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Varia

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A Note from the Editors

The collection of papers in this volume represents a sampling of research by graduate students and faculty of the Department of Linguistics at the Ohio State University. The volume is not devoted to any specific theme but rather, comprises work by researchers from diverse areas of linguistics: phonology (No-Ju Kim, David Odden), psycholinguistics (Kim Ainsworth-Darnell), syntax (Qian Gao, Karin Golde, Arnold Zwicky).

Henceforth, two regular volumes of the *Working Papers in Linguistics* will appear annually, an autumn issue and a spring issue. The contents of the autumn issue will be made up of a collection of works from different areas of linguistics, while the spring issue will focus on a particular subfield. In addition to the two regular publications each year, special issues may also be published dealing with specific topics in linguistics.

Forthcoming: **Papers in Phonology**
Spring 1996

Ohio State University Working Papers in Linguistics No. 47

Varia

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OSU Working Papers in Linguistics 47, 1-19

Discriminating Between Syntactic and Semantic Processing: Evidence from Event-related Potentials

Kim Darnell[1]

Abstract By measuring the event-related brain potentials (ERPs) elicited during a visual word-by-word presentation of sentences containing either a syntactic incongruity, semantic incongruity, or a combined syntactic and semantic incongruity, I investigated whether the N400 and P600 waveforms are discrete components reflective of independent semantic and syntactic processing or simply sub-parts of a larger wave caused by general sentential processing difficulty. Words that were syntactically inconsistent with the sentence structure elicited a P600 potential, while words that were semantically inconsistent elicited an N400 potential. Words that caused both a syntactic and semantic violation of the sentence in which they appeared evoked both a P600 and an N400 waveform. The results support the hypothesis that the N400 and P600 are independent waveforms, suggesting that the brain is capable of responding specifically to anomalies at both the syntactic and semantic levels. These findings are used to evaluate the functionality of three currently popular descriptions of the relationship between the syntactic and semantic levels of the human language processor.

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[1]This research was made possible through funding provided by the Ohio State University Center for Cognitive Science, the Department of Psychology, and the Department of Linguistics. My appreciation is extended to my collaborators, Dr. Harvey Shulman and Dr. Julie Boland, for their guidance and support during this project, and to Dr. Peter Culicover for his comments and suggestions on earlier drafts of this paper. Thanks also to Rob Tigner, Christina Pencheff, Karen West, Maria Miles, and Angie Wascovich for their assistance in collecting and analyzing the data. All errors are mine. Questions should be sent via electronic mail to darnellk@ling.ohio-state.edu.

Language comprehension is an intricate process, involving the evolution of a linguistic stimulus from a string of phonological or orthographic code into coherent, hierarchical structure that can be interpreted in terms of stored lexical and pragmatic knowledge. Developing a clear blueprint of the mechanisms that allow this process to take place has been a focus of psycholinguistic research for decades. In particular, there has been substantial debate concerning the relationships between the various levels of processing that compose the language comprehension system. Do the mechanisms that extract the different levels of linguistic representation from the stimulus act in isolation from one another? Or are the processing tiers interconnected, influencing one another during the application of their respective operations?

Essentially, the debate concerning the architecture of the language processor concerns the sequence in which processes from different levels cooperate. According to the serial autonomous view, language comprehension is strictly a bottom-up process, with processes at each level of representation operating in turn. The output of a lower level process serves as the input for the next level of computations. Word recognition processes, for example, generate the mental representations necessary for syntactic rules to be applied. Interactive views, on the other hand, hold that different kinds of linguistic knowledge can be applied simultaneously. Contextual information, then, might be used to guide the development of sentential structure by helping to select the syntactic rules that should be applied to a given string.

The distinction between computationally autonomous, or modular, processes as in Fodor (1983) and non-modular, or interactive, processes has played a key role in this debate. Within the literature on sentence processing, most of the focus has been on the syntactic level and the question of whether it is computationally independent from other parts of the grammar. Syntactic processing is a reasonable candidate for a modular process because the development of sentential structure could take place within a singular and narrowly defined domain. This is how Fodor (1983) defined peripheral processes. Peripheral processes are special purpose routines for inputting and outputting information. They can be distinguished from central processes like problem-solving and reasoning, which are general purpose cognitive processes, and therefore would not be computationally autonomous. The semantic level of processing, where meaning is determined, is seen as more central to human cognition, and thus less likely to be purely linguistic (Fodor, 1983).

Functionally, an autonomous syntax module in the language processor results in an architecture like that shown in Figure 1. Here, hierarchical structure is applied to incoming lexical information without recourse to contextual or pragmatic knowledge; thematic roles and word meanings are considered separately from structural function.

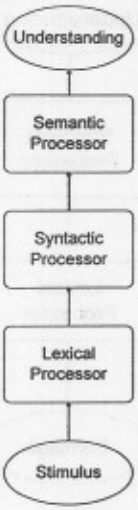

Figure 1 A modular view of the language processor including an autonomous syntax level.

Indeed, when language processing is perceived as the serial application of sets of rules, it is consistent with a modular architecture. But if information from multiple levels of representation influence processing decisions at a given level, the system takes on a more interactive character. Interactive models permit higher processing levels to influence processing decisions together with lower levels (see Boland and Tanenhaus, 1991; Marslen-Wilson and Tyler, 1980; Marslen-Wilson, Tyler, and Seidenberg, 1978; Tyler and Marslen-Wilson, 1977; Taraban and McClelland, 1988). The evaluation of the stimulus still requires an orderly application of grammatical rules, but the range of rules that may be applied at a given level is restricted by the outcome of computations at higher levels.

In contrast with their modular counterparts, many interactive models focus on the sharing of information between the syntactic and semantic levels of the processor. In the Marslen-Wilson and Tyler (1980) model, for example, the two levels in question are separate but are able to share information during the sentence comprehension process and guide one another in their respective manipulations of the incoming material (Figure 2). A more extreme model proposed by Bates and MacWhinney (1987), on the other hand, depicts syntactic and semantic information being dealt with on the same processing level; this results in a single mental representation encompassing both syntactic and semantic elements of the current input (Figure 3).

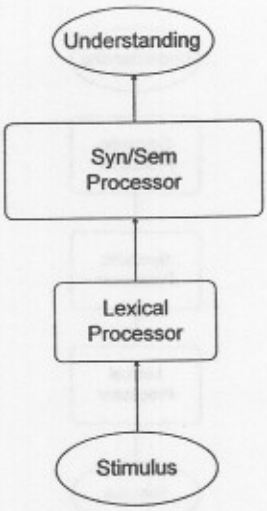

Figure 2 An interactive view of the language processor with parallel processing between the syntax and semantic level.

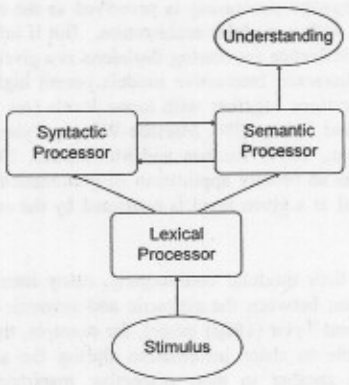

Figure 3 An interactive view of the language processor with a single level for the processing of syntactic and semantic information.

Determining what configuration of the language processor best describes human beings' actual comprehension performance has proven to be an extremely difficult task. Subjects in psycholinguistic experiments, for example, cannot self-report on how syntactic and semantic information come together to produce understanding because the process is normally entirely unconscious. Traditional experimental methodologies, such as reading time and dual task paradigms, have also failed to provide a resolution--a claim supported by the literature, which contains evidence in favor of both the modular and interactive architecture using these sorts of paradigms.

Recent advances in cognitive neuroscience, however, may allow us to investigate the architecture of the linguistic processor in terms of the physiological responses of the brain. If there are physiological differences between syntactic and semantic processing, for example, this would suggest that the two levels are separate. Were this true, there would be cause to prefer models like those in Figures 1 and 2 over the one offered by Bates and MacWhinney (1987). Moreover, physiological evidence that syntactic and semantic responses occur in a fixed order could be used to argue for a modular framework over an interactive one.

One method of measuring brain responses is electroencephalography, or EEG. This involves attaching electrodes to the surface of the head in predetermined locations (Figure 4). The brain's response to an external event is extracted from the EEG by averaging the recordings for several repetitions of the event. These extracted responses appear as waveforms called event-related potentials, or ERPs.

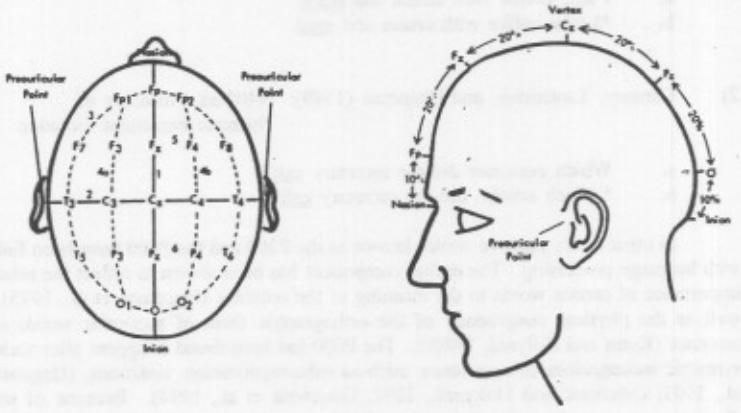

Figure 4 Locations for electrode placement according to the International 10-20 system.

An ERP waveform is composed of positive and negative peaks. These peaks reflect natural changes in the biochemical polarity of the brain that develop as neurons transfer information to one another. To make interpreting ERPs simpler, a standardized system has been devised to label prominent peaks. This includes information about whether a peak is positive or negative, and the average time it takes the peak to maximize after the onset of the stimulus. Thus, a large positive component peaking at approximately 100 milliseconds after a stimulus has been presented is referred to as a P100, while a negative component peaking 100 milliseconds later would be an N200.

Crucially, certain peaks on the ERP waveform seem to be directly correlated to particular kinds of language processing. The N400 wave, for example, has been linked to semantic congruency in two ways: predictability of a word to the context, with larger N400s for less predictable words (Kutas and Hillyard, 1980a, 1983; 1984; Polich, 1985), and the failure of a given word to fulfill thematic constraints (Garnsey, Tanenhaus, and Chapman, 1989).

Examples 1 and 2, below, show sample stimuli from two N400 studies. At the underlined word, the difference in the peak amplitudes of the N400 in sentences like (a) was compared with that in anomalous sentences like (b). The N400 was found to be significantly larger on the reading of the final word in the anomalous condition.

1) Kutas and Hillyard (1980a): N400 as a measure of predictability

a. I take coffee with cream and <u>sugar</u>
b. *I take coffee with cream and <u>mud</u>

2) Garnsey, Tanenhaus, and Chapman (1989): N400 as a measure of thematic constraint violation

a. Which customer did the secretary <u>call</u>?
b. *Which article did the secretary <u>call</u>?

In other work, positive waves known as the P300 and the P600 have been linked with language processing. The earlier component has been shown to reflect the relative importance of certain words to the meaning of the sentence (Friedman et al., 1975), as well as the physical congruency of the orthographic form of particular words in a sentence (Kutas and Hillyard, 1980b). The P600 has been found to appear after various syntactic incongruities in a sentence, such as subcategorization violations, (Hagoort et al., 1993; Osterhout and Holcomb, 1992; Osterhout et al., 1994). Because of some disagreement as to the uniqueness of the P600 as compared to the P300, some refer to the later component simply as the Syntactic Positive Shift (SPS) or, even less dramatically, as the Late Positivity (LP). While making no claims about the validity

of P300/P600 contrast, I will refer to the positive component that is sensitive to syntactic incongruity here as the P600.

Example 3 provides sample stimuli from a P600 study by Osterhout and Holcomb (1992). As before, the amplitude of the wave in question was measured at the underlined word in control and anomalous sentence conditions. The P600 to the final word in (b) was significantly larger than that to the word in the same position in (a).

3) Osterhout and Holcomb (1992): P600 as a measure of verb subcategorization violation

a. The broker planned to conceal the transaction.
b. *The broker persuaded to buy the stock.

In short, research has shown that semantic anomalies induce an N400, while syntactic anomalies evoke a P600. While this may suggest a discussion concerning the discreteness of the syntactic and semantic levels of the language processor is moot, there are still several points to consider. First, studies to date investigating the N400 and the P600 have used entirely unrelated stimuli in different experiments to evoke each of the two waveforms, making the results difficult to compare. It is certainly possible that the N400 and P600 are independent phenomena generated in response to the processing of semantic or syntactic incongruencies, respectively. However, it might also be the case that the N400 and P600 are just very salient, measurable sub-parts of a single complex brainwave component that reflects general processing difficulty. Consider, for example, the possibility that there exists some complex waveform that is induced by language processing or some other cognitive process that occurs during the reading of sentences that is initially positive, but becomes negative towards its end. If this waveform were generated in the appropriate time course such that it overlaid an N400-P600 complex, it could conceivably minimize one of the components, making it appear as if only a significant negative or a significant positive shift had been evoked by the anomaly under study.

Thus, in order to get a clearer picture of what information the N400 and the P600 waveforms can truly provide concerning the nature of semantic and syntactic processing and the relationship between them, it is necessary to develop experimental stimuli that permit a comparison across syntactically anomalous and semantically anomalous conditions. In addition, there should be a condition where the critical word reflects both a syntactic and semantic anomaly; this would determine if a doubly incongruous element evokes a waveform in which the N400 and P600 remain distinct.

To this end, stimuli like that described in Example (4) were developed. Each sentence centers around a non-alternating dative verb, or verb that is subcategorized to take both a direct and indirect object, in that order. More specifically, each verb calls

for a noun phrase (NP) direct object, to be followed by a prepositional phrase (PP) headed by the preposition 'to' and containing an animate NP indirect object. Every stimulus has four versions, each identical in its acceptability up to the point where the anomaly is introduced (indicated by the underlined word). Version (a), the control, is proper both syntactically and semantically according to the grammar. Version (b) is syntactically incorrect, failing to contain the required preposition, but remains semantically viable because the noun phrases that are present possess the necessary animacy features and can be interpreted meaningfully through application of thematic and real world knowledge.[2] Version (c) is syntactically sound, having the 'to', but semantically unacceptable as a result of the NP in the indirect object position being inanimate and thus violating the verb's thematic constraints. Version (d) is erroneous both syntactically and semantically, having no preposition 'to' and an inanimate indirect object NP.

(4) a. Lee introduced his dog to everyone at the big party.
b. Lee introduced his dog everyone at the big party.
c. Lee introduced his dog to entrances at the big party.
d. Lee introduced his dog entrances at the big party.

Assume that structural issues like subcategorization demands made by the verb are defined as syntactic, while thematic constraints like animacy value are defined as semantic, and that there are different waveform patterns produced when violations occur at each of these levels of linguistic computation. It should be the case, then, that individuals seeing condition (b) should have a significantly larger P600 at the critical word than those seeing condition (a), with no difference between the N400 amplitudes in the two conditions. Those seeing condition (c) should display just the opposite pattern, namely a significantly larger N400 than the control, but not a larger P600. People seeing condition (d) should produce both significantly larger P600s and N400s as compared to in condition (a). Moreover, if the two waveforms in question are truly independent, then the amplitudes of the N400 and P600 in the doubly anomalous condition should be no larger than the same waveforms evoked in the single anomaly. In addition, the waveforms in condition (d) should have similar waveform parameters, such as scalp distribution and waveform topography, as their counterparts in the singly anomalous conditions.

The final concern relates to rate of presentation. It is common for studies of this nature to use time windows around 650 milliseconds for the presentation of each word (e.g., Osterhout and Holcomb, 1992). Considering that one of the components of interest is a broad waveform with a midpoint around 600 milliseconds post stimulus, such a short presentation window could easily result in this late component overlapping

[2]Questionnaires completed by an independent subject group indicate that sentences in the syntactically anomalous condition are interpreted in the manner intended, despite their structural malformation.

with early processing components evoked by the word after the stimulus, making it difficult to measure accurately. Moreover, if a short window of presentation allowed late processing components induced by the word before the critical word to overlap with waves initiated early by that critical word--waves like the N400--it might be difficult to evaluate the actual significance of these waves as compared to those elicited at the same location in the control. To address this issue, the current stimuli were presented at a slower rate, allowing 1000 milliseconds for each word. While this is much slower than average reading speed, it greatly reduces the chance of waveforms from different words overlapping and interfering with the measurements of the components of interest

METHOD

Subjects Thirty-two Ohio State University students from an introductory psychology class participated in this experiment as part of their course requirements. All of the students were native speakers of English, had no reading disabilities, and had normal or corrected-to-normal vision.

Materials Stimuli for this experiment used 20 non-alternating dative verbs identified through an earlier norming study (see Example 4). Two different sentence sets were constructed from each verb, for a total of 40 critical trials. Each sentence had four versions: a control; a syntactically anomalous condition; a semantically anomalous condition; and a doubly anomalous condition that contained both a syntactic and a semantic violation. The validity of the intended interpretation of the anomalous sentences was confirmed through a series of sentence completion questionnaires completed by a separate group of subjects.

There were four experimental lists, each with one version of the 40 critical trials. Conditions were rotated across the four lists so that there were equal numbers of each condition on each list. Each list also contained 40 distracter trials of various syntactic types to prevent subjects from recognizing patters in the critical trials and developing a strategy of response.

Apparatus Surface electrodes were attached to the scalp of each subject at the frontal (Fz), central (Cz), and parietal (Pz) sites located along the midline between the bridge of the nose and the base of the skull. Eye movements were measured by means of additional electrodes above and below the left orbit; jaw movements were measured by electrodes placed on each mastoid. Signal recordings were referenced to the left mastoid. A separate channel recorded the left mastoid referenced to the right. The data were subsequently referenced digitally to the average of the two mastoid electrodes.

Utilizing a Grass Model-12 Neurodata Acquisition system, the EEG recordings were amplified and digitized on-line with a sampling frequency of 100 Hz. Sampling began two words before the presentation of the critical word in each trial (at the third

word), with sampling epochs varying according to the length of each sentence. The input data were bandpass filtered with cutoffs of .01 Hz and 30 Hz.

PROCEDURE

The stimuli were presented to each subject in a computer-generated random order. Eight subjects saw each list. Each sentence appeared word-by-word in the center of a computer screen, with the word framed by a white line box 10 centimeters across and eight centimeters high. Each word was presented for 500 milliseconds, followed by a 500 millisecond interval when the box was empty. Subjects were asked to read each word carefully and try to link the words together in their minds to produce a comprehensible sentence.

After a trial was completed, the white box disappeared, leaving the screen blank and alerting the subject that she could blink her eyes. The screen remained blank until the subject pressed a key on a computer keyboard indicating that she was ready for the next trial. At this juncture, one-third of the trials were followed by YES/NO comprehension questions that appeared at the top of the screen; these were included to motivate subjects to be attentive to the sentences. The subject was asked to consider the truth of the question based on the sentence she had just seen and to respond either YES or NO by pressing the Y or N keys on the keyboard. After the subject had given her response, the screen again went blank. Only upon a second keypress was the white box brought back to the center of the screen so that the next trial could begin. If there was no comprehension question, then the first keypress after the subject's "blink break" initiated the onset of the next trial.

Subjects were seated approximately 75 centimeters away from the computer screen, resulting in a horizontal visual angle of at least two degrees and a vertical visual angle of three degrees. Testing took place in a sound-proof cubicle, with the subject seated in a comfortable chair. Before any responses were recorded, each subject ran through 10 practice trials to become familiar with the experimental procedure. Participants were told to expect grammatical problems with some of the sentences, but were not told precisely what types of problems. Including electrode application and removal, each subject's session lasted approximately 90 minutes.

RESULTS

The raw EEG data were digitized and visually evaluated on a trial-by-trial basis for excessive eye or jaw movement that would interfere with standard manipulation of the data for analysis; trials where irreparable amounts of movement occurred were eliminated. Remaining trials were first corrected for the influence of blinking, if necessary, and were then averaged by condition for each subject. These averages were compiled into a grand average across subjects for each condition. The mean N400 and P600 voltages following the critical word were measured and subtracted from a baseline

voltage taken from the average of a 50 milliseconds window beginning 250 milliseconds prior to the onset of the critical word.

Responses to the anomalous word in each of the three critical conditions at the Cz and Pz electrodes are contrasted with the control in Figures 5a and 5b, respectively. Each waveform graph shows the grand averaged responses for each pair of conditions from the word prior to the critical word through two words after the critical word. The onset of the critical word is indicated by an arrow on the x-axis timeline. Consistent with previous research in this area, the N400 waveform was found to be most robust at the Cz site, while the P600 was most salient at the Pz site.

The N400 was quantified as the mean voltage in a 40 milliseconds window centered at 400 milliseconds after the onset of the critical word. Because the P600 is a broader, longer lasting potential, it conversely was quantified as the mean voltage in a 400 millisecond window centered 880 milliseconds after the same onset. A bar graph of the average amplitude of the N400 at the Cz and the P600 at Pz is given in Figure 6.

A two-way analysis of variance (ANOVA) was performed with repeated measures on four levels of anomaly type and three levels of electrode position (frontal, central, and parietal). Significance tests were adjusted by the Geisser-Greenhouse correction. This analysis revealed a main effect of electrode and condition for the N400 waveform [$F(1,31) = 11.10$, $P < .01$; $F(3,93) = 4.26$, $P < .01$], and for the P600 waveform [$F(1,31) = 9.68$, $P < .01$; $F(3,93) = 3.01$, $P < .05$]. Paired t-tests by electrode between the mean amplitudes of the N400 waveform in each critical condition with that of the control revealed a reliable difference (2-tail $P < .05$) between the semantically anomalous condition and the control at Cz and Pz. There was also a reliable difference between the doubly anomalous condition and the control at Fz and Cz, with a marginal effect at Pz. The same tests performed for the P600 showed a reliable difference between the syntactically anomalous condition and the control at Pz. At Fz, there was a marginal difference (2-tail $P < .10$) between the control and both the semantically anomalous and doubly anomalous conditions.

DISCUSSION

Our results provide evidence that distinctive waveform patterns are evoked in response to syntactic anomaly, semantic anomaly, and a combination of the two. The syntactic anomaly condition evoked a strong, broad positivity beginning around 600 milliseconds after the presentation of the indirect object, a result that is consistent with previous findings by Osterhout and colleagues (1992, 1994) and Hagoort et al. (1993). The semantic anomaly condition evoked a sharp negativity centering at approximately 400 milliseconds after the presentation of the indirect object, in keeping with reports by Kutas and Hillyard (1980a, 1983, 1984) and Garnsey, Tanenhaus, and Chapman (1989) concerning the N400 component. This pattern of results suggests that the language

processor does distinguish between anomalies normally defined as syntactic and semantic within the grammar.

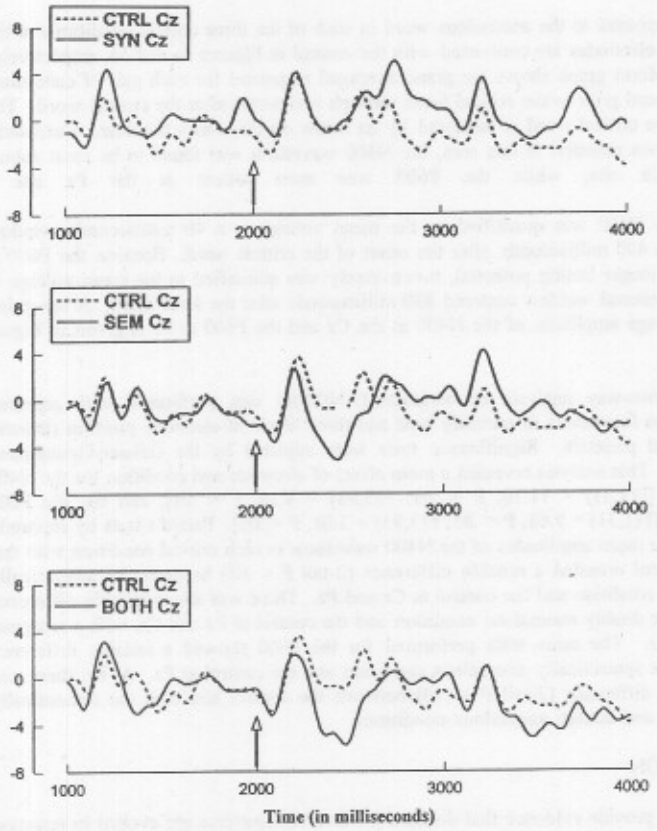

Figure 5a Grand-averaged waveforms at Cz from one prior to one word after the critical word, with each of the anomalous conditions contrasted with the control. The arrow indicates the onset of the critical word. SYN is the syntactically anomalous condition, SEM is the semantically anomalous condition, and BOTH is the doubly anomalous condition.

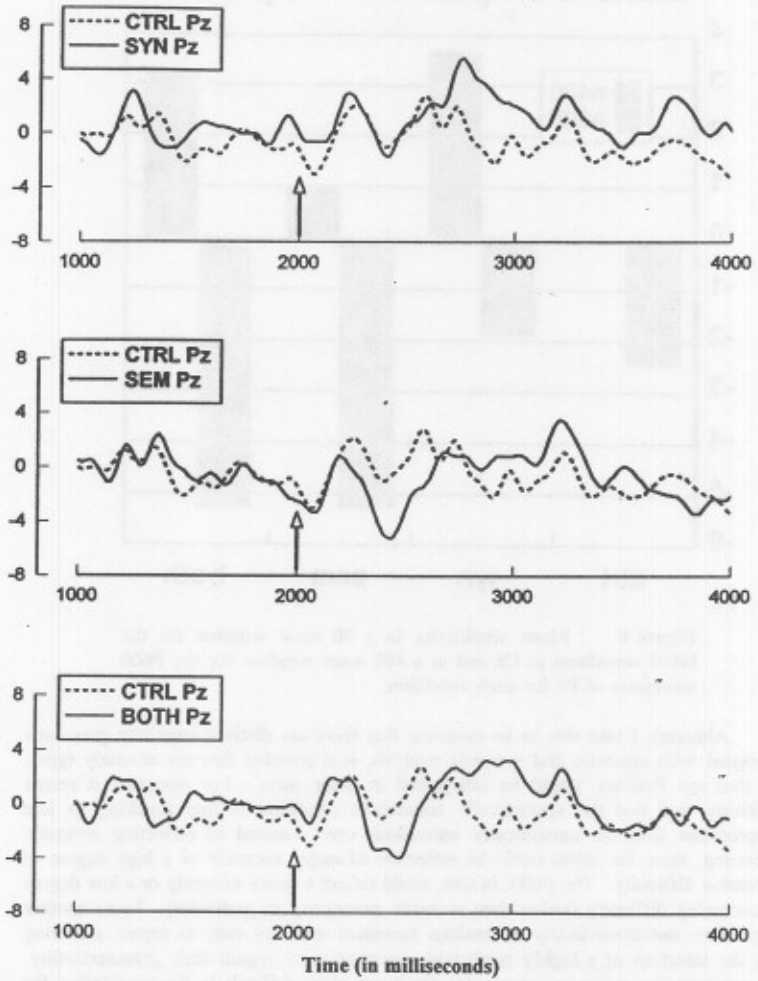

Figure 5b Grand-averaged waveforms at Pz from one prior to one word after the critical word, with each of the anomalous conditions contrasted with the control.

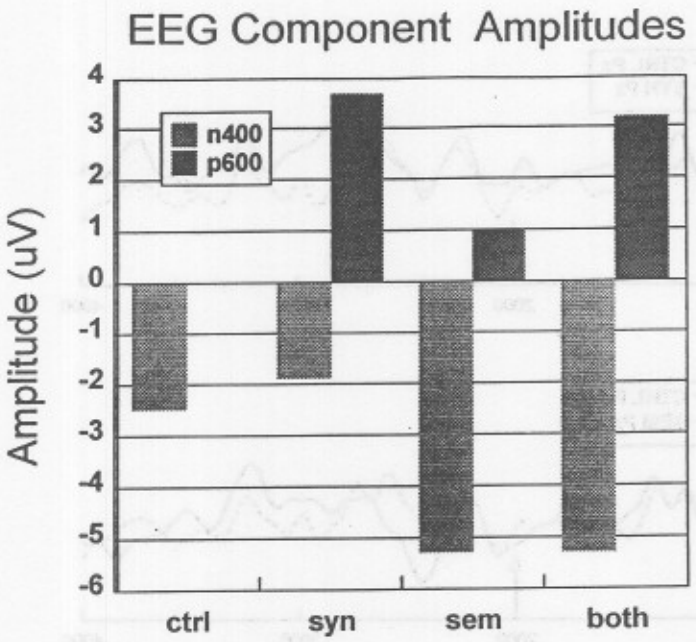

Figure 6 Mean amplitudes in a 40 msec window for the N400 waveform at Cz and in a 400 msec window for the P600 waveform at Pz for each condition.

Although I take this to be evidence that there are distinct cognitive processes associated with syntactic and semantic analysis, it is possible that my anomaly types, and thus my findings, could be interpreted in other ways. For example, it seems intuitively true that the syntactically anomalous condition is less shocking or less inappropriate than the semantically anomalous one. Instead of reflecting semantic processing, then, the N400 could be reflective of major anomaly or a high degree of processing difficulty. The P600, in turn, could reflect a minor anomaly or a low degree of processing difficulty (rather than syntactic processing in particular). From another perspective, our syntactically anomalous sentences are very easy to repair, requiring only the insertion of a highly predictable preposition to regain their grammaticality. The semantically anomalous sentences are much more difficult to fix considering the wide variety of animate nouns a subject could choose from to make them coherent. If ease-of-fix, not anomaly type, was the key factor, it could be that our two waveforms reflect different levels of reparability, not structural and interpretational problems per se.

A closer look at these alternatives, however, reveals that both interpretations may be perfectly confounded with the original predictions. In other words, if the N400 and the P600 reflect degree of processing difficulty or reparability instead of anomaly type, but these factors are directly correlated with what the grammar refers to as semantics and syntax, my line of argumentation is not seriously affected. The current data still offers substantial evidence that the ERP methodology can effectively discriminate between the processing of these two types of sentential information.

Another concern is the purity of the semantically anomalous condition. Recall that the verbs in the current stimuli were chosen because they were non-alternating datives, calling for a NP PP complement. A post-experimental review of these verbs, however, revealed that some of them could also take an infinitive verb phrase (VP^{inf}), such as 'to go' or 'to be', in place of the complement PP. As a result, some subjects could have interpreted the word 'to' after the NP direct object as an infinitive marker, not as the head of a prepositional phrase. Those that perceived the infinitive marker would, in turn, expect the next word to be an infinitive verb form, not an NP. When they did encounter the indirect object NP and attempt to incorporate it into the developing sentential structure, the categorical mismatch of the stimulus and what was expected could easily induce a syntactic processing difficulty.

To address this concern, a post hoc comparison was performed on the sentences in the semantically anomalous condition. Three native English speakers were presented with the stimuli up to the word 'to' and asked to provide both noun and verb completions for each fragment. Stimuli for which one or none of the evaluators were able to think of a completion beginning with a verb were considered "pure" NP PP stimuli; all others were categorized as NP VP^{inf} stimuli. There were 20 sentences in each group. The blink-corrected data for the two groups of stimuli were grand averaged and the resulting waveforms were compared. If the NP VP^{inf} set of stimuli had a larger P600 at the critical word than the NP PP set, there would be evidence that a syntactic anomaly had been introduced. Moreover, if the N400 for the NP VP^{inf} stimuli was smaller than for the NP PP sentences, this would suggest that the intended semantic anomaly had not been perceived by the subjects. Utilizing the same baseline and peak window parameters as before, I examined the amplitudes of the N400 and P600 in both sets of stimuli. The largest difference between the two waveforms was two microvolts, which was clearly not significant. These findings suggest that few subjects, if any, misinterpreted 'to' as an infinitive marker or experienced a syntactic processing difficulty when reading the semantically anomalous sentences.

Lastly, I must address the possibility that our pattern of results may have been influenced by design differences between our study and previous work. In particular, our rate of presentation allowed subjects to view each word for 500 milliseconds (with an additional 500 milliseconds delay between each word) in order to reduce the overlap of brainwave components. A much more common rate is 300 milliseconds display time per word (with an 350 milliseconds delay between words), as found in Osterhout and

Holcomb (1992). Considering that the average person reads text at a rate of 200-300 milliseconds per word, participants are required to read at a substantially slower pace than normal in either case, but the difference was more exaggerated in the present study. It is important to know whether the slower presentation rate could have led to abnormal reading behavior.

To explore this issue, I performed two replications of Osterhout and Holcomb (1992), one using the original 650 millisecond stimulus onset asynchrony (SOA) and one using 1000 SOA. In both cases, I found that the P600 was a significant and identifiable measure of verb subcategorization violation, with the positivity being only slightly attenuated at the slower presentation rate as compared to the faster one. Because these findings are consistent with those published in the source paper, I conclude that for responses as robust as the N400 and P600, increasing the rate of presentation to 1000 milliseconds SOA does not affect the waveform patterns evoked by the type of stimuli in question. Moreover, the slower rate provides the benefit of minimizing component overlap and, thus, facilitating an analysis of the results.

Having dealt with these concerns, I may now evaluate how effectively each of the two interactive configurations of the linguistic processing model predicted our findings. It is almost immediately clear that the configuration in the inclusive model proposed by Bates and MacWhinney (1987), is not supported by our data. If syntactic and semantic processing were taking place by means of the same mechanism, I would not expect to find different waveform components correlated to each of these two levels of linguistic knowledge. The autonomous interactive model, conversely, seems to make the right predictions to account for our data: two levels of processing that have independent manifestations in the realm of electrochemical response.

One might be tempted to suggest that our findings can even reveal which of the two remaining models, namely the Ferreira and Clifton (1986) serial model and the Marslen-Wilson and Tyler (1980) interactive model, provides the most useful description of the relationship between the syntactic and semantic levels of processing. This is because, while both predict that the syntactic and semantic processing functions are discrete, they have different hypotheses about when syntactic and semantic processing take place with respect to each other. The serial processing model maintains that syntactic processing must be complete before semantic processing can begin, whereas the interactive model allows for semantic processing to begin before a final syntactic evaluation of the stimulus has taken place. Even the very labels of the N400 and P600 waveforms tell us that the correlate to semantic processing manifests earlier in the time course of comprehension than does the correlate for syntactic processing. This is consistent with the implication that semantic processing begins before syntactic processing finishes, and thus supports the interactive framework. When making any assumptions about the association between cognitive processes and neurobiological phenomena, however, it is prudent to be cautious. There is no evidence that whatever temporal relationship exists between the output of the syntactic and the semantic levels

of processing is preserved in their manifestations as event-related potentials. If these processes are independent, as I am now wont to argue, they could well have completely different functions mapping their cognitive and physical states. This possibility prevents us from drawing too bold a conclusion concerning the limited set of data I have presented here.

