993, Zubizarreta 1998). This article is organized as follows. *Section 2* provides a brief introduction into Feng's research concerning the bi-directional model, its theoretical implications and its relevance for our current topic. *Section 3* illustrates the application of Feng's model on selected adjunction structures in West Germanic languages, namely, 'late' adjunct insertion in Dutch, German and Pennsylvania German. *Section 4* serves as a summary of this study.

II.   Feng's Bi-directional Model

In Chinese, prosody also plays an important role in syntax and, as a function of its influences on syntax, prosody can even invalidate an entire sequence of legitimate syntactic structure. According to Feng, in Chinese prosody (the emphatic/contrastive focus rule) can make a sentence grammatical. Therefore, syntax must react to structures on the basis of their prosodic properties. Focusing on [Verb + Resultative] (hereafter VR) constructions in Chinese (e.g. a resultative verb merged with a complement (adjectival or nominal)), Feng illustrates the contrast in grammaticality between disyllabic VR and trisyllablic VR forms, with the latter being ungrammatical:

(3)

	Disyllabic VR	Trisyllabic VR
a.	guan yan chuanghu close tight window 'To close the window tightly'	*guan yanshi chuanghu close tight-solid window 'To close the window tightly'
b.	da lao jichu make firm foundation 'To make the foundation firm.'	*da laogu jichi make firm-tight foundation 'To make the foundation firm'
c.	xiang tou wenti think thorough problem 'To think the problem thoroughly'	*xiang touche wenti think thorough-thorough problem 'To think the problem thoroughly'

(Feng 2003b:3)

All disyllabic VR forms can take a post-verbal object freely, but all trisyllabic VRR (with very few exceptions) fail to do so. Based on this fact, Feng presents the following general restriction:

Prosodic Restriction on VR forms: A verb + resultative form cannot take a postverbal object unless the V+R is disyllabic.

The grammaticality of the [V + R NP] construction is syllable-based, thus its acceptability is dependent upon its prosodic well-formedness. From a 'purely' syntactic perspective, there does not appear to be any existing constraints that would render the examples in (3) as ungrammatical. Therefore, only the active presence of prosody in the computation is capable of explaining why [VR NP] is grammatical while *[VRR NP] is not.

After establishing the ungrammaticality of *[VRR NP] forms, Feng examined the [Verb + Object + Durative/Frequentive phrase] (hereafter [V NP D/FP]) structure. In Chinese syntax, it has been recognized in the literature that only one constituent is allowed to appear after the main verb (expect when the object is a pronoun or definite NP). For example, a durative or frequent phrase [D/FP]

cannot appear after the [V+O]. If, however, the [V+N] expressions may be used as VO compounds, they function as single verbs and the invalidity of the structure is obviated. The contradictory behavior of *[V NP D/FP] constructions can be rectified through prosodic reanalysis.

In his review of previous research into the prosody-syntax interface, Feng mentioned the seminal studies of Cinque (1993) and Zubizarreta (1998) and their relationship within his bidirectional model of derivation. Stating the obvious, Feng finds fault with these previous analyses based on the mono-directionality of the approaches, i.e., the syntax feeds the prosody. This claim is self-evident when examining Cinque's Nuclear Stress Rule (NSR):

<u>Cinque's (1993) Theory of Sentence Stress</u>: No parameterization for NSR
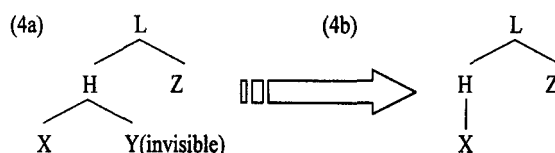
- Eliminates the projection parameter: headedness of stress projection is predictable from word order variety (i.e., head-parameter).

- The Nuclear Stress Rule (NSR) assigns main stress to the most deeply embedded phrase in a sentence.

