A Metrical Theory of Stress and Destressing in English and Dutch

Een metrische theorie over klemtoon en klemtoonverlies
in het Engels en het Nederlands
(met een samenvatting in het Nederlands)

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René Willibrord Joseph Kager

geboren op 17 juli 1957 te Hilversum

promotor: Prof. Dr. W. Zonneveld
Faculteit der Letteren, Rijksuniversiteit Utrecht

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voor Jacquelien

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Chapter 0

Introduction

1. Introduction

1.1 Properties of word stress

This thesis will be concerned with the word stress systems of English and Dutch. These systems share many properties with the stress systems of other languages. Before discussing the special properties of English and Dutch, it will be useful to introduce a number of *universal* properties of word stress. We will do this by means of an example from English.

Consider the word *Apalachicola*, and its stress pattern *àpalàchicóla*. The main (or *'primary'*) stress is on the fifth syllable, which contains the long vowel [ow]. *Secondary* stresses are on the first and the third syllables, which are open and contain the short vowel [æ]. The second, fourth, and sixth syllable are open, and contain reduced vowels. These syllables are stressless, which is clear from their vowel quality. They alternate with the stressed syllables, forming a trochaic rhythmic pattern. Alternation is enhanced by a prominence difference among the two secondary stresses, of which the initial one is the strongest.

Let us now place these observations into an initial theoretical perspective, focusing on properties which constitute the basic phenomena for theories of word stress. Although not all of these are universal, all are found in many more systems than just English and Dutch.

The first property is that every word that belongs to a lexical category contains a syllable that carries the *primary* stress. Hence no stressless lexical words occur.

The second property is that every word has *exactly one* syllable carrying the primary word stress, while all other stresses (these only occur in long words) are subordinated to the primary stress as secondary stresses. Together with the first property, this is called the *culminative* property of stress. The culminative property holds for *Apalachicola*, where the unique primary stress is on the fifth syllable, while the remaining stresses are subordinated to it.

The third property is that primary stress is located near the borders of the stress domain, thus signaling its edges. This tendency is enhanced by the fact that the strongest non-primary stress tends to be on the opposite side of the domain from the primary stress. This is called the *delimitative* property of stress. *Apalachicola* illustrates this delimitative property in that the rightmost stressable syllable has the primary stress, whereas the initial syllable has the strongest non-primary stress.

The fourth property found in numerous stress systems besides English and Dutch is that *syllable weight* affects stress placement. Weight distinctions coincide with syllable composition, in which complex syllables count as heavy, and simple syllables as light. Heavy syllables generally attract stress regardless of their position in the word. The sensitivity for syllable weight, also known as *quantity-sensitivity*, is not a universal, although extremely common among stress systems. In English for example, *closed* syllables and syllables with *long vowels* are heavy, and typically stressed, while open syllables with short vowels are light. In contrast, light syllables are stressed only according to their *position* in the word. In *Apalachicola*, the syllable that has the primary stress is heavy, as it contains a long vowel.

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Abstract

The topic of this study is word stress, more specifically the relation between rules of stress and destressing within the framework of metrical phonology. Our claims will be largely based on in-depth analyses of two word stress systems: those of English and Dutch. We intend to offer a contribution to the following theoretical issues.

First, the controversy about *constituency* in stress representations, the status of which was questioned in the form of grid-only theory (Prince 1983), but recently revived in the form of bracketed-grids theory (Hammond 1984, McCarthy & Prince 1986, Halle & Vergnaud 1987, Hayes 1987). Related to this issue is the question whether stress can be an *inherent* property of stress-bearing elements, such as syllables or morae, apart from being a product of constituency. We will argue in favor both of constituents and 'inherent stress'. But in contrast to assumptions of bracketed-grids theory, we will claim that constituents in word stress representations consist of precisely *two* elements, a claim to which we will refer as the Strict Binarity Hypothesis. Thus, all constituency is eliminated which is not strictly binary. Among the victims are *non-branching constituents* (also known as monosyllabic feet) and, at the next higher level, *unbounded* constituents, used in assigning main stress. The function of the former is mainly transferred to *syllable weight*. More specifically, we will re-interpret quantity-sensitivity as a wellformedness condition relating syllable weight and stress. The function of unbounded constituents in prominence will be transferred to the constituentless End Rule, as proposed by Prince (1983).