This does not, however, mean that it is not possible to use the ERP paradigm to try and determine whether the relationship between the syntactic and semantic levels of the language processor is autonomous or interactive. Indeed, I am currently developing an experiment involving the processing of garden path filler-gap sentences like that in (5) to address this very issue.

(5) a. Which athlete$_i$ did the coach encourage _ _ _ John to watch _____$_i$?
b. Which game$_j$ did the coach encourage _ _ _ John to watch _____$_j$?

Native English speakers have the tendency to assume the fronted NP in (5a), *athlete*, is the direct object of the verb *encourage* (indicated by broken underline), when in fact is actually the direct object of *watch* (indicated by solid underline). When they encounter *John* in the expected gap, speakers realize that they have misanalyzed the sentence and must conduct repairs to make the sentence comprehensible. My colleagues and I are interested in investigating the electrophysiological manifestations of the 'garden path experience' found with these types of sentences. Does a processing difficulty arise because *athlete* and *John* are assigned to the same structural position, giving rise to a syntactic anomaly, or is the problem that the two NPs have been assigned the same thematic role, resulting in a semantic anomaly? Is it both?

A contrastive analysis of the N400 and P600 waveforms produced at the critical gaps in sentences like that in (5a) with that in (5b) should help us find the answer. The serial model predicts that any processing difficulty evoked by the reading of *John* in (5a) should be syntactic and, therefore, marked by a large P600; there should be no N400 at this word position, because, according to this framework, semantic processing of the clause would not yet have taken place. By this same reasoning, the fronted NP *game* in (5b) should evoke a P600 as well, because there is no selectional information, like animacy value, available during the parse to remove this noun phrase as from consideration as a filler for the direct object position.

While the interactive model would also allow for the elicitation of a P600 upon reading the noun phrase *John* in (5a), it differs crucially in its prediction for (5b). Because this model allows for semantic processing to occur in parallel with syntactic processing, it should be possible for the interpreter to identify *game* as an inappropriate theme for the verb *encourage*--due to the concept's lack of animacy--and in turn guide the parser to search for a more appropriate noun phrase to fill the direct object position. The parser should, therefore, have no difficulty when it encounters the noun phrase

John and elects to place it in the direct object slot, and thereby have no cause to generate a P600 waveform.

In sum, I offer evidence that syntactic and semantic processing are indeed independent functions of the language processing system and, thus, that only a model that allows for the separation of these two levels of information can effectively predict the pattern of results displayed in our data. Moreover, I believe this study reinforces the notion that the ERP paradigm is a viable and useful tool for psycholinguistic research.

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The Syntactic Structure of Chinese Formal Focus*

Qian Gao

0. Introduction

Focus may be understood as having pragmatic functions (Dik 1980) or discourse functions (Halliday 1967). However, recent studies show that, like Topicalization, it also displays some syntactic properties. For instance, various focus movements have been discussed in Korean (Choe 1992), Standard Arabic (Ouhalla 1992), Hungarian (Brody 1991), Modern Greek (Tsimpli 1992) and some Western Romance languages (Uriagereka 1992), among others. It has been proposed that these focus movements involve various sorts of syntactic categories. But basically they display either head movement properties (an X^0 moves to morphologically support the focus head) or wh-movement (an X^{max} category moves to [Spec, FP] to satisfy Spec-Head Agreement requirement). In this paper I will investigate focus structures in Chinese. I will show that Chinese evidences a convincing case for focus movement triggered by the Focus Criterion, which is a specific case of Spec-Head Agreement outlined in Brody 1991 and Chomsky 1992.

The paper is organized as follows. In Section 1, I discuss various focus phenomena in Chinese, with a special interest on formal focus. I argue that there are (at least) two lexical entries for *dōu*, and one of them must be treated as a focalizer signaling that the phrase preceeding it is in a focused position. In section 2, I show that formal focus in Chinese involves syntactic movement and this movement is triggered by the Focus Criterion. Section 3 is devoted to Focus Phrase and its positions in Chinese sentential structure. It is argued that Focus Phrase (FP) is a level of verbal projections and is

* This paper originates from Peter Culicover's Seminar on GB Syntax. I thank all the participants in the seminar for their helpful discussions on the topic in various languages. Many of my ideas benefit directly from them. I am also very grateful to Peter Culicover, Brian Joseph, Carl Pollard and James Tai for their constant advice and insightful comments on the earlier versions of this paper. This paper was also presented in the colloquia of Department of Linguistics and Department of East Asian Languages and Literatures. I thank both audiences for their insightful suggestions in the topic discussed in the paper. All errors, of course, remain mine.

optionally selected by Agr. I discuss the interactions of Topicalization, Wh-movement, and Focus movement in Sections 4 and 5. In the conclusion, I consider some theoretical consequences of the case study of the formal focus structures in Chinese.

1. Focus in Chinese

1.1. Two Kinds of Foci[1]

Like some other languages (Korean (Choe 1992), English (Culicover 1992), Arabic (Ouhalla 1992), etc.), Chinese also displays two kinds of focus constructions: Focus in situ as is shown in (1) and formal focus as in (2).[2]

(1) a. **Zhāngsān** chī-le yī-ge píngguǒ.
Zhangsan eat-PER one-CL apple
'It is **Zhangsan** who has eaten an apple.'

b. Zhāngsān chī-le yī-ge **píngguǒ**.
Zhangsan eat-PER one-CL apple
'Zhangsan has eaten an **apple**(, not a banana).'

c. Zhāngsān chī-le **yī-ge** píngguǒ.
Zhangsan eat-PER one-CL apple
'Zhangsan has eaten **one** apple(, not two).'

d. Zhāngsān **chī-le** yī-ge píngguǒ.
Zhangsan eat-PER one-CL apple
'Zhangsan has **eaten** an apple(, not cut one).'

(2) Mǎli lián **píngguǒ** dōu chī.
Mary even apple FOC eat
'Mary eats even **apples**.'

As the translations show, in-situ focus gives contrastive information. The focused expression usually bears sentential stress and remains in its base-generated position. Virtually any element in a sentence can be stressed and thus contrasted. In (1) the stressed elements are shown to be the subject in (1a), the object in (1b), the classifier phrases in

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[1] Other possible candidates for focus structures are the *bǎ*-construction and the *shì...de* construction. In the *bǎ*-construction, *bǎ* is usually followed by NP's. Thus *bǎ*-phrases are discussed in the literature either as secondary topic (Tsao 1987 and Gao 1991) or as fronted objects (Thompson 1973, Li and Thompson 1981, and Huang 1982). However, Gao 1992 has strongly argued for a prepositional analysis of *bǎ*, which is base-generated in a preverbal position. As for the *shì...de* construction, Gao 1989 has some arguments for it to be treated as an emphatic structure, as is shown in (i)

(i) Zhāngsān shì cóng zhōngguó lái de
Zhangsan SHI from China come DE
'Zhangsan is from China.'

In (i) we generally do not get a contrastive reading. Instead, it is either a confirmation of a previous statement (with the stress on *shì*) or simply a new piece of information (with the stress on *cóng zhōngguó*).

Since in these constructions, neither the NP after *bǎ* nor the phrase after *shì* must have the sentential stress and none of them necessarily provides contrastive information, I will not discuss them in this paper as focus structures. The readers may find some discussion of the *bǎ*-phrase as a prepositional phrase in Section 2.2.

[2] Throughout this paper, stressed (hence focused) elements are put into boldface letters both in the original language as well as in the translation, but not in the glossing.

(1c)[3], and the verb in (1d). In addition, in-situ foci give new information, as they can appear in question/answer pairs.[4] Thus (1a-c) can be used to answer questions in (3a-c) respectively.

(3) a. **Shéi** chī-le yī-ge píngguǒ?
who eat-PER one-CL apple
'Who has eaten an apple?'

b. Zhāngsān chī-le yī-ge **shénme**?
Zhangsan eat-PER one-CL apple
'What has Zhangsan eaten?'

c. Zhāngsān chī-le **jǐ-ge** píngguǒ?
Zhangsan eat-PER how-many-CL apple
'How many apples did Zhangsan eat?'

Formal focus, on the other hand, involves the use of some focus word, which I will call focalizer, and the focused element always appears before the focalizer. The element in the focus position also bears stress and yields contrastive information. In (2), the focalizer is *dōu* and the element appeared in the focus position is *lián píngguǒ* 'even apples',[5] corresponding to a gap in the postverbal object position. The difference between formal focus and in-situ focus is that formal focus does not give new information. For instance, it cannot be used to answer questions. Thus (2) cannot be the answer for (4).

(4) Mǎli chī shénme?
Mary eat what
'What does Mary eat?'

The appropriate answer to (4) can only be (5), which involves the use of in-situ focus.

(5) Mǎli chī **píngguǒ**.
Mary eat apple
'Mary eats **apples**.'

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3 For a detailed discussion of classifier phrases in Chinese, the readers are encouraged to refer to Gao 1994.

4 See Rochemont and Culicover 1990 for discussion.

5 Although I constantly use 'even' to translate the *lián...dōu* construction, the reader should be cautioned that *even* is not an English equivalent for Chinese *lián*. For one thing, in English 'even' signals the polarity context in which Fauconnier's (1975b) pragmatic scales apply. The same context in Chinese, however, is provided by the focalizer, not *lián*, since *lián* is only optional. Thus it may be appropriate to treat 'even' as equivalent only to the (*lián*)...*dōu* construction in Chinese. (Carl Pollard personal communication). For a detailed discussion of English *even*, the readers are referred to Fauconnier 1975a and Barker 1991.

Semantically, *lián* seems to be related to the preposition *lián* in (i), which means 'adding' or 'together with'.

(i) Lián wǒ zhèli yígòng sānshi-ge rén.
adding I here altogether thirty-CL person
'Adding me, there are thirty people here.'

Thus, in the *lián...dōu* construction, the use of *lián* is to suggest that there are more items than have been mentioned. This can be further comfirmed by the fact that when a universal quantifier is used before the focalizer, *lián* is no longer felicitous, as is shown by the following.

(ii) Zhāngsān (*lián) **shénme** dōu chī.
Zhangsan even everything FOC eat
Zhangsan (*even) eats **everything**.

Formal focus does not rule out the possibility that some element in other than the focus position in the same sentence can be stressed. Thus it is possible that in the same formal focus construction, we may also have other in-situ focus. Usually, if two kinds of foci are found in the same sentence, it is the in-situ focus, not the formal focus, that will bear the primary sentential stress.[6] This is shown in (6).

(6) **Mǎli** lián píngguǒ dōu bu chī.
Mary even apple FOC not eat
'It is **Mary** who does not even eat apple.'

1.2. Difference between Quantificational Use of *dōu/yě* and the Focalizer *dōu/yě*

I have shown that the word *dōu* is used as a focalizer to mark the focus position in formal focus structures. However, not all the occurrences of *dōu* signal the formal focus structures. This is because the word *dōu* is also used as a universal quantifier, as is shown in (7).

(7) Tāmen **dōu** lái-le
they all come-PER
a. 'All of them have come.'
b. *'Even they have come.'

(8) **Zhāngsān** dōu lái-le
Zhangsan FOC come-PER
a. *'All of Zhangsan has come.'
b. 'Even Zhangsan has come.'

The difference between the quantificational use of *dōu* and the focalizer *dōu* can be explained as follows. First, the quantificational *dōu* is used to modify plural entities, while there is no such requirement for the focalizer *dōu*. This becomes clear if we compare (7) with (8). In (7), where the subject is plural in number, we get the quantificational interpretation. In (8), however, the quantificational interpretation is absent simply because there is no appropriate element for *dōu* to quantify over.

Secondly, quantificational *dōu* usually gets the sentential stress while the focalizer *dōu* does not. Instead, it is the element appearing before the focalizer that gets the sentential stress. This is shown in (7) and (8) as well as in the following.

(9) Háizimen **dōu** lái-le
children all come-PER
a. 'All the children have come.'
b. *'Even the children have come.'

(10) **Háizimen** dōu lái-le
children FOC come-PER
a. *'All the children have come.'
b. 'Even the children have come.'

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[6] It has come to my attention that English seems to have the same phenomenon. In (i) we have the formal focus structure where the object *John* is placed into focus position. However, in (ii) *Mary* is given a primary stress hence contrasted. In (iii) the primary stress is on *saw*.

(i) It was **John** that Mary saw.
(ii) It was John that **Mary** saw.
(iii) It was John that Mary **saw**.

Thirdly, it is always possible to have a particle *lián* 'even' cooccurring with the focalizer.[7] This combination is not possible if *dōu* is used quantificationally. The following examples show this.

(11) *Lián tāmen **dōu** lái-le
even they all come-PER

(12) *Lián Zhāngsān **dōu** lái-le
even Zhangsan FOC come-PER

Finally, the focalizer *dōu* has a fixed position (see subsequent sections for the analysis) while the quantificational *dōu* does not. Variation of the position of the quantificational *dōu* signals different scope relations with other elements in the sentence, e.g. negation. This is not possible for the foculizer *dōu*. as can be seen in the following examples.

(13)a. Tāmen **dōu** méiyou lái.
they all not-PER come
'None of them has come.'

b. Tāmen méiyou **dōu** lái.
they not-PER all come-PER
'Not all of them have come.'

(14)a. Wǒmen **dōu** bu hui qù de
we all not will go PARTICLE
'None of us will go.'

b Wǒmen bu hui **dōu** qù de
we not will all go PARTICLE
'Not all of us have come.'

(15)a. Lián **tāmen** dōu méiyou lái.
even they FOC not-PER come
'Even they have not come.'

b. *Lián **tāmen** méiyou dōu lái.
even they not-PER FOC come

(16)a. Lián **Zhāngsān** dōu bu yuànyi qù
even Zhangsan FOC not willing go
'Even Zhangsan does not want to go.'

b. *Lián **Zhāngsān** bu yuànyi dōu qù
even Zhangsan not willing FOC go

Another word that can be used as a focalizer in Chinese is *yě*, which is homophonous with an adverb meaning 'also'. The adverbial use of *yě* is given in (17), where the translations show when a different element is stressed (in-situ focus).

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[7] It is still not clear to me how *lián* should be treated syntactically. It behaves like a focus particle in the same way that *ne* does as the negation particle in the analysis of French in Pollock 1989. For instance, just like French *ne*, *lián* is often optional. The difference between *lián* and *ne*, though, is that *lián* always moves with the focused element. That is, it is always to the left of the focused element no matter where the focused element is at S-Structure. This unique property is always helpful in identifying the focused element. Thus I will disregard its optionality and, whenever possible, always use it when a formal focus structure is introduced. The reader should be aware that this treatment is only for the purpose of convenience.

(17) Zhāngsān yě chī píngguǒ
Zhangsan also eat apple
a. '**Zhangsan** also eats apples.'
b. 'Zhangsan also **eats** apples.'
c. 'Zhangsan also eats **apples**.'

(18) Zhāngsān (lián) **píngguǒ** yě chī.
Zhangsan (even) apple FOC eat
a. *'**Zhangsan** also eats apples.'
b. *'Zhangsan also **eats** apples.'
c. 'Zhangsan even eats **apples**.'

The possible cooccurrence of *lián* with *yě* in (18) shows that *yě* is not used as an adverbial. Instead, it is a focalizer which signifies that the element before it is in focus. When *yě* is used as a focalizer, it is often interchangeable with *dōu*. Thus if we replace *yě* with *dōu* in (18), the meaning of the sentence remains the same.

1.3. The Semantics of *(lián)...dōu/yě*

Like in-situ focus, formal focus structure always yields additional semantic interpretations. Consider (19) and (20) below.

(19) Zhāngsān lián **Mǎlì** dōu bu rènshi
Zhangsan even Mary FOC not know
'Zhangsan does not even know **Mary**.'

(20) Zhāngsān lián **Mǎlì** dōu qǐng-le
Zhangsan even Mary FOC invite-PER
'Zhangsan even invited **Mary**.'

In (19), we do not only get the interpretation that Zhangsan does not know Mary. In uttering (19), the speaker presupposes that there is a set of people among whom Mary is the most likely person that Zhangsan may have known. The use of the focused structure thus gives us contrastive information: since Zhangsan does not know Mary, it is unlikely that he would know anyone else (in the presupposed set). The same presupposition is apparent in (20), where the speaker assumes that Mary is the least likely person that Zhangsan would invite. Since Zhangsan did invite her, he must have invited all the people (in the presupposed set).

Another important aspect about formal focus structure is that it provides a polarity context with negation. Consider (21) below.

(21) Zhāngsān lián **yī-ge** píngguǒ dōu bu chī
Zhangsan even one-CL apple FOC not eat.
'Zhangsan does not eat **one single** apple.'

The focused element in (19) is *yī-ge píngguǒ* 'an apple'. According to Paris 1979, the classifier phrase *yī-ge* is usually used as an existential quantifier. However, in (21) this classifier phrase has the quantificational force of a universal quantifier. Paris believes that this reversion of polarity can be explained by assuming Fauconnier's (1975b) 'pragmatic scales'. The pragmatic scalar principle says roughly that if a property holds for x_j on a scale S, it will hold for x_i if $x_i < x_j$. For example, if the scale S is a quantitative scale and R stands for 'Zhangsan eats', then 'Zhangsan eats two apples' pragmatically implies 'Zhangsan eats one apple'. This pragmatic implication can be reversed in the context of

negation. Thus in (21), *yī-ge* is lowest on the quantitative scale, but under negation, it is reversed to the highest on the scale, hence the quantificational effect of a universal quantifier. If we assume that the negation reverses the polarity, then it must be the case that the focalizer *dōu* provides the polarity contexts. Note that without the focalizer, there is no polarity item for the reversion. This is clearly demonstrated in (22).

(22) Zhāngsān bu chī yī-ge píngguǒ.
Zhangsan not eat one-CL apple
'Zhangsan does not eat an apple.'

If *yī-ge* is indeed a polarity item in (21) and under negation it behaves as a universal quantifier, as Paris argues, then we should expect that if it is replaced by another universal quantifier, the meaning should not be changed. Paris claims that *shénme* in Chinese is an example of a universal quantifier[8]. The following examples show that the prediction is borne out (Cf Footnote 5)

(23) Zhāngsān (*lián) **shénme píngguǒ** dōu bu chī.
Zhangsan even every apple FOC not eat
'Zhangsan does not eat **any (kind of) apples**.'

(24) Mǎlì (*lián) **shénme** dōu huì zuò.
Mary even everything FOC know do
'Mary can do **everything**.'

---

[8] It has been claimed that *shénme* also functions as existential quantifier. For instance, Cheng 1992 claims that *shénme* in the following is ambiguous between a wh-word and an existential quantifier.

(i) Nǐ xiǎng chī shénme ma?
you want eat what Q

However, I find (and many of my colleagues also agree with me) that it is very hard, if not impossible, to get the existential reading of the wh-word in (i). That is, (i) is not ambiguous at all and can only have the reading of an information question (at least for those Chinese speakers I encountered). In order for the wh-word to be understood as carrying an existential force, we have to use the *diǎnr*, as in the following.

(ii) Nǐ xiǎng chī diǎnr shénme ma?
you want eat a-little what/something Q
a. 'What do you want to eat (a little bit of)?'
b. 'Do you want to eat (a little bit of) something?'

That is, only when *diǎnr* 'a little bit' is used can we find the wh-word ambiguous. But then it is no longer appropriate to claim that it is the wh-word that causes the ambiguity. Thus it is still doubtful that wh-words can function as existential quantifiers in Chinese.

Another piece of evidence comes from the absence of the accompanying word *lián*. As noted in Footnote 5, *shénme*, when formally focused, does not go with *lián*. This seems to be consistent with other universal quantifiers such as *shuǒyoude* 'every single one of'.

(iii) Tā (*lián) **shénme píngguǒ** dōu chīguo.
he even every apple FOC eat-PAST
'Zhangsan tasted **all (kind of) apples**.'

(iv) Tā (*lián) **shuǒyoude píngguǒ** dōu chīguole.
he even every-singe-one-of apple FOC eat-PAST-PER
'Zhangsan tasted **all apples**.'

It should also be mentioned that even if *shénme* could be used as an existential quantifier, it would not alter the analysis presented in this paper, for the existential use of wh-word may also be treated like other existential quantifiers.

Another piece of evidence to show that *yī-ge* in (21) is not a usual classifier phrase but a polarity item (the lowest on the quantitative scale) comes from the fact that classifiers other than singular number cannot appear in the focused position. This is shown in the following examples.[9]

(25) Zhāngsān lián **yī-ge/*liǎng-ge/*shí-ge** píngguǒ dōu bu chī
Zhangsan even one-CL two-CL ten-CL apple FOC not eat.
'Zhangsan does not eat **any** apple.'

(26) Zhāngsān bu chī yī-ge/ liǎng-ge/shí-ge píngguǒ.
Zhangsan not eat one-CL two-CL ten-CL apple
'Zhangsan does not eat an apple/two apples/ten apples.'

Thus I have shown that there are (at least) two entries of *dōu* in the Chinese lexicon, one as the universal quantifier, and another as a focalizer. If this distinction is indeed true, we should predict that cooccurrence of the two within a single structure should be allowed without redundancy of information. This prediction is borne out in the following examples. Suppose that two groups of people are required to have full attendance at a conference but when found that both groups have some absentees, each group may use (27b) as an excuse (when asked by the conference organization committee). If we have the right context, (28b) is also a perfectly acceptable sentence.

(27)a. Tāmen méiyou **dōu** lái.
they not-PER all come
'Not all of them have come.'

b. Lián **tāmen** dōu méiyou **dōu** lái.
even they FOC not-PER all come
'Even they have not all come.'

(28)a. Tāmen méiyou **dōu** mǎi zhè běn shū.
they not-PER all buy this CL book
'Not all of them have bought this book.'

b. Lián **tāmen** dōu méiyou **dōu** mǎi zhè běn shū.
even they FOC not-PER all buy this CL book
'Even they have not all bought this book.'

2. Focus Movement and the Focus Criterion

2.1. The Focus Movement

I have shown that *dōu/yě* in Chinese can be treated as a focalizer because it provides a polarity environment and the constituent before it bears sentential stress, thus yielding contrastive information. I will call this stressed constituent the focused element. In this section I will show that the focused element is best understood not to be base-generated in the pre-focalizer position, but moved to this position through Move α. I will also show that the movement to pre-focalizer position is an obligatory movement to [Spec, FP] triggered by the Focus Criterion, which is a specific instantiation of the universal principle of Spec-Head Agreement.

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[9] Peter Culicover (personal communication) points out to me that English displays a similar phenomenon.

(i) Not one apple/*two apples/*ten apples did John eat.

In order to show that the focused element in a formal focus structure is not an in-situ category, we must show that a) this category is subcategorized for something other than the focalizer, b) there is a gap in the subcategorized position that holds a one-to-one relation with the focused elements, and c) the focused element c-commands[10] the gap. That is, the trace must be properly governed by the antecedent focused element. The following examples show that this is indeed true with formal focus structures in Chinese.

(29)a. Xiǎoméi bu huì chàng gē.
Xiaomei not know sing song
'Xiaomei doesn't know how to sing a song.'

b. *Xiǎoméi lián dōu bu huì chàng gē.
Xiaomei even FOC not know sing song

c. Xiǎoméi lián **gē** dōu bu huì chàng.
Xiaomei even song FOC not know sing
'Xiaomei even don't know how to sing **a song**.'

(30)a. Zhè wǎn fàn, Xiǎoméi méiyou chī yi kǒu.
this bowl rice Xiaomei not-PER eat one mouth
'Xiaomei did not take a bite of this bowl of rice.'

b. *Zhè wǎn fàn, Xiǎoméi lián dōu méiyou chī yi kǒu.
this bowl rice Xiaomei even FOC not-PER eat one mouth

c. Zhè wǎn fàn, Xiǎoméi lián **yi kǒu** dōu méiyou chī.
this bowl rice Xiaomei even one mouth FOC not-PER eat
'Xiaomei even did not take **a single bite** of this bowl of rice.'

(31)a. Xiǎoméi bu gǎn zuò fēijī.
Xiaomei not dare sit airplane
'Xiaomei does not dare to take a ride on an airplane.'

b. *Xiǎoméi lián dōu bu gǎn zuò fēijī.
Xiaomei even FOC not dare sit airplane

c. Xiǎoméi lián **zuò fēijī** dōu bu gǎn.
Xiaomei even sit airplane FOC not dare
'Xiaomei does not dare even to **take a ride on an airplane**.'

(32)a. Zhāngsān bu yuànyi cóng jiāli náchū yi-ben shū lai.
Zhangsan not willing from home take-out one-CL book come
'Zhangsan does not want to bring out a book from his home.'

b. *Zhāngsān lián dōu bu yuànyi cóng jiāli náchū yi-ben shū lai.
Zhangsan even FOC not willing from home take-out one-CL book come

c. Zhāngsān lián **cóng jiāli náchū yi-ben shū lai** dōu bu yuànyi.
Zhangsan even from home take-out one-CL book come FOC not willing
'Zhangsan does not want even to **bring out a book from his home**.'

(33)a. Zhāngsān bu gǎn bǎ Lǐsì dǎ yī-xià.
Zhangsan not dare BA Lisi hit one-CL
'Zhangsan does not dare to hit Lisi once.'

b. *Zhāngsān lián dōu bu gǎn bǎ Lǐsì dǎ yī-xià.
Zhangsan even FOC not dare BA Lisi hit one-CL

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[10] I assume the definition of c-command found in Chomsky 1986b, which goes as follows.

(i) α c-commands β iff α does not dominate β and every δ that dominates α dominates β.

c. Zhāngsān lián **bǎ Lǐsì dǎ yī-xià** dōu bu gǎn.
Zhangsan even BA Lisi hit one-CL FOC not dare
'Zhangsan does not dare even to **hit Lisi once**.'

(34)a. Wǒ tóngyi nǐ dào měiguo qù xuéxi.
I agree you arrive-at America go study
'I agree for you to go to the U.S. to study.'

b. *Wǒ lián dōu tóngyi nǐ dào měiguo qù xuéxi.
I even FOC agree you arrive-at America go study

c. Wǒ lián **nǐ dào měiguo qù xuéxi** dōu tóngyi.
I even you arrive-at America go study FOC agree
'I agree even **for you to go to the U.S. to study**.'

In the above examples, the one-to-one correspondence between the focused element and the gap is clear. In (29c) and (30c), the focused elements are NPs and so are the gaps. (31c), (32c), and (33c) show that moved elements are VPs and so are the gaps. In (34c) the focused element is a clause and so is the gap. Based on the one-to-one relationship between the focused elements and the gaps and the similar logical relations between the (a) and (c) sentences, it is reasonable for us to assume that the traces are indeed left behind by the focused elements when they have moved. The ungrammaticality of the (b) sentences show that if *(lián)...dōu* is present, the focused elements must move to the left of *dōu*. These examples also show that the moved elements are maximal projections (i.e. full phrases such as NP's[11] in (29)-(32), a VP in (33) and a CP in (34)) and that, in each sentence, only one maximal projection is moved to the left of *dōu*.

Examples in (29)-(34) also show that the gap in each (c) sentence is best analyzed as a trace, not a pro. This is because the antecedent of a pro cannot be VP. In (32c) and (33c), however, the antecedents are VPs.

I will assume the more restrictive Empty Category Principle discussed in Rizzi 1990, which says that an EC must be antecedent-governed as well as lexical-governed at S-Structure. Thus the traces in the (c) sentences in (29)-(34) all obey the ECP. If we assume with Tang 1990 that in Chinese adverbial phrases are adjuncts which are adjoined to XPs and therefore are not lexical-governed, then we will predict that adverbial phrases do not undergo focus movement in Chinese. This prediction is borne out.

(35)a. Mǎlì zuótian méiyou lái.
Mary yesterday not-PER come
'Mary did not come yesterday.'

b. *Mǎlì lián **zuótian** dōu méiyou lái.
Mary even yesterday FOC not-PER come

(36)a. Zhāngsān bùxiaǒxǐn dǎ-shāng-le Lǐsì.
Zhangsan carelessly hit-wound-PER Lisi
'Zhangsan carelessly wounded Lisi.'

b. *Zhāngsān lián **bùxiaǒxǐn** dōu dǎ-shāng-le Lǐsì.
Zhangsan even carelessly FOC hit-wound-PER Lisi

Prepositional phrases in Chinese behave like adverbials in that they are mainly found in preverbal positions and are generally used to modify verb phrases. Thus

[11] In (30), I am assuming an empty head in the object NP, where *yi kǒu* is treated as the specifier of the NP. See Gao 1994 and in progress for a detailed discussion of this analysis.

syntactically they cannot be treated as subcategorized categories of verbs. Therefore we should not expect them to undergo formal focus movement.[12] The following examples show that this is the case.

(37)a. Zhāngsān cóng jiāli ná-lái-le yī-ben shū.
Zhangsan from home take-come-PER one-CL book
Zhangsan has brought a book from his home.

b. *Zhāngsān lián **cóng jiāli** dōu ná-lái-le yī-ben shū.
Zhangsan even from home FOC take-come-PER one-CL book

(38)a. Mǎlì bǎ gōngzuò wánchéng-le.
Mary BA work complete-PER
Mary has completed her work.

b. *Mǎlì lián bǎ gōngzuò dōu wánchéng-le.
Mary even BA work FOC complete-PER

2.2. The Focus Criterion

Recent studies (Chomsky 1991, Rizzi 1991, Culicover 1992) pursue the hypothesis that in languages constituents move only to satisfy some requirements. The basic requirement outlined in Chomsky 1992 is Spec-Head Agreement. For instance, some maximal projections move to [Spec, XP] only because they have some active features to check off. Some X^0 categories move to adjoin to other X^0 categories because either they have some features that need to be discharged or other X^0 categories need to be morphologically supported (Chomsky 1992, Culicover 1993). For instance, to account for wh-movement in English (as well as in other languages with either overt or covert wh-movement), Rizzi 1991 proposes the Wh-Criterion, which goes as follows.

(39) The Wh-Criterion
A. A Wh-Operater must be in a Spec-Head configuration with an X0[+WH].
B. An X0[+WH] must be in a Spec-Head configuration with a Wh-Operator.

---

12 One exception is the PP headed by *duì* 'towards'. In Paris 1979 we find the following example.

(i) Zhāngsān lián **duì zìji de tàitai** dōu bu shuō yī-ju huà
Zhangsan even towards self DE wife FOC not say one-CL speech
Zhangsan doesn't say a word even to his wife.

The exact explanation for this is still unknown. However, we want to point out that *duì* behaves differently from other prepositions also in other aspects of syntax. For instance, in Chinese prepositional phrases generally do not modify NP's, as the following examples show.

(ii) *bǎ gōngzuò de wánchéng
BA work DE completion
(iii) *cóng zhōngguó de lǚxing
from China DE journey

However, phrases headed by *duì* are constantly found as NP modifiers.

(iv) duì zǔguó de rèài
towards motherland DE love
'the love for the motherland'
(v) duì lǎoshi de zūnzhòng
towards teacher DE respect
'the respect for teachers'

The Wh-Criterion in (39) explains the following.

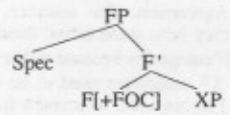
(40)a. *I wonder [C^0[+WH] [Mary has seen who.]]
b. I wonder [who C^0[+WH] [Mary has seen t.]]

Since *wonder* selects a CP headed by C^0[+WH], (40a) violates (39) because C^0[+WH] is not in a Spec-Head configuration with a Wh-Operator. On the other hand, (40b) is well formed simply because the [Spec, CP] is filled with a Wh-Operator.

In the same manner, Rizzi also proposes the Negation Criterion to account for Negative Inversion in English and some other languages. A similar version of the Focus Criterion is also suggested in Brody 1991 and Choe 1992 to account for focus structures in Hungarian and Korean, respectively. If these proposals are UG principles, we should expect them to apply in Chinese as well. In this subsection, I will show that this is the case.

First, let's assume that the focalizer in a Chinese formal focus construction is the head of a focus phrase. According to X-bar theory, this head (F) will project to its maximal projection FP, thus creating a FP configuration as (41), where F always carries the [+FOC] feature.

(41)



Let us also assume that the Focus Criterion of Brody and Choe, stated in (42), holds for Chinese.

(42) The Focus Criterion
A. The focused element must be in a Spec-Head configuration with the F[+FOC].
B. The F[+FOC] must be in a Spec-Head configuration with the focused element.

Now let's look at the examples in (29)-(34) again. In all the (a) sentences, no focalizer is present, thus [+FOC] is absent. The Focus Criterion is vacuously satisfied and we get these normal and grammatical sentences. In all the (b) sentences, the focalizer *dōu* is present and carries the [+FOC] feature. However, nothing moves into [Spec, FP] to check off the [+FOC] feature and thus the Focus Criterion is violated. This causes these sentences to crash at PF.[13] All the (c) sentences, on the other hand, are well formed. The presence of the focalizer signals the presence of the [+FOC] feature and the [Spec, FP] is also filled. Thus, the Focus Criterion is satisfied. Those sentences are therefore understood as carrying contrastive information.

[13] I assume with Chomsky 1992 that beyond the S-Structure there are two interface levels: the phonetic form (PF) and the logical form (LF). At PF the phonetic well-formedness of a sentence will be checked. At LF the semantic well-formedness will be checked. In the case of feature-checking, strong features must be checked at S-Structure so as to satisfy the phonetic well-formedness condition at PF. The checking of weak features can be delayed until LF since it does not affect the phonetic well-formedness at PF.

Thus, I have shown that if we assume the Focus Criterion, Chinese formal focus structure can be analyzed as movement to [Spec, FP], and that (29)-(34) show that the Focus Criterion must be satisfied at S-Structure for formal focus structures.

2.3. The Focus Criterion and In-situ Focus.

I have shown that Chinese formal focus structures can be explained by assuming the Focus Criterion, which triggers focus movement at S-Structure. It is reasonable now to ask whether the Focus Criterion applies to in-situ focus, since in-situ focus does not involve overt syntactic movement.