- When two phrases are in a sister relation, i.e., when they are at the same level of depth of embedding, the embeddedness is determined by the direction of recursion of syntactic projection, i.e., the right node bears stress in right-branching structures; the left node bears stress in left-branching structures (Ishirara 2000:2).

$$C_k$$
$$C_i \qquad C_j \quad \text{(Where } C_i \text{ and } C_j \text{ are sisters)}$$
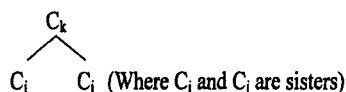
Zubizarreta's research is an attempt to meet descriptive adequacy, while keeping alive the basic insight in Cinque's theory mentioned above. The goal of Zubizarreta's (1998) work pursues the formulation of "an adequate theory of nuclear stress" (p.18). Building upon the NSR formulated by Liberman and Prince (1977), Zubizarreta arrives at a "modularized NSR" (MNSR). This MNSR comprises both a positional NSR, which is sensitive to constituent ordering (C-NSR), and a rule that is sensitive to selectional ordering (S-NSR) and thus incorporates the insights of the argument-structural account. The C-NSR is an extension of Cinque's (1993) Theory of Sentence Stress and is in essence a correspondence between the asymmetric c-command ordering of the syntax and prosodic ordering. This theory works best when applied to Romance and Germanic languages, however, as we shall see, they cannot explain the various stress patterns produced by means of the Late Adjunction Hypothesis in a succinct, uniform way. Besides, the facts that *[VRR NP] – a form syntactically

well-formed – is ungrammatical due to the prosodic deficiencies of the construction cannot be accounted for by Cinque and Zubizarreta's proposal. Furthermore, neither approach can explain why *[V NP D/FP] is inconsistent in its grammaticality. In either of these theories the most embedded element should be assigned neutral stress without any subsequent violations, yet the result is still ungrammatical. Only prosody can account for and solve this problem.

To improve upon previous theories and alleviate existing shortcomings, Feng argues that the assignment of neutral stress in Chinese (as in other languages with verb final structures – German) is only sensitive to the head-complement relation. Paramount to our current study is Feng's hypothesis that adjuncts in Chinese and German do not attract neutral stress even when they have a complex structure regardless of their position in the linear hierarchy. Adjuncts behave similar to pronouns, definite expressions, empty categories in that they are metrically invisible to the NSR. This invisibility condition is captured by the formulation of the Structural Removing Condition (Feng 2003b):
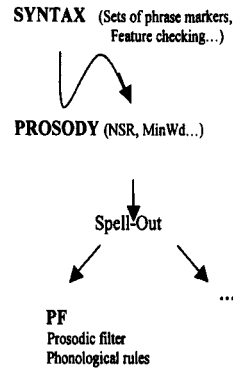
(4a)
```
        L
       / \
      H   Z        (4b)        L
     / \                      / \
    X   Y(invisible)         H   Z
                             |
                             X
```

Structural Removing Condition
Remove all the prosodically invisible elements (with their syntactic branches) from the tree structure, before the application of the NSR.

The application of the Structural Removing Condition can be seen from the Dutch data (examples (1) and (2)) at the beginning of this article. Both Dutch examples possess the PP [op een bankje], however, as already illustrated, there is a clear distinction in the stress patterns of these two sentence: where as the PP receive no prosodic prominence in (1), the PP is stressed in (2). This is due to the fact that the PP in (1) is an adjunct. Applying the Structural Removing Condition to this example, we see that adjuncts are render 'invisible' to prosodic stress assignment. It remains to be seen, however, if the adjunct is actually present in the hierarchy at the time of stress assignment based on the Late Adjunction Hypothesis. It is the behavior of late adjunction – both pre- and post-verbal in West Germanic – that will be analyzed in this article.