Constituents arise by adjunction between two grid elements at the same level. As adjunction inherently requires precisely two grid elements, all constituency is inherently *binary*. Adjunction is an instantiation of a general prosodic scheme, related to a rule type proposed by Hayes (1984) for phrasal rhythmic adjustment.

The second issue concerns the relation between rules that assign stress, and rules that eliminate stress (destressing rules). In spite of their differences, these rule types also share properties such as quantity-sensitivity and boundedness (rhythmic alternation). To capture this, Prince (1985) re-interprets the relation between rules of stress and destressing as *primary metrical analysis* versus *metrical reanalysis*, involving the same re-applying set of rules. The differences result from the assumption that only the former are subject to the Free Element Condition, the requirement not to affect any element that is part of a constituent. Prince's proposal implies that stress rules have direct access to syllable weight, as rules of metrical reanalysis tend to make a distinction between stressed heavy and light syllables, leaving the former unaffected. Therefore we will assume that stress resulting from syllable weight has a global character, being an *inherent* property of heavy syllables, while binary stress is *non-inherent* in the syllable carrying it, the reflex of binary constituency. Hence in the absence of statements to the contrary, rebracketing rules cannot eliminate stresses due to weight, but they can eliminate stresses due to the constituency they overrule.

Given this background, we are now in a position to formulate the leading concept of this study, which is that word stress compositionally reflects three properties: (a) *binary constituency*, (b) *syllable weight*, and (c) higher level stress, or *prominence*. That is, these three properties are essentially autonomous, while their mutual interactions arise by co-occurrence in the bracketed grids representation of stress. The exposition will take the following course.

In the introductory chapter 0, we will present a general discussion of current issues in word stress theory, notably those that will take an important place in this study. We will also preview our approach to these issues, which involves the decomposition of word stress into three main factors: binary constituency, syllable weight, and prominence.

Chapter 1 summarizes the data of the complicated word stress system of English, and the basic issues over the past two decades. We will discuss the location of stressed syllables (stress placement and retraction) apart from the rules selecting primary and secondary stresses. We will review the role of destressing rules in generalizing stress rules. Our viewpoint will focus on similarities between stress rules (placement and retraction) and destressing rules as to *boundedness* and *Q-sensitivity*. As a general trend in the literature, the balance between stress and destressing has been redressed, where destressing has come to account for stress patterns formerly accounted for by stress rules. The main question is if binary (alternating) stress rules have direct access to syllable weight. On the one hand heavy syllables are best interpreted as basically stressed, but on the other hand, surface stress on closed syllables is sensitive to contextual stresses.

In chapter 2 we will propose an analysis of English word stress embedded in a compositional theory of stress. We will first show that Q-insensitive stress retraction can be well performed by two independently required destressing rules, i.e. Sonorant Destressing and the Arab Rule. These are rules of primary metrical analysis (Prince 1985), as they feed primary stress assignment. However, by destroying structure these rules violate the Free Element Condition. This problem is solved once it is assumed that constituency is strictly binary, because crucially, these destressing rules never affect a binary constituent. Q-sensitivity will be re-interpreted as a wellformedness condition, yielding stress values for stray syllables, which singly formed non-branching feet in earlier analyses. We will show that different word stress systems, some of which are purported examples of the necessity of non-branching constituents, are compatible with our views, and that some are even better analysable. Then we will turn to the effects of strict binarity for various aspects of English word stress, which will turn out to be positive. For instance, the rule of Pre-Stress Destressing can be simply eliminated. We will show that the basic insights of Hayes (1981) and Selkirk (1984) as to extrametricality and final stress, transfer to our theory. We will argue that *cyclicity* involves autosegmental planes (Halle & Vergnaud 1987), and that merging of cyclic planes is subject to the Elsewhere Condition (Kiparsky 1982). The latter analysis faces some problems that are partly solved in our framework. Then we will motivate the format of syllable adjunction for Post-Stress Destressing, actually the only remaining rule of metrical reanalysis. It will be formalized as a level-2 reapplication of level-1 syllable adjunction. We will discuss destressing by loss of prominence, and the effects of weight decreases and increases. As a final topic, we will analyse word-internal rhythmic adjustments.