Recall that in-situ focus is different from formal focus in Chinese in that in-situ focus gives new information and it can be used in question/answer pairs. This is no surprise if we consider that questions are generally linguistic forms for soliciting new information. Thus it is quite understandable that in-situ focus be directly related to wh-questions. Chinese has been widely cited as a wh-in-situ language. But being a wh-in-situ language does not mean that wh-phrases do not move at all. Following Huang 1982 and Aoun 1986, I assume that wh-phrases in Chinese do move, not at S-Structure, but at LF, in order to get wide scope. Thus in wh-in-situ languages, the WH-Criterion is satisfied at LF.

Similarly, for in-situ focus structures, I propose that Focus Criterion is also satisfied at LF, thus no overt focus movement is found in Chinese in-situ focus structures. My proposal is based on the following reasoning: In Chinese formal focus structures, the FOC feature is carried by the lexical head (the focalizer) *dōu/yě*. Suppose that this makes the FOC feature strong. According to the proposal in Pollock 1989, Chomsky 1991, and Hoekstra and Zwart 1992, strong features must be checked at S-Structure. Otherwise the unchecked feature will cause the sentence to crash at PF. This entails that the Focus criterion must apply to Chinese formal focus structures at S-Structure. In-situ focus, on the other hand, carries only a weak FOC feature. Thus it does not have to be checked at S-Structure, since unchecked weak features does not cause the sentence to crash at PF. However, the FOC feature will be checked at LF so that we get the correct interpretation of the sentence. According to the Economy Principle (Chomsky 1991), movement at LF is more economical than that at S-Structure. This explains why Chinese in-situ focus does not involve overt focus movement: the focused elements only moves at LF.[14]

3. Position of Focus Phrases

3.1. The Subject and the FP.

I have shown that in Chinese formal focus structures must satisfy the Focus Criterion at S-Structure. Thus we have explained why the focused element must move to [Spec, FP]. Now we consider the question where the FP is in a Chinese formal focus sentence.

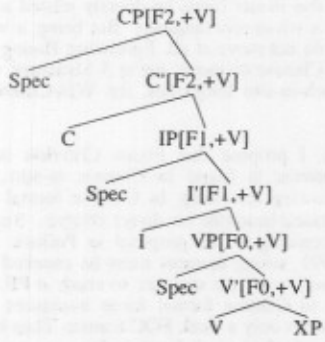
Recall that in Section 2 we showed that the focused element must c-command its gap. This will rule out the possibility that FP is adjoined to a category that contains the gap because the Spec of adjoining XP cannot c-command anything that is dominated by

[14] This strong/weak feature distinction may also be used to explain covert wh-movement in Chinese and overt wh-movement in English: in Chinese, the [+WH] features are weak, thus wh-words move only at LF; in English, on the other hand, [+WH] features are strong, thus we find syntactic wh-movement (at S-Structure).

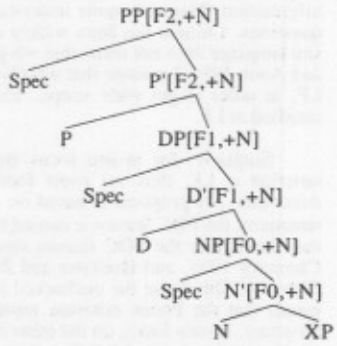
the adjoined category. In order for the Spec of FP to c-command its gap, the gap must be dominated by the category that is subcategorized for by the head F.

In light of this reasoning, I will assume FP as a level of the verbal projections, along the lines suggested in Grimshaw 1991, where two basic projections are strongly argued for. One kind of projection is headed by N (a nominal projection having the feature [+N]). DP is regarded as an extended projection over NP and PP is an extended projection over DP. PP, DP, and NP all share the lexical feature [+N]. They differ from each other by levels: NP is an F0 level projection, DP is an F1, and PP is F2. Contrasted with the nominal projections are the verbal projections which all share the feature [+V]: VP is an F0 level verbal projection, IP is F1, and CP is F2. Thus the two basic projections form the following configurations.

(43) Verbal projections



(44) Nominal projections



Some restrictions on the projections are also discussed. For instance, it is argued that V and N are the only lexical heads, which can select XP's that belong to a different projection. That is, a V can select either an XP[+V] or an XP[+N], and so can a N. Other heads are functional heads, which can only select XP's that share the same lexical feature with the selecting head and that are one level down. Thus C can only select IP, and I only VP. For evidence supporting this system and a discussion of its advantages, see Grimshaw 1991.

In this system, the functional levels are designated by numerals and therefore are made very flexible. There seem to be no restrictions on how high the levels can go. But this should not be a big concern in this paper.[15] In recent studies of focus structure, FP has been suggested as a level of verbal projection. For instance, Brody 1991 proposes that FP is one level higher than IP, thus F can select IP to form an FP-IP sequence. However, Horvath 1991 voices concern about this treatment. She observes that FP is not an obligatory category. If FP is absent, C will have to select IP, which is two levels down from CP, thus violating the restriction that functional head can only select a one-level-down XP. To avoid this violation, I follow Culicover 1993 in assuming that FP is on the same level as IP. The restriction on the selectional power is accordingly revised to allow a functional head to select an XP either of the same level or one level down. Armed

15 However, some believe that this is a serious defect in the theory (Cf. Iatridou 1990). This paper will stay within the Minimalist Program Framework and keep the projections to the lowest possible levels.

with this theoretic background, let's turn to the following Chinese formal focus structures.

(45) Zhāngsan lián **Mǎlì** dōu bu rènshi.
Zhangsan even Mary FOC not know
'Zhangsan even doesn't know Mary.'

(46) Xiǎoméi lián **chàng gē** dōu bu huì.
Xiaomei even sing song FOC not know
'Xiaomei even doesn't know how to sing.'

In (45) and (46), we notice that Chinese focused elements occur to the right of the subject. Under the standard assumption, the subject occupies [Spec, IP] position in S-Structure because subjects need Case and [Spec, IP] is a Case position. This suggests that in Chinese FP should follow IP. That is, FP is selected by I. Under the previous assumption we made that IP and FP are of the same level verbal projections, this might seem reasonable. However, Horvath 1991 has voiced an objection to the IP-FP sequence. She notes that since the FP-IP sequence has been observed in many languages, it is wrong to assume that in another language we should find the IP-FP sequence. I believe Horvath's objection to IP-FP sequence is very reasonable. In addition, I find that there is also evidence against this treatment in Chinese. Consider the following examples.

(47) Zhāngsan chī-le fàn.
Zhangsan eat-PER meal
'Zhangsan has eaten his meal.'

(48) Zhāngsan méiyou chī fàn.
Zhangsan not-PER eat meal
'Zhangsan has not eaten his meal.'

According to Li and Thompson 1981, Dai 1991, and Gao 1992, *-le* is an inflectional morpheme, marking the perfect tense (Gao 1993). *Méiyou* is the negative counterpart of *-le*.[16] Suppose that in Chinese, VP is base generated to the right of I (or

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[16] This relation can be shown in the following examples, where *méiyou* and *-le* are mutually exclusive in a single declarative sentence simply because they give conflicting statements.

(i) Zhāngsan chī-le fàn.
Zhangsan eat-PER meal
'Zhangsan has eaten (his) meal.'

(ii) Zhāngsan méiyou chī fàn.
Zhangsan not-PER eat meal
'Zhangsan hasn't eaten (his) meal.'

(iii) *Zhāngsan méiyou chī-le fàn.
Zhangsan not-PER eat-PER meal

In Chinese, yes-no questions can take the form of A-not-A (See Huang 1988, Gao 1992). Thus (iv) is a declarative sentence and (v) is a corresponding question.

(iv) Zhāngsan xǐhuan Mǎlì.
Zhangsan like Mary
'Zhangsan likes Mary.'

(v) Zhāngsan xǐhuanbuxǐhuan Mǎlì?
Zhangsan like-not-like Mary
'Does Zhangsan like Mary?'

The A-not-A form for the perfect tense *-le*, however, is the combination of *-le* and *méiyou*, not *le*-not-*le*, though it is possible to use *youméiyou* in some dialects.

VP is selected by I) and I is the residual position for the tense morpheme. Then at S-Structure, V has to move to morphologically support the tense morpheme, since *-le* is not a free morpheme. This explains why we have a V+I complex in (47), just like the case of French V+I complex proposed in Pollock 1989.[17] In (40), on the other hand, there is a Neg head intervening between I and V, thus blocking V from joining I to form the V+I complex. Instead, the Neg head moves to adjoin to I and forms a Neg+I complex, which is realized phonologically as *méiyou*[18] in (48). Therefore we have an I-V sequence. Since *méiyou* is already an independent word and no longer needs to be morphologically supported, we do not expect the V to move up to adjoin to I. This analysis explains why the sentences in (49) are ungrammatical.

(49)a. *Zhāngsan chī-méiyou fàn.
Zhangsan eat-not-PER meal

b. *Zhāngsan méiyou chī-le fàn.
Zhangsan not-PER eat-PER meal

c. *Zhāngsan le chī fàn.
Zhangsan PER eat meal

If the above analysis is correct, it makes predictions inconsistent with the hypothesis that in Chinese we have an IP-FP sequence. This is because, as (50) and (51) show, FP, in Chinese, can only occur to the left of I, not to the right.

(vi) Zhāngsan chī-le fàn méiyou?
Zhangsan eat-PER meal not-PER
'Has Zhangsan eaten (his) meal?'

This phenomenon confirms that *méiyou* is indeed a negative counterpart of the perfect tense marker *-le*.

[17] Following Pollock 1989 and Rivero 1990, I assume that syntactic head-to-head movements do play an important role in word formations in some languages, especially here in Chinese. I am aware that this is very problematic in the case of Greek (Joseph and Smirniotopoulos 1993). One possible explanation for the difference between Greek and Chinese may be traced to the strength of morphology in the two languages. Intuitively at least, Greek has a strong (or rich) morphology, thus a syntactically derived sequence of morphemes is often overridden by morphological rules if mismatches occur. Chinese, on the other hand, has a very weak (or poor) morphology. Thus syntactical rules often prevail in determining the sequence of morphemes. However, as Brian Joseph (personal communication) points out, we need an understanding of what constitutes a strong morphology that reaches further than what our intuition provides.

[18] This assumption is supported by the fact that in some Chinese dialects (Southern China and South East Asia), the A-not-A form of the inflection can be *yǒuméiyou*.

(i) Zhāngsan zuótiān yǒuméiyou chī fàn?
Zhangsan yesterday PER-not-PER eat meal
'Did Zhangsan eat (his) meal yesterday?'

(ii) Mǎlì yǒuméiyou lái zhōngguó?
Mary PER-not-PER come China
'Has Mary come to China?'

In some South East Asian dialects we have even found that *-le* is constantly replaced with *yǒu* in preverbal position, as is in the following sentences.

(iii) Zhāngsan zuótiān yǒu chī fàn.
Zhangsan yesterday PER eat meal
'Zhangsan ate (his) meal yesterday.'

(iv) Tā zuótiān yǒu xiūxi.
he yesterday PER rest
'He took a day off yesterday.'

(50) Zhāngsān [$_{FP}$ lián **fàn**$_i$ dōu [$_{IP}$ méiyou [$_{VP}$ chī t_i]]].
Zhangsan even meal FOC not-PER eat
'Zhangsan hasn't even eaten **his meal**.'

(51) *Zhāngsān [$_{IP}$ méiyou [$_{FP}$ lián **fàn**$_i$ dōu [$_{VP}$ chī t_i]]].
Zhangsan not-PER even meal FOC eat

Sentence (50) and (51) are exactly the same except the order of FP and IP. In (50), the FP *lian fàn dōu* appears to the left of the IP, giving an FP-IP sequence, and the sentence is acceptable. In (51), on the other hand, the FP is positioned to the right of the IP, yielding an IP-FP sequence, and this results in an ungrammatical sentence. Therefore, we can conclude from (500 and (51) that in Chinese, we also have an FP-IP sequence in the verbal projections.

3.2. Nominative Case Assignment and the FP

As the above discussion shows, in Chinese, the FP, an intermediate verbal projection, can appear to the right of the subject. It also appears to the left of I. That is, an FP in Chinese appears between the subject and I. Under the normal assumption that the subject occupies [Spec, IP] and is assigned nominative Case by I under the configuration of Spec-Head Agreement, this would appear to be a serious problem, since FP intervenes between the [Spec, IP] and the head I. Recall that usually I is assumed to contain a bundle of features, among which there is an Agr, which is responsible for nominative Case assignment. Thus I will continue to assume the Split Infl Hypothesis in treating Agr as a separate head from I. Agr heads its own maximal projection AgrP. The subject is moved to [Spec,AgrP] and assigned the nominative Case by Agr under the Spec-Head Agreement Principle. Under this analysis, I is freed from any nominative Case assignment obligations and therefore no longer has to be adjacent to the subject.[19] In our case, AgrP and IP can be separated by an FP without causing any theoretical problems. If this line of analysis is correct, then FP is (optionally) selected by Agr, which, in the absence of FP, is also the selector for IP[20] headed by the inflectional morpheme. Thus in a tensed negative sentence with FP present, the sequence of verbal projections will look like AgrP-(FP)-IP-(NegP)-VP, where FP and NegP are not obligatory projections. Under the present analysis, (50) has the following structure.

(50') [$_{AgrP}$Zhāngsān [$_{FP}$lián **fàn**$_j$ dōu [$_{IP}$ méi$_i$-you [$_{NegP}$ t_i [$_{VP}$ chī t_j]]]]].
Zhangsan even meal FOC not-PER eat
'Zhangsan hasn't even eaten **his meal**.'

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[19] This proposal seems to suggest that Chinese lacks I-to-Agr movement, contra Chomsky 1992 who claims that I-to-Agr movement is needed if Agr is to assign nominative Case to the subject. One explanation for this may be that in English, Agr is a phonologically realized lexical form, for instance, the third person singular morpheme -s in simple present tense. The fact that I-to-Agr is needed is not because of the nominative Case assignment obligations, but because the bound Agr morpheme needs to be morphologically supported. In Chinese, however, Agr is never phonologically realized. Thus I does not need to move to Agr for morphological support.

[20] In the literature, when I is freed from nominative Case assignment obligations, it is often said to head a Tense Phrase (TP) and I is accordingly changed to T. This, however, is only a terminological difference. In this paper, I will not use TP for Tense Phrase. Instead, I will continue to use IP although I no longer contains the Agr feature. TP will be reserved for Topic Phrase.

4. Focus Movement and Topicalization

4.1. Subject and Nominative Case Assignment

I have shown that in Chinese, the nominative Case assigner must be separated from the tense morpheme. This analysis enables us to have FP between the subject and IP. Now let's consider the cases where the subject itself is the focused element, as the following examples show.

(52) Lián **Zhāngsān** dōu bu rènshi Mǎlì.
even Zhangsan FOC not know Mary
'Even **Zhangsan** does not know Mary.'

In (52), *Zhāngsān* is in the normal focused element position. But it also functions as the subject of the sentence and therefore must be in the position where Agr can assign it nominative Case. There are two possible ways to analyze this structure. The first is to assume that *Zhangsan*, being base-generated within VP (cf: Koopman and Sportiche 1991 and Speas 1990), moves to [Spec, FP] and stays there. It can get the nominative Case from Agr if we assume that Agr can be an exceptional Case assigner, in the way that Horvath suggests for Hungarian. Another way to analyze (52) is that when *Zhangsan* moves to [Spec, FP] and gets the [+FOC] feature discharged, it will continue to move up to [Spec, AgrP] to get Case. Of the two analyses, we have two reasons to choose the second one. First, it is not clear why Agr can assign exceptional Case (Case that the head assigns to the Spec position of its subcategorized XP). Besides [Spec, FP], we do not have any other evidence that nominative Case is assigned this way. For instance, in examples where [Spec, AgrP] and [Spec, FP] are both filled, which position should have the priority in receiving the nominative Case? At the very least, we would have to stipulate some kind of priority principle in cases like this. Second, another piece of evidence suggests that the focused element will continue to move to satisfy other requirements. For instance, it may move again to the left of the subject, as is shown by the following examples.

(53) Lián **Mǎlì** Zhāngsān dōu bu rènshi.
even Mary Zhangsan FOC not know
'Zhangsan even does not know **Mary**.'

In (53), the primary stress on *Mǎlì* and the possible cooccurrence of *lián* to the left of *Mǎlì* indicate that *Mǎlì* is the focused element. It must have been moved out of [Spec, FP] to the left of the subject, hence to the left of AgrP. In the next subsection, we will discuss what this position is.

4.2. Difference between [XP, TP] and [Spec, TP]: the Binding Principle

In the case of (53), one may suggest that the position that *Mǎlì* takes is the Topic position. But there may be some problems with this assumption. First, as Chinese is often quoted as one of the topic prominent languages, it has been argued that Topic is base generated. This is because there is substantial evidence that there is no one-to-one correspondence between the Topic and the possible gap within the sentence. For instance, Gao 1992 gives the following examples. (Also see Huang 1989 and Her 1991 for examples with multiple topics.)

(54) Wǔ-ben xīn shū, tā jièzǒu-le sān-ben.
five-CL new book he borrow-go-PER three-CL
'Of the five new books, he checked out three.'

(55) Zhè dōng fángzi, tāmen gāng ānzhuāng-hǎo chuānghu.
this CL house they just install-ready window
'As for this house, they have just installed the windows.'

If we assume that topic structure is always base-generated in Chinese, then *Mālī* in (53) may not move into the topic position. Actually, the following examples show that the focused element is moved to a position between the topic and the subject.

(56) Wǔ-ben xīn shū, lián **yī-ben** Zhāngsān dōu bu kàn.
five-CL new book even one-CL Zhangsan FOC not see.
'Of the five new books, Zhangsan does not read even one of them.'

(57) Zhè dōng fángzi, lián **chuānghu** tāmen dōu méiyou ānzhuāng-hǎo.
this CL house even window they FOC not-PER install-ready
'As for this house, they even haven't installed the windows.'

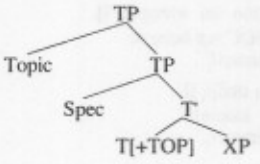
If the assumption that the topic is base generated in the initial position is correct, then we should not expect the possibility that the base-generated topic may be positioned in [Spec, FP]. This prediction is borne out in the following examples.[21]

(58)a. *Tā lián **wǔ-ben xīn shū** dōu jièzǒu-le sān-ben.
he even five-CL new book FOC borrow-go-PER three-CL
b. *Lián **wǔ-ben xīn shū**, tā dōu jièzǒu-le sān-ben.
even five-CL new book he FOC borrow-go-PER three-CL

(59)a. ***Lián zhè dōng fángzi**, tāmen dōu méiyou ānzhuāng-hǎo chuānghu.
even this CL house they FOC not-PER install-ready window
b. ***Tāmen lián zhè dōng fángzi** dōu méiyou ānzhuāng-hǎo chuānghu.
they even this CL house FOC not-PER install-ready window

In light of the above discussion, I will assume with Choe 1992 that in topic-prominent languages, the topic is base-generated adjoined to TP, as is shown in (60).

(60)



[21] It has been pointed out to me (Carl Pollard personal communication) that with the help of *gèng-tán-bu-dào* 'not to speak', the acceptability of (59a) can be much improved (acceptable to some Chinese speakers).

(i) Lián zhè dōng fángzi, tāmen dōu méiyou ānzhuāng-hǎo chuānghu, gèng-tá-bu-dào nèi dōng fángzi le.
even this CL house they FOC not-PER install-ready window not-to-speak that CL house LE
'They did not even install the windows in this house, not to mention the other house.'

I suspect that this is because, for some Chinese speakers, *lián...dōu...*, *gèng-tán-bu-dào* is a (contrastive) conjunction. Thus (i) may have a very different structure from (59a). Note that with this conjunction, even the ungrammatical sentences discussed in (35)-(38) may be much improved.

In (60), the topic is base-generated in D-Structure. [Spec, TP] is where the focused element will be moving to if it has the [+TOP] feature that needs to be discharged. I will use 'topicalized focus' to refer to the phrase that occupies the [Spec, TP]. The structure in (60) suggests that topicalized focus moves to [Spec, TP] only because the moved phrase has the [+TOP] feature that needs to get discharged. The movement is justified by the Spec-Head Agreement principle. If this is true, we should not expect the topicalized focus to go beyond [Spec, TP]. The following examples show that our prediction is correct.

(61) *Lián **yī-ben**$_i$ [$_{TP}$ wǔ-ben xíng shū, tā dōu bu kàn t_i]
even one-CL five-CL new book he FOC not see

(62) *Lián **chuānghu**$_i$ [$_{TP}$ zhè dōng fángzi, tāmen dōu méiyou ānzhuāng-
even window this CL house they FOC not-PER install-
hāo t_i]
ready

The separation of base-generated topic and topicalized focus predicts that they have different binding properties. The following examples show that this prediction is borne out.

(63)a. Tā$_{*i/j}$ de māma, [$_{TP}$[$_{AgrP}$Zhāngsān$_i$ bu rènshi]].
he DE mother Zhangsan not know
'His$_j$ mother, Zhangsan$_i$ does not know.'

b. [$_{TP}$Lián **tā$_{i/j}$ de māma** [$_{AgrP}$Zhāngsān$_i$ dōu bu rènshi]].
even he DE mother Zhangsan FOC not know
'Zhangsan$_i$ does not know **his$_{i/j}$ mother**.'

c. [$_{TP}$[$_{AgrP}$Zhāngsān$_i$ bu rènshi tā$_{i/j}$ de māma]].
Zhangsan not know he DE mother
'Zhangsan$_i$ does not know his$_{i/j}$ mother.'

(64)a. *Tāzìji$_i$, [$_{TP}$[$_{AgrP}$Zhāngsān$_i$ bu xiāngxìn]].
himself Zhangsan not believe

b. [$_{TP}$Lián tāzìji$_i$ [$_{AgrP}$Zhāngsān$_i$ dōu bu xiāngxìn]].
even himself Zhangsan FOC not believe
'Zhangsan$_i$ does not believe himself$_i$.'

c. [$_{TP}$[$_{AgrP}$Zhāngsān$_i$ bu xiāngxìn tāzìji$_i$]].
Zhangsan not believe himself
'Zhangsan$_i$ does not believe himself$_i$.'

In the above examples, each of the (a) sentences[22] has a base-generated topic which is separated from the rest of the sentence by a comma (representing an intonational break). In (b) the initial phrase preceded by *lián* is the topicalized focus with (c) as the source sentence. In (55a) *tā de māma* 'his mother' is base-generated at the Topic position. Assuming that Chinese does not allow backward binding, although *tā* is free in the NP *tā de māma* , which is the governing category, coindexing *Zhāngsān* with *tā* is disallowed since *Zhāngsān* is not in a c-commanding position over *tā*. In (63c), *tā* is free in its governing category, the NP *tā de māma* 'his mother', but is freely coindexed with the subject outside its category. When the NP is moved to [Spec, TP] through [Spec, FP], this coindexing is carried over and (63b) is grammatical. In (64a), the reflexive *tāzìji*

22 I am assuming that the empty category in the object position of the (a) sentences is a pro, not a trace.

'himself' is base-generated outside the governing category of the subject *Zhangsan*, hence coindexing it with the subject violates Principle A. In (64c) the reflexive is base-generated at the object position. And when the reflexive moves to [Spec, TP] through [Spec, FP], its trace is governed by the subject *Zhangsan* and Principle A requires it to be coindexed with the subject.

For more evidence of the distinction between a base-generated topic and a topicalized focus phrase, the readers are encouraged to see Shyu 1994.

5. Focus Movement and Wh-Movement

5.1. Wh-Word and Wh-Movement

At the end of section 1, I discussed examples with universal quantifiers in the focused position. It is very interesting to note that some of the universal quantifiers share the same morphological forms as the wh-words.[23] Compare the following examples.

(65)a. Tā **shénme píngguǒ** dōu chī.
he every apple FOC eat.
'He eats **all (kinds of) apples**.'

b. Tā chī shénme píngguǒ?
he eat what apple
'What (kinds of) apples does he eat?'

(66)a. Tā **shénme** dōu méiyou zuò.
he everything FOC not-PER do
'He has not done **anything**.'

b. Tā méiyou zuò shénme?
he not-PER do what
'What has he not done?'

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[23] Other words that show the same phenomenon includes *shéi* 'who' or 'everyone', *zěnme* 'why' or 'for every reason', *shá* (typically in some Northern China dialects) 'what' or 'everything', *duōshǎo* 'how much' or 'any amount', etc.

(i) a. Tā **shéi** dōu bu pà.
he everyone FOC not afraid
'He is not afraid of **anyone**.'

b. Tā bu pà shéi?
he not afraid who
'Who is he not afraid of?'

(ii) a. Tā **shá** dōu shuō.
he what FOC say
'He says **everything**.'

b. Tā shuō shá?
he say what
'What does he say?'

(iii)a. Tā **duōshǎo** dōu néng názǒu.
he any-amount FOC can take-away
'He can carry **any amount**.'

b. Tā néng názǒu duōshǎo?
he can take-away how-much
'How much can he carry?'

In the above examples, the (a) sentences show the quantificational use of *shénme* while the (b) sentences show that *shénme* is used as a wh-word. It is very interesting to note that the homophonous form is disambiguated when it appears in different syntactic positions: if *shénme* appears in the formal focus position, it has an interpretation of a universal quantifier only. This phenomenon can be readily explained under the analysis I have proposed so far. Recall that in Section 2 I showed that in Chinese formal focus structures the Focus Criterion must be satisfied at S-Structure. Suppose *shénme* is a potential [+FOC] or [+WH] feature carrier in the lexicon. What feature it carries in a sentence is then determined by the contexts it occurs in. If FP is present in a sentence, it is possible that F will license the [+FOC] feature on *shénme*. Then the Focus Criterion will force *shénme* to move to [Spec, FP]. Thus we interpret *shénme* only as a universal quantifier. If, on the other hand, *shénme* does not appear in a formal focus structure, or it appears in a formal focus structure but is not licensed with [+FOC], then it must carry [+WH] feature. In this case, we should not expect it to move to [Spec, FP]. Since Chinese is classified as a wh-in-situ language, where the WH-Criterion can be satisfied at LF (see Huang 1982, Rizzi 1991, and Lasnik and Saito 1992 for discussion), we will not see any overt wh-movement. Thus we get the interpretation of wh-questions in (b) sentences simply because *shénme* moves at LF and the WH-Criterion is satisfied there.[24]

Following Huang 1982, Aoun 1986, Lasnik and Saito 1992, I assume that the landing site for a wh-phrase is [Spec, CP]. CP is an optional verbal projection over AgrP.

5.2. In-Situ Focus and Wh-Movement

In the above section, I have discussed Chinese formal focus movement and wh-movement. The difference between the two is manyfold. In a formal focus structure, the movement takes place at S-Structure, while a wh-phrase moves only at LF. The focused element moves to [Spec, FP], which is to the right of the subject, while the landing site for a wh-phrase is [Spec, CP], which is to the left of the subject. However, when we compare wh-movement with in-situ focus structures, we find that there are more similarities than differences. First of all, both wh-phrase and in-situ focus involve movement at LF. I have argued that in the in-situ focus structure, the [+FOC] feature is weak, thus focus movement can be delayed until LF without causing the structure to crash at PF. It can also be assumed that in Chinese the [+WH] feature is also weak (compared with that of English, for instance).

Second, both wh-questions and in-situ focus structures have something to do with new information: a wh-question seeks for new information, but an in-situ focus structure provides new information. Formal focus structures, on the other hand, do not convey new information. This is shown clearly in Section 1 where I discuss the possibility that only in-situ focus structures can be used as answers to wh-questions, not formal focus structures. Besides, as in in-situ foci, wh-phrases often receive sentential stress. Thus (65b) and (66b) are often used with *shénme* having primary sentential stress and the meaning remains the same. These facts may greatly affect our considerations for the

[24] The natural question to ask at this point seems to be what happens if *shénme* carries both [+FOC] and [+WH]. The Chinese data seem to suggest that this never happens. One possible explanation for this may be that [+WH] is a lexical feature that *shénme* carries in the lexicon. [+FOC], on the hand, is a syntactic feature that is assigned by the head F. We may assume that when *shénme* is assigned [+FOC] feature, its [+WH] will be overridden. Otherwise, the [+WH] prevails.

landing site of the focused element in an in-situ focus structure. That is, when an in-situ-focused element moves at LF, should it move to [Spec, CP] or [Spec, FP]?

Before answering the question, let's first consider some other facts about in-situ focus. We have seen that in-situ focus and formal focus can cooccur in the same sentence. This is shown in (6) and the following.

(6) **Mǎli** lián píngguǒ dōu bu chī.
Mary even apple FOC not eat
'It is **Mary** who does not even eat apple.'

(67) Lián **Zhāngsān** dōu bu rènshi **Mǎlì**.
even Zhangsan FOC not know Mary
'Even **Zhangsan** does not know **Mary**.'

Suppose that we take in-situ focus movement to be the LF counterpart of the S-Structure formal focus movement. That is, in (59) *Mǎlì* will also move to [Spec, FP] at LF. Then we are forced to wonder how the same head F can contain both strong and weak [+FOC] feature at the same time. Secondly, we have shown that a formally focused element may move to [Spec, TP] if it also carries the [+TOP] feature. Generally, only elements that appear in the topic position are said to convey old information (or background information) (Choe 1992, Huang 1989, and Her 1991). If an in-situ-focused element behaves like a formally focused element, we may expect it to be able to move to [Spec, TP] when it also carries the [+TOP] feature. Then it is very hard to explain how an in-situ-focused element which generally conveys new information can also convey old information at the same time. These difficulties can be avoided if we do not assume that the landing site for in-situ focused element is [Spec, FP]. Especially, when we consider the similar behavior discussed earlier between wh-questions and in-situ focus structures, it is advisable that in-situ focus movement be treated on a par with wh-movement. Thus I will assume that an in-situ-focused element will move to [Spec, CP] at LF[25].

6. Conclusion

In this paper, I have shown that the Chinese formal focus displays convincing evidence for the Focus Criterion. I have argued that in Chinese formal focus structures the Focus Criterion must be satisfied at S-Structure. As for the cases of in-situ focus discussed at the beginning of this paper, one explanation is to assume the Dynamic Agreement Principle as discussed in Rizzi 1991: since there is no overt category F, hence a strong [+FOC] feature, to trigger focus movement, the focus element will move only at LF, where the head will be endowed with the [+FOC] feature by the focused element. Thus the Focus Criterion is satisfied there. The difference between in-situ foci and formal foci is thus attributed to the presence or absence of the overt category F at S-Struture.

Thus, after a detailed investigation, we have come to the conclusion that a Chinese sentence should have the projection sequence TP-(CP)-AgrP-(FP)-IP-(NegP)-VP. As a topic prominent language, the base-generated topic phrase is adjoined to TP. A topicalized phrase moves to [Spec, TP] to check off the [+TOP] feature. [Spec, CP] is where a wh-phrase or an in-situ-focus phrase will move to at LF. The difference between TP and CP is that TP is related to so-called background information while CP contains new or foreground information. This sequence also satisfies the general word order

25 This may lead to the collapsing of wh-movement and in-situ-focus movement in Chinese: both involve a weak feature and thus LF movement; both have something to do with new information: wh-words seek new information while non-wh-words provide new information.

requirement in Chinese that background information usually precedes the foreground information. The subject stays in [Spec, AgrP] where it can get the nominative Case from the head Agr. The first landing site for the formal focus phrase is [Spec, FP]. This can be illustrated through the following example.

(68) [$_{TP}$ Nèi cì jùhuì, [$_{TP}$lián **Mǎlì**$_i$ [$_{AgrP}$nǐ [$_{FP}$ t_i dōu [$_{IP}$méi$_j$you [$_{NegP}$ t_j
that CL reunion even Mary you FOC not-PER
[$_{VP}$rènchūlai t_i]]]]]]]
recognize
'As for the reunion, you did not even recognize **Mary**.'

The Chinese data presented in this paper and the analysis we have proposed also have a number of consequences for the current studies of the Focus Criterion. For instance, in the analysis of Modern Greek focus structures, Tsimpli 1992 argues for relaxing Clause A of the Focus Criterion. She claims that the primary function of Clause A is to motivate movement of the focus phrase to [Spec, FP] and in most cases, this movement is motivated independently for scope reasons, examples including English in-situ focus and wh-movement (see Chomsky 1986a and Culicover 1993 for discussion) as well as Modern Greek focus structures. Although this proposal may also seem to work with Chinese in-situ focus structures and wh-questions, other data presented in the paper seem to suggest otherwise. In Chinese formal focus structures, a focus phrase does not move to sentence-initial position to get wider scope. Instead, it only moves to a preverbal position. Thus we must assume that Clause A is needed (at least for Chinese type formal focus structures).

Second, in a discussion of Hungarian focus structure, Horvath 1991 suggests that the Focus Criterion may be replaced by [+FOC] assignment, along the lines of Case assignment. The Chinese data seem to show that [+FOC] feature is different from Case in at least two aspects. First, a single noun phrase may get both [+FOC] feature and (for instance, a nominative) Case. If [+FOC] behaves like Case, then we may have to revise the Case Theory to allow a single noun phrase to receive two Cases at the same time. This does not seem to be a theoretically sound proposal. Second, a Case position is regarded as the destination for NP movement. Once an NP gets Case, there is no reason for it to move again simply to get another Case.[26] This, however, is not true for Chinese focus phrases. We have seen instances where an object NP can move to [Spec, FP] although the object position is regarded as a typical Case position.

For languages like English, [Spec, CP] seems to host both wh-phrases and focus phrases (see Culicover 1993). Thus it is possible to collapse the Wh-Criterion with the Focus Criterion. However, Chinese formal focus structures seem to suggest that [+FOC] and [+WH] features need to be kept distinct if the two features do not have the same functional strength.

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26 There do seem to be a few languages where an NP can have two case markers. The exact nature of how and why the NPs in these langauges get more than two cases remain unexplained.

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Employing a Multimodal Logic in an Approach to German Pronoun Fronting

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0. Introduction

As frameworks for accounting for natural language phenomena, the traditional categorial type logics have proved inadequate, due in one sense to the global availability of their structural rules. Because of this, relaxing structural sensitivity in order to account for specific phenomena involving non-adjacent composition entails relaxation of the entire system, which leads to overgeneration. To allow restricted access to non-adjacent modes of composition, Moortgat and Oehrle (1994) develop a multimodal logic of categorial type inference. In this paper, I propose an analysis of German pronoun fronting, and discuss how this and other German word order phenomena may be accounted for in Moortgat and Oehrle's theoretical framework.