Returning to Feng's research, we see that prosody not only blocks certain forms in certain environments (i.e., *[VRR NP]), but also rules out a canonical syntactic structure (i.e., *[V NP D/FP]). Feng presents two processes for explaining the active interaction between prosody in syntax: a filter process and an interaction process. The two approaches are unified within the bi-directional model.
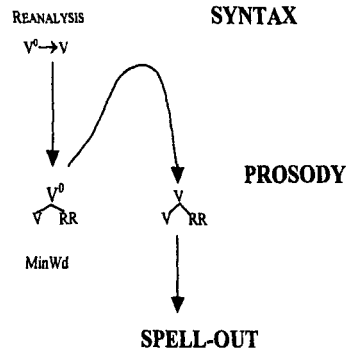
Feng's (2003a:40) Bi-directional Model

SYNTAX (Sets of phrase markers,
Feature checking...)

PROSODY (NSR, MinWd...)

Spell-Out

PF
Prosodic filter
Phonological rules

...

The presence of a mono-directional prosodic filter will not account for all of the grammatical outcomes nor repair all of the prosodically ill-formed utterances generated in the computation.[2] For example, *[VRR NP] can only be ruled out by NSR. However, the NSR cannot do so unless it sees the internal structure of [VRR]. The [VRR] is generated by head-movement; hence it belongs to the V^o category. If [VRR] is V^o, NSR cannot rule out the *[VRR NP] because the [VRR] is the governor and hence the NP is the NS target. Feng (2003a:41) illustrates this repair sequence in the following diagram:

Possible syntactic outputs (for [V+R] forms)

a. V^0 b. V^0 c. V^0 d. V^0

V   R   V   R   V   R   V   R

σ   σ   σ σσ σ   σ σ σ   σσ σ
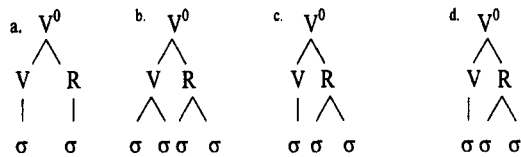
Bi-directional Interface Process (for (c))

REANALYSIS   **SYNTAX**

$V^0 \rightarrow V$

V^0

V⌒RR

V⌒RR

MinWd

PROSODY

SPELL-OUT

As can be expected, the interaction between prosody and syntax will most likely not be as strong in Germanic languages when compared to Chinese (for example it appears that the NSR is conducted at a much more local level in Chinese than in German). However as we shall see from the data in the following section, the bidirectional model provides a lucid explanation to how syntax can account for the adjunct/argument distinction in tandem with the Late Adjunction Hypothesis.

I.   Late Adjunction in Dutch, German and Pennsylvania German

Merge and Adjunction

The process of Merge has consequences for both the PF and LF interfaces, provided the features of minimal and maximal projects must be accounted for in the derivation. This establishes a distinct difference between arguments, which participate in Merge, and adjuncts that do not:

Merge (α,β) = $\{\alpha,\beta\}$ (non-adjunction)
Merge (α,β) = $\{\alpha, <\beta,\beta>\}$ (adjunction of α to β)

This definition of adjunction captures the fact that, if α is adjoined to β, then α is a daughter of $\{\alpha, <\beta,\beta>\}$ but β is not. Adjunction, therefore, is not involved in the semantic selection of the Head(α) and is integrated into the syntax purely by means of PF. This distinction is crucial in understanding the categorical differences between adjuncts and arguments, especially along the lines of stress assignment. Furthermore, the proposed algorithm of Merge enforces a particular timing in the application of 'substitution' Merge and 'adjunction' Merge. Thus, adjuncts are said to be merged non-cyclically/post-cyclically in overt syntax, in a different workspace.[3] In other words, there is a main component, where phases succeed each other, and another component, where parts of the syntactic structure (e.g. adjuncts) are created and merge with the main components at a later stage. Consider the examples from Dutch ((1) and (2)) from the introduction of this

paper. I will re-represent them below as (5) and (6) respectively for the benefit of the reader:

(5) ...dat ik op een bankje **wacht**
...that I on a bench wait
'...that I wait, on a bench'

(6) ...dat ik op een **bankje** wacht
...that I on a bench wait
'...that I wait on a bench'

The array for (5) is listed below in (7):

(7) The array: [C *dat*], [D], [N *ik*], T, *v*, [P op], [D een], [N bankje], [V *wacht*]

The derivation proceeds in phases and we reach the stage when C is merged with TP, as in (8):

(8) [$_{CP}$ dat [$_{TP}$ [$_{DP}$ ik [$_{vP}$ t$_s$ [$_{vP}$ *v* [$_{VP}$ wacht]

At this stage [$_{PP}$ op een bankje], already separately assembled, is the only remaining object in the derivation. It can then merge with *v*P post-cyclically. As in German, Dutch adjuncts are eliminated from the derivation by means of the Structural Removing Condition before proceeding to the Prosodic Filter. The PP in (6) exhibits the stress properties of an argument based on the assumption that the most deeply embedded structure is assigned primary stress. This is only possible if [$_{PP}$ op een bankje] has merged with V as a complement. The aforementioned Dutch data provide evidence, albeit weak, for the presence of the bidirectional model's application in West Germanic. The Dutch data set, however, is not representative of all adjunction structures in West Germanic. In particular, discourse-oriented late adjunction structures, i.e., adjuncts/'afterthought' material that appear to the left of the verb in SOV constructions (in the '*Nachfeld*') are more difficult to explain. The remainder of this section will focus on these discourse-oriented structures in German and Pennsylvania German, showing that the bidirectional model provides us with the most accurate and parsimonious system of accounting for the stress properties of this phenomenon. In addition, it will be demonstrated (contra Feng) that adjuncts that appear in the *Nachfeld* can receive stress and are not always opaque to the Structural Removing Condition.

Discourse-oriented Late Adjunction

German and Pennsylvania German are traditional SOV-languages. As a result of this typological distinction, adjuncts should not appear to the right of the final verb. Although this fact is borne out in the *prescriptive* standard language, standard *descriptive* discourse allows the placement of adjuncts (usually referred

to as 'afterthought material') in the *Nachfeld* (primary stress indicated in **boldface**):
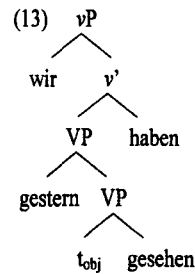
(9)   Wir haben ihn gestern in der Kneipe **gesehen.**   (prescriptive)
       We have   him yesterday in the bar seen

(10)   Wir haben ihn gestern gesehen in der **Kneipe.**   (descriptive)
      We have   him yesterday seen in the bar
      'We have seen him yesterday in the bar.'

On the other hand, Pennsylvania German licenses both aforementioned constructions. The difference in structural preference lies in religious affiliation rather than linguistic rationale, i.e., non-sectarian Pennsylvania German speakers such as the Amish prefer to place the PP exclusively in the *Nachfeld*, whereas sectarian speakers exhibit the opposite behavior:

(11)   Mir hen in de Hof **tschpielt.**   (sectarian PG)
      we have in the yard played

(12)   Mir hen tschpielt **in de Hof.**   (non-sectarian PG)
      We have played in the yard
      'We played in the yard.'   (Louden 1988:186)

Interestingly in (10) and (12) the adjunct appearing in the *Nachfeld* receives nuclear stress. Based on the assumption that adjuncts are metrically invisible to stress assignment, this should not be the case. Even if the PP was an argument it should not be the recipient of NS because, a.) it is not the most embedded element in the structure and b.) it does not appear on the recursive side of the structure. Provided that in most cases adjunction structures do not carry nuclear stress, how do we account for this unpredicted prosodic patterning? Furthermore, Cinque's NSR and Zubizarreta's research cannot account for this shortcoming either.