Chapters 3 to 5 are devoted to the word stress system of Dutch. Our interest in Dutch resides in the following aspects. First, Dutch has a universally rare syllable weight distinction: open syllables with long (non-diphthongal) vowels are light, and closed syllables and syllables with diphthongs are heavy. Second, vowel reduction exhibits sensitivity to differences in the position of stressless syllables, which turns out to be captured by the Strict Binarity Hypothesis. The third interesting property of Dutch is that lexical schwa behaves as if absent at level-1, the level where primary syllabification and stress assignment reside.

In chapter 3, we will discuss three aspects of Dutch syllable structure. First, the 'bimoraic minimum', or the absence of short vowels in open syllables will be formalized by means of an obligatory level-1 rule of Core Syllable Formation, similar to Weight-by-Position

(Hayes 1989), but ordered before Onset Formation. Second, *maximum* weight constraints will be related to combinatory restrictions on consonant clusters outside the bimoraic core syllable. Third, we will address syllabification of *schwa.* Consonant clusters before schwa behave as part of the preceding syllable at level-1, which appears from consonant distribution. We will formalize this observation by leaving schwa moraically weightless at level-1, and having it syllabified only by level-2 default syllabification.

Chapter 4 addresses the location of primary stress in Dutch underived words. We will argue, with Lahiri and Koreman (1987), that the syllable weight distinction between (light) open syllables and (heavy) closed and diphthongal syllables, which is universally 'odd', results from the fact that Dutch has no monomoraic syllables at level-1, as shown in chapter 3. As Dutch lacks the mora count distinction between light monomoraic syllables and heavy bimoraic syllables, another, non-moraic distinction can take over. We will formalize the weight distinction in terms of 'melodic complexity'. This notion of weight refers to the number of feature matrices (root nodes) linked to a core syllable. As long non-diphthongal vowels involve one feature matrix, and closed and diphthongal core syllables two, the latter are heavier. A level-1 syllable adjunction rule will be proposed similar to the basic one of English. We will show that our analysis of schwa as being weightless at level-1 directly accounts for (a) its being unstressable, and (b) the fact that pre-schwa consonants add to the weight of the preceding syllable, which cannot be skipped by stress assignment, even if it is open at the surface. This analysis accounts for the basic generalizations on the location of main stress, which we will motivate by independent evidence from 'mispronunciations' and new words. We will also discuss in some detail stress patterns deviating from the 'minor' generalizations but still falling within the 'major' generalizations. The markedness of such patterns will be captured by two devices: lexical stresses and lexically governed late extrametricality. Crucially, such devices are weak enough not to annihilate the major generalizations, and thus they substantiate the partly 'free' nature of Dutch word stress.

Chapter 5 will address secondary stress and vowel reduction in Dutch, phenomena that provide independent evidence for the rules used in the analysis of primary stress in chapter 4. First we will show that secondary stress essentially recapitulates the binary, Q-sensitive nature of the rules motivated for primary stress, and that an extension of these rules to the remaining parts of the domain yields much of the actual distribution of secondary stresses. Still some level-2 adjustments are required to arrive at the surface secondary stress pattern. After this we will turn to vowel reduction hierarchies among reducible syllables. We will show that level-2 reapplication of syllable adjunction, independently needed for secondary stress, yields a distinction between 'stray' and 'adjunct' positions that vowel reduction refers to. More precisely, among two identical vowels, the one in an adjunct position reduces before the one in a stray position. This provides independent evidence for the Strict Binarity Hypothesis.