1. Moortgat and Oehrle's Multimodal Logic

1.1 Categorial Type Logics

The multimodal logic presented in Moortgat and Oehrle is based on type logics such as the Lambek Calculus (Lambek 1958, 1988). In these, the categorial reduction system assumed in classical categorial grammar is reinterpreted as a calculus analogous to the implicational fragment of propositional logic. As such, it consists of three components: a set of types, a model theoretic interpretation for those types, and a set of inference rules. The set of types is freely generated from a product connective '$\circ$' and its left and right residuals '/' and '\', together with a set of primitive categories (such as *s*, *np*, *pp*). An intransitive verb, for example, will have the type 'np\s'; a category which needs an NP on its left to form a sentence.

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The function ν is the model theoretic interpretation, mapping logical types into linguistic expressions:

(1)
$$\begin{aligned} \nu(A \circ B) &= \{xy \mid \exists x \in \nu(A) \,\&\, \exists y \in \nu(B)\} \\ \nu(C/B) &= \{x \mid \forall y(y \in \nu(B) \rightarrow xy \in \nu(C))\} \\ \nu(A\backslash C) &= \{y \mid \forall x(x \in \nu(A) \rightarrow xy \in \nu(C))\} \end{aligned}$$

Thus, for example, a category C/B is mapped onto a set of expressions x such that given an expression y of type B on its right, the resulting expression xy is of type C.

Given this interpretation of the set of types, the following residuation relation must hold among the type constructors:

(2)
$$A \rightarrow C/B \text{ iff } A \circ B \rightarrow C \text{ iff } B \rightarrow A\backslash C$$

The inference rules for the type constructors are presented here in Gentzen sequent notation.[1] A, B, and C, are single occurrences of a type, while Γ and Δ are terms representing a configuration of types. The notation $\Delta[A]$ stands for a configuration of types Δ containing an occurrence of A. The sequents themselves are of the form $\Gamma \Rightarrow X$, where Γ is a nonempty configuration of succedent types, and X is a single occurence of a succedent type.

(3)
$$\frac{}{A \Rightarrow A}\,[Ax]$$

$$\frac{\Gamma, B \Rightarrow A}{\Gamma \Rightarrow A/B}\,[R/] \qquad \frac{\Gamma \Rightarrow B \quad \Delta[A] \Rightarrow C}{\Delta[A/B, \Gamma] \Rightarrow C}\,[L/]$$

$$\frac{B, \Gamma \Rightarrow A}{\Gamma \Rightarrow B\backslash A}\,[R\backslash] \qquad \frac{\Gamma \Rightarrow B \quad \Delta[A] \Rightarrow C}{\Delta[B\backslash A, \Gamma] \Rightarrow C}\,[L\backslash]$$

$$\frac{\Gamma[A, B] \Rightarrow C}{\Gamma[A \circ B] \Rightarrow C}\,[L\circ] \qquad \frac{\Gamma \Rightarrow A \quad \Delta \Rightarrow B}{\Gamma, \Delta \Rightarrow A \circ B}\,[R\circ]$$

Each type constructor has a rule of introduction (a 'right' rule), and a rule of elimination (a 'left' rule). For example, the rule [L/] allows us to eliminate an occurrence of the / connective in A/B if there is a configuration of types Γ immediately to its right such that Γ can be proven to be an occurrence of B. The corresponding rule [R/] introduces an instance of the / onto the succedent type. A sequent can be proven to be valid in the type

[1] See Moortgat (1988:27-39) for a more detailed discussion of Gentzen-sequent derivations.

logic by using the rules of introduction and elimination to reduce all of the branches of the proof tree to occurrences of the Axiom case, also given in (3).

Thus a derivation of the sentence *John loves Mary*, (or rather, the configuration of types which has this sentence as its interpretation), will involve two applications of the [L/] rule to prove that the type *s* is in fact derivable from the types assigned to the expressions *John*, *loves*, and *Mary*:

(4)

$$\dfrac{\dfrac{}{np \Rightarrow np}\,[Ax] \quad \dfrac{}{s \Rightarrow s}\,[Ax] \quad \dfrac{}{np \Rightarrow np}\,[Ax]}{\dfrac{}{(np,\ np\backslash s) \Rightarrow s}\,[L\backslash]}\,[L/]$$

$$(np,\ ((np\backslash s)/np,\ np)) \Rightarrow s$$

In addition to the logical rules, the type logic may also include a set of structural rules, which do not prove any new formulas that are distinct with respect to the basic type logic, but rather allow us to characterize the linguistic forms corresponding to these formulas in a flexible and detailed way. The associative, non-commutative Lambek calculus **L**, for example, will have the following structural rule for Associativity as one of its properties:

(5)

$$\dfrac{\Gamma[(\Delta_1, (\Delta_2, \Delta_3))] \Rightarrow A}{\Gamma[((\Delta_1, \Delta_2), \Delta_3)] \Rightarrow A}\,[Assc]$$

Because associativity renders the bracketing of a configuration of types irrelevant, parentheses are traditionally omitted in Gentzen proofs such as (4) when they are done in **L**. Alternatively, the structural rule in (5) could be explicitly appealed to in order to rebracket the configuration in the antecedent where necessary for the logical rules to be able to apply.

In the stronger Lambek-Van Benthem system known as **LP**, there is an additional structural rule for Permutation:

(6)

$$\dfrac{\Gamma[\Delta_2, \Delta_1] \Rightarrow A}{\Gamma[\Delta_1, \Delta_2] \Rightarrow A}\,[P]$$

This rule ensures that if A is derivable from a particular sequence of types, it is also derivable from any permutation of that sequence. Note that the derivation in (4) is possible in both **L** and **LP**, since no appeal to structural rules is necessary. However, unlike **L**, it is possible in **LP** to derive the topicalized sentence *Mary, John loves*, because Permutation is available to reorder the succedent types so that the logical rules can apply:[2]

[2]Since **LP** is associative, the parentheses in this derivation are omitted.

(7)

$$\dfrac{\dfrac{\dfrac{}{\text{np} \Rightarrow \text{np}}\,[\text{Ax}] \quad \dfrac{}{\text{np} \Rightarrow \text{np}}\,[\text{Ax}]}{\text{s} \Rightarrow \text{s}}\,[\backslash\text{L}]}{\text{np} \Rightarrow \text{np}}\,[/\text{L}] \qquad \dfrac{\dfrac{}{\text{np} \Rightarrow \text{np}}\,[\text{Ax}] \quad \dfrac{}{\text{np} \backslash \text{s} \Rightarrow \text{s}}\,[\backslash\text{L}]}{\text{np}, \text{np} \backslash \text{s} \Rightarrow \text{s}}\,[/\text{L}]}{\text{np}, (\text{np}\backslash\text{s})/\text{np}, \text{np} \Rightarrow \text{s}}\,[\text{P}]$$

$$\text{np}, \text{np}, (\text{np}\backslash\text{s})/\text{np} \Rightarrow \text{s}$$

Since structural rules like Permutation are global options, always available, **LP** is of course much too strong, and can derive many ungrammatical sentences as well. Clearly what is needed is some way to have limited access to these structural rules, so that they can be used only when needed for particular constructions. To this end, Moortgat and Oehrle (1994) propose a multimodal type logic, in which it is possible to combine various modes of composition into the same system.

1.2 Multimodal type logic

The multimodal type logic proposed by Moortgat and Oehrle takes as its basis the architecture of classical categorial type logics, but no longer includes just one set of type constructors whose properties are interpreted with respect to one set of structural rules. Instead, all type constructors are subscripted with an index $i \in I$, where I is the set of *resource management modes*, which may have properties like associativity and commutativity.[3] Thus for every mode i there exists a family of type constructors $\{\circ_i, /_i, \backslash_i\}$.

The type constructors are now interpreted with respect to multimodal (Kripke style) ternary frames $<W, R_i>$, where the 'worlds' W are the linguistic expressions, and R is a three-place accessibility relation over W. The function v now respects the structure of the complex types, (where 'R_ixyz' is read as 'combining expressions x and y in mode i yields the expression z').

(8)

$$v(A \circ_i B) = \{z \mid \exists x \exists y [R_i xyz \,\&\, x \in v(A) \,\&\, y \in v(B)]\}$$
$$v(C /_i B) = \{x \mid \forall y \forall z [(R_i xyz \,\&\, y \in v(B)) \rightarrow z \in v(C)]\}$$
$$v(A \backslash_i C) = \{y \mid \forall x \forall z [(R_i xyz \,\&\, x \in v(A)) \rightarrow z \in v(C)]\}$$

For example, $C/_iB$ is mapped onto an expression x such that if x is combined with y in mode i to yield z, and y is an expression of type B, then z is an expression of type C.

Consequently, the residuation laws will also respect the resource management modes:

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[3]The properties of the individual modes are expressed via Kripke style frame conditions. For example, if c is a commutative mode, then it must satisfy the condition:

(i) $(\forall x,y,z \in W) R_c xyz \Rightarrow R_c yxz$

See Moortgat & Oehrle (1994:3) for further details.

(9)

$$A \to C/_i B \quad \text{iff} \quad A \circ_i B \to C \quad \text{iff} \quad B \to A\backslash_i C$$

The inference rules will be similarly parameterized, as shown in (10). Because concatenation is no longer the only way of combining two expressions, the notation $(A, B)^i$, which is understood as the result of combining A and B in mode i, is now necessary in order to specify the mode of combination.

(10)

$$[R/_i]\ \frac{(\Gamma, B)^i \Rightarrow A}{\Gamma \Rightarrow A/_i B} \qquad [L/_i]\ \frac{\Gamma \Rightarrow B \quad \Delta[A] \Rightarrow C}{\Delta[(A/_i B, \Gamma)^i] \Rightarrow C}$$

$$[R\backslash_i]\ \frac{(B, \Gamma)^i \Rightarrow A}{\Gamma \Rightarrow B\backslash_i A} \qquad [L\backslash_i]\ \frac{\Gamma \Rightarrow B \quad \Delta[A] \Rightarrow C}{\Delta[(\Gamma, B\backslash A)^i] \Rightarrow C}$$

$$[L\circ_i]\ \frac{\Gamma[(A, B)^i] \Rightarrow C}{\Gamma[A \circ_i B] \Rightarrow C} \qquad [R\circ_i]\ \frac{\Gamma \Rightarrow A \quad \Delta \Rightarrow B}{(\Gamma, \Delta)^i \Rightarrow A \circ_i B}$$

For example, the $[L/_i]$ rule can be used to prove that a type $A/_i B$ combined with B in mode i derives A, whereas it can not prove that $A/_i B$ combined with B in mode j derives A.

Crucially, the structural rules are no longer a global option, but are now mode-specific. For example, Permutation is restricted to those types composed in a commutative mode, represented by c, and rebracketing is restricted to associative modes, (a):

(11)

$$[P]\ \frac{\Gamma[(\Delta_2, \Delta_1)^c] \Rightarrow A}{\Gamma[(\Delta_1, \Delta_2)^c] \Rightarrow A}$$

(12)

$$[\text{Assc}]\ \frac{\Gamma[(\Delta_1, (\Delta_2, \Delta_3)^a)^a] \Rightarrow A}{\Gamma[((\Delta_1, \Delta_2)^a, \Delta_3)^a] \Rightarrow A}$$

In addition to the Gentzen-sequent presentation, it is also possible to express the multimodal type logic using an axiomatic presentation.[4] Since in some ways, this presentation is clearer than the Gentzen-sequent, I introduce it here in order to eventually use it to illustrate partial derivations. Corresponding to the structural rules in (11) and (12) there are structural axioms for commutativity and associativity:

[4]See Moortgat and Oehrle (1994:3-4) for discussion.

(13)

$$A \circ_c B \leftrightarrow B \circ_c A$$

(14)

$$(A \circ_a B) \circ_a C \leftrightarrow A \circ_a (B \circ_a C)$$

Since each derivation may involve multiple modes of combination, it is also necessary to have rules or axioms to relate different modes to one another. These will take the form of Inclusion and Interaction Rules/Axioms. The Inclusion Rules/Axioms relate two modes in terms of how informative they are with respect to the structure of the linguistic expressions.

One such Inclusion Rule will be for non-commutative (n) and commutative (c) products. Since n is more informative than c (it places an additional restriction on the structure of the expressions), it will hold that whenever two expressions are combined in a non-commutative mode, they may also be combined in a commutative mode to yield the same result.[5] Therefore in order for the logic to be complete, the Inclusion Rule in (15) and corresponding Inclusion Axiom in (16) are necessary:

(15)

$$\frac{\Gamma[(\Delta_1, \Delta_2)^c] \Rightarrow A}{\Gamma[(\Delta_1, \Delta_2)^n] \Rightarrow A}$$

(16)

$$A \circ_n B \rightarrow A \circ_c B$$

The Interaction Rules/Axioms regulate communication between two modes found in a single configuration. As an example, consider Moortgat & Oehrle's Interaction Rule/Axiom of Mixed Associativity, where i represents some adjacent mode of communication, and j some non-adjacent mode.[6]

(17)

$$\frac{\Gamma[(\Delta_1, (\Delta_2, \Delta_3)^j)^i] \Rightarrow A}{\Gamma[((\Delta_1, \Delta_2)^i, \Delta_3)^j] \Rightarrow A}\ \text{R2}$$

(18)

$$\text{Ax2:}\quad (A \circ_i B) \circ_j C \rightarrow A \circ_i (B \circ_j C)\ .$$

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[5]Formally, this property is expressed by the following frame condition (Moortgat & Oehrle 1994:3):

(i) $(\forall x,y,z \in W)R_n xyz \Rightarrow R_c xyz$

[6]Ax2 and R2 correspond to the following frame condition:

(i) $(\forall xyzuv \in W)[(R_i xyz \ \&\ R_j zuv) \Rightarrow \exists t(R_j xut \ \&\ R_i tyv)]$

See Moortgat & Oehrle 1994:7-9 for a more detailed explanation of the "adjacency parameter."

These can then be used to constrain specific cases by replacing *i* and *j* with the appropriate type constructors, these axioms serve to constrain specific cases. More concrete examples of Interaction Axioms will be given later.

1.3 Prosodic sort labelling

To further increase the expressive power of the type logic, Moortgat and Oehrle introduce a sort labelled type system, where every (sub)type has a subscript indicating its prosodic sort.[7] Thus there may be a distinction for example between an expression A of a 'lexical' sort, written A_w, and an expression A of a 'phrasal' sort, written A_{ph}.

The sorts are structured on an inheritance hierarchy, so that a more general sort subsumes a more specific sort; hence the phrasal sort subsumes the lexical sort. This means that it is possible to infer that any type of sort word is also of sort phrase, using the axiom in (20) which is based on the logical axiom schema in (19):

(19)
$$A_a \rightarrow A_b \text{ if } b \subseteq a$$

(20)
$$A_w \rightarrow A_{ph} \quad ph \subseteq w$$

The sorts are also useful for distinguishing composition at different levels, such as affixation at the word level from concatenation in the syntax.[8]

1.4 Moortgat & Oehrle's analysis of Dutch verb-raising and cross-serial dependencies

As an illustration of how their system may be applied to linguistic phenomena, Moortgat and Oehrle present an analysis of Dutch verb-raising and cross-serial dependency. While they restrict themselves to an example using intransitive verbs, I provide a derivation with transitive verbs to make it apparent how the analysis predicts the cross-serial dependency.[9] Furthermore, since their treatment of verb raising involves "clustering" of the verbs, this may later be compared to my analysis of German pronoun fronting which involves pronoun clusters.

In Dutch, verbs may cluster at the end of an embedded clause, resulting in a cross-serial dependency between the verbs and their arguments.

(21)
dat Jan Marie de kinderen bier zag laten drinken
that Jan Marie the children beer see let drink
'that Jan sees Marie let the children drink beer'

To apply the multimodal type logic in an analysis of this phenomenon, Moortgat and Oehrle introduce headedness as another parameter for the resource management

[7]See Moortgat & Oehrle (1994:6) for details on further adjustments now required in the model theory and proof theory.
[8]See Moortgat & Oehrle (1994:7) for an example showing how the use of a labelled type system allows both phrasal and lexical composition within a single derivation.
[9]The derivation of (21) was worked out in David Dowty's Winter 1995 Categorial Grammar seminar.

modes. The products $\circ_l$ and $\circ_r$ combine two types such that the left or right subtype, respectively, is the head. They also introduce various wrapping modes, which allow for non-adjacent composition.[10] In particular, $\circ_{lh}$ is a mode which combines two types such that the left subtype is the head, which wraps, or 'infixes', into the right subtype.

They also introduce new prosodic sorts. In their analysis, the verbs *zag* and *laten* would be sort **i** for 'infixing verb', because they are wrapped into their VP argument, which they subcategorize for in the *lh* mode of combination. The verb *drinken* would be of sort **v** for 'verb' or 'verb cluster.' The infixing verbs form a recursively built verb cluster with the verb of sort **v**, so that the verb cluster in (21) will look like:

(22)

$$(\text{zag}_i \circ_l (\text{laten}_i \circ_l \text{drinken}_v)_v)_v$$

On the sort hierarchy, **v** is supralexical but subphrasal, ($\text{ph} \subseteq \text{v} \subseteq \text{w}$). The result is that it may contain multiple lexical verbs without also allowing composition at the phrasal level to take place. This is necessary since full phrasal complements are excluded from the verb clusters.

Thus the expressions will have the following category assignments (where *vp* abbreviates $np\backslash_r s$, and the prosodic sort is phrasal where it is not indicated):

(23)

Jan, bier, etc.	np
drinken	$(\text{np}\backslash_r\text{vp})_v$
zag	$((\text{np}\backslash_r\text{vp})/_{lh}\text{vp})_i$
laten	$((\text{np}\backslash_r\text{vp})/_{lh}\text{vp})_i$

Finally, it will be necessary to have Inclusion and Interaction Rules/Axioms.[11] Here I will only give the axiomatic presentation. First note that the following Inclusion Axiom is valid because it involves going from a more informative mode (simple left-headed concatenation) to a less informative mode (one which allows permutation):

(24)

$$(\text{A} \circ_l \text{B}) \rightarrow (\text{A} \circ_{lh} \text{B})$$

The job of the Inclusion Axiom here will be to allow a verb cluster, in which the types are combined in the *l* mode, to be reanalyzed as phrase-level configuration in which the types are combined in the *lh* mode. Therefore it is necessary to constrain the Inclusion Axiom in (24) to a more specific sort-decorated configuration. The left side of the axiom is recognizable as the form of a verb cluster, with the right side reflecting the appropriate changes in sort and mode of composition:

(25)

$$\text{A1: } (\text{A}_i \circ_l \text{B}_v)_v \rightarrow (\text{A}_i \circ_{lh} \text{B}_v)_{ph}$$

This change will allow the configuration to be available so that the relevant Interaction Axiom, A5, may apply. The effect of A5 is simply to allow the wrapped in 'infixing' verb to permute up a right-headed string, while preserving any sort information that is present on the subtypes:

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[10] See Moortgat & Oehrle (1994:9-11) for discussion of their complete set of head wrapping products.

[11] See Moortgat & Oehrle (1994:10) for more details on the communication between the dependency system (i.e. concatenative modes), and the head wrapping system.

(26)

A5: $A \circ_r (B \circ_{lh} C) \rightarrow B \circ_{lh} (A \circ_r C)$

Now a (partial) derivation of (21) can be given in the axiomatic presentation (where again the sort of the types is **ph** if not otherwise specified):

(21')

$dat \circ_l (Jan \circ_r (Marie \circ_r (de\ kinderen \circ_r (bier \circ_r (zag_i \circ_l (laten_i \circ_l drinken_v)_v)_v))))$
$\downarrow$ A1 (*twice*)
$dat \circ_l (Jan \circ_r (Marie \circ_r (de\ kinderen \circ_r (bier \circ_r (zag_i \circ_{lh} (laten_i \circ_{lh} drinken_v))))))$
$\downarrow$ A5
$dat \circ_l (Jan \circ_r (Marie \circ_r (de\ kinderen \circ_r (zag_i \circ_{lh} (bier \circ_r (laten_i \circ_{lh} drinken_v))))))$
$\downarrow$ A5
$dat \circ_l (Jan \circ_r (Marie \circ_r (zag_i \circ_{lh} (de\ kinderen \circ_r (bier \circ_r (laten_i \circ_{lh} drinken_v))))))$
$\downarrow$ A5
$\underline{dat} \circ_l (\underline{Jan} \circ_r (\underline{Marie} \circ_r (\underline{zag_i} \circ_{lh} (\underline{de\ kinderen} \circ_r (\underline{laten_i} \circ_{lh} (\underline{bier} \circ_r \underline{drinken_v}))))))$
$s/_l s \quad np \quad np \quad ((np\backslash_r vp)/_{lh} vp)_i \quad np \quad ((np\backslash_r vp)/_{lh} vp)_i \quad np \quad (np\backslash_r vp)_v$

Throughout this paper, for the sake of clarity, the derivations will include the lexical expressions rather than their types up until the last line; the axioms should still be understood as operating on types. The first line is the hypothesized string which is to be proven to be a sentence.

The Inclusion Axiom A1 applies to it twice to 'undo' each part of the recursively built verb cluster. At this point the Interaction Axiom A5 may apply to move first the infixing verb *zag*, and then *laten*, up the right-headed string. In the last line, it can be verified that the types are in the proper configuration for the logical connectives to be eliminated; this last part of the derivation is not given.

2. German Data

2.1 General Assumptions

The data discussed here will be restricted to embedded clauses which exhibit the SOV order considered basic for German. The assumption here, common in studies of German syntax, is that the best strategy for analyzing certain phenomena is to begin with verb-final clauses because they represent the most general case. Later the analysis may be extended to verb-second and verb-initial clauses.[12]

Furthermore, only data with constituents in their "unmarked" order will be discussed. Here the term "unmarked" is used as defined by Lenerz (1977), that is, roughly, the word order which is considered to be grammatical given any context.

[12]What this means for the present analysis is that pronouns will be treated as clustering with an initial complementizer in an embedded clause with SOV word order. However, if the analysis were extended to verb-second or verb-initial clauses, the pronouns would then be considered to cluster with the preceding finite verb. Further discussion appears in §2.5.

2.2 Pronoun Fronting

It has often been noted that in German, unstressed pronouns appear together at the left in an embedded clause, and that unlike full NPs, they always remain in a fixed order with respect to one another, namely nom>acc>dat (e.g. Lenerz 1977, Uszkoreit 1987). Lenerz also observes that if the subject is a full NP, it has the option of appearing to the left of the pronouns, and that this order is equally unmarked. Thus given an embedded clause with a transitive verb, the following judgments hold:

(27) daß der Doktor den Mann sieht
that the doctor-NOM *the man*-ACC *sees*

(28) daß er den Mann sieht
that he-NOM *the man*-ACC *sees*

(29) *daß den Mann er sieht
that the man-ACC *he-NOM sees*

(30) daß der Doktor ihn sieht
that the doctor-NOM *him*-ACC *sees*

(31) daß ihn der Doktor sieht
that him-ACC *the doctor*-NOM *sees*

(32) daß er ihn sieht
that he-NOM *him*-ACC *sees*

(33) *daß ihn er sieht
that him-ACC *he*-NOM *sees*

2.3 Unmarked order of NPs

There is some debate as to the unmarked order for accusative and dative arguments when they are full NPs. One view is that either order is unmarked, whereas the other is that only the dat>acc order is possible without special context. Lenerz discusses the two possibilities, and comes down in favor of the latter by applying his tests for markedness to sentences with the verb *geben*, 'to give'. The issue does not seem to be settled, (cf. Gadler 1982), but here it will be assumed that Lenerz is correct, and that the unmarked order for full NPs is nom>dat>acc.

This together with the facts about pronoun fronting discussed above means that given an embedded clause with a ditransitive verb, only the following orders are grammatical (and unmarked):

(34) daß der Doktor dem Mann das Buch gibt
that the doctor-NOM *the man*-DAT *the book*-ACC *gives*

(35) daß er dem Mann das Buch gibt
that he-NOM *the man*-DAT *the book*-ACC *gives*

(36) a. daß der Doktor ihm das Buch gibt
that the doctor-NOM *him*-DAT *the book*-ACC *gives*

b. daß ihm der Doktor das Buch gibt
that him-DAT *the doctor-NOM the book*-ACC *gives*

(37) a. daß der Doktor es dem Mann gibt
that the doctor-NOM *it*-ACC *the man*-DAT *gives*
b. daß es der Doktor dem Mann gibt
that it-ACC *the doctor*-NOM *the man*-DAT *gives*

(38) daß er ihm das Buch gibt
that he-NOM *him*-DAT *the book*-ACC *gives*

(39) daß er es dem Mann gibt
that he-NOM *it*-ACC *the man*-DAT *gives*

(40) a. daß der Doktor es ihm gibt
that the doctor-NOM *it*-ACC *him*-DAT *gives*
b. daß es ihm der Doktor gibt
that it-ACC *him*-DAT *the doctor*-NOM *gives*

(41) daß er es ihm gibt
that he-NOM *it*-ACC *him*-DAT *gives*

Personal pronouns, as noted, indisputably appear in the order nom>acc>dat. This discrepancy has generally been treated as an idiosyncratic fact, and apparently no plausible explanation has been put forth.[13] Therefore I will similarly not attempt an explanation, but rather will later account for the difference in §3.3 by having ditransitive verbs wrap an accusative full NP in over the dative argument.

2.4 Adverbials

The ordering of adverbials with respect to arguments of the verb is governed by many factors, including of course the type of adverbial itself (Uszkoreit 1987). Therefore the discussion here is limited to the sentential adverb *trotzdem*, 'nonetheless', which is able to appear in any position among full NP arguments:

(42) a. daß trotzdem der Doktor dem Mann das Buch gibt
that nonetheless the doctor the man the book gives
b. daß der Doktor trotzdem dem Mann das Buch gibt
c. daß der Doktor dem Mann trotzdem das Buch gibt
d. daß der Doktor dem Mann das Buch trotzdem gibt

However, the adverb may not appear among the pronouns and the element to their left (which will be either the complementizer or an NP subject):[14]

[13]Thiersch (1978) does in fact attempt a principled explanation by claiming that an accusative pronoun (but not an accusative NP) moves to a special 'W' (for 'Wackernagel') node between the nominative and dative argument positions, where it may cliticize onto the preceding element and become phonologically reduced. This account has a number of problems I will not discuss here; see also McKay (1985) for discussion.

[14]Grewendorf and Sternefeld (1990) also note that scrambling of full NPs cannot result in an NP appearing to the left of a pronominal subject. Presumably this could be extended to the generalization that scrambling cannot result in an NP appearing anywhere among pronouns and their host.

(43) a. daß trotzdem der Doktor es ihm gibt
that nonetheless the doctor it him gives
b. *daß der Doktor trotzdem es ihm gibt
c. *daß der Doktor es trotzdem ihm gibt
d. daß der Doktor es ihm trotzdem gibt

(44) a. *daß trotzdem er dem Mann das Buch gibt
that nonetheless he the man the book gives
b. daß er trotzdem dem Mann das Buch gibt

2.5 Pronoun fronting as "clustering"

Given these data, German pronouns can be seen to share several properties generally attributed to clitics, (observed, e.g. in Zwicky 1977). To begin with, they are phonologically light, being monosyllabic and unstressed. Secondly, pronouns appear in a rigidly fixed position within the clause, always after the complementizer or NP subject in these cases. Their order with respect to one another is also fixed as nom>acc>dat, and is different from the canonical order of full NPs. Finally, no other elements may intervene between two pronouns, or between a pronoun and the element immediately to its left.

German pronouns are not traditionally considered to be clitics, as they generally do not exhibit phonological reduction.[15] However, the fact that they have these properties suggests that it is not unreasonable to analyze them as such.[16](David Dowty, Arnold Zwicky, p.c.) In order to account for the fixed order of the pronouns and the unacceptability of intervening elements, I will be treating these configurations involving pronoun fronting as recursively built up "clitic" clusters, with the complementizer or NP subject acting as the original host.

While complementizers and NPs are unusual hosts for clitics, it should be kept in mind that the treatment here of pronouns in verb final clauses is only a preliminary step. The analysis given here should eventually extend to verb initial and verb second clauses as well. In such clause types, the pronouns are for the most part found clustering around the finite verb. The approach being developed here will therefore involve pronouns attaching to the finite verb, a much more familiar type of host. It is only because of the assumption that verb final clauses are more basic than verb initial and verb second clauses that complementizers, rather than finite verbs, are behaving as hosts. Presumably the two play parallel syntactic roles in their respective clauses.

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[15]An exception is the accusative neuter pronoun *es*, which is treated by Thiersch (1978) as a clitic because it may in fact be phonologically reduced.

[16]Zwicky (1977:6) cites Hale's (1973:339-44) discussion of the Australian language Warramunga. Hale observes that Warramunga seems to be in an intermediate stage in the development of its pronouns from independent words to clitics, while the neighboring language Walpiri has already fully developed its pronouns as clitics. The description of Warramunga pronouns is strikingly similar to German pronouns: "...in Warramunga the clitic pronouns are merely unstressed variants of independent pronouns, but have moved into 'second position,' after the first (nonpronominal) constituent of the sentence."

3. An account of German pronoun fronting

3.1 Pronoun clusters (with the complementizer as host)

To show how these generalizations about German word order can be analyzed in a multimodal framework, I will begin by discussing pronoun clusters with a complementizer host, as found in examples (31) and (32), repeated here:

(31) [daß ihn] der Doktor sieht
that *him*(acc) *the doctor*(nom) *sees*

(32) [[daß er] ihn] sieht
that *he*(nom) *him*(acc) *sees*

Complementizers will be of sort **h**, for 'host', as will the pronoun clusters which are built up recursively from the original host. The pronouns themselves will be of sort **p**, while full NPs are of sort **ph**. This enables verbs to have a type such that they combine with full NPs with right-headed concatenation, but with pronouns in a new *rp* ('right-headed pronominal') mode, henceforth abbreviated *p*. This will ultimately result in pronouns being linearized in pronoun clusters. Thus the type assignments will be:

(45)

daß	$(s'/\!\!\diamond s)_h$
er, ihn	np_p
der Doktor	np_{ph}
sehen	$NP\backslash_{(p)}(NP\backslash_{(p)}s)$ where: $NP\backslash_{(p)}A = np_{ph}\backslash_r A \cup np_p\backslash_p A$

In the type for *sehen*, the symbol '$\cup$' indicates a type which is the join of two other types.[17] This type will therefore be the join of the following four types, exhausting the possible combinations of pronominal and NP arguments:

(46)

$np_{ph}\backslash_r(np_{ph}\backslash_r s)$ $\quad$ $np_p\backslash_p(np_{ph}\backslash_r s)$
$np_{ph}\backslash_r(np_p\backslash_p s)$ $\quad$ $np_p\backslash_p(np_p\backslash_p s)$

On the sort hierarchy, **h** will be supralexical but subphrasal (i.e. ph $\subseteq$ h $\subseteq$ w), like Moortgat and Oehrle's **v** sort, so that an element of sort **h** may contain multiple lexical items, without being a phrase prosodically. However, it is crucial that sort **p** not be subsumed by the sort **ph**. Otherwise, it would be a valid step in a derivation to make the inference that pronouns are also sort **ph**, which would allow them to be combined with the verb in the *r* mode rather than the *p* mode. This would then preclude their forming pronoun clusters.

Given these sorts and type assignments, the following Inclusion Axiom will be necessary:

(47)

A1: $(A_h \circ_l B)_h \rightarrow (A_h \circ_p B)_{ph}$

[17] See Moortgat & Oehrle (1994:20) for further discussion of join types.

A1 will apply to a configuration unique to pronoun clusters, reanalyzing it as a phrase-level type where the subtypes are combined in the *p* mode.

This will allow the new configuration to have access to the following Interaction Axioms:

(48)

A4: $(A \circ_p B) \circ_l C \rightarrow A \circ_l (B \circ_p C)$

(49)

A5: $A \circ_p (B \circ_r C) \rightarrow B \circ_r (A \circ_p C)$

Their effects are illustrated in the derivation for (31):[18]

(31′)

$(\text{daß}_h \circ_l \text{ihn})_h \circ_l (\text{der Doktor} \circ_r \text{sieht})$
↓ A1
$(\text{daß}_h \circ_p \text{ihn}) \circ_l (\text{der Doktor} \circ_r \text{sieht})$
↓ A4
$\text{daß}_h \circ_l (\text{ihn} \circ_p (\text{der Doktor} \circ_r \text{sieht}))$
↓ A5
$\underline{\text{daß}}_h \circ_l (\underline{\text{der Doktor}} \circ_r (\underline{\text{ihn}} \circ_p \underline{\text{sieht}}))$
$(s'/s)_h \quad np_{ph} \qquad np_p \quad np_p\backslash_p(np_{ph}\backslash_r s)$

The first step in this derivation is to apply A1 to reanalyze the pronoun cluster; A4 then rebrackets the string so that the pronoun is now combined with the string on its right in the *p* mode. Now A5 permutes the pronoun down through the right-headed string. After one application, the pronoun has reached the site at which the conditions for the elimination of the logical connectives are met.

The derivation of (32) shows how pronoun clusters are built up recursively:

(32′)

$((\text{daß}_h \circ_l \text{er})_h \circ_l \text{ihn})_h \circ_l \text{sieht}$
↓ A1
$((\text{daß}_h \circ_l \text{er})_h \circ_p \text{ihn}) \circ_l \text{sieht}$
↓ A1
$((\text{daß}_h \circ_p \text{er}) \circ_p \text{ihn}) \circ_l \text{sieht}$
↓ A4
$(\text{daß}_h \circ_p \text{er}) \circ_l (\text{ihn} \circ_p \text{sieht})$
↓ A4
$\underline{\text{daß}}_h \circ_l (\underline{\text{er}} \circ_p (\underline{\text{ihn}} \circ_p \underline{\text{sieht}}))$
$(s/s)_h \quad np_p \quad np_p \quad np_p\backslash_p(np_p\backslash_p s)$

Here A1 applies twice, first to 'undo' the outer cluster in which *ihn* takes *daß er* as its host, then the inner cluster in which *er* takes *daß* as its host. Since the types are already in the proper linear order, A4 applies twice to simply rebracket the string.

[18] Where the sorts are left unmarked in these derivations, the sort of the pronouns is understood as **p**, and elsewhere, **ph**.