I will show that Feng's bidirectional model equips us with an ample framework to explain this phenomenon of late adjunction in German and Pennsylvania German. This can only be achieved through prosodic reanalysis due to the counter-cyclic nature of adjunction discussed earlier in this article. Here is the vP shell structure of (10) at then end of the syntactic derivation represented as (13):

(13) vP

```
        vP
       /  \
     wir   v'
          /  \
        VP   haben
       /  \
  gestern  VP
          /  \
       t_obj  gesehen
```
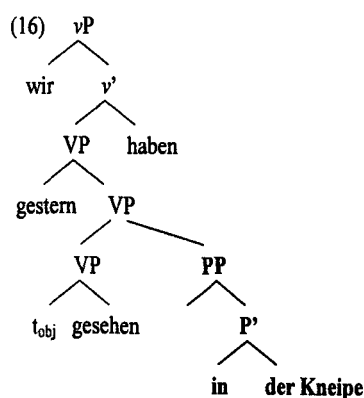
At this point I will assume with Adger (2000) that there are two levels of prosodic phrasing relevant to us here – one (Γ) associated with the CP, and one (ω) with lexical domains. The precise nature of these levels is not crucial here, however based on evidence from modern languages, these are roughly Phrase and Phonological Word respectively (Nesper & Vogel 1986). Here we shall see (contra Adger) that prosodic phrasing is not wholly parasitic upon syntactic structure and that prosody can re-assign, or better yet, repair stress assignment patterns. Returning to the levels of prosodic phrasing, there are two alignment constraints that govern this phenomenon:

(14)   Align left edge of Γ with the left edge of CP
(15)   Align left edge of ω with the left edge of L°

L represents N, V and A. These two constraints, interacting with the syntactic assumptions motivated above, conspire to explain of the prosodic filter that exists in West Germanic languages regard late adjunction. Within this framework, the Dutch examples (5 – 6) are easily accounted for: the adjunct PP in (5) appears to the left of the final verb. Based on the Structural Removing Condition which indicates that adjuncts are invisible to prosodic stress assignment, the [$_{PP}$ op een bankje] is stressless. The PP in (6) is an argument, therefore, eligible for the application of the NSR. Most often, these prosodic phrasing constraint requirements are met within the NSR, however as indicated by the German and Pennsylvania German data, this isn't always the case.

Returning to the parsed vP in (13), the only place that can serve as a landing site for [$_{PP}$ in der Kneipe] is the most embedded VP. Therefore we have rightward adjunction, and have a structure similar to (16 – adjoined PP indicated in **boldface**):

(16) *v*P
```
        vP
       /  \
     wir    v'
           /  \
         VP    haben
        /  \
    gestern  VP
            /    \
          VP      PP
         /  \    /  \
    t_obj  gesehen   P'
                    /  \
                  in   der Kneipe
```

At the completion of all syntactic operations, neutral stress would be assigned to *gesehen* ('seen'), provided that it is the most embedded element remaining. It is at this point that the adjunct PP would be merged to the VP. At this point the Structural Removing Condition should come into effect and eliminate the adjunct PP. This cannot happen, because the presence of the PP to the right of the verb in the *Nachfeld* is a violation of the (ω) constraint. Below (17) is an illustration of the application of Adger's alignment constraints ((14) and (15))

(17)   *{ Γ [$_{CP}$ Wir$_i$ [$_{TP}$ haben$_j$ [$_{DP}$ ihn$_k$]]] [$_{vP}$ t$_i$ [$_v$ t$_j$][$_{VP}$ gestern] [$_{VP}$ [$_{DP}$ t$_k$] **gesehen**]] ω } [$_{PP}$ in der Kneipe]

As stated before, the NSR cannot explain this and neither can the Structural Removing Condition. The only way to salvage this utterance is to send it through the prosodic filter for reconstruction. The two options for nuclear stress assignment are listed below (indicated by the diacritic: NS):