Finally, the epilogue will summarize the main conclusions of this study, and briefly address the differences between English and Dutch as to word stress.

The fifth semi-universal property of English and Dutch is that stressed and stressless syllables tend to alternate at *rhythmically ideal disyllabic distances*. Rhythmic alternation manifests itself by the avoidance of sequences of stressed syllables, as well as of long sequences of stressless syllables.

Rhythmic alternation is enhanced by the tendency for stronger and weaker stresses to alternate. Binary alternation, also called *boundedness*, is not a universal, yet it is the dominant style of alternation in stress systems that exhibit alternation. Conversely, ternary or even quaternary styles of alternation are universally highly restricted or even lacking. Therefore, binarity is no doubt a basic phenomenon in universal word stress theory. *Apalachicola* has a rhythmic pattern of alternation between stressed and stressless syllables. Light stressed syllables (the first and third) are at binary distance from other stresses. Rhythmic alternation occurs as well among the three stressed syllables, the weakest of which is the middle one.

Naturally, further universal properties could be mentioned, but for the time being we will focus on those mentioned above, and discuss the pre-theoretical conceptions of stress which they induce. Various conceptions of word stress seem in fact possible. Though these are hardly ever attested in their purest forms, they constitute the basic insights at the root of theoretical accounts of stress.

On the one hand, prominence differences between syllables seem to argue for viewing stress as a *hierarchical* property, involving three prominence levels: a stressless, a secondary, and a primary level. By hierarchical ordering between the levels, only syllables prominent at level n can be prominent at the next higher level $n+1$. Extreme versions of this idea interpret stress as the reflex of some prominence *relation* between pairs of weak and strong syllables, which recursively extends to superordinate structures over syllables, allowing for a (potentially) infinite numbers of prominence levels. These conceptions take the *culminative* property of stress and subordination as basic.

On the other hand, word stress may be interpreted as an *inherent* property of vowels or syllables, typically as a function of their quantity. That is, long vowels and closed syllables attract stress simply because of their weight. Stress will then be a reflex of syllable-internal complexity.

Finally, rhythmic alternation may lead to an interpretation of stress as the reflex of binary organization imposed on strings of syllables, in alternating patterns. Stress enhances maximal contrasts between adjacent elements, binary alternation being simply the maximal degree of rhythmic organization compatible with the requirement that adjacent stresses are to be avoided.

Shifts in conceptions of word stress have shaped theoretical developments in generative word stress theory over the past two decades, in which analyses of English have played a central role, although other languages have begun to be investigated over the past decade. The claims about word stress made in the present thesis will be largely based on in-depth analyses of only two stress systems: those of English and Dutch. We intend to offer a contribution to word stress theory which bears on common, but important theoretical issues, among which the following have attracted the largest amount of attention.

First, consider the controversy about *constituency* in stress representations, the status of which was questioned by the grid-only theory of Prince (1983), but recently revived by proponents of bracketed-grids theory (such as Hammond 1984, Prince 1985, McCarthy & Prince 1986, Halle & Vergnaud 1987, Hayes 1987, and Steriade 1988). Related to this issue is the question whether stress can be considered an *inherent* property of syllables apart from a product of constituency or not. We will argue in favor both of constituents and inherent stress on the basis of English and Dutch word stress.

The second issue concerns the relation between rules that assign stress, and rules that eliminate stress (destressing rules). The latter type has been formalized as a structure-destroying operation since Selkirk (1980) and Hayes (1981). In spite of their mutual differences, rules of stress and destressing share properties such as quantity-sensitivity and rhythmic alternation. To capture this, Prince (1985) has interpreted the relation between stress rules and destressing rules as *primary metrical analysis* versus *metrical reanalysis*, involving the same re-applying set of rules. Although this idea represents an important contribution, its application to complex word stress systems such as those of English and Dutch is not immediately obvious, and requires developing.

Before we will preview our contributions to these issues, we will introduce the formalism which will be our point of departure: the bracketed-grids theory of Halle and Vergnaud (1987). After this, we will add comments on this formalism, and point out a number of flaws. Then we will preview our own contribution, in two sections: one devoted to constituency in word stress, another to the relation between stress and destressing.