Given these axioms, it is mandatory for the pronouns to start out as part of a cluster in the linearized string. The only possible mode of combination in a linearized string is concatenation, so that in order for the pronouns to be combined in the *p* mode required by the verb's type, A1 must be able to apply. But A1 is restricted to the configuration of a pronoun cluster, so it will be impossible to derive (32) by starting, for example, with the linearized string in (32´´):

(32´´)
*daß$_h$ °$_l$ (er °$_r$ (ihn °$_r$ sieht))

Similarly, the ungrammatical example (29) may not be derived, where (29´) is given below as a possible starting point for an attempt at a derivation:

(29) *daß den Mann er sieht

(29´) *daß$_h$ °$_l$ (den Mann °$_r$ (er °$_r$ sieht))

Finally, this analysis also predicts that pronouns must remain in the same order with respect to each other. Therefore it will not be possible to derive (33):

(33) *daß ihn er sieht

(33´) ((daß$_h$ °$_l$ ihn)$_h$ °$_l$ er)$_h$ °$_l$ sieht
↓ A1
((daß$_h$ °$_l$ ihn)$_h$ °$_p$ er) °$_l$ sieht
↓ A1
((daß$_h$ °$_p$ ihn) °$_p$ er) °$_l$ sieht
↓ A4
(daß$_h$ °$_p$ ihn) °$_l$ (er °$_p$ sieht)
↓ A4
daß$_h$ °$_l$ (ihn °$_p$ (er °$_p$ sieht))
↓ ?

While all the same steps may occur as they did in the derivation of (32), there now needs to be a way to permute the object *ihn* over the subject *er*. However, A5 is the only Interaction Axiom allowing permutation of a pronoun, and it requires that the mode of combination on the right be right-headed concatenation, while in this configuration that mode is *p*. Thus pronouns may never permute over one another, and will remain in their fixed order.

Note also that A5 will prevent a pronoun from starting in a higher clause and permuting down into the embedded clause, because such a move would require permutation over left-headed concatenation, the mode in which the complementizer combines with the sentence.

3.2 Pronoun clusters (with the NP subject as host)

As was noted in §2.1, a full NP subject is the only element that can appear between pronouns and the complementizer in an embedded clause:

(30) daß der Doktor ihn sieht

In such cases, it appears that the NP subject is behaving as the host for a pronoun cluster. Thus it can be assumed that like complementizers, all nominative NPs are sort **h** as well,[19] and *der Doktor ihn* will be a pronoun cluster.

Note that subject NPs are subcategorized for by the verb with right-headed concatenation. Therefore the pronoun cluster in (30), (consisting of the subject NP and the object pronoun), will be combined with the string on its right with right-headed concatenation. A4 will not apply to this configuration, since is designed to rebracket a string in which the pronoun cluster has a complementizer host, and is thus combined with the string on its right with left-headed concatenation. Instead, a new axiom, A4´ will allow this step:

(50) A4´: $(A \circ_p B) \circ_r C \rightarrow A \circ_r (B \circ_p C)$

The derivation for (30) shows how A1 still applies to introduce the *p* mode, so that A4´ may rebracket the string:

(30´) $daß_h \circ_l ((der\ Doktor_h \circ_l ihn)_h \circ_r sieht)$
$\downarrow$ A1
$daß_h \circ_l ((der\ Doktor_h \circ_p ihn) \circ_r sieht)$
$\downarrow$ A4'
$daß_h \circ_l (der\ Doktor_h \circ_r (ihn \circ_p sieht))$
$\downarrow$
$\underline{daß_h} \circ_l (\underline{der\ Doktor} \circ_r (\underline{ihn} \circ_p \underline{sieht}))$
$(s/_l s)_h \quad np_{ph} \quad np_p \quad np_p\backslash_p(np_{ph}\backslash_r s)$

There is still one final step necessary after A4´. The verb subcategorizes for a subject NP of sort **ph**, but *der Doktor* is sort **h**. Since **ph** subsumes **h** on the sort hierarchy, an axiom exists following the logical axiom schema given in (19):

(51) $A_h \rightarrow A_{ph}$

This allows the inference in the last step of (4´) to be made, after which the logical connectives may be eliminated.

3.3 Wrapping account of nom>dat>acc order of NPs

Examples (34) and (41), repeated here, show the differing unmarked orders for pronominal and NP arguments:

(34) daß der Doktor dem Mann das Buch gibt
that the doctor-NOM *the man*-DAT *the book*-ACC *gives*

(41) daß er es ihm gibt
that he-NOM *it*-ACC *him*-DAT *gives*

[19]This point will be elaborated upon further in §4.2.

By giving a ditransitive verb a type that subcategorizes for the accusative argument in a right-headed 'wrap' mode, *rw*, only when it is a full NP, it is possible to correctly predict this difference. (The new wrap mode, *rw*, will henceforth be abbreviated *w*.) Since the Inclusion Axiom which introduces the wrap mode may only apply to a configuration with a verb, verbs will be made identifiable by their sort, **v**.

The type for a ditransitive verb like *geben* 'to give' will accordingly be:

(52)

geben: $(NP\backslash_{(p}(NP\backslash_{(p,w)}(NP\backslash_{(p}s)))_v$
where: $NP\backslash_{(p,w)}A = np_p\backslash_p A \cup np_{ph}\backslash_w A$

This allows the following eight types:

(53)

$(np_{ph}\backslash_r(np_{ph}\backslash_w(np_{ph}\backslash_r s)))_v$ $(np_{ph}\backslash_r(np_p\backslash_p(np_p\backslash_p s)))_v$
$(np_{ph}\backslash_r(np_{ph}\backslash_w(np_p\backslash_p s)))_v$ $(np_p\backslash_p(np_{ph}\backslash_w(np_p\backslash_p s)))_v$
$(np_{ph}\backslash_r(np_p\backslash_p(np_{ph}\backslash_r s)))_v$ $(np_p\backslash_p(np_p\backslash_p(np_{ph}\backslash_r s)))_v$
$(np_p\backslash_p(np_{ph}\backslash_w(np_{ph}\backslash_r s)))_v$ $(np_p\backslash_p(np_p\backslash_p(np_p\backslash_p s)))_v$

A new Inclusion Axiom is needed to allow right-headed concatenation to be reanalyzed as wrap when the right subtype is a verb:

(54)

A2: $(A \circ_r B_v) \rightarrow (A \circ_w B_v)$

This makes a configuration available for the Interaction Axiom A6, which permutes the accusative argument up a right-headed string:

(55)

A6: $A \circ_R (B \circ_w C) \rightarrow B \circ_w (A \circ_R C)$

Here '*R*' is used as an abbreviation for any right-headed mode of combination, (namely, *r*, *(r)p*, and *(r)w*).

The derivation of (35) shows how these axioms apply:

(35′)

$(daß_h \circ_l er)_h \circ_l (dem\ Mann \circ_r (das\ Buch \circ_r gibt_v))$
↓ A2
$(daß_h \circ_l er)_h \circ_l (dem\ Mann \circ_r (das\ Buch \circ_w gibt_v))$
↓ A6
$(daß_h \circ_l er)_h \circ_l (das\ Buch \circ_w (dem\ Mann \circ_r gibt_v))$
↓ A1
$(daß_h \circ_p er) \circ_l (das\ Buch \circ_w (dem\ Mann \circ_r gibt_v))$
↓ A4
$\underline{daß_h} \circ_l (\underline{er} \circ_p (\underline{das\ Buch} \circ_w (\underline{dem\ Mann} \circ_r \underline{gibt_v})))$
$(s/_l s)_h \quad np_p \quad np_{ph} \qquad np_{ph} \qquad (np_{ph}\backslash_r(np_{ph}\backslash_w(np_p\backslash_p s)))_v$

Given the formulation of A2, the wrap mode could be introduced next to transitive or intransitive verbs as well. Applying A2 in these situations, however, would not lead to a complete derivation, as it is only a ditransitive verb that subcategorizes for its accusative argument in this mode.

It is crucial that A6 allow permutation over any right-headed mode, to account for cases where the dative argument is a pronoun. The derivation of (38) shows an application of A6 where *R* is instantiated as the *p* mode:

(38′)

$((\text{daß}_h \circ_l \text{er})_h \circ_l \text{ihm})_h \circ_l (\text{das Buch} \circ_r \text{gibt}_v)$
$\downarrow$ A2
$((\text{daß}_h \circ_l \text{er})_h \circ_l \text{ihm})_h \circ_l (\text{das Buch} \circ_w \text{gibt}_v)$
$\downarrow$ A1
$((\text{daß}_h \circ_l \text{er})_h \circ_p \text{ihm}) \circ_l (\text{das Buch} \circ_w \text{gibt}_v)$
$\downarrow$ A1
$((\text{daß}_h \circ_p \text{er}) \circ_p \text{ihm}) \circ_l (\text{das Buch} \circ_w \text{gibt}_v)$
$\downarrow$ A4
$(\text{daß}_h \circ_p \text{er}) \circ_l (\text{ihm} \circ_p (\text{das Buch} \circ_w \text{gibt}_v))$
$\downarrow$ A4
$\text{daß}_h \circ_l (\text{er} \circ_p (\text{ihm} \circ_p (\text{das Buch} \circ_w \text{gibt}_v)))$
$\downarrow$ A6
$\underline{\text{daß}_h} \circ_l (\underline{\text{er}} \circ_p (\underline{\text{das Buch}} \circ_w (\underline{\text{ihm}} \circ_p \underline{\text{gibt}_v})))$
$(s/\!\!s)_h \quad np_p \quad np_{ph} \qquad np_p \quad (np_p\backslash_p(np_{ph}\backslash_w(np_p\backslash_p s)))_v$

Again, notice that A6 prevents the accusative NP from starting out in a higher clause by not allowing permutation over a left-headed mode. Thus a wrapping account of the word order differences between NPs and pronouns makes the correct predictions without interfering with the clustering of the pronouns.

3.4 Adverbials

To account for the potentially free ordering of adverbials among arguments, we can again use the wrap mode. Adverbs will be of sort **adv**, with a type that allows them to combine with an expression in the wrap mode. So the sentential adverb *trotzdem* ('nonetheless') will be assigned the category $(s/_w s)_{adv}$.

A new Inclusion Axiom A3 allows right-headed concatenation to be reanalyzed as wrap whenever the left subtype is an adverb:

(56)

A3: $(A_{adv} \circ_r B) \rightarrow (A_{adv} \circ_w B)$

This will allow the resulting configuration to be available to the previously discussed Interaction Axiom, A6. This time it is the adverb which A6 permutes up a right-headed string until it gets to the top of the clause where it can take the embedded sentence as its argument. Again, the adverb cannot move over a left-headed mode, so it is predicted to always be linearized in the clause it modifies.

The derivation of (57a) provides an illustration:

(57) a. daß der Mann den Doktor trotzdem sieht
that the man the doctor nonetheless sees

(57a´)

$daß_h \circ_l$ (der Mann $\circ_r$ (den Doktor $\circ_r$ ($trotzdem_{adv} \circ_r$ sieht)))
↓ A3
$daß_h \circ_l$ (der Mann $\circ_r$ (den Doktor $\circ_r$ ($trotzdem_{adv} \circ_w$ sieht)))
↓ A6
$daß_h \circ_l$ (der Mann $\circ_r$ ($trotzdem_{adv} \circ_w$ (den Doktor $\circ_r$ sieht)))
↓ A6
$\underline{daß_h} \circ_l$ ($\underline{trotzdem_{adv}} \circ_w$ (<u>der Mann</u> $\circ_r$ (<u>den Doktor</u> $\circ_r$ <u>sieht</u>)))
$(s/_r s)_h$ $(s/_w s)_{adv}$ np_{ph} np_{ph} $np_{ph}\backslash_r(np_{ph}\backslash_r s)$

The derivations of (57b) and (57c) will look very similar:

(57) b. daß der Mann trotzdem den Doktor sieht
c. daß trotzdem der Mann den Doktor sieht

Since A3 can introduce the wrap mode next to an adverb regardless of the sort of the right hand subtype, an adverb may be linearized anywhere among the arguments in the clause it modifies.

It will be impossible, however, to derive a linearized string in which the adverb is in the middle of a pronoun cluster:

(58) * $(daß_h \circ_l$ trotzdem$)_h \circ_l$ er $)_h \circ_l$ ihn$)_h \circ_l$ sieht

A1 could apply to 'undo' the cluster containing *trotzdem*, but then *trotzdem* would be combined in the *p* mode, which does not match with its lexical category. And as previously discussed, pronouns must be linearized in a pronoun cluster.

The derivation of (59) provides an example of how various axioms are able to work together:

(59) daß er dem Mann das Buch trotzdem gibt

(59′) $(\text{daß}_h \circ_l \text{er})_h \circ_l (\text{dem Mann} \circ_r (\text{das Buch} \circ_r (\text{trotzdem}_{adv} \circ_r \text{gibt}_v)))$
$\downarrow$ A1
$(\text{daß}_h \circ_p \text{er}) \circ_l (\text{dem Mann} \circ_r (\text{das Buch} \circ_r (\text{trotzdem}_{adv} \circ_r \text{gibt}_v)))$
$\downarrow$ A4
$\text{daß}_h \circ_l (\text{er} \circ_p (\text{dem Mann} \circ_r (\text{das Buch} \circ_r (\text{trotzdem}_{adv} \circ_r \text{gibt}_v)))$
$\downarrow$ A3
$\text{daß}_h \circ_l (\text{er} \circ_p (\text{dem Mann} \circ_r (\text{das Buch} \circ_r (\text{trotzdem}_{adv} \circ_w \text{gibt}_v)))$
$\downarrow$ A7
$\text{daß}_h \circ_l (\text{er} \circ_p (\text{dem Mann} \circ_r (\text{trotzdem}_{adv} \circ_w (\text{das Buch} \circ_r \text{gibt}_v)))$
$\downarrow$ A7
$\text{daß}_h \circ_l (\text{er} \circ_p (\text{trotzdem}_{adv} \circ_w (\text{dem Mann} \circ_r (\text{das Buch} \circ_r \text{gibt}_v)))$
$\downarrow$ A7
$\text{daß}_h \circ_l (\text{trotzdem}_{adv} \circ_w (\text{er} \circ_p (\text{dem Mann} \circ_r (\text{das Buch} \circ_r \text{gibt}_v)))$
$\downarrow$ A2
$\text{daß}_h \circ_l (\text{trotzdem}_{adv} \circ_w (\text{er} \circ_p (\text{dem Mann} \circ_r (\text{das Buch} \circ_w \text{gibt}_v)))$
$\downarrow$ A6
$\underline{\text{daß}_h} \circ_l (\underline{\text{trotzdem}_{adv}} \circ_w (\underline{\text{er}} \circ_p (\underline{\text{das Buch}} \circ_w (\underline{\text{dem Mann}} \circ_r \underline{\text{gibt}_v})))$
$(s/\underline{s})_h \quad (s/_w s)_{adv} \qquad np_p \quad np_{ph} \qquad np_{ph} \quad (np_{ph}\backslash_r(np_{ph}\backslash_w(np_p\backslash_p s)))_v$

Thus a multimodal framework enables us to account for at least three distinct phenomena of German word order; the placement of pronouns, the difference in unmarked orders of NP and pronominal objects, and the relatively free ordering of adverbials. By assigning these expressions types of different sorts, and then allowing these sorts to have access to different modes of composition, it is possible to a large extent to predict the relevant facts.

4. Remaining questions

4.1 Double host problem

Given that both complementizers and NP subjects are sort **h**, the derivation of (60) shows how it is possible to derive an ungrammatical sentence in which there are two pronouns which each take a different element as its host.

(60) *daß es der Mann ihm gibt

(60')

$(\text{daß}_h \circ_l \text{es})_h \circ_l ((\text{der Mann}_h \circ_l \text{ihm})_h \circ_r \text{gibt})$
$\downarrow$ A1
$(\text{daß}_h \circ_p \text{es}) \circ_l ((\text{der Mann}_h \circ_p \text{ihm}) \circ_r \text{gibt})$
$\downarrow$ A4
$(\text{daß}_h \circ_p \text{es}) \circ_l (\text{der Mann}_h \circ_r (\text{ihm} \circ_p \text{gibt}))$
$\downarrow$ A4
$\text{daß}_h \circ_l (\text{es} \circ_p (\text{der Mann}_h \circ_r (\text{ihm} \circ_p \text{gibt})))$
$\downarrow$ A4
$\text{daß}_h \circ_l (\text{der Mann}_h \circ_r (\text{es} \circ_p (\text{ihm} \circ_p \text{gibt})))$
$(s/fs)_h \quad np_{ph} \qquad np_p \quad np_p \quad (np_p\backslash_p(np_{ph}\backslash_h(np_p\backslash_p s)))_v$

To prevent this there must be some way of restricting the number of hosts in a single clause. However, given that no lexical item subcategorizes for both hosts, it is very difficult to see how this would be accomplished in a categorial framework.

4.2 NP as a subphrasal sort

In §3.2 it was proposed that all nominative NPs are of sort **h**, so that they may act as hosts for pronoun clusters. However, this raises questions about why an expression which is clearly a phrase should be assigned to a subphrasal sort. The sort hierarchy is intended to distinguish composition at different prosodic levels. so that for example, once composition has occurred at the phrasal level, it is no longer possible to return to the lexical level for affixation. Since NPs must be composed at the phrasal level, it is not clear how they would then be reanalyzed as the subphrasal sort **h**.

However, considering the observation that these pronouns seem to behave like clitics, it could be that, similar to the behavior of the English possessive, the pronouns are not using the whole NP as their host, but rather some final element (David Dowty, p.c.). Thus it is not the NP itself which is sort **h**. There would have to be some way then of identifying the final element of a nominative NP as being sort **h**, but since this is not an isolated morphological phenomenon, and because this system has such expressive power, it could conceivably be worked into the present analysis.

5. Conclusion

This paper has motivated a possible analysis of German pronoun fronting involving clusters of pronouns around a complementizer or NP subject host. As discussed in §2.5, these hosts are peculiar to verb final clauses. An extension of the analysis to other clause types should result in finite verbs also acting as hosts for pronoun clusters in a parallel manner.

Along with word order phenomena involving sentential adverbs and the apparently idiosyncratic ordering of full NPs, it has been shown that pronoun clusters may to a large extent be accounted for in the system of multimodal logic developed in Moortgat and Oehrle (1994). While certain problems and questions remain, the overall approach appears promising.

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The Interaction of Segmental-Prosodic Rules with Tonal Rules: A Case Study of North Kyungsang Korean*

No-Ju Kim

This paper undertakes an investigation into the interaction of segmental-prosodic rules with tonal rules in North Kyungsang Korean (NK Korean). Verb roots in NK Korean are divided into one of three tone classes: the Default H-tone Class, the Floating H-tone Class and the Precoindexed H-tone class. However, segmental-prosodic changes in certain verb stems cause verbs to shift from one tone class to another depending on the nature of the segmental-prosodic modification. These tone changes have been overlooked by all previous studies on NK Korean since they have presented a mixture of NK Korean tones and Seoul Korean segments.[1] This paper will show that all the tonal changes induced by segmental-prosodic changes are explained by the hypothesis that all segmental-prosodic rules affecting the Tone Bearing Unit (TBU) of this language (= the syllable) are applied earlier than tonal rules.

Section 1 briefly deals with the tone system in NK Korean. Section 2 treats the interaction of segmental-prosodic rules with tonal rules. Section 3 highlights the differences between this study and previous studies. Section 4 makes a concluding remark.

1. Tonal Phonology in NK Korean[2]

There are three tone classes in NK Korean: (i) the Default H-tone Class, (ii) the Tone Doubling Class, and (iii) the Precoindexed H-tone Class. Stems of the Default H-tone Class consist of two different groups. First, all the stems containing final syllables

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[1] Most educated NK Korean speakers can speak with the Seoul Korean segmental system as well as the NK Korean segmental system. Even though they use the segmental system of Seoul Korean, NK Korean tones are still superimposed on their speech. It might be the main reason why previous studies on NK Korean tonology have made the mistake of mixing the segmental system of Seoul Korean with the NK Korean tone system.

[2] This section is mainly based on my previous studies, N.-J. Kim (1993) and (1994a).

which are heavy belong to this class, e.g., *maknéé* 'the last child (Noun (N))' and *po.néé-* 'to send (Verb (V)).' Second, all the stems where H-tones are realized on the penultimate syllable of the stem belong to this class, e.g., *a.pú.či* 'father (N)' and *pɔ́.li-* 'to throw away (V).' The tone pattern of this class is predictable, and therefore, stems of this class are assumed to be toneless in the underlying representation (UR).

The rule of H-Insertion (HI) in (1) blindly inserts a H-tone into a toneless stem. This rule is motivated by the fact that NK Korean does not allow words with all L-tones.

(1) H-Insertion (HI)

ø ------> H / [ ]

The rule of H-Association (HA) in (2) associates a floating H-tone with the appropriate syllable of stems. The appropriate syllable is the final syllable in case it is heavy (e.g. *mak.néé* 'the last child'), and otherwise it is the penultimate syllable (e.g. *a.pú.či* 'father'). These two syllables can be located by the foot-building process in (2a). Only long vowels are assumed to be heavy in NK Korean: the syllable (C)VC is not counted as a heavy syllable (Y.-H. Chung 1991a and N.-J. Kim 1993). Once the appropriate syllables are located, the H-tone will be associated with the head syllable of the foot by the process in (2b).

(2) H-Association (HA)

a. Construct a single left-headed foot based on the two moras at the right edge of the domain.
b. Associate a H-tone with the syllable that is the head of the foot.

Stems of the Tone Doubling Class have H-tones on the initial two syllables, e.g., *ká.či* 'branch (N),' *hóó.láŋ.i* 'tiger (N),' *pán.káp-* 'to be glad (V),' and *tɔ́ɔ́.lɔ́p-* 'to be dirty (V).' This class has no H-tone underlyingly if the stem-initial syllable is heavy, and otherwise has a floating H-tone. The two underlyingly different groups of the stems are classified as the same class since they exhibit the same surface tone pattern. The stem-initial heavy syllables always have a H-tone and therefore this H-tone is predictable. The H-tone is inserted into a toneless stem containing a heavy syllable by the rule of Heavy Syllable H-Insertion (HSH) in (3):

(3) Heavy Syllable H-Insertion (HSH)

ø ----------> H / _____
[σ]
/ \
μ μ

A floating H-tone either inserted by the rule of HSH or existing in the UR is associated with the stem-initial syllable by the rule of Initial Tone Association (ITA) in (4). Note that ITA precedes the rule of H-Insertion (HI) in (1). Thus, the H-tone inserted later by HI does not undergo ITA.

(4) Initial Tone Association (ITA)

H
|
|
|
[σ

The initially-associated H-tone is doubled by the rule of Tone Doubling (TD) in (5):

(5) Tone Doubling (TD)

Stems of the Precoindexed H-tone Class like /mé.nu.li/ 'daughter-in-law,' /sa.ta.li/ 'ladder,' and /pat.tɔ́l-/ 'to revere (V)' have a H-tone coindexed with a designated vowel in the UR. After syllabification, the H-tone (originally coindexed with a designated vowel) will be linked to a syllable, the TBU, where the designated vowel is a syllabic nucleus. The precoindexed H-tone on the non-final syllable remains unchanged, as shown in (6):

(6) /mé.nu.li-meŋ.ku.lo/ 'like a daughter-in-law' > *mé.nu.li.meŋ.ku.lo*
/mé.nu.li-e.ke/ 'to a daughter-in-law' > *mé.nu.li.e.ke*

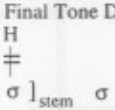
If there is a precoindexed H-tone on a stem-final light syllable which is followed by a suffix, it appears in a predictable position, as shown in (7a–b). The final H-tone falls on the final heavy syllable when the final syllable is heavy, as shown in (7a). If not, the final H-tone falls on the penultimate syllable of the word, as indicated in (7b).

(7) a. /ka.či-po.taa/ 'than an eggplant' > *ka.či-po.táá*

b. /ka.či-meŋ.ku.lo/ 'like an eggplant' > *ka.či-meŋ.kú.lo*
/pat.tɔ́l-to.lok/ 'to revere + Projective' > *pat.təl-tó.lok*

For the above tone shift, we need to assume a rule which delinks a H-tone on the stem-final light syllable when the stem is followed by a suffix. In addition, we need to apply the rule of HA cyclically since the delinked H-tones are associated with the syllables predicted by the rule of HA at the word level. Thus, the rule of Final Tone Delinking (FTD) in (8) is proposed. The H-tone may be reassociated with a final heavy syllable by the rule of HA, as in *ka.či-po.táá*, derived from /ka.či-po.taa/ 'than an eggplant;' or it may be associated with the penultimate syllable by the rule of HA, as in *ka.či-meŋ.kú.lo*, derived from /ka.či-meŋ.ku.lo/ 'like an eggplant.'

(8) Final Tone Delinking (FTD)



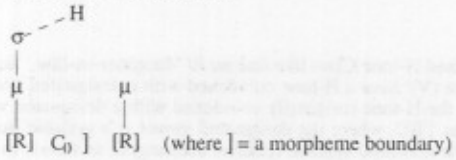
The H-tone on the stem-final light syllable appears to remain unshifted in (9a) where the stem is followed by a vowel-initial suffix. However, there is independent evidence which suggests that a H-tone should be delinked and reassociated with a syllable that is immediately followed by a vowel-initial suffix, as shown in (9b).

(9) a. /sa.ta.li-e.sə/ 'from a ladder' > *sa.ta.li-e.sə*
/pat.tɔ́l-ət-sim.ni-ta/ 'revered + Formal' > *pat.tɔ́l-ət-sim.ni-ta*

b. /pat.tɔ́l-kes-ə-yo/ 'to revere + Future + Inf + Informal Pol' > *pat.təl.ké.sə.yo*
/pat.tɔ́l-kes-ə-to/ 'to revere + Future + Inf + Conce' > *pat.təl.ké.sə.to*

For this, the rule of Prevocalic Docking (PVD) in (10) is proposed, which associates a H-tone with the syllable that is immediately followed by a vowel-initial suffix:

(10) Prevocalic Docking (PVD)



(where] = a morpheme boundary)

To sum up, NK Korean has three tone classes and the derivation of the surface tone patterns is accounted for by the seven ordered rules in (11):

(11) 1. Heavy Syllable H-Insertion (HSH)
2. Initial Tone Association (ITA)
3. Tone Doubling (TD)
4. H-Insertion (HI)
5. Final Tone Delinking (FTD)
6. Pre-Vocalic Docking (PVD)
7. H-Association (HA)

2. The Interaction of Segmental-Prosodic Rules with Tonal Rules

This section deals with the interaction of segmental-prosodic rules with tonal rules. The TBU is the syllable in NK Korean (G.-R. Kim 1988 and N.-J. Kim 1994a). There are five types of segmental-prosodic rules which affect the TBU of this language. They are (i) shortening, (ii) glide formation, (iii) syllable deletion, (iv) epenthesis, and (v) syllable fusion (N.-J. Kim 1995). These five types of segmental-prosodic rules induce tonal changes, as outlined in (12). The interaction of segmental-prosodic rules with tonal rules is accounted for by the hypothesis that all the segmental-prosodic rules affecting the TBU of this language must be applied earlier than tonal rules. In (12), a 'spreading' H-tone means a H-tone associated with two TBUs, while a 'non-spreading' H-tone means a H-tone associated with a single TBU.

(12) Tonal Changes Caused by Segmental-Prosodic Changes

	Shortening	Glide Formation	Syllable Deletion	Epenthesis	Syllable Fusion
Tonal Changes	Spreading H-tone —> Non-spreading H-tone	Non-spreading H-tone —> Spreading H-tone	Non-spreading H-tone —> Spreading H-tone	Epenthesized ə plays significant roles in the application of tonal rules	Syllable fusion does not change the number of moras, and thus no significant tone change follows.

2.1 Shortening: Mora Deletion

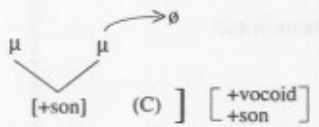
2.1.1 Stem Vowel Shortening and Its Interaction with Tones

The stem-final vowels in (13a) are heavy in the UR. However, they are shortened when they are followed by a vowel-initial suffix, as indicated in (13b):[3]

(13)	a.	*káám-tá*	'to wind + Ind'
		káám-tó.lok	'to wind + Proj'
		káám-nɔ́n-ta	'to wind + Present + Ind'
	b.	*kám-ə-lo*	'to wind + Epenthesized ə+ Obj'
		kám-ə-na	'to wind + Epenthesized ə+ Adver'
		kám-ə-ni	'to wind + Epenthesized ə+ Effec1'
		kám-ət-ta – kám-at-ta	'to wind + Past + Ind'

All dynamic verbs exhibit shortening regardless of the nature of stem-final consonants when they are followed by vowel-initial suffixes. However, the nature of stem-final consonants is significant for stative verbs — if the stem-final consonant is [-son], then shortening is blocked. Based on these observations, the rule of Stem Vowel Shortening (SVS) in (14) is proposed (N.-J. Kim 1995). When the stem is followed by a vowel-initial suffix, the rule of SVS shortens a stem-final long vowel under the condition that [-son] is a blocker when the preceding stem is stative.

(14) Stem Vowel Shortening (SVS)[4]



Cond: If the stem is stative and C = [-son], then this rule is blocked.

The rule of SVS and the tonal rule of Prevocalic Docking (PVD) interact with each other. It should be noted that the two rules of SVS and PVD are applied in the same environment, namely before a vowel-initial suffix. It is independently motivated that all stems containing heavy syllables have no H-tones in the UR (Y.-H. Chung 1991a and N.-J. Kim 1994a). The H-tone is inserted into the toneless stems by the rule of Heavy Syllable H-Insertion (HSH). The inserted floating H-tone is associated with the initial

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[3] The following abbreviations are used throughout this paper:

Adver = Adversative	Caus = Causative	Con = Conditional	Conce = Concessive
Connec1 = Connective1	Connec2 = Connective2	Effec1 = Effective1	Effec2 = Effective2
Hon = Honorific	Imp1 = Imperative1	Imp2 = Imperative2	Imp3 = Imperative3
Ind = Indicative	Inf = Infinitive	Obj = Objective	Pass = Passive
Pol = Politeness	Proj = Projective	Propo = Propositive	Pros = Prospective
Rel = Relativizer	Retro = Retrospective		

[4] Throughout this paper, Hayes's (1989) moraic theory and Clements & Hume's (1995) theory of feature organization are adopted in formulating rules.

heavy syllable by the rule of Initial Tone Association (ITA) and doubled by the rule of Tone Doubling (TD), as in *kàámtá* 'to wind + Ind.'

If long vowels were shortened by the rule of SVS, then a H-tone could not be inserted by HSH since the stems where the rule of SVS applies contain no heavy syllables — they remain toneless until other tone assignment rules are applied. Since phonetically toneless words are not allowed in NK Korean, the H-tone should be inserted by another independently motivated tonal rule, namely H-Insertion (HI). The inserted H-tone will be associated with a stem-final syllable by the rule of PVD since the following suffix begins with a vowel. In *kámətta* 'to wind + Past + Ind,' the stem-final syllable is *kám-* since the stem is monosyllabic. Note that PVD is ordered later than TD, and therefore, the H-tone associated by this rule cannot be doubled. As predicted, the word *kámətta* shows a non-spreading H-tone in the stem. This interaction of the segmental rule of SVS and the tonal rule of PVD is explained by the hypothesis that the rule of SVS precedes tonal rules.

The derivation of surface tonal patterns is given in (15):

(15)

Gloss:	'to wind + Ind'	'to wind + Past + Ind'
(i) UR:	/kaam-ta/	/kaam-ət-ta/
---------- Segmental-Prosodic Phonology		
(ii) SVS:	NA	//kam-ət-ta//
---------- Tonal Phonology		
Input:	/kaam-ta/	//kam-ət-ta//
(iii) HSH:	H //kaam-ta//	NA
(iv) ITA:	H | //káám-ta//	NA
(v) TD:	H / \\ //káám-tá//	NA
(vi) HI:	NA	H //kam-ət-ta//
(vii) PVD:	NA	H | //kám-ət-ta//
(viii) SR:	*káám.tá*	*ká.mət.ta*

2.1.2 Derivational Vowel Shortening and Its Interaction with Tones

There are two derivational suffixes which do not begin with vowels. They are the passive suffix and the causative suffix. When these two derivational suffixes are combined with stems, the long vowels in the stem-final syllables exhibit shortening, as shown in (16a–b):

(16)

a. Shortening with the passives

kɑ́ɑ́m-tɑ́	'to wind + Ind'	vs.	*kam-kíi-ta*	'to wind + Pass + Ind'
púúl-tá	'to blow + Ind'	vs.	*pul-líi-ta*	'to blow + Pass + Ind'
ɑ́ɑ́n-tɑ́	'to hug + Ind'	vs.	*an-kíi-ta*	'to hug + Pass + Ind'
síip-tɑ́	'to chew + Ind'	vs.	*sip-híi-ta*	'to chew + Pass + Ind'

b. Shortening with the causatives

nɔ́ɔ́m-tɑ́	'to overflow + Ind'	vs.	*nɔ́m-ki-ta*	'to overflow + Caus + Ind'
ɑ́ɑ́l-tɑ́	'to know + Ind'	vs.	*ɑ́l-li-ta ~ al-líi-ta*	'to know + Caus + Ind'
úút-tɑ́	'to laugh + Ind'	vs.	*út-ki-ta*	'to laugh + Caus + Ind'

This phenomenon is very similar to that of Stem Vowel Shortening, which is discussed in the preceding section. However, there is one crucial difference. These derivational suffixes begin with a consonant, whereas suffixes that trigger the rule of SVS begin with a vowel. Thus, we need to posit an independent rule to account for this phenomenon. Following G.-R. Kim (1988:100) and Y.-H. Chung (1991a:207), N.-J. Kim (1995) proposes a rule of Derivational Vowel Shortening (DVS), which shortens long stem vowels if stems are followed by either the passive or the causative:

(17) Derivational Vowel Shortening (DVS)

The rule of DVS induces the same tonal change as that caused by the rule of SVS: the interaction of DVS and tonal rules is also explained by the hypothesis that the segmental-prosodic rules precede tonal rules. If long vowels were shortened by the rule of DVS, then a H-tone cannot be inserted by HSH since the stems where the rule of DVS has applied contain no heavy syllables. Since phonetically toneless words are not allowed in NK Korean, the H-tone should be inserted by another independently motivated rule, namely H-Insertion (HI). The inserted H-tone should be associated with a TBU by the rule of H-Association (HA). The rule of HA associates a H-tone with the stem-final syllable unless the final syllable is heavy, as in *{{ nɔ́m-ki}-ta}* 'to overflow + Caus + Ind.' If the final syllable is heavy, the H-tone is associated with the final syllable, as in *{{ kam-kíi}-ta}* 'to wind + Pass + Ind.' It should be noted that the derivational suffix *-ki ~ -kii* and the inflectional suffix *-ta* constitute two separate phonological levels (Y.-H. Chung 1991a and N.-J. Kim 1993). In (18), curly brackets, {}, represent separate derivational and inflectional levels. Note that the H-tone is associated with the predictable syllable regardless of the length of the following inflectional suffixes, as in *{{úl-li}-sim.ni-a}* ~ *{{ul-líi}-sim.ni-a}* 'to cry + Pass + Formality + Ind.' It should be also noted that the rule of HA is ordered later than the rule of Tone Doubling (TD), and therefore, the H-tone associated by the rule of HA cannot be doubled.