(18)   Possible NS assignments to lowest VP:

a.
```
     VP
    /  \
  V_NS  PP
```
b.
```
     VP
    /  \
   V   PP_NS
```
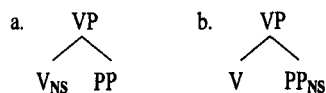
(18a) represents the array in (17), which clearly violates (ω). (18b) is the only option, however to elicit this form prosodic reconstruction must occur. This is due to the Late Adjunction Hypothesis and the Structural Removing Condition. The latter constraint is no longer valid for *Nachfeld adjuncts*. This prosodic repair is only possible through a counter-feeding relationship between prosodic and syntax. The following model, akin to Feng's Bi-directional Interface, demonstrates how this reanalysis would take place:

(19)   Prosodic Repair

STRESS REASSIGNMENT SYNTAX

V→PP

VP

V   PP

V   PP

PROSODY

SPELL-OUT
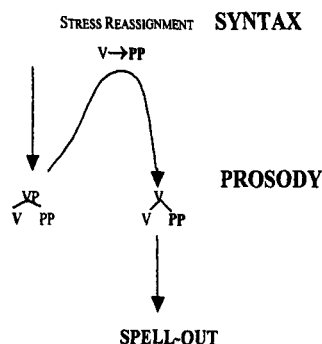
The default stress assignment on the verb (based on the NSR) would take place prior to the late adjunction of the PP. At this point the prosodic filter would intervene and recognize that the adjunction structure merged at the end of the derivation is to the right of the verb. If stress were to remain on the verb, the sentence would be ungrammatical by violating the (ω) constraint. Here we see the necessity of the bi-directional model: as stated before, the NSR cannot account for the shift in neutral stress, and provided the nature of adjuncts to merge into the array counter-/post-cyclically, only an approach in which syntax and prosody can interact with one another systematically accounts for the syntactically accepted, yet prosodically ill-formed constructions.

II.   Conclusion

This paper has argued for the bi-directional interaction of prosody and syntax in syntactic derivation. The data sets from Chinese and West Germanic languages (e.g. Dutch, German and Pennsylvania German) validate this hypothesis. For most grammatical outputs, especially in the individual prescriptive variants of West Germanic, prosodically acceptable structures are generated through the NSR. We have seen, however, that this does not account for all grammatical utterances, especially those in descriptive speech. This highlights a major difference between Chinese and West Germanic languages in regards to their prosodic formation filters: the NSR and other prosodic restructuring effects occur at a more local level, i.e. intra-phasal, in comparison to West Germanic, which operates at the phasal level.

The primary advantage of the proposed bi-directional model is that it provides us with a theoretical description of the prosodic stress rules regarding *Nachfeld adjuncts*. Furthermore, the hypotheses forwarded in this article can offer a new perspective on controversial subjects, such as scrambling/object shift, VP ellipsis, etc., in future studies.

Notes

[2] An anonymous reviewer questions why the *[VRR NP] cannot simply be eliminated at the PF-interface. In other words, why is the bi-directional model proposed by Feng necessary? The central issue at hand, however, is determining whether or not p-movement takes place in the narrow syntax in a cyclic fashion or is a post-derivational phenomenon. Many researchers support such an approach in regards to p-movement (Feng 2003a; 2003b, Sauerland and Elbourne 2002, Zubizarreta 1998). If p-movement is considered to be a purely post-syntactic phenomenon, the bi-directionality model proposed by Feng (2003b) is empirically flawed. This paper, however, agrees with Feng that p-movement is part of the cyclic derivation. Admittedly, continued research regarding the nature of p-movement is necessary.

[3] There is, of course, a strong and a weak version of the Late Adjunction Hypothesis. The weaker version (Leabeaux 1988) states that adjuncts can adjoin late, whereas the stronger approach (Stepanov 2001) argues that adjuncts *must* adjoin late.

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