1.2 The formalism

The primary function of a linguistic formalism is to allow one to express 'significant generalizations', not just to blot down the facts in a convenient way. The most recent proposal for stress is *bracketed-grids* theory, proposed in different versions by Hammond (1984), Halle & Vergnaud (1987), McCarthy & Prince (1986), and Hayes (1987). Our interest in this theory resides in the fact that it shares important properties with the one we will eventually assume. Let us therefore investigate to which extent bracketed grids meet the criterion of expressing the linguistically relevant properties of word stress. We will take Halle & Vergnaud's version as our point of departure.

This theory assumes that stress is represented by means of a *grid* which is enriched by *bracketing* to indicate stress *constituents*. The grid is a hierarchically layered representation consisting of columns of elements (asterisks), the height of which indicates stress levels. A hierarchy between stress levels is assumed, where all elements at a level *n* must be aligned with an element on a next-lower level *n-1*. The hierarchy between the elements of different levels expresses the *subordinative* property of word stress. Adjacent elements on the same level can be organized into constituents, whose *unique* head element is aligned with an element at the next-higher level, accounting for the *culminative* property of word stress:

```
(1)              *       line 2
      (*   *     *)      line 1
      (**) (* *) (* *)   line 0
       Apalachicola
```

At the lowest level, each syllable is aligned with a place-holder grid element. At the next-higher level, only stressed syllables are aligned with a grid element. Only one of the latter elements is aligned with a grid element at the highest level, representing the primary stress. Stress rules assign grid elements and construct constituents (indicated by brackets), in a bottom-up fashion. Stress rules may insert asterisks without inserting constituent brackets. For instance, a line 1 asterisk may be assigned to each heavy syllable in a language that has a syllable weight distinction. We will call this the Quantity-Sensitivity Rule (QS), after Prince (1983):

(2) **Quantity-Sensitivity Rule** (QS)
    Assign a level-1 element to a heavy syllable.

In our example *Apalachicola*, the penultimate syllable is heavy as it has a long vowel [ow]. The application of QS yields (3):

```
(3)                                           *         line 1
     * * *   * * *   QS   * * *   * * *     line 0
     Apalachicola    =>   Apalachicola
```

Line 1 asterisks may belong to the lexical representation of a word in various ways, especially where stress is *lexically distinctive*. Lexical stresses and the Quantity-Sensitivity rule express the claim that stress can be a local and *inherent* property of its bearers (syllables, vowels). Stresses not due to inherent specifications, result from *constituent structure*.

Line 0 asterisks can be organized into line 0 constituents, which may be bounded (maximally binary), or unbounded (no maximum restriction). Each constituent has a unique head, aligned with a line 1 asterisk. The head is peripheral in its constituent, which is referred to as left-headed or right-headed, depending on the location of the head. Line 0 constituents are commonly referred to as stress *feet*.

Bounded constituents are constructed by rules scanning words in a leftward or rightward sweep. In (4), *left*-headed line 0 constituents are constructed in a *leftward* fashion:

```
(4)                                  *        *    *       *       line 1
     * * * *  * *   QS   * * * *  * *       (* *)(* *)  (* *)     line 0
     Apalachicola   =>   Apalachicola  =>  Apa  lachi  cola
```

These rules respect stresses that are already present (lexical stresses, and stresses by QS), analyzing these as pre-marked heads. When no binary constituent can be constructed, a default non-branching constituent will be constructed. This will happen to the two final line 0 elements in the example below:

```
(5)                          *  *          *    *   *       line 1
     * * * *       QS     * * * *         (* *)(*) (*)      line 0
     rodomontade   =>    rodomontade  =>  rodo mon tade
```

Halle & Vergnaud (1987) assume that default constituent construction is an effect of the condition that constituent structure be *exhaustive*, or in slightly different words, that the entire domain be parsed into constituents.