The derivation of surface tonal patterns is given below:

(18)

Gloss:	'to wind + Pass + Ind'	'to wind + Pass + Formality + Ind'
(i) UR:	{{kaam-ki}-ta}~{{kaam-kii}-ta}	{{uul-li}-sim.ni-ta}~{{uul-lii}-sim.ni-ta}
---------- Segmental-Prosodic Phonology		
(ii) DVS:	{{kam-ki}-ta}~{{kam-kii}-ta}	{{ul-li}-sim.ni-ta}~{{ul-lii}-sim.ni-ta}
---------- Tonal Phonology		
Input:	{{kam-ki}-ta}~{{kam-kii}-ta}	{{ul-li}-sim.ni-ta}~{{ul-lii}-sim.ni-ta}
(iii) HI:	H H	H H
	{{kam-ki}-ta}~{{kam-kii}-ta}	{{ul-li}-sim.ni-ta}~{{ul-lii}-sim.ni-ta}
(iv) PVD:	NA NA	NA NA
(v) HA:	H H	H H
	{{kám-ki}-ta}~{{kam-kíi}-ta}	{{úl-li}-sim.ni-ta}~{{ul-líi}-sim.ni-ta}
(vi) SR:	*kám-ki-ta ~ kam-kíi-ta*	*úl-li-sim.ni-a ~ ul-líi-sim.ni-a*

2.2 Glide Formation and Its Interaction with Tones

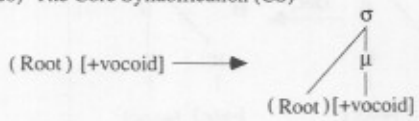
The stems in (19a) end with an onsetless syllable. When the onsetless syllable is followed by a vowel-initial suffix, the stem vowel becomes an onset of the following syllable, as shown in (19b):

(19) a.	/i-ta/	>	*í.ta*		'to carry on the head + Ind'
	/mo.i-ta/	>	*mó.i.ta*		'to gather + Ind'
	/o-ta/	>	*ó.ta*		'to come + Ind'
	/sa.u-ta/	>	*sá.u.ta*		'to fight + Ind'
	/me.u-ta/	>	*mé.u.ta*		'to fill in + Ind'
b.	/i-ə/	>	*yə́*	**í.ə*	'to carry on the head + Imp1'
	/mo.i-ə/	>	*mó.yə*	**mó.i.ə*	'to gather + Imp1'
	/o-ə/	>	*wá*	**ó.ə*	'to come + Imp1'
	/sa.u-ə/	>	*sá.wə*	**sá.u.ə*	'to fight + Imp1'
	/me.u-ə/	>	*mé.wə*	**mé.u.ə*	'to fill in + Imp1'

The above phenomenon of glide formation is explained by syllabification theory (N.-J. Kim 1995). If we syllabify the two vowels V_1V_2 as the syllabic nuclei, then two onsetless syllables would be obtained. There is a strong tendency in languages to avoid onsetless syllables. However, if we syllabify V_1 as an onset of the following vowel V_2, then we obtain the most preferred syllable structure CV. Furthermore, V_1 cannot be

syllabified as an onset of the following V_2 when V_1 is preceded by a consonant due to a general tendency of avoiding complex onsets. Following Steriade (1984), the rule of Core Syllabification (CS) in (20) is adopted:[5]

(20) The Core Syllabification (CS)



The rule of CS interacts with tonal rules. The rule of CS does not induce tonal changes unless the vowel that is syllabified as an onset by the rule of CS contains a H-tone in the UR. For instance, the H-tone is realized on the penultimate syllable of the stems like *mó.i-* 'to gather' and *sá.u-* 'to fight.' In section 1, it was argued that all the stems having H-tones on the penultimate syllables do not have any underlying H-tones. Thus, the syllable that is syllabified as an onset, i.e., the second syllable of stems like *mó.i-* and *sá.u--* has no underlying H-tone. Therefore, as predicted, no tonal changes follow the rule of CS, as shown in words like *mó.yət.ta* 'to gather + Past + Ind' and *sá.wət.ta* 'to fight + Past + Ind.'

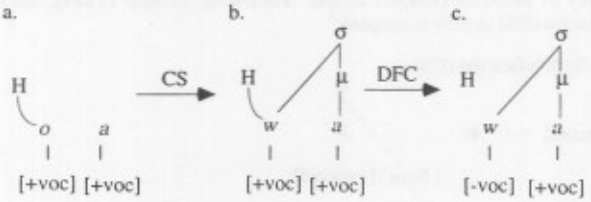
If the vowel that is syllabified as an onset by the rule of CS contains a H-tone in the UR, CS induces tonal changes. NK Korean has two kinds of underlying H-tones — floating H-tone and precoindexed H-tone. First, if the vowel that is syllabified as an onset by the rule of CS has a floating H-tone in the UR, it cannot bear a H-tone since it becomes a glide. Thus, the H-tone will be associated with the syllable that is built on the following vowel by the rule of Initial Tone Association (ITA), and doubled by the rule of Tone Doubling (TD). The stem /o-/ 'to come,' which has a floating H-tone in the UR, behaves as predicted. Note that the H-tone is realized on the initial two syllables in *ó.tá.la* 'to come + Retro,' where CS has not applied. The H-tone is also realized on the initial two syllables in *wáttá* 'to come + Past + Ind,' where CS has applied. This example shows that the prosodic rule CS must be applied earlier than tonal rules. Otherwise, we would be obliged to assume a tone shift rule which would explain the tone change of *ó-át-ta* 'to come + Past + Ind' to *wát.tá.*

Second, if a vowel which is coindexed with a H-tone becomes an onset of the following syllable by the rule of CS, then the vowel becomes a glide. Cross-linguistic evidence has shown that there is a difference between vocalic and consonantal glides (Hume 1993). Furthermore, Herman (1994) shows that there are two phonetically identical but phonologically distinct labial glides within a language, Karuk. I assume that glides are consonantal, [-vocoid], in NK Korean. After a vowel becomes a glide, the feature [+vocoid] will be replaced by [-vocoid] by the default feature-changing rule. The [-vocoid] segment no longer sponsors a H-tone. Thus, the coindexing between the vowel and the H-tone is lost, and therefore, the H-tone becomes a floating H-tone. These processes are illustrated in (21):

---

[5] Short vowels are assumed to have no specification of moras in the UR, whereas long vowels are specified as having two moras in the UR. The moraic value, one mora, will be given to a short vowel only when the short vowel occurs in the syllabic nucleus position. Therefore, this rule does not induce compensatory lengthening even when the first segment is [+vocoid] in the structural description. It happens in a number of languages that compensatory lengthening does not follow glide formation when glide formation is correlated with the lack of the onset, e.g., Latin (Steriade 1984), Romanian (Steriade 1984) and Kikerewe (Odden 1995).

(21) a. b. c.



The floating H-tone will be realized on the initial two syllables by ITA and TD, which are independently motivated (G.-R. Kim 1988, Y.-H. Chung 1991a, N.-J. Kim 1994a).

As predicted, the stem /i-/ 'to carry on the head' exhibits such a tonal change. The stem /i-/ shows a non-spreading H-tone, as shown in (22a–b). In (22b), H-tones shift rightward and are realized on the penultimate syllable of the word. This stem belongs to the Precoindexed H-tone Class (N.-J. Kim 1993).

(22) a. *í-ta* 'to carry on the head + Ind'
í-ni 'to carry on the head + Effec1'
í-mən 'to carry on the head + Con'

b. *i-két-ta* 'to carry on the head + Future + Ind'
i-tó.lok 'to carry on the head + Proj'
i-ket-sim.ní-ta 'to carry on the head + Future + Formality + Ind'

When CS has applied, the H-tone is realized on the initial two syllables, as in (23). This tonal change can be explained if we assume that the prosodic rule of CS is applied earlier than tonal rules.

(23) /i-ət-ta/ > *yə́t.tá* 'to carry on the head + Past + Ind'
/i-ə-sə/ > *yə́.sə́* 'to carry on the head + Inf + Connec1'
/i-ə-to/ > *yə́.tó* 'to carry on the head + Inf + Conce'
/i-ə-yo/ > *yə́.yó* 'to carry on the head + Inf + Informal Pol'

The derivation of surface tone patterns is given below:

(24) Gloss: 'to carry on the head + Past + Ind' 'to come + Past + Ind'
(i) UR: H H
/i-ət-ta/ /o-ət-ta/

---------- Segmental-Prosodic Phonology

(ii) DS: NA H
/o-at-ta/

(iii) CS & DFC H H
/y-ət-ta/ /w-at-ta/

---------- Tonal Phonology

(iv) Input: H /y-ət-ta/ H /w-at-ta/

(v) ITA: H /y-ə́t-ta/ H /w-át-ta/

(vi) TD: H /y-ə́t-tá/ H /w-át-tá/

(vii) SR: *yə́t.tá* *wát.tá*

2.3 Syllable Deletion and Its Interaction with Tonal Rules

The past suffix is /-ət/, as shown in words like *mə́kətta*, derived from /mək-ət-ta/ 'to eat + Past + Ind'. When the preceding stem ends with the vowel [a], it might appear that the vowel ə in /-ət/ is deleted, as shown in (25):

(25) /ča-ət-ta/ > *čát.tá* 'to sleep + Past + Ind'
/ka-ət-ta/ > *kát.tá* 'to go + Past + Ind'
/na-ət-ta/ > *nát.tá* 'to be born + Past + Ind'

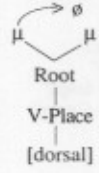
However, NK Korean has the rule of Dorsal Spreading by which /ə/ harmonizes to the dorsality of the preceding stem vowel [o] or [a] and therefore the underlying vowel /ə/ is realized as [a]. Therefore, there is an intermediate representation between the underlying representation and the surface representation, as indicated in (26):

(26)

UR		IR		SR	
/ča-ət-ta/	>	//ča-at-ta//	>	*čát.tá*	'to sleep + Past + Ind'
/ka-ət-ta/	>	//ka-at-ta//	>	*kát.tá*	'to go + Past + Ind'
/na-ət-ta/	>	//na-at-ta//	>	*nát.tá*	'to be born + Past + Ind'

Assuming the derivation in (26), we can argue that the stem vowel [a] instead of the past suffix vowel [a], is deleted. N.-J. Kim (1995) proposes that the first [a] is deleted by the rule in (26) when the vowel cluster *aa* is derived by the rule of Dorsal Spreading. It will be shown that we encounter a problem if we alternatively assume that the second suffix vowel *a* is deleted. Note that this rule is applied only to the derived vowel cluster [aa] since the underlyingly long /aa/ remains unshortened, as in *áán.tá* 'to hug + Ind.'

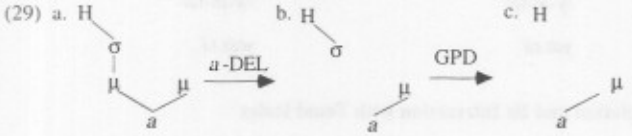
(27) *a*-Deletion (*a*-DEL)



When the first mora is deleted, the syllable structure on that mora will be subsequently deleted by the principle of Generalized Parasitic Delinking (GPD) stated in (28). GPD is a generalized version of Hayes' (1989) Parasitic Delinking.[6]

(28) Generalized Parasitic Delinking (GPD)
Syllable structure is deleted when the syllable contains no overt nuclear element (mora or a nuclear segment).

The rule of *a*-Deletion also interacts with tonal rules. First, if the stem has a precoindexed H-tone in the UR, then the H-tone would become a floating H-tone since the docking place of the H-tone is deleted by *a*-DEL and GPD, as shown in (29):

(29)


The stem /sá-/ 'to buy' exhibits such a tonal change. In (30), the stem /sá-/ is shown to have a non-spreading H-tone:

(30)	*sá-ta*	'to buy + Ind'	*sá-ni*	'to buy + Effec1'
	sá-ko	'to buy + Connec2'	*sa-kə́la*	'to buy + Imp3'
	sa-tə́la	'to buy + Retro'	*sa-tólok*	'to buy + Propo'

However, it shows a spreading H-tone in the words where the rule of *a*-DEL has applied, as shown in (31).

(31)	/sá-ət-ta/	> //sá-at-ta//	>	*áttá*	'to buy + Past + Ind'
	/sá-ə-la/	> //sá-a-la//	>	*álá*	'to buy + Inf + Imp2'
	/sá-ə-sə/	> //sá-a-sə//	>	*ásə́*	'to buy + Inf + Connec1'
	/sá-ə-to/	> //sá-a-to//	>	*átó*	'to buy + Inf + Conce'
	/sá-ə-yo/	> //sá-a-yo//	>	*áyó*	'to buy + Inf + Informal Pol'

This tonal change is explained by the assumption that *a*-DEL and GPD are applied earlier than tonal rules. If we alternatively assume that the suffix vowel, instead of the stem vowel, is deleted, then it is hard to explain the subsequent tonal changes induced by the rule of *a*-Del. This is the reason of why I assume that the stem vowel [a], instead of the suffix vowel [a], is deleted.

On the other hand, the stems in (32) have a floating H-tone underlyingly so that these stems exhibit a spreading H-tone regardless of the application of *a*-DEL and GPD, as shown in (32a–b). This fact is also explained by the hypothesis that the segmental and prosodic rules of *a*-DEL and GPD are applied earlier than tonal rules.

(32) a.	*tʰá-tá*	'to get on + Ind'	*tʰá-ní*	'to get on + Effec1'
	tʰá-kó	'to get on + Connec2'	*tʰá-kə́la*	'to get on + Imp3'
b.	*tʰáttá*	'to get on + Past + Ind'	*tʰálá*	'to get on + Inf + Imp2'
	tʰásə́	'to get on + Inf + Connec1'	*tʰátó*	'to get on + Inf + Conce'

[6] Parasitic Delinking (Hayes 1989:268)
Syllable structure is deleted when the syllable contains no overt nuclear segment.

The derivation of surface tonal patterns is given below:

(33)

Gloss:	'to buy + Past + Ind'	'to get on + Past + Ind'
(i) UR:	H | /sá-ət-ta/	H /t^{h}a-ət-ta/
---------- Segmental-Prosodic Phonology		
(ii) DS:	H | //sá-at-ta//	H //t^{h}a-at-ta//
(ii) *a*-DEL & GPD:	H ∔ //sø-at-ta//	H //t^{h}ø-at-ta//
---------- Tonal Phonology		
(iii) ITA:	H | //sø-át-ta//	H | //t^{h}ø-át-ta//
(iv) TD:	H / \\ //sø-át-tá//	H / \\ //t^{h}ø-át-tá//
(v) SR:	*sáttá*	*t^{h}áttá*

2.4. Epenthesis

NK Korean has nine suffixes that show an ə/ø alternation. The schwa appears when the preceding stem ends with a [-approximant] consonant, as in (34). The [-approximant] consonants includes all consonants except liquids and glides.

(34)			
	Relativizer	*-ən*	*čáp-ən-* 'to catch + Rel'
	Honorific	*-əsi*	*čáp-əsi-* 'to catch + Hon'
	Prospective	*-əl*	*čáp-əl-* 'to catch + Pros'
	Objective	*-əlo*	*čáp-əlo* 'to catch + Obj'
	Effective1	*-əni*	*čáp-əni* 'to catch + Effec1'
	Effective2	*-ənik'a*	*čáp-ənik'a* 'to catch + Effec2'
	Conditional	*-əmən*	*čáp-əmən* 'to catch + Con'
	Formal Propositive	*-əso*	*čáp-əso* 'to catch + Propo'
	Adversative	*-əna*	*čáp-əna* 'to catch + Adver'

When the preceding stem ends with a vowel or a liquid, the ø (zero) form appears, as shown in (35a–b). In (35b), it is shown that the stem-final /l/ is deleted by the process of /l/-Deletion when it is followed by /n/ or /s/ (N.-J. Kim 1994b). Note that /ə/ is not inserted after /l/ even though /l/ is not deleted in *úúl.mən* 'to cry + Con.'

(35) a. the zero form after a vowel

Relativizer	*-n*	*čá-n-* 'to sleep + Rel'
Honorific	*-si*	*čá-sí-* 'to sleep + Hon'
Prospective	*-l*	*čá-l-* 'to sleep + Pros'
Objective	*-lo*	*čá-lo* 'to sleep + Obj'
Effective1	*-ni*	*čá-ni* 'to sleep + Effec1'
Effective2	*-nik'a*	*čá-nik'a* 'to sleep + Effec2'
Conditional	*-mən*	*čá-mən* 'to sleep + Con'
Formal Propositive	*-so*	*čá-só* 'to sleep + Propo'
Adversative	*-na*	*čá-na* 'to sleep + Adver'

b. the zero form after /l/

Relativizer	*-n*	*úú-n-* 'to cry + Rel'
Honorific	*-si*	*úú-sí-* 'to cry + Hon'
Prospective	*-l*	*úú-l-* 'to cry + Pros'
Objective	*-lo*	*úúl-ló* 'to cry + Obj'
Effective	*-ni*	*úú-ní* 'to cry + Effec1'
Effective2	*-nik'a*	*čá-nik'a* 'to cry + Effec2'
Conditional	*-mən*	*úúl-mɔ́n* 'to cry + Con'
Formal Propositive	*-so*	*úú-só* 'to cry + Propo'
Adversative	*-na*	*úú-ná* 'to cry + Adver'

It is proposed that /ə/ is epenthesized between a [-approximant] consonant and a consonant (N.-J. Kim 1995). The above rule must be morphologically conditioned since /ə/ is epenthesized only when one of the above-mentioned nine morphemes follows the stem.

(36) ə-Epenthesis (ə-EPEN)

ø ⟶ ə / [-approximant] + _____ [Prospective /-l/ | Relativizer /-n/ | Honorific /-si/ | Objective /-lo/ | Adversative /-na/ | Effective1 /-ni/ | Effective2 /-ni.k'a/ | Conditional /-mən/ | Propositive1 /-so/]

Let me now consider the interaction of ə-Epenthesis and tonal rules. If the stem has a floating H-tone in the UR, it is always realized on the initial two syllables regardless of the application of ə-Epenthesis, as shown in (37a–b). This tonal pattern is explained by the hypothesis that the segmental rule ə-Epenthesis is ordered earlier than tonal rules.

(37) a. *č^{h}ám-tɔ́la* 'to endure + Retro'
č^{h}ám-kɔ́la 'to endure + Imp3'
č^{h}ám-tólok 'to endure + Propo'
č^{h}ám-sípni-ta 'to endure + Formality + Ind'

b. *č^{h}ám-ɔ́-si-* 'to endure + Hon'
č^{h}ám-ɔ́-lo- 'to endure + Obj'
č^{h}ám-ɔ́-ni- 'to endure + Effec1'
č^{h}ám-ɔ́-mən- 'to endure + Con'
č^{h}ám-ɔ́-na 'to endure + Adver'

On the other hand, if the stem has a precoindexed H-tone in the UR, the H-tone shifts to the penultimate syllable of the word unless the suffix begins with a vowel, as shown in (38a). This tonal shift is explained by the two tonal rules, Final Tone Delinking (FTD) and H-Association (HA). However, the H-tone remains unshifted when ə is epenthesized between the stem and the suffix, as shown in (38b). This tonal pattern is also explained by the assumption that the segmental rule of ə-Epenthesis precedes the tonal rule of Prevocalic Docking (PVD). PVD reassociates a delinked H-tone with the stem-final syllable when the following suffix begins with a vowel.

(38) a. /mə́k-təla/ > *mək-tə́la* 'to eat + Retro'
/mə́k-kəla/ > *mək-kə́la* 'to eat + Imp3'
/mə́k-tolok/ > *mək-tólok* 'to eat + Proj'
/mə́k-sip.ni-ta/ > *mək-sipní-ta* 'to eat + Formality + Ind'

b. /mə́k-si-/ > //mək-ə-si-// > *mə́k-ə-si-* 'to eat + Hon'
/mə́k-lo-/ > //mək-ə-lo-// > *mə́k-ə-lo-* 'to eat + Obj'
/mə́k-ni-/ > //mək-ə-ni-// > *mə́k-ə-ni-* 'to eat + Effec1'
/mə́k-nik'a-/ > //mək-ə-nik'a-// > *mə́k-ə-nik'ə-* 'to eat + Effec2'
/mə́k-mən-/ > //mək-ə-mən-// > *mə́k-ə-mən-* 'to eat + Con'
/mə́k-so/ > //mək-ə-so// > *mə́k-ə-so* 'to eat + Formal Propo'
/mə́k-na/ > //mək-ə-na// > *mə́k-ə-na* 'to eat + Adver'

The derivation of surface tone patterns is given below:

(39)

Gloss:	'to eat + Effec2'	'to endure + Con'
(i) UR:	H | /mə́k-nik'a/	H /č^{h}am-mən/
---------- Segmental-Prosodic Phonology		
(ii) Epenthesis:	H | //mə́k-ə-nik'a//	H //č^{h}am-ə-mən//
---------- Tonal Phonology		
Input:	H | //mə́k-ə-nik'a//	H //č^{h}am-ə-mən//
(iii) ITA:	NA	H | //č^{h}ám-ə-mən//
(iv) TD:	NA	H / \\ //č^{h}ám-ə́-mən//

(v) FTD: H
‡ NA
//mək-ə-nik'a//

(vi) PVD: H
| NA
//mák-ə-nik'a//

(vii) SR: *mákənik'a* *č^{h}ámámən*

2.5 Syllable Fusion and Its Interaction with Tones

The suffix-initial /ə/ undergoes Dorsal Spreading: it becomes /a/ when the preceding stem-vowel is /o/ or /a/. When the stem vowel is /a/, then the stem vowel *a* of the derived vowel cluster /aa/ is deleted by *a*-Deletion (*a*-DEL), as already discussed in 2.3. When vowels like /ə/ and /a/ are immediately preceded by other vowels, the rule of Syllable Fusion occurs, as shown in (40). The subsequent segmental changes which occur in (40) can be explained by segmental rules.[7] However, this paper does not deal with those segmental rules in detail since they do not cause any prosodic change, and thus they are not relevant to the discussion.

(40) a. /ču-ət-sim.ni-ta/ > *čóót.sím.ni.ta* 'to give + Past + Formality + Ind'
/so-ət-sim.ni-ta/ > *sóót.sím.ni.ta* 'to shoot + Past + Formality + Ind'
//pi-ət-sim.ni-ta// > *pîît.sim.ni.ta* 'to be empty + Past + Formality + Ind'
/ke-ət-sim.ni-ta/ > *kéét.sim.ni.ta* 'to make a bed + Past + Formality + Ind'
/sə-ət-sim.ni-ta/ > *sə́ə́t.sím.ni.ta* 'to stand+ Past + Formality + Ind'

b. /po-ə/ > *paa* **poo* 'to see + Imp1'
/p^{h}u-ə/ > *p^{h}əə* **p^{h}oo* **p^{h}uu* 'to scoop up + Imp1'
/puC-ə/ > *pəə* **poo* **puu* 'to pour + Imp1'
/puuC-ə/ > //puC-ə// > *pəə* **poo* **puu* 'to pour + Imp1'

The rule of Syllable Fusion fuses two monomoraic syllables into one dimoraic syllable when the two vowels occur strictly adjacently. Note that the second syllable is

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[7] In (40a), the root node of /ə/ or /a/ is delinked and the preceding vowel is compensatorily lengthened. Furthermore, when the sequence /u+ə/ occurs as in /ču-ət-sim.ni-ta/ 'to give + Past + Formality + Ind', the output is *oo* rather than *ɯ*, as shown in *čóó.sím.ni.ta*. For this reason, I assume that the derived /uu/ becomes lowered by an Adjustment Rule, which operates after Compensatory Lengthening. Note that only the derived /uu/ becomes lowered since any non-derived /uu/ remains unchanged as in *úúl-tá* 'to cry + Ind'. For these phenomena, the three segmental rules of Suffix Vowel Delinking (SuVD), Compensatory Lengthening, and Adjustment Rule are motivated in N.-J. Kim (1994b).

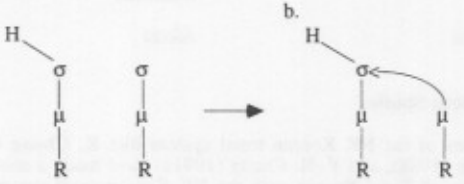
In (40b), /puC-/ 'to pour' and /puuC-/ 'to swell', have empty C-slots, and the two empty C-slots end in zero forms when the following suffix begins with a vowel (N.-J. Kim 1994b & 1995). The long vowel in /puuC-/ 'to swell' is shortened by Stem Vowel Shortening discussed in 2.1.1. The root node of the stem vowel appears to be delinked and compensatory lengthening seems to operate from right to left after Dorsal Spreading has applied. For these phenomena, a rule of Stem Vowel Delinking (StVD) is motivated, and the mirror-image rule of Compensatory Lengthening is proposed in N.-J. Kim (1994b) & (1995). If we compare StVD to SuVD, StVD is a more specific rule, and therefore, it is applied before the more general rule SuVD.

onsetless, and therefore it is unstable. This is the reason why the first syllable survives the rule of SF.

(41) Syllable Fusion (SF)

The prosodic rule of SF interacts with tonal rules. The process of SF destroys the second syllable but keeps the first one. Note that the second syllable is a suffix, and that all suffixes are toneless. The first syllable can bear a H-tone, but it remains undestroyed. Therefore, this process will not cause any significant tonal changes. If the stem vowel has a precoindexed H-tone underlyingly, the structure in (42b) will be obtained after the prosodic rule of SF has applied. The precoindexed H-tone on the first syllable remains as it is, but it is now realized on the heavy syllable.

(42) a. b.



As predicted, the stem /mé-/ 'to fasten,' which has a precoindexed H-tone in the UR, shows no significant tone change, as shown in *méétta* derived from /mé-ət-ta/ 'to fasten + Past + Ind' — the H-tone is realized on the initial heavy syllable. The stem /púC-/ 'to pour,' which also has a precoindexed H-tone in the UR, shows no significant tone change, as shown in *póótta* derived from /púC-ət-ta/ 'to pour + Past + Ind,' in which the H-tone is realized on the initial heavy syllable. This fact is explained by the hypothesis that all the segmental-prosodic rules are applied earlier than tonal rules.

On the other hand, if the stem has a floating H-tone, it is realized on the initial two syllables. As predicted, the stem /so-/ 'to shoot,' which has a floating H-tone in the UR, exhibits a H-tone in the initial two syllables, as in *sóóttá* derived from /so-ət-ta/ 'to shoot + Past + Ind.' However, if tonal rules applied first, then it would be unnecessary to explain why the final syllable *-tá* has a H-tone in *sóóttá*.

The derivation of surface tone patterns is given below:

(43)

Gloss:	'to fasten + Past + Ind'	'to shoot + Past + Ind'
(i) UR:	H | /mé-ət-ta/	H /so-ət-ta/

---------- Segmental-Prosodic Phonology

(ii) SF & subsequent segmental rules:

H	H
|	
//méét-ta//	//soot-ta//

---------- Tonal Phonology

Input:

H	H
|	
//méét-ta//	//soot-ta//

(iii) ITA:

NA	H
	|
	//sóót-ta//

(iv) TD:

NA	H
	/ \
	//sóót-tá//

(v) SR: *méétta* *sóóttá*

3. Comparison with Previous Studies

All previous analyses of the NK Korean tonal system like K. Chung (1980), Narahara (1985), G.-R. Kim (1988), and Y.-H. Chung (1991a) have made a mistake of mixing the segmental system of Seoul Korean with the NK Korean tonal system, thus obscuring some interesting facts about tones and segments within NK Korean.

Certain verbs may be spoken segmentally in two different ways, i.e., (i) with the NK Korean segmental system as in (44b) below and (ii) with the Seoul Korean segmental system as in (44c) below. Note that the two verbs /su-ət-ta/ 'to make a soup + Past + Ind' and /so-ət-ta/ 'to shoot + Past + Ind' are neutralized into *soot.ta* when spoken with the NK Korean segmental system, while they do not neutralize when spoken with the Seoul Korean segmental system. The more interesting problem is that words show different tonal patterns depending on the difference in segments. When spoken with the NK Korean segmental system, a spreading H-tone is used in *sóót.tá*. However, a non-spreading H-tone is used when spoken with the Seoul segmental system, as in *sú.ət.ta* and *só.at.ta*. Previous studies based on such data as *sú.ət.ta* and *só.at.ta* (i.e., the mixture of the NK Korean tonal system and the Seoul Korean segmental system) ignored two empirically significant issues. First, segmental changes in *sóót.tá* were left unexplained. Second, the subtle tonal difference between *sóót.tá* and *sú.ət.ta* and *só.at.ta* was also left unaccounted for. Consequently, the interaction of segmental-prosodic rules with tonal rules was largely ignored.

(44)

a. UR	b. with NK Korean Segments	c. with Seoul Korean Segments
/su-ət-ta/ 'made a soup'	*sóót.tá*	*sú.ət.ta*
/so-ət-ta/ 'shot'	*sóót.tá*	*só.at.ta*

4. Conclusion

Segmental-prosodic changes in certain verb stems cause verbs to shift from one tone class to another depending on the nature of the segmental-prosodic modification. This paper has shown that all the tonal changes caused by segmental-prosodic changes are explained by the hypothesis that all segmental-prosodic rules affecting the TBU of this language are applied earlier than tonal rules.

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The Status of Onsetless Syllables in Kikerewe*

David Odden

1. Introduction

Recent work in prosody has shown that the Onset constraint, which prohibits vowel-initial syllables, plays a fundamental role in explaining a range of phonological phenomena. This paper presents data from the Bantu language Kikerewe, spoken in Tanzania, which illustrate the importance of syllable onsets to this language. Vowels which lack onsets have a special phonological status in Kikerewe. Unlike vowels with onsets, onsetless vowels cannot be long. They have an anomalous pattern of compensatory lengthening under Glide Formation, and they cannot bear tone. The goal of this paper is to demonstrate the extent to which onsetless syllables have a special status in Kikerewe, and to provide a theoretical explanations for these special properties. The hypothesis which will be set forth is that onsetless vowels do not in fact define syllables.

The observation that syllables prefer to have onsets has a venerable status in phonological theory. Jakobson (1962) makes this observation; Steriade (1982), Clements & Keyser (1983) and Hyman (1985) build this principle into their algorithms for syllabification. Ito (1986) and (1989) similarly acknowledges the strong tendency for languages to require syllable onsets. McCarthy & Prince (1993) argue that, apart from stating a preference for CV syllables over V syllables, the Onset constraint interacts with other

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phonological principles, and they exploit the Onset constraint in explaining phonologically conditioned patterns of infixation in Timugon Murut and other languages. Rosenthall (1994) argues that the Onset constraint can be called on to explain the existence of Glide Formation and other hiatus-resolving phonological principles. Downing (1993, 1994, 1995) shows that this constraint is relevant to problems in stress, tone and reduplication in a variety of languages.

Kikerewe stands out among languages which strongly obey the Onset constraint in providing multiple lines of evidence which bear on the constraint. Particularly important is the fact that onsetless vowels exhibit anomalous prosodic properties which are related only in that they occur in conjunction with an onsetless vowel.

2. Resolution of hiatus

Phonetically onsetless syllables in this language have a very limited occurrence; they appear only at the beginning of the utterance, as indicated in (1).

(1)	akalima	'he cultivated (remote)'
	echáála	'finger'
	igogo	'tree trunk'
	olímá	'you (sg.) cultivate'

One consequence of the ban on onsetless syllables in Kikerewe is that whenever vowel sequences would arise by morphemic or syntactic concatenation, the second would-be onsetless syllable is provided an onset by syllabic fusion. This onset is provided either by turning the first vowel into a glide which serves as an onset, or by otherwise merging the two syllables into one, thereby eliminating the second onsetless syllable. In (2), the examples on the left contain the noun class prefixes *ebi*, *omu* and *olu* before a consonant-initial stem; this column reflects the underlying form. On the right, the same prefixes stand before a vowel-initial stem, and in that case the underlyingly prevocalic high vowel of the prefix becomes a glide, with compensatory lengthening of the second vowel. By fusing the two syllables into one, the onset of the leftmost underlying syllable thereby provides an onset for the second vocalic segment.

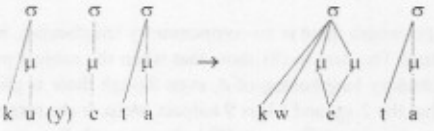
(2)	ebi-tooke	'bananas'	/ebi-ála/	→ eby-áála	'fingers'
	omu-tima	'heart'	/omu-aga/	→ omw-aaga	'compulsion'
	olu-bíbo	'fish trap'	/olu-íle/	→ olw-íile	'sky'

Further examples of hiatus resolution by glide formation can be seen in (3). Stem initial *y* deletes optionally in Kikerewe, and this might result in a sequence of vowels and therefore a violation of the Onset constraint. However, the first vowel merges with the second, giving a single long syllable. Thus, underlying /ku-yeta/ would become *kueta* by *y*-deletion. The expected vowel-vowel sequence is eliminated by glide formation.

(3)			
	ku-yeta	kweeta	'to call'
	tu-yaniká	twaaniká	'we spread'
	eli-yóma	elyóóma	'it will dry'
	tu-yi-teekélá	twiiteekélá	'we call for ourselves'

Fusing the two syllables into one eliminates the second onsetless syllable, and with it, the violation of the Onset constraint.

(4)



In case the first vowel of a would-be divocalic sequence is *a*, the hiatus is removed by segmentally merging the two vowels into one nonhigh vowel. This is illustrated in (5) with stems beginning with *y*. On the left is given the variant retaining *y*, and on the right is the variant without *y*, showing the effect of vowel merger, driven by the need to eliminate violation of the Onset constraint.

(5)			
	ga-yeléélá	geeléélá	'they (cl. 6) float'
	ba-yíbá	béébá	'they steal'
	ba-yoléká	booléká	'they point'
	baka-yéta	bakééta	'they called'
	akagá-yómya	akagóómya	'he dried them (cl. 6)'

There is also resolution of vocalic hiatus at the phrasal level. When any vowel-initial word is preceded by another word, the two vowels coalesce into one long syllable.

(6)		
	ekaluumbeeta	'trumpet'
	nkabala	'I counted'
	nkabal' eekaluumbeeta	'I counted the trumpet'
	omuuntu	'person'
	akabala	'he counted'
	omutw' aakabala	'the person counted'

This brings up the first complication introduced by onsetless vowels. Underlying V+V exceptionlessly results in syllable merger and almost always results in compensatory lengthening of the surviving vowel. The data in (7a) show the underlying form of the 1 pl. and Class 8 subject prefixes, *tu* and *bi*. The examples in (7b) show that when these prefixes are followed by the tense prefix *a*, the vowel of the subject prefix desyllabifies and *a*- compensatorily lengthens.

(7)	a.	tu-téékà	'we cook (hab.)
		bi-téékwá	'they (cl. 8) are cooked (hab.)'
		tu-ka-tééka	'we cooked (rem)'
		bi-ka-tééka	'they (cl. 8) were cooked (rem.)'
	b.	tw-aa-téékà	'we just cooked'
		by-aa-téékwá	'they (cl. 8) were just cooked'
		ti-tw-áá-téeka	'we didn't just cook'
		ti-by-áá-téekwa	'they (cl. 8) weren't just cooked'

However, there is a context where there is no compensatory lengthening, and that is when the first vowel is onsetless. The data in (8) show that when the subject prefix is vowel initial, there is no compensatory lengthening of *a*, even though there is glide formation. The data in (8a) show that the 2 sg. and Class 9 subject prefixes are respectively *o* and *e*. When followed by the past tense prefix *-a-* in (8b), these vowels become glides, but unlike the situation in (7), there is no lengthening of *-a-*.

(8)	a.	o-téékà	'you sg. cook (hab.)'
		e-téékwá	'it (cl. 9) is cooked (hab.)'
		o-ka-tééka	'you sg. cooked (rem)'
		e-ka-téékwa	'it was cooked (rem.)'
	b.	w-a-téékà	'you sg. just cooked'
		y-a-téékwá	'it was just cooked'
		ti-w-átéeka	'you sg. didn't just cook'
		ti-y-á-téekwa	'it (cl. 9) was not just cooked'

Another context where an onsetless vowel becomes a glide without compensatory lengthening of the following vowel is when a nominal class agreement prefix is placed before the associative prefix *-a-* 'of'. The examples in (9a) show the underlying forms of the nominal agreement prefixes *gu-* 'cl. 3', *li-* 'cl. 5', *o-* 'cl. 1' and *e-* 'cl. 9'. Data in (9b) show that when combined with the prefixes *gu* or *li* which have onsets, the agreement prefix fuses syllabically with the associative prefix *a* resulting in a long vowel. Finally, the data in (9c) show that the prefixes *o* and *e* become glides in this context, but without lengthening of the associative prefix *-a-*.

(9)	a.	gu-líí'yá	'that (cl. 3)'	gú-nu	'this (cl. 3)'
		li-líí'yá	'that (cl. 5)'	lí-nu	'this (cl. 5)'
		o-líí'yá	'that (cl. 1)'	ó-nú[1]	'this (cl. 1)'
		e-líí'yá	'that (cl. 9)'	é-nú	'this (cl. 9)'
	b.	gw-aa-Bulemo		'(cl. 3) of Bulemo'	
		ly-aa-Bulemo		'(cl. 5) of Bulemo'	

[1] The tonal variation in the form of the demonstratives is also connected with the onsetless status of these prefixes, as discussed in section 4.

c. w-a-Bulemo '(cl. 1) of Bulemo'
y-a-Bulemo '(cl. 9) of Bulemo'

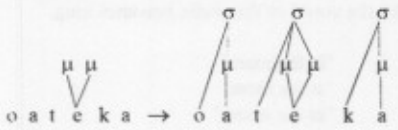
The question is how to explain this lapse in the otherwise exceptionless pattern that there is always compensatory lengthening associated with glide formation. This lapse is not a general property of glide formation and onsetless vowels in all languages since, for example, in Kimatuumbi (see Odden 1995) when a prevocalic high vowel becomes a glide, the following vowel compensatorily lengthens, and therefore /u-a-téljike/ becomes [waatéljike] 'you sg. cooked (remote)'.

The general pattern in Kikerewe, indeed in almost all languages, is that within a morpheme, each vowel projects at least one mora which forms the nucleus of a syllable. Thus where there is an underlying sequence of two consecutive vocalic elements in /tu-a-teeka/, core syllabification forms a syllable on *tu*, and Glide Formation applies to that, with compensatory lengthening of *a*.

(10)

Building a syllable in this manner when the vowel is onsetless is generally problematic since it results in a violation of the Onset constraint, and doing this for a vowel sequence like *oa* is doubly so, since it would result in two violations of the constraint. A better solution is to allow *o* to function as the onset of a syllable, by directly grouping both segments into a CV syllable by core syllabification.

(11)



A similar asymmetry in the compensatory lengthening concomitant of glide formation between V+V and CV+V sequences is also found in North Kyungsang Korean (Kim 1995), which is also explained in terms of the contrast between core syllabification versus glide formation affecting syllabified vowels. The alternation between glide and vowel is governed by two mechanisms in Kikerewe; the choice of which mechanism to employ in syllabifying underlying vowel sequences is dictated by the desire to minimize violations of the Onset constraint.

3. Long vowels and onsetless syllables

Another way in which the Onset constraint is involved in explaining anomalous phonological behavior is seen in the fact that Kikerewe disallows long onsetless vowels. There are contexts where one would have expected to find such long vowels, but they do not exist. For example, it is a general principle in the language that any vowel which precedes a sequence composed of a nasal plus a consonant must be long. Without exception, any vowel within a stem is long when it is followed by a such a sequence.

(12)	omukuundi	'navel'	obuluunda	'smallpox'
	ekigaambo	'word'	ekihíinzú	'piece'
	ekikóómbe	'cup'	ekipáánga	'knife'
	enaanzá	'lake'	ibáánza	'debt'
	iboondo	'larynx'	iháángá	'clan'
	ihéémbe	'cow horn'	ekituungánwá	'livestock'
	akaléengéétuko	'slope'	ekiteendeegwe	'type of bean'

But if a vowel both precedes a nasal+consonant sequence and is also utterance-initial, then the vowel remains short.

(13)	embaata	'duck'	embógó	'buffalo'
	embúzi	'goat'	endosyo	'dipping spoon'
	endálá	'leopard'	endezu	'beard'
	endíilo	'relish'	engaamba	'language'
	engezi	'flood'	engiingo	'body'

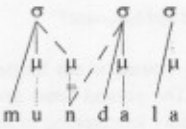
The requirement that vowels are always long before nasal plus consonant results in phonological alternations. The locative prefixes *mu* and *ha* have an underlying short vowel, as (14a) shows. When these prefixes precede a noun stem which begins with a nasal plus consonant sequence in (14b), the vowel of the prefix becomes long.

(14)	a.	mu-chúúmba	'in the room'
		ha-chúúmba	'at the room'
		mu-mabáále	'in the stones'
		ha-mabáále	'at the stones'
	b.	muu-ndálá	'in the leopard'
		haa-mbúzi	'at the goat'
		muu-mpéte	'in the ring'
		haa-ndíilo	'at the relish'

Lengthening the prefixal syllable of *muundálá* can be straightforwardly accounted for. It is assumed that all preconsonantal nasals in Kikerewe are underlyingly moraic, as they are in most Bantu languages. However, nasals cannot serve as syllable peaks on the surface, and since there are no codas in the language, the nasal must syllabify as part of the

onset of the following syllable. It therefore abandons its mora, which attaches to the previous syllable.

(15)



As (16) shows, when the same NC-initial nouns are preceded by the onsetless vowel *e*, that vowel does not lengthen.

(16)	e-ndálá	'leopard'	e-mbúzi	'goat'
	e-mpété	'ring'	e-ndiilo	'relish'

The failure of the vowel to lengthen in this context is due to the ban on long onsetless vowels.

Additional examples illustrate the fact that onsetless vowels do not lengthen. The data in (17a) demonstrate the underlying short vowels of the prefixes *ka, ba* and *li*, and the data in (17b) show lengthening of the vowel in these prefixes before an NC sequence, involving the 1 sg. object prefix *-n-*.

(17)	a.	a-ka-chúmíta	'he stabbed'
		ba-chumítá	'they stab'
		ba-li-chumítá	'they will stab'
	b.	a-kaa-n-chúmíta	'he stabbed me'
		baa-n-chumítá	'they stab me'
		ba-lii-n-chumítá	'they will stab me'

The examples in (18) show that when a vowel initial prefix precedes a nasal+consonant sequence, that vowel is not lengthened.

(18)	a-n-chumítá	'he stabs me'
	o-n-chumítá	'you stab me'
	a-n-chumisílé	'he stabbed me'
	o-n-chumisílé	'you stabbed me'

There is one last point to be made regarding vowel lengthening before NC sequences, as shown in (19), and that is that the effect is found at the phrasal level[2].

[2] Presumably, there would be lengthening at the phrasal level only if the target vowel is preceded by a consonant. However, there are no words in Kikerewe composed of a single vowel, so this prediction cannot be tested.

(19)	ndalá kí	'which leopard'
	akabala	'he counted'
	akabalaa ndalá kí	'which leopard did he count?'

Illustration of the restriction against onsetless long vowels is not limited to the context of a following sequence of nasal plus consonant. The present tense prefix *-ku-* optionally deletes, as shown in (20), resulting in compensatory lengthening of the vowel in the preceding subject prefix.

(20)	tu-ku-bábála	tuu-bábála	'we are counting them'
	ba-ku-múlúuba	baa-múlúuba	'they are following him'
	mu-ku-túbúuta	muu-túbúuta	'you pl. are choking us'
	zi-ku-bálúma	zii-bálúma	'they (cl. 10) are biting them'

However, just in case the preceding subject prefix lacks an onset consonant, there is no lengthening.

(21)	a-ku-múbála	a-múbála	'he is counting him'
	o-ku-túlóla	o-túlóla	'you are looking at us'
	e-ku-bálúma	e-bálúma	'it (cl. 9) is biting them'

There is one final context which actively demonstrates that onsetless vowels may not be long. The noun class agreement prefix which appears before the stem *-ha* 'which?' has a long vowel providing that the prefix syllable has an onset; if the prefix is composed of a simple vowel, the prefix remains short.

(22)	báá-há	'which (cl. 2)?'	gúú-há	'which (cl. 3)?'
	zíí-há	'which (cl. 4)?'	líí-há	'which (cl. 5)?'
	ó-há	'which (cl. 1)?'	é-há	'which (cl. 9)?'

We will delay considering the explanation for this constraint on long vowels until section 7, after we have considered the full range of phonological issues related to the Onset constraint.

4. Tone and onsetless vowels

A third special property of onsetless vowels is that they cannot bear (H) tone.[3] As background to considering the tonal evidence, it should be noted that any H tone spreads to the following syllable provided that it is toneless, by a Tone Doubling process. The

[3] As is typical in Bantu languages, Kikerewe presents an opposition between H toned and toneless syllables, rather than H toned and L toned syllables. A privative tonal contrast between H and ∅ will thus be assumed.

data in (23) show that the verb stems *bala* and *buuka* are toneless, but when they are preceded by a H toned prefix such as *tu*, the H of the prefix spreads to the verb root.

(23)	ku-bala	'to count'	ku-tú-bála	'to count us'
	ku-buuka	'to comb'	ku-tú-búuka	'to comb us'

In general, any H tone in the language spreads one syllable to the right, unless that H tone is in the phrasal penult (cf. *kubóha* 'to tie', *kubóhá Bulemo* 'to tie Bulemo'). The effect of Tone Doubling will be seen throughout the data.

The surface tone which appears on a verbal subject prefix is a function of morphosyntactic properties interacting with phonological constraints. In subordinate clauses, the subject prefix is generally H toned. The examples in (24) show that in various relative clause forms of the verb, there is an underlying H tone on the subject prefix, which is *ba* in these examples.

(24)	a-bá-kú-luunduma	'they who are growling'
	a-bá-lúúnduma	'they who growl'
	a-bá-lúúndumile	'they who growled (yesterday)'

Data in (25) show that the subject prefix (*ba, tu, bi*) in the conditional is also H toned.

(25)	bá-ká-luunduma	'if they growl'
	tú-ká-luunduma	'if we growl'
	bí-ká-luunduma	'if they (cl. 8) growl'

In (26) it can be seen that when the subject prefix is one of the onsetless prefixes *o-* '2 sg.', *a-* '3 sg. human' or *e-* 'cl. 9', the subject prefix does not bear a H tone. Instead, the syllable which follows the subject prefix bears the H tone.[4]

(26)	a-kú-lúúnduma	'he who is growling'
	e-kú-lúúnduma	'it (cl. 9) which is growling'
	a-lúúndúma	'he who growls'
	e-lúúndúma	'it (cl. 9) which growls'
	a-lúúndúmile	'he who growled (yesterday)'
	e-lúúndúmile	'in (cl. 9) which growled (yesterday)'
	o-ká-lúúnduma	'if you sg. growl'
	a-ká-lúúunduma	'if he growls'

[4] The relative clause form of the verb is composed of a head marker which is a nonhigh copy of the following subject prefix's vowel, viz. *a-bá-lúúnduma* 'they who growl', *e-ki-lúúnduma* 'it (cl. 7) which growls', *o-gú-lúúnduma* 'it (cl. 3) which growls'. One would expect the underlying forms of the 3 sg. and cl. 9 subject forms of this verb to be /e-e-luunduma/ and /a-a-luunduma/. These vowel sequences must be eliminated, which would normally lead to a single long vowel. However that vowel would be onsetless, so therefore the vowel surfaces as short.

Thus the H tone remains on the subject prefix in *abákúluunduma* since the subject prefix has an onset, but it must shift to the aspect prefix *ku* in *akúlúúnduma* since the subject prefix is onsetless and thus cannot bear tone because of its special prosodic status.

In certain noun classes, the agreement prefix for numerals bears a H tone, and yet for other classes the numeral prefix is toneless, as the data in (27) demonstrate.

(27)	bá-bíli	'2 (cl. 2)'	i-bili	'2 (cl. 4)'
	bí-bíli	'2 (cl. 8)'	a-bili	'2 (cl. 6)
	tú-bíli	'2 (cl. 13)'	i-bili	'2 (cl. 10)'

Notice that it is precisely those agreement prefixes which are onsetless that do not bear a H tone.

Other evidence shows that onsetless vowels cannot bear tone. Nouns in Kikerewe typically have a class prefix with the shape VCV, i.e. *omu* in *omu-gela* 'river' or *emi* in *emi-gela* 'rivers'. The first vowel in this structure is generally referred to as the pre-prefix, and is a non-high copy of the prefixal vowel (or *e* if the prefix contains no vowel). The distribution of the pre-prefix morpheme is governed by semantic and syntactic properties. The pre-prefix is not used on proper names (cf. *Buzúne*, *Bulemo*), and it is also lacking when a noun is modified by a wh-word, cf. *omugela* 'river', *mugela ki* 'which river?'. In addition, some nouns are lexically marked for not taking a preprefix, for example *liibuléla* 'hawk'.

In (28) we find examples of the instrumental prefix *na* appearing before various nouns which lack a preprefix. In these examples, the syllable of the instrumental prefix has no H tone.

(28)	Buzune	(proper name)	na-Buzúne	'by Buzune'
	mugelá kí	'which river'	na-mugelá kí	'by which river'
	liibuléla	'hawk'	na-liibuléla	'by a hawk'

In contrast, when a noun has a preprefix, the preprefix vowel fuses with that of the instrumental prefix. In addition, there is an apparently inexplicable H tone on the syllable of the instrumental prefix.

(29)	o-mu-gela	'river'	n-óó-mú-gela	'by a river'
	o-mw-áána	'child'	n-óó-mw-áána	'by a child'
	e-mí-hyó	'knives'	n-éé-mí-hyó	'with knives'

This can be explained under the hypothesis that the pre-prefix has an underlying H tone, so *omugela* is underlyingly /ómugela/. Since the pre-prefix is usually in a syllable which lacks an onset, that H tone cannot dock to the vowel of the pre-prefix, and therefore the

H tone is lost. However, in case an instrumental prefix is added, the H tone can be realised on the pre-prefix syllable since the instrumental prefix provides an onset consonant.

Having shown that onsetless vowels are not proper tone bearing units, it is important to clarify that onsetless vowels are excluded from bearing tone only with respect to word level phonological phenomena. Whenever a H tone stands at the end of the utterance, it spreads leftward to the preceding syllable, which results in alternations between the prepausal and phrase medial forms of words. (30) gives words which underlyingly have a single H on the final vowel. On the left can be seen the phrase-medial form, where that H is the only H within the word. On the right is the same word prepausally, illustrating the effect of tone throwback.

(30)	endalá yáange	'my leopard'	endálá	'leopard'
	ekihyó kílaandúúba	'the herd will follow me'	ekihyó	'herd'

An important fact, shown in (31), is that prepausal H will spread leftward even to an onsetless vowel.

(31)	embwá yáánge	'my dog'	émbwá	'dog'
	iti likagwa	'the tree fell'	iti	'tree'

Therefore, as far as phrase level tone spreading is concerned, an onsetless vowel is indeed a legitimate tone bearer.

Further exemplification of the fact that onsetless vowels cannot bear tone (except due to phrase level leftward spreading) can be seen in the form of certain nominal prefixes. As the following data show, the noun class agreement prefix for 'what kind' has a H tone if the prefix has an onset consonant (this H spreads rightward by Tone Doubling). If the agreement prefix lacks an onset consonant, the prefix has no H and instead H appears on the stem *-tá*. These examples illustrate the nonprepausal pronunciation.

(32)	gú-tá...	'what kind (cl. 3)'	kí-tá...	'what kind (cl. 7)'
	gá-tá...	'what kind (cl. 6)'	zí-tá...	'what kind (cl. 10)'
	e-tá...	'what kind (cl. 9)'	a-tá...	'what kind (cl. 1)'

The prefixes for demonstrative agreements have an analogous variation between having H tone and being toneless, as the following utterance medial variants show.

(33)	bá-nú...	'those (cl. 2)'	kí-nú...	'that (cl. 7)'
	o-nú...	'that (cl. 1)	e-nú...	'this (cl. 9)'

The surface shape of the noun class agreement prefix on the modifier 'some' simultaneously illustrates that an onsetless vowel cannot bear tone, and also further exemplifies the prohibition against long onsetless vowels.

(34)	a-báá-ndi	'some (cl. 2)'	e-kíí-ndi	'some (cl. 7)'
	o-lúú-ndi	'some (cl. 11)'	a-káá-ndi	'some (cl. 12)'
	ó-ndi ~ o-ndí...	'some (cl. 1)'	é-ndí ~ e-ndí...	'some (cl. 9)'

The stem 'some' is underlyingly *-ndi*, and since the stem begins with an NC cluster, the preceding vowel must be lengthened. In addition, the agreement prefix attached to this stem is H toned. However, the language disallows the second of a sequence of underlyingly adjacent H tones from surfacing, and therefore the H tone of the stem is deleted in *a-báá-ndi* from *a-báá-ndí*.[5] Note also that the agreement prefix is preceded by the pre-prefix vowel. In the forms *ondi* and *endi*, the agreement prefix is onsetless, and therefore it cannot be long. Normally, the NC sequence would cause lengthening of the preceding vowel; furthermore the sequence of two vowels in underlying /o+o/ and /e+e/ (the first vowel being the pre-prefix and the second being the agreement prefix) would fuse into a long vowel if there were an onset consonant. The onsetless prefix vowel also cannot bear H tone, so there is no sequence of H tones, and therefore the underlying H of the stem *ndi* is retained.

5. Deletion of *y*

This section considers another phonological problem which is related to the prohibition against onsetless syllables in Kikerewe, namely the constraints on deletion of *y*. It was noted in section 2 that stem-initial *y* deletes optionally. The data in (35) provide additional cases of this deletion of *y*. The underlying form of relevant words is directly reflected in the surface form on the left, where *y*-deletion does not apply. In the variant on the right, *y* has deleted, which alone would result in a vowel cluster and a violation of the Onset constraint. The offending onsetless syllable is removed by general processes of vowel merger.

(35)	ba-ka-yéta	bakééta	'they called'
	ba-ka-yómya	bakóómya	'they dried'
	ba-ka-yíba	bakééba	'they stole'
	ba-yétá	béétá	'they call'
	ba-yómyá	bóómyá	'they dry'
	ba-yíbá	béébá	'they steal'

The same point is made in (36), which contains examples of the 1 pl. subject prefix *tu* whose vowel becomes *w* before another vowel, providing that *y* has deleted.

[5] Multiple adjacent H toned syllables appear freely in words, e.g. *ómú* 'this (cl. 1)'. However those syllables bear a single H tone which is multiply linked, due to postlexical tone spreading.

(36)	tu-yétá	twéétá	'we call'
	tu-yómyá	twóómyá	'we dry'
	tu-yíbá	twéébá	'we steal'

The examples in (37) show that if the stem is preceded by the vowel-initial prefixes for second singular or class 9 subjects, *y* may delete, and the vowel of the subject prefix then becomes a glide, in order to give the resulting syllable an onset.

(37)	o-yéta	wéétá	'you sg. call'
	o-yíbá	wíibá	'you sg. steal'
	e-yíbwá	yíibwá	'it (cl. 9) was stolen

In contrast, the data of (38) show that after the 3 sg. subject prefix *a*, *y* may not delete.

(38)	a-yétá	'he calls'	*(e)eta
	a-yómyá	'he dries'	*(o)oma
	a-yíbá	'he steals'	*(e)eba

The reason why *y* cannot delete after this vowel initial prefix, but can delete after other vowel initial prefixes in (37), is that when preceded by /e/ or /o/, the vowel of the subject prefix can be desyllabified to form the onset of the syllable containing the stem initial vowel. It is impossible to make *a* be a syllable onset, so deletion of *y* would result in unresolvable vowel hiatus. Thus *y*-deletion is blocked after the third singular prefix *-a-*.

The picture is more complex, as becomes clear upon consideration of the role of the past tense prefix *-a-*. The examples in (39) show that while the 3 sg. subject prefix is generally *a*, when it precedes the tense prefix *-a-*, it appears as *y*.

(39)	a-ka-bala	'he counted'
	a-bazílé	'he counted (yesterday)'
	y-a-bálá	'he just counted'

This allomorphy no doubt has a functional explanation. Given the expected underlying form of the recent past tense form, /a-a-balá/, what would surface is [abálá] (given that a long vowel cannot surface in word-initial position). Such a form exists, but it is the habitual form 'he counts' (cf. [tubálá] 'we count'). The selection of the allomorph *-y-* for the 3 sg. recent past avoids an otherwise systematic neutralization between the habitual and recent past.

Up to this point, *y*-deletion has been blocked from applying after the 3 sg.subject prefix *a-*, the reason being that this prefix lacks an onset consonant, so deleting *y* would worsen the situation with respect to violations of the Onset constraint. Since the *y* allo-

morph has an onset consonant, *y*-deletion should be allowed if the 3 sg. subject prefix is followed by the prefix *-a-*, and the data in (40) show that it is.

(40)	y-a-yésile	yéésile	'he called (today)'
	w-a-yésile	wéésile	'you called'

Another restriction on *y*-deletion is that it cannot apply if the preceding syllable is long. Consider the examples in (41). Here, a long syllable precedes *y* and *y* cannot delete.

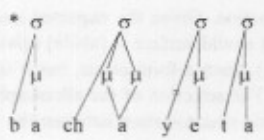
(41)	a-ba-tá-á-yésile	'they who didn't call (rem)'	*abatéésile
	ba-ch-áá-yéta	'they are still calling'	*bachééta
	ti-b-áá-yésile	'they didn't call (rem)'	*tibéésile

The impossibility of *y*-deletion in this case is again the result of the Onset constraint interacting with a constraint that processes of syllable destructuring such as syncope and glide formation do not destroy long syllables.[6] The effects of this constraint in Kikerewe can be seen when the present tense prefix *ku* optionally deletes, a phenomenon discussed in section 3. Deletion of *ku* is prohibited in (42), where the prefix *ku* precedes the 1 sg. object prefix /-n-/. Recall that preconsonantal *n* desyllabifies and compensatorily lengthens the preceding vowel, as indicated in section 3.

(42)	bakuuntéékéla	*baantéékéla	'they are cooking for me'
	mukuundúúba	*muundúúba	'you pl. are following me'

Since the syllable *ku* is long in this context, it cannot be deleted, due to the constraint against destructuring a long syllable.

The failure of *y*-deletion after a long vowel can be explained in terms of this constraint against destructuring long syllables in conjunction with the principle that syllables must have onsets. If *y* were deleted in (43), an onset violation would result. The option of fusing the two syllables into one is not available, since doing so would require destruction of a long syllable. Therefore the only solution is to block *y*-deletion.

(43) 

It is possible for *y* to delete after the tense prefix *-a-*, but only in case that vowel heads a short syllable. Furthermore, the syllable containing *a* will be short only in case the preceding subject prefix was onsetless. If the preceding subject prefix has an onset

[6] See Odden (1995) for examples of the inalterability of long syllables in Kimatuumbi.

consonant, one finds standard glide formation and compensatory lengthening of *a*. The only way for *a* to be short is if the subject prefix vowel directly syllabifies as the onset of the syllable by core syllabification, which happens only when that prefix is onsetless.

(44)	twaayétá	'we just called'	wayétá	'he just called'
	*twéétá		wéétá	idem

Another context where deletion of *y* is blocked is when *y* is word initial. As shown by the examples in (45), *y*-deletion is impossible in the imperative, where the stem is word initial.

(45)	yétá	*étá	'call!'
	yaandíka	*(a)andíka	'write!'
	yaníka	*aníka	'spread out to dry!'
	yoyéla	*oyéla	'sweat!'

Again, this follows from the pattern previously seen, namely that deletion of *y* is possible only in case the vowel to the right can be preceded by an onset at the surface.

6. Summary of anomalous patterns

To summarise the status of onsetless syllables in Kikerewe, it has been shown that what appear to be onsetless syllables exist only in utterance initial position. Whenever two underlying vowels are concatenated, they fuse into one syllable, with compensatory lengthening, so /tu-a-bálá/ becomes [twaabálá] 'we counted'. However, if the first syllable is onsetless, there is no compensatory lengthening and the resulting syllable is monomoraic, and thus /o-a-bálá/ becomes [wabálá] 'you counted'. This difference in the compensatory lengthening concomitant of glide formation exists for underlying sequences of onsetless vowel plus vowel, but derived vowel sequences which arise by deletion of *y* always have compensatory lengthening, even when the first vowel is onsetless, thus /o-yétá/ surfaces as [wéétá] 'you call' and /tu-yétá/ surfaces as [twéétá] 'we call'. Deletion of *y* is constrained so that it does not increase the number of violations of the Onset constraint, explaining why deletion is barred in [ayétá] 'he calls'. Onsetless vowels also cannot be compensatorily lengthened by the mora of a preconsonantal nasal as shown by [endálá] 'leopard'; and finally, onsetless vowels cannot be tone bearing units at the word level, though they may be TBU's postlexically.

7. Explaining the anomalies

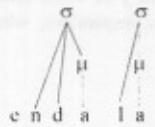
Given these facts, the question arises as to exactly how these patterns are accounted for. While the Onset constraint is no doubt the ultimate driving force in these anomalies, prosodic theory does not generally give any special status to an onsetless syllable in the same way that a heavy syllable has a special status.[7] The hypothesis to be explored is that the Onset constraint directly causes onsetless vowel to have a special

[7] But see Davis 1988 where such a proposal is made.

structural status. It is claimed that, in essence, onsetless vowels do not define proper syllables.

One possible tack to take in explaining the loss of the pre-prefixal H tone and the lack of vowel length before the sequence N+C in *endálá* 'leopard' would be to assume that the Onset constraint prohibits the initial vowel from being parsed into a syllable, and thus the word has the following representation.

(46)



The problem with this approach is that it violates the commonly assumed principle (Ito 1986) that segments which are not licensed by affiliation into prosodic structure are deleted, so given (46), if such a principle is universal the unattached vowel *e* would incorrectly be deleted.

To avoid this theoretical problem, we will consider approaches employing non-canonical prosodic structures for onsetless vowels. Two candidates stand out, drawing on the theories of anomalous syllables proposed by Downing (1993) and Piggott (1995) in dealing with unrelated phenomena. Following Downing (1993) it might be assumed that such initial vowels are moraically licensed but do not constitute syllables, as in (47a). Or, following Piggott (1994) one could postulate that such vowels define syllables which have no moraic value as in (47b).

(47) a.

b.

Both representations avoid violation of the Onset constraint, given in (48) in moraic terms.

(48) *$\lfloor_{\sigma}$ α
μ

Under the moraic non-syllabic theory (47a) the initial vowel has no syllable so no violation of the Onset constraint results. Under the syllabic non-moraic theory (47b), the vowel has a syllable, but the first element in the syllable is not moraic. Either way, the

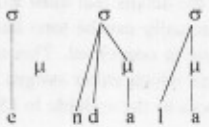
resulting structure does not have the configuration banned in (48). At the same time, the vocalic segment is prosodically licensed.

Now consider how these structural accounts might explain the fact that onsetless vowels cannot be long; as shown in section 3, a mora deriving from a preconsonantal nasal which would otherwise cause lengthening of the vowel fails to cause lengthening if the vowel is onsetless. As indicated in (49), the moraic nonsyllabic theory treats onsetless vowels as being licensed by a mora, but that mora is not part of a syllable, and on the assumption that compensatory lengthening involves docking a floating mora to an existing syllable, there is no syllable node for the nasal's mora to attach to, hence there is no compensatory lengthening.[8]

(49)

The syllabic non-moraic theory in (50) would block the affiliation of the nasal's mora with the syllable, since linking that mora to the syllable would create a regular syllable and therefore a violation of the Onset constraint, so the only way to avoid the onset violation is to prohibit all moraic structure, which blocks transfer of the nasal's mora.

(50)



Thus both structural accounts can explain lack of lengthening in an onsetless vowel.

Moving to the fact that onsetless vowels are not proper tone-bearers, both models can provide an explanation for this fact. As discussed in Odden (1994), there are a number of reasons for linking tones to syllables rather than moras in Kikerewe, and it will therefore be assumed that tones link to syllables in Kikerewe. Under the moraic nonsyllabic account in (51), the failure of onsetless vowels to bear tone follows from the structural property that such vowels have no syllable nodes, so tones cannot dock to them.

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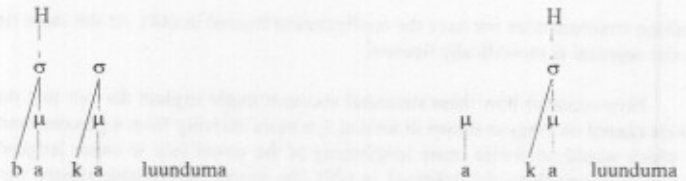
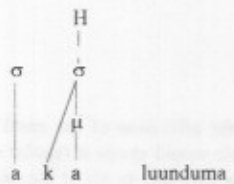
[8] Another consideration may be called on to block bimoraic unsyllabified vowels. It is often assumed (Zec 1988) that one mora of a long vowel is the head mora and the other is a non-head mora. If the head-nonhead distinction is a property of the relation between syllables and moras, no such distinction can be maintained for an unsyllabified mora. It is therefore reasonable to assume that unsyllabified moras cannot serve to define a long vowel, since they cannot enter into the head/non-head contrast which defines a long vowel.

(51)



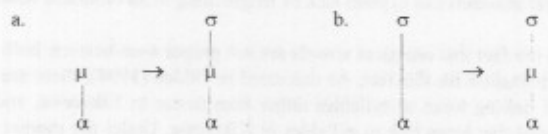
The syllabic nonmoraic account in (52) would assume a principle that although the tone structurally links to the syllable, it is the mora which is responsible for syllabic licensing, and therefore a syllable can bear tone only if it has a mora. Again there is a structural representation of the exceptional status of onsetless syllables with respect to tone.

(52)



Thus it would seem that attributing a special quasi-syllable status to onsetless vowels will resolve these two anomalies. However there are details that must still be accounted for. The first is the fact that onsetless vowels actually can be tone bearers, at least as far as the phrase-level throwback of final H tone is concerned. This could be remedied by assuming a postlexical syllable-fixing process which either assigns full syllable status to a vocalic mora as in (53a) or assigns a mora to the syllable in (53b), despite the violation of the Onset constraint.

(53)



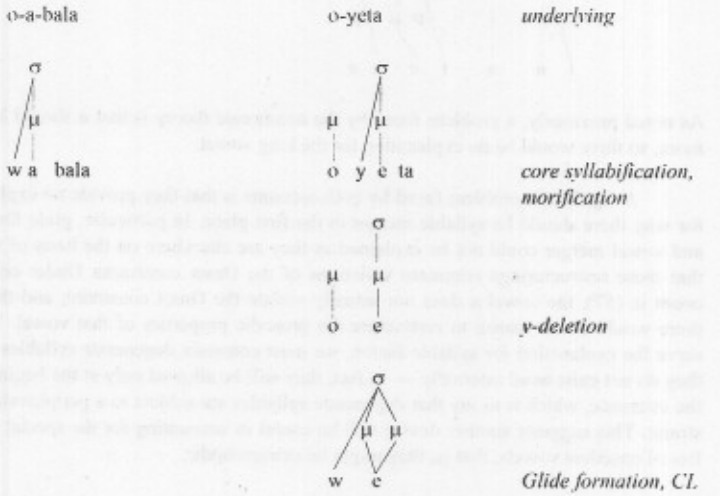
Another explanation for these facts will be considered momentarily.

The second problem has to do with the asymmetry between an onsetless vowel which is underlyingly followed by a vowel, where there is glide formation without compensatory lengthening, versus a sequence composed of an onsetless vowel followed by a vowel in a derived representation, where the second vowel is made onsetless by deletion of *y*. Recall that in the latter case there is compensatory lengthening.

(54) o-a-bala → wabala 'you counted'
o-yétá → oétá → wéétá 'you called

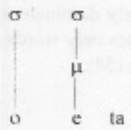
The question is how one accounts for compensatory lengthening in *wéétá*. Under the moraic nonsyllabic theory, one could account for this distinction through a derivational difference, where one first constructs a monomoraic CV syllable out of a V-V sequence by core syllabification based on the underlying form. A mora, but not a syllable, will be assigned to the initial vowel in *oyeta*. Subsequently, *y*-deletion eliminates the *y*, which creates an onset violation that is repaired by glide formation. There is compensatory lengthening in this kind of V-V sequence, since the initial vowel does have a mora.

(55)



The form *wéétá* is more problematic for the syllabic nonmoraic account. Under the assumption that onsetless vowels are amoraic, there should be no compensatory lengthening since the initial vowel ought to have no mora.

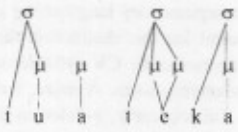
(56)



The final problem has to do with the fact that there is compensatory lengthening in *twaatéékâ*. Under the assumption that onsetless vowels do not have regular syllable

status, we would expect either the representation (57a) for the moraic nonsyllabic theory or (57b) for the syllabic nonmoraic theory.

(57) a.



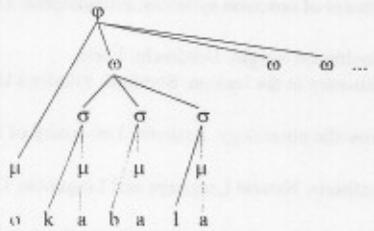
b.

As noted previously, a problem faced by the nonmoraic theory is that *a* should have no mora, so there would be no explanation for the long vowel.

A significant problem faced by both accounts is that they provide no explanation for why there should be syllable merger in the first place. In particular, glide formation and vowel merger could not be explained as they are elsewhere on the basis of the fact that these restructurings eliminate violations of the Onset constraint. Under either account in (57), the vowel *a* does not actually violate the Onset constraint, and therefore there would be no reason to restructure the prosodic properties of that vowel. To preserve the explanation for syllable fusion, we must constrain degenerate syllables so that they do not exist word internally — in fact, they will be allowed only at the beginning of the utterance, which is to say that degenerate syllables are subject to a peripherality constraint. This suggests another device will be useful in accounting for the special properties of onsetless vowels, that is, they might be extraprosodic.

A solution to the positional limitation on the special structure of asyllabic vowels in the moraic nonsyllabic theory is based on structural limits on extraprosodicity. Following Inkelas (1989), Downing (1995), it is assumed that an extraprosodic element is one that is contained within the morphological constituent which forms the basis for constructing a given prosodic domain, but which is not a member of that prosodic constituent. For Kikerewe, it is assumed that prosodic words may only dominate syllables. The postlexical phrase that organises sequences of words dominates only words (at least preferentially). However, a phrase can also dominate a mora, as in (58).

(58)



Under this proposal, an onsetless vowel will not be part of the phonological word at least as far as prosodic phenomena are concerned, and therefore H tone cannot be assigned to it at the word level. However the syllable can be seen at the phrasal level, and thus is eligible to be the target of prepausal H tone throwback.[9] Thus, no special readjustment is required to explain the fact that at the phrasal level, an onsetless vowel can be a bearer of tone.

8. Conclusions

In conclusion, it has been shown that onsetless vowels have a number of peculiar phonological properties in Kikerewe, a fact which can be traced to the desire to avoid onset violations. It has been argued that this results in a special structural status for such vowels. Two models of that special status have been considered: these vowels might be licensed by a mora but are not part of any syllable, or they might be syllabified with no mora. Either structure results in a prosodically licensed vowel which does not violate the onset constraint. Of these proposals, the moraic-licensing account is better able to handle the asymmetry between /V+V/ syllabification without compensatory lengthening versus /CV+V/ syllabification with compensatory lengthening. Under both proposals, this special structural configuration is allowed only utterance-initially, which can be handled by appeal to extraprosodicity.

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[9] Unless a postlexical syllable-formation process is assumed which assigns full syllable status to an unsyllabified mora, this would entail that H tones link *preferably* to syllables, but may directly link to a mora if no syllable node is available.

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Exceptional degree markers: A puzzle in internal and external syntax*

Arnold M. Zwicky

0. Introduction. Most approaches to syntax – especially, but by no means exclusively, monostratal approaches – adopt (whether explicitly or implicitly) very restrictive assumptions about how the external and internal syntax of an expression can be determined.

One of these is the principle of Strictly Categorial Determination below, according to which, both with respect to the external distribution of an expression and with respect to its internal makeup, the only thing that matters about it is its category, its properties as a whole. External syntax cannot 'look into' an expression, nor internal syntax 'look out' from it. (The apparatus of 'X-bar syntax' – see Kornai & Pullum 1990 – can in fact be seen as designed to ensure Strictly Categorial Determination.)

Strictly Categorial Determination: The category of an expression (a) entirely determines its external syntax and (b) is entirely determined by its internal syntax.

Another is the principle of Strictly Local Determination below, according to which syntactic rules look 'out' only at sisters (not nieces, mothers, aunts, or more distant external relatives) and 'in' only at daughters (not granddaughters or more distant internal relatives).

Strictly Local Determination: Both the external and internal syntax of an expression are determined strictly locally – (a) its external syntax by its strictly local external context, that is, by the properties of its coconstituents and its relations to them, and (b) its internal syntax by its strictly local internal context, that is, by the properties of its immediate constituents and the relations between them.

I should point out that nonlocal determination is really troublesome only when there is no finite bound on the distance between the determining and determined elements

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(see No 1990, 1991). For external syntax, for instance, ordinary 'depth-0' rules, in which sister constituents determine one another's properties, can be augmented by a system of depth-*n* rules, in which one constituent determines properties of an *n*-depth daughter of another, without any alteration in the stringsets admitted or the tree structures admitted. Nevertheless, there is something especially attractive about a syntactic framework in which the only constituents that can constrain one another are those that are especially close to one another structurally.

In any case, apparent exceptions to one or both principles abound. 'Extraction' constructions, for instance, appear to violate both: a VP with an XP missing somewhere within it has a different external syntax from a VP with no extracted XP, yet both are VPs; and VPs of both types can have immediate constituents that are identical in the relevant respects, as are *meet people from* (as in *Which cities did you meet people from?*) and *meet people*, both composed of a V and its direct object NP. In this case it has been argued that 'missing an XP' is in fact a property of VPs as wholes, that is, that missing-an-XP is one of the features that together can characterize a category; VP and VP-missing-an-XP are distinct categories. In addition, it has been argued that this feature is shared between a mother category and at least one of its daughters, so that missing-an-XP on the VP *meet people from* is in fact determined by a daughter of this VP, the NP *people from* (which, on this analysis, is also missing-an-XP), and is only indirectly determined by its great-granddaughter, the missing NP object of the P *from*. (This is the treatment of extraction in generalized phrase structure grammar, as in Gazdar et al. 1985.)

There is a substantial literature on one large class of apparent exceptions to Strictly Categorial Determination, and usually to Strictly Local Determination as well, namely constructions involving 'shifts' in rank (word, phrase, or clause) or category. (See Subramanian 1991 for a survey of relevant phenomena.) There is, for instance, a rank shift when *that*-marked finite clauses occur in noun phrase positions, in particular as subjects (*That pigs can't fly distresses me*) or objects (*I concluded that pigs can't fly*), and there is a category shift when gerundive verb phrases (Pullum 1991) occur in such positions (*Your rebelling against these ideas distresses me*, *I am distressed at your rebelling against these ideas*). In both cases there is a mismatch between the external syntax of a constituent (which is that of an NP in both of these examples) and its internal syntax (which is that of S and VP, respectively), against the predictions made by Strictly Categorial Determination.

Almost invariably, such examples present problems for Strictly Local Determination as well. Note that *that*-marked clauses don't have the full external syntax of NPs, since they don't occur as objects of prepositions (**I am distressed at that pigs can't fly*), and that gerundive verb phrases don't have the full external syntax of NPs, since they don't have possessive forms (contrast *the purpose of your talking to me* with **your talking to me's purpose*, and note the acceptability of *the person talking to me's purpose*). That is, there are restrictions on the distribution of these expressions that will not be accounted for merely by assigning the category NP to them; their external syntax needs to see 'inside' this NP.

In another class of phenomena, only Strictly Local Determination is threatened. These cases involve one constituent's requiring that a sister constituent have a particular lexical item as one of its daughters; the selection is then apparently of a niece. Sometimes these selections seem like idioms; this is the case for English verbs that require particular prepositions marking their objects: *rebel against these ideas*, *adhere to no religion*, *agree with your objections*, *resign from their posts*, and so on. Sometimes these selections involve 'grammatical words', like the preposition *of* in *a lot of books* or the infinitive marker *to* in *I want to go*; again, the selection is apparently of a niece. Since

the selection, in both situations, is so item-specific, there is a strong inclination for analysts to treat the determining element and the determined element as forming a syntactic unit (*rebel against*, *a lot of*, *want to*); this inclination is especially strong when the elements are fused phonologically, as in *alotta books* or *I wanna go*. Nevertheless, in the interesting cases there is evidence that determined element forms a syntactic constituent with the material that follows it, not with the first element: for instance, the extraction in *To which ideas did they stubbornly adhere?* and the zeroing in *A lot of books were destroyed, but then a lot were saved.*

This paper investigates an English construction that appears to run against both principles; it presents some characteristics of the shifting examples and some of the niece-selection examples. An expression like *too big* is an AdjP with Deg and Adj as its immediate constituents, yet its external syntax is not that of other AdjPs like *very big* and *more extraordinary*; instead of combining with N to make N' (as in *very big dog*, *more extraordinary idea*), it combines with an NP with the particular determiner *a* to make NP, as in *too big a dog*.

These facts about degree modifiers are problematic for Strictly Categorial Determination because on the basis of its internal makeup *too big* is simply an AdjP, as is *very big*, yet on the basis of their external distributions the two expressions belong to different categories. In this respect, the construction is much like the shifting examples I mentioned above.

These facts are also problematic for Strictly Local Determination, because *too big* determines not merely the category NP of its coconstituent, but also internal properties of that NP: the fact that the NP has the immediate constituents Det and N', and that fact that the Det in question is the specific item *a*. In American dialects with the variant *too big of a dog*,[1] the nonlocal determination extends through two levels, to the determination both

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1. This variant has not escaped the notice of speakers of other varieties, including both syntacticians (Abney 1987: 324 and Radford 1993: 85) and mildly alarmed non-linguists, as in this short piece on the *New York Times* editorial page from Sunday 8 March 1992:

> It was one, maybe two years ago that the woman first noticed it: the way the "of" was showing up where it wasn't needed. She'd overheard somebody describing something as "not that big of a deal."
>
> "Isn't that strange," she mused to a friend, who said promptly: "Not at all. It's a regionalism. After all, New Yorkers are always talking about the Port *of* Authority."
>
> ...Then, however, multiple "ofs" started popping up on her soap opera, a monument to misused words that is taped in Los Angeles. Lunch was not "that big of a meal"; a dress had not "that short of a skirt."
>
> Finally, last week, the driver of the Eighth Avenue bus announced that the time was 10 A.M., and that it was not "that good of a day."
>
> Clearly, "of" is now something more than a mere preposition. It's a virus.

of the P *of* and also of the Det *a*. That is, the construction presents the same sort of difficulties as the niece-selection examples I mentioned above.

I will be arguing here that the apparent violations of Strictly Local Determination engendered by exceptional degree modifiers fall in with a large number of other situations in which 'particle words' like the indefinite article *a* in English mark syntactic constructions. What is called for in such cases is a feature on the relevant mother constituent (for instance, the modified NP in *too big a dog*), a feature realized on a daughter of this constituent (here, the Det daughter *a*).

I will also be arguing that the apparent violations of Strictly Categorial Determination have a natural analysis, but not one involving garden-variety determination of features. Instead, what is needed is the ability to refer directly to the specific construction exemplified by an expression.

1. Two types of degree modifiers. Degree modifiers of adjectives in English fall into two groups according to their distribution:

(1) Deg_1:
very, rather, quite, pretty,...
Adj-ly
more (...than S/NP)
most [absolute]
the most (...of NP)/(...that S)
not too/so 'not very'

(2) Deg_2:
so...that S
SO [emphatic], that
as...as S/NP
too (...(for NP) to VP)
more[2] (...than NP) [in negative contexts]
how, however

Adverbs of both groups are available to modify predicate adjectives:

(3) a. This shrub is very/rather/enormously/most/SO/too impressive.
b. These shrubs seem too dense for us to drive through.
c. My current class is becoming more inquisitive than last year's.
d. How impressive have the candidates been?
e. However impressive this shrub is, I still don't want a garden.

The groups split in their behavior with prenominal adjectives, however.

This use of *of* is presumably an extension of the rule for NPs with quantity (rather than degree) modifiers like *more*, *less*, *enough*, and *a bit*, in combination with singular count nouns: *more of a liar*, *enough of a linguist*, *a bit of a charmer*. Baker's (1989: 331) version of this rule is '(74) A noun phrase can consist of a quantity phrase followed by an *of* phrase, where the object of *of* is a noun phrase introduced by *a(n)*.'

2. The negative-polarity item *more* that is a Deg_2 modifier differs from the ordinary, Deg_1, modifier *more* in other ways: Deg_2 *more* doesn't alternate with *–er* (*I've never seen more handsome a dog*, **I've never seen handsomer a dog*), while the Deg_1 does (*I've never seen a dog that was more handsome*, *I've never seen a dog that was handsomer*).

Deg_1 + Adj has essentially the distribution of Adj alone; it combines with a bare N, to yield an expression with the same distribution as that of N.[3] Thus, the expressions in (4a) all have essentially the same distribution, that of singular count Ns; the expressions in (4b) all have essentially the same distribution, that of plural count nouns; and the expressions in (4c) all have essentially the same distribution, that of (singular) mass nouns.

(4) a. shrub, impressive shrub, very/most impressive shrub,....
b. shrubs, impressive shrubs, very/most impressive shrubs,...
c. shrubbery, impressive shrubbery, very/most impressive shrubbery,...

Things are different with Deg_2 + Adj, which has a new distribution. It combines with no bare Ns at all –

(5) a. *too/how impressive shrub
b. *too/how impressive shrubs
c. *too/how impressive shrubbery

– but instead combines only with a particular kind of indefinite phrase: an NP with the determiner *a*, or (in many American English varieties) a partitive PP with such an NP as the object of the P *of*. Given that the NP must be indefinite count singular, these prenominal modifiers are possible only for singular count Ns:

(6) a. too/how/that impressive a shrub [standard]
b. too/how/that impressive of a shrub [dialectal]

One peculiar consequence of these restrictions is an asymmetry in the relationships between statements (as in (7a-c) below) and yes-no questions (as in (7a'-c'). For prenominal adjectives, it is impossible to question degree merely by substituting the Deg_2 WH word *how* for an ordinary (Deg_1) degree modifier:

(7) a. They saw a very impressive shrub.
a'. *A (just) how impressive shrub did they see?
b. They saw very impressive shrubs.
b'. * (Just) how impressive shrubs did they see?
c. They saw very impressive shrubbery.
c'. * (Just) how impressive shrubbery did they see?

For singular count nouns there is a grammatical Deg_2 alternative to the ungrammatical (7a'), as in (8). But there are no such alternatives for (7b') and (7c'); instead, a large-scale shift to a predicative construction, as in (9), is required.

(8) (Just) how impressive a shrub did they see?

(9) (Just) how impressive { was the shrub / were the shrubs / was the shrubbery } that they saw?

3. That is, the resulting expression is a phrase, not a word, but it is not NP, since it is syntactically unsaturated – N', or N^1, in systems where a syntactically saturated non-headed expression is N^2.

In any event, Deg_1 modifiers act like well-behaved modifiers, while Deg_2 modifiers present a number of puzzles with respect to the relationship between the internal and external syntax of the AdjPs they participate in (which I will refer to as '$AdjP_1$' and '$AdjP_2$', without intending these as anything more than ad hoc labels). The internal syntax of both $AdjP_1$ and $AdjP_2$ appears to be simply Deg + Adj, and there is no evidence that I know of, beyond the facts in (4)-(6), that would argue that the $AdjP_1$ and $AdjP_2$ have different category or bar-level assignments; both have predicative function, as in (3), and can participate in *though*-fronting, as in (10).

(10) Rather/Too big though the box was, we tried to lift it.

$AdjP_2$s, then, have the following external properties that distinguish them from $AdjP_1$s: (A) they combine with NP (or PP), rather than with some bare N-type constituent; and (B1) they require an NP with the indefinite article, though other properties of this NP are free, as the questions in (11) illustrate.[4] In addition, (B2) in dialects where $AdjP_2$s combine with PPs, the P must be the (partitive) *of*, and requirement (B1) must still be satisfied for the object of this P.

(11) How big a (kind of) new shrub from France were you thinking of buying?

These properties present two different sorts of theoretical difficulties. What property (A) means is that $AdjP_2$s are exceptions to the generalization that the external distribution of an expression type is predictable from the distribution of its head – on the assumption, of course, that Adj is the head in Deg_2 + Adj as well as in Deg_1 + Adj. The distribution of $AdjP_2$ is determined in part by its Adj constituent, in part by its Deg constituent. What properties (B1) and (B2) mean is that a determining element ($AdjP_2$, here) can place requirements on a niece (*a* in *how big a problem*, *of* in *how big of a problem*) or even a grand-niece (*a* in *how big of a problem*), as well as on a sister. Both of these theoretical difficulties have parallels that have been extensively treated in the syntactic literature.

2. Partitive uses of *of*. I'll take the properties up in reverse order. Property (B2) is familiar from the many instances of 'grammatically used' Ps in the languages of the world. Indeed, English has plenty of other grammatical uses for the P *of*, including a wide variety of constructions in which a PP headed by *of* combines with a constituent of category N, as in (12). The quantifier constructions in (12a-d) are especially interesting here, in that they exhibit both different requirements on the object NP (in (12a,b) this can be any definite NP, while in (12c,d) only certain sorts of bare-N objects are permitted) and also different conditions on the occurrence of *of* (in (12a,c), *of* is obligatory, while in

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4. Baker's (1989: 327) rules for prenominal modifiers simply stipulate the indefinite article and the class of exceptional degree modifiers, and in fact mention the Deg_2 class twice:

> (58) A common noun phrase can consist of an adjective phrase followed by a smaller common noun phrase, with the following restriction: The adjective phrase must not include a complement and must not be introduced by *as*, *so*, *that*, or *too*.
>
> (59) A noun phrase introduced by *a(n)* can be combined with a preceding adjective phrase introduced by one of the degree words *as*, *so*, *that*, and *too* to form a larger noun phrase.

(12b,d) there are alternatives without *of*, and in still other constructions, like *every problem*, there is no alternative with *of*).

(12) a. a few/lot of these problems, two/some of your best friends
b. both (of) these problems, all (of) your best friends
c. a lot of problems/nonsense
d. a couple (of) problems
e. a cup of tea, three sheets of paper
f. a skirt of leather, a desk of teak
g. a vase of flowers, a garden of weeds
h. the problem of bank failures
i. the department of student affairs
j. the secretary of the society
k. the last pages of my novel
l. a friend of my cousin's
m. a photograph of my dog
n. the restoration/restoring of old paintings by artisans
o. the disappearance of the dodo, the singing of my friends

What we want, here and in a great many other situations, is a general scheme for describing the selection of PPs with particular (grammatically used) head Ps. This is achieved by treating the Ps in question as parallel to inflections on NPs, that is, as the realization of a case feature on PPs. Noting the use of *of* in (12n,o) to mark direct objects of transitives and subjects of intransitives, and observing that *of* seems to be the default, general-purpose, P in English, I will use the label Absolutive for the case of PPs with *of* as head. (Nothing that is crucial to this discussion hinges on the label, or on my decision to posit only one case flagged by *of*, rather than several.) The constructions in (12) then all involve the combination of an N-headed constituent and a PP[Case:Absolutive], and NPs like those in (6b) – dialectal *too/how/that impressive of a shrub* – involve the combination of an Adj-headed constituent and a PP[Case:Absolutive].

3. Selection of the article *a*. Property (B1), the selection of NPs with the particular determiner *a*, is again an instance of a much more general phenomenon, the selection of XPs with particular specifiers in them. This is what is going on in constructions requiring marked infinitives, that is, VPs with the specifier *to*, as in (13). It is also what is going on in the selection of predicative (nonreferential) NPs in (14), where singular count NPs must have the determiner *a*, and in the selection of NP sisters to the exclamatory determiners *such* and *what* in (15), where again singular count NPs must have the determiner *a*; in neither case will a bare N do, nor will some other indefinite NP.

(13) I am to leave soon, try to sing, expect them to be angry,...

(14) a. be a poor spy
b. *be poor spy
c. *be one poor spy[5]

(15) a. Such/What a (good) dog!
b. *Such/What (good) dog!
c. *Such/What one (good) dog!

---

5. The NP in (14c) is to be read with unaccented *one*; *one* here is the ordinary, non-exclamatory quantifier. The exclamatory NP in *Kim is ONE poor SPY* needs a separate analysis.

In such cases, we take the particular specifier to be the reflex of a grammatical category on XP, just as we took a particular grammatically used P to be the reflex of a grammatical category on PP. For infinitival *to*, for instance, Gazdar et al. (1985) take the specifier to be a reflex of the feature value VForm:Inf on VP; this feature value is governed by particular classes of verbs as in (13), or is otherwise selected in particular constructions (infinitival complements, infinitival relatives, infinitival purpose clauses, and the like). A parallel treatment of the singular count NP examples in (14) and (15), and in (6a) above (*too/how/that impressive a shrub*), takes the specifier *a* to be a reflex of a feature value on NP (say, NForm:Indef; again, the label is not important, so long as this feature value is kept distinct from whatever distinguishes indefinite from definite NPs in general); this feature value is governed by $AdjP_2$ in (6a), governed by a particular class of determiner Ns in (15), and selected in the predicative construction in (14).

The feature value VForm:Inf is part of a system of values for VForm (the rest of which are realized by inflectional morphology rather than by a separate word) and of values for other features for V (among them, a feature distinguishing finite VPs from nonfinite ones). Although it is not my purpose here to give a full description of NPs and their features, I do want to point out that the feature value NForm:Indef is also part of a system of other values (NForm:Def, for instance, realized by the article *the*) and other features. In particular, NForm:Indef interacts with such other NP features as Count and Number to give the paradigms in (16) for the predicative construction and in (17) for the exclamatory determiner construction. The $AdjP_2$ construction differs from these in governing not only NForm:Indef but also Count:+ and Number:-, as illustrated in (18).

(16) a. be a poor spy
b. be poor spies
c. be human rubbish

(17) a. such/what a good dog
b. such/what good dogs
c. such/what nice shrubbery

(18) a. too/how impressive a shrub
b. *too/how impressive shrubs
c. *too/how impressive shrubbery

We have already seen other instances of NForm:Indef, on plural count and singular mass NPs, in the quantifier constructions of (12c) (*a lot of problems/nonsense*) and (12d) (*a couple (of) problems*).

4. Determination at two levels. We are not quite finished with (B1) and (B2), however. Dialectal variants of the $AdjP_2$ construction (*too big of a problem*) and quantifier constructions like *a lot of problems* still appear to involve the determination of properties on a niece rather than on a sister, since in both a modifier phrase (AdjP *too big*, determiner NP *a lot*) determines not only a feature value, Case:Absolutive, of its sister but also a feature value, NForm:Indef, of one of the constituents of that sister, namely the NP object of *of*.

Once again, the problem is not some small detail in the analysis of a couple of English constructions. As I note in Zwicky (1992), it seems to be a general property of case-marking by Ps that the Ps are mere flags of the case and that the external syntax of such PPs follows from the properties of the NP objects in them (except of course for the requirement that particular Ps be present). In particular, verbs show agreement with features of such P-flagged NPs. What we have in *too big of a problem* and *a lot of*

problems is the expected counterpart to these agreement facts: government of features on P-flagged NPs.

It is not entirely clear what sort of general account should be given for these characteristics of P-flagged NPs. In Zwicky (1992) I provide a scheme for using the Head Feature Convention and the Control Agreement Principle of Gazdar et al. (1985) to this end. This scheme also relies on the fact that NP and PP together constitute a category, [V:-]P; values of the Case feature are assigned to this category, which is then further specified as [N:+] or [N:-] depending on which value Case has. The category [V:-, N:-]P (= PP) branches into [V:-, N:-] (= P) and [V:-, N:+]P (= NP), and the other features of the mother PP are distributed some to the P daughter and some to the NP daughter. In particular, a PP with the feature values Case:Absolutive and NForm:Indef should have the former distributed to its P daughter and the latter to its NP daughter.

In Zwicky (1993) I suggest that the problematic characteristics of grammatically used Ps are in fact shared with a number of other classes of constructions, all of which have fallen under the umbrella of 'specifiers' in the recent syntactic literature: auxiliaries in combination with main verbs, determiners in combination with main nouns, and complementizers in combination with clauses. My conclusion in this more recent paper is that these problematic constructions involve two constituents, one of which bears certain characteristics of the central element in the combination, the other of which bears certain other such characteristics. For P-flagged NPs, we want to say that the P can govern the NP and agree with it (and therefore acts like the 'head' internally), but that the NP can also be governed externally and can control agreement on external constituents (and so acts like the 'head' externally). Such a proposal connects the analysis of P-flagged NPs to the analysis of a variety of other construction types, but in itself provides no mechanism for the distribution of features.

5. Apparent non-local effects of Deg_2. Up to this point, I have used '$AdjP_1$' and '$AdjP_2$' as ad hoc labels for the distinction between AdjPs with modifier daughters that are Deg_1 and those with modifier daughters that are Deg_2. In contrast, the distinction between Deg_1 and Deg_2 is a genuine (sub)category distinction. What makes property (A), the fact that $AdjP_2$s combine with NP or PP rather than with a bare N-type constituent, problematic is that AdjP appears to 'inherit' this distributional peculiarity from a (Deg_2) modifier, rather than from its head Adj.

Given the discussion that has just preceded, a natural suggestion to make is that the Deg_2 + Adj construction is another one in which the characteristics of the 'head' are split between two constituents. The suggestion would be that Deg_1s are ordinary modifiers, but that Deg_2s are specifiers, and have some 'head' characteristics – at least the characteristic of participating (as the governor) in external government. This proposal would be hard to square with the fact that the Adj, in Deg_2 as well as Deg_1 combinations, does most of the work in determining the external distribution of an AdjP. Whether an AdjP is attributive only, predicative only, or both (see the survey in Quirk et al. 1985: secs. 7.31-39) is determined by the Adj in it; the attributive-only Adjs in (19a) remain attributive-only when modified by Deg_1 as in (19b) and by Deg_2 as in (19c), and similarly for the predicative-only Adjs in (20a).

(19) a. a clear failure, a strong opponent, an occasional visitor
b. a very clear failure, a most strong opponent, a not so occasional visitor
c. so clear a failure, that strong an opponent, how occasional a visitor

(20) a. be faint, be afraid, be fond of nuts
b. be extremely faint, be most afraid to speak, be not too fond of nuts
c. be as faint as Pat, be too afraid, be so fond of nuts that they'll eat acorns

Instead, the Deg_2 facts should be seen as falling in with a large number of other situations in which the external distribution of a constituent is determined in part by the *specific construction* the constituent is an instance of. Properties of head words (in any of the senses of 'head') make a contribution to the external distribution of constructions, but they are not the sole determinants, and sometimes they are virtually irrelevant.

Consider, for example, the distribution of passive VPs like those in (21), or fronted-WH clauses like those in (22).

(21) made in America, not constructed by elves, given little money

(22) what the butler saw, when I gave them the money, how we sang

The head V of a VP in (21) has properties that contribute to determining the distribution of the VP, in particular, to determining its ability to occur as a complement to the verbs *be* and *get*: its past participle inflection and its membership in a particular subcategory of transitive Vs. But the absence of a direct object also makes a contribution; *made these automobiles in America* cannot be a passive VP. What makes a constituent a passive VP is an assemblage of properties that can be manifested in several different places. The point is even more striking for the clauses in (22), where the properties of the head V have little to do with determining their distribution, in particular, with determining their ability to occur as objects of verbs like *wonder*, *ask*, and *realize*. The main thing that makes a clause a fronted-WH clause is its initial WH-containing phrase, and that is a specifier rather than a head.

Instead of rigging things so that a VP can 'inherit' the property of being passive from its head, or that a clause can 'inherit' the property of being a fronted-WH clause from a non-head constituent, what we want to say is that certain other constructions call for certain specific subconstructions (see Zwicky 1987, 1989, 1994). Thus, a rule describing VPs composed of a head V *be* or *get* and a VP complement to that head will require that the VP complement be an instance of Construction 55, the passive VP construction. And a rule describing VPs composed of a head V (in a rather large class of verbs of speech and mental action) and a clausal object of that head will require that the object be an instance of Construction 167, the fronted-WH-clause construction.

What we then want to say about Deg_2 + Adj combinations is not that the AdjP 'inherits' some property from its Deg_2 constituent, or that the Deg_2 constituent is in any sense a 'head', but that there are two distinct rules combining AdjP and an N-type constituent, the first of which calls for an AdjP that is an instance of Construction 235 (the Deg_1 modification construction), the second of which calls for an AdjP that is an instance of Construction 470 (the Deg_2 modification construction). In somewhat more detail:

(23) Construction 236: N' can have as constituents a Construction 235 AdjP and a bare N: *very impressive + shrub*.

(24) Construction 471: NP can have as constituents a Construction 470 AdjP and an NP[NForm:Indef, Count:+, Number:-]: *too impressive + a shrub*. [standard]

Construction 471': NP can have as constituents a Construction 470 AdjP and a PP[Case:Absolutive, NForm:Indef, Count:+, Number:-]: *too impressive + of a shrub*. [dialectal]

6. Postnominal modifiers. One consequence of allowing direct reference to specific constructions is that the same construction can be called in more than one rule. Multiple invocations (Zwicky 1989) of the same construction are in fact quite common. For instance, the various interrogative, clause-initial focus, and subjunctive sentence types in (25) all invoke the subject-auxiliary inversion construction.

(25) a. Have you seen Terry?
b. You haven't seen Terry, have you?
c. Who have you seen?
d. I saw Terry, and so did you.
e. Not a person have I seen.
f. Had I seen more people, I would have stayed.
g. May we never see another day like this one!

As it happens, the Deg_2 modifier construction (Construction 470) is invoked by at least one rule in addition to the one for NPs like *too big a dog* (Construction 471). This is a rule for one type of postnominal modification.

There seem to be four relevant generalizations about postnominal AdjPs. (There are additional generalizations for other types of postnominal modifiers, including relative clauses, participial VPs, and adverbials.) The first of these is that postnominal AdjPs must be licensed as predicative AdjPs; attributive-only AdjPs like those in (19a) do not occur, in the appropriate senses, postnominally, and (with only a handful of types of apparent exceptions) there are no postnominal AdjPs that cannot occur predicatively:

(26) a. *a visitor more occasional than most, *an opponent too strong to resist 'someone who opposes too strongly to resist'
b. many people fond of nuts, two friends afraid that the world would end

The remaining generalizations presuppose this association between predicative occurrence and postnominal occurrence. The second generalization is that for the compound indefinite pronouns (*anyone*, *nobody*, *something*, etc.) a modifying AdjP must be postnominal, but otherwise can be any available AdjP, even a single word; contrast the (grammatical) AdjPs following indefinite pronouns in (27a) with the (ungrammatical) ones following indefinite NPs with nonpronominal heads in (27b):

(27) a. anything useful, no one tall, someone extremely entertaining, everything helpful to the homeowner, nobody that tall
b. *any proposal useful, *no person tall, *some linguist extremely entertaining

The third is that any available AdjP containing a complement can be used as a postnominal modifier, as in (28a). In general, postnominal AdjPs without a complement, even if they have premodifiers to make them longer, heavier, or more complex, will not do; see (28b).

(28) a. many faces bright with joy, a linguist more impressive than Chris, several candidates too impressive to ignore
b. *many faces very bright, *a linguist most impressive, *several candidates not especially impressive, *a person more impressive

The fourth generalization – the one of interest in this note – is that $AdjP_2$ postmodifiers are always acceptable, even if they don't have complements:

(29) any person so/that/as impressive, no linguist more impressive, any candidate too tired

Here we have another rule that refers to Construction 470 AdjPs.

7. Conclusion. I have now argued that the apparent failures of Strictly Local Determination in $AdjP_2$s involve the government of features by a functor (modifier) constituent on a nonfunctor (modified) coconstituent. These features include Case:Absolutive and NForm:Indef.

All the fundamental theoretical assumptions of this part of the analysis receive support from a variety of phenomena in a number of languages: use of values of the feature Case to describe 'grammatical' adpositions as well as inflections; reference to an XForm feature in describing types of XPs; realization of an XForm feature in grammatical marker words, or flags, as well as in inflections; the possibility that in relationships of government and agreement, grammatical adpositions are transparent, or disregarded; recognition of very eccentric subcategories of major categories like V and N, including one-member subcategories; a split between a functor XW 'head' constituent and an XP 'base' constituent (both of them head-like in one way or another) in certain sorts of specifier constructions; and the possibility that such a head can govern features on its base.

I have also argued that the apparent violations of Strict Categorial Determination in $AdjP_2$s involve the selection of constituents exemplifying specific constructions (Construction 235, Construction 470).

Having one construction invoke specific other constructions in this way is, like the other theoretical assumptions in my analysis, supported by a variety of phenomena in a number of languages. It is argued for by Zwicky (1987, 1989, 1994), Välimaa-Blum (1989), and Kuh (1990), in an approach that has developed from GPSG, and it is central to the 'construction grammar' of Fillmore and his associates (see Fillmore 1988 and Lambrecht 1990 and items cited by them), which has developed separately; see also Manaster-Ramer 1987 and Zadrozny & Manaster Ramer (1990).

It is true that the individuation of (and reference to) constructions in this fashion runs directly counter to much 'principles and parameters' and 'minimality' work of recent generative syntactic theory, but Pullum & Zwicky (1991), at least, argue that the elimination of parochial (that is, language-particular) constructions in favor of universal principles (plus parochial parameter settings) is exactly the wrong theoretical move to make.

This paper is thus another chapter in the great book of parochial constructions – understanding, of course, that the component syntactic conditions of a parochial construction will themselves be chosen from an inventory of possible syntactic conditions that is universal. And this paper continues the line of research initiated by Perlmutter & Postal's (1977) constructional analysis of the passive, in explicit opposition to versions of

generative syntax that dissociate the formal conditions in a construction from one another and from the semantics they jointly convey.

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