Apart from *bounded* constituents (which contain two elements maximally), *unbounded* (unrestricted) constituents may be constructed. Such a constituent type is involved in primary stress assignment in English. A *right*-headed unbounded constituent is constructed on line 1, resulting in a line 2 asterisk, the primary stress:

```
(6)a.           *     b.           *      c.            *     line 2
     (*    *    *)      (*    *    *)       (*   *      *)    line 1
     (* *)(* *) (* *)   (* *)(*)  (*)       (*)(* *)  (* *)   line 0
      Apa lachi cola    rodo mon tade       Ti conde  roga
```

The delimitative property of word stress now follows from the condition that heads be *peripheral* in their constituents. The culminative property of word stress follows from the condition that all elements on a line *n* correspond to an element (a *landing site*) at line *n-1*.

1.3 Remarks on the formalism

An important functional difference exists between bounded and unbounded constituent-building rules, which can be formulated as follows. Bounded rules scan the word, parsing the domain into constituents. This parsing function is absent in unbounded rules, as shown in (6), line 1. Since the unbounded constituent boundaries on line 1 coincide with the boundaries of the stress domain, which makes them essentially *redundant*, they have a function different from constituent boundaries laid down by bounded rules. These rules are essentially *counting devices*, whose output is clearly non-redundant with respect to the stress domain, every output boundary fixing the location of subsequent boundaries. Halle & Vergnaud (1987:121) seem to agree on this important difference.

Since boundaries of unbounded constituents are basically redundant, the delimitative and culminative functions of line 1 unbounded rules can be relegated to *constituentless* End Rules (Prince 1983). End Rules promote a *peripheral* asterisk to a new and *highest* level in the domain, without constructing an unbounded constituent. See (7)[1]:

```
(7)a.             *     b.              *     c.             *     line 2
       *    *     *          *     *    *          *   *     *     line 1
      (* *)(* *) (* *)      (* *) (*)  (*)        (*) (* *) (* *)  line 0
       Apa lachi cola        rodo mon tade         Ti conde roga
```

There is also a type of line 0 *bounded* constituent that has exactly this kind of redundancy: *non-binary* constituents, which always result from *default* construction applying when no binary constituent can be built. Boundaries of non-binary line 0 constituents are never crucial to the location of *following* boundaries, just as boundaries of unbounded constituents never crucially determine the location of other boundaries. To illustrate this, observe that default application occurs either (i) when the bounded rule reaches the end of the stress *domain*, where simply no following constituent can be constructed, or (ii) when the bounded rule must respect an *existing* stress. Consider the latter situation:

```
(8)a.                       *           *    *               *  *
       * * * *   =>  * * (* *)   =>  (* *)(* *)   NOT:  * (* *)(*)

   b.      *             *  *              *  *                  *
       * * * *   =>  * * * (*)   =>  * (* *)(*)   NOT:  *  * (* *)
```

A right-headed rule scans the domain in a right-to-left fashion. On its first application two logical possibilities exist: either it will apply in a maximal fashion (8a), or not (8b), obliged as it is in the latter case to respect the existing stress on the penult. Thus a non-branching constituent is constructed by default. Note that the left-boundary of this constituent need not be visible for a correct second application of the bounded rule, for the existing stress must be respected in any case. Then consider (7a); here, the left-boundary of the binary constituent of the first application is crucial to a correct execution of the second application. As the penult has remained stressless after the first application, only the constituent boundary to its left can be the cause of the failure of the the penult to be incorporated over again as the head of a new constituent.

The redundancy of non-branching constituents (whose only syllable is not inherently stressed by syllable weight, or otherwise) is reflected in analyses of many stress systems either by the simple device of deletion at the end of the relevant derivation, or invisibility to End Rules.

This raises the question of what arguments in fact support the notion of non-branching default constituents. Strong arguments for stress constituency have been presented in the recent literature, for example the migration of stress within constituents (see Rappaport 1984, Al-Mozainy, Bley-Vroman, and McCarthy 1985, and Halle & Vergnaud 1987). But these arguments typically involve *binary* constituents. Of course, a strong argument for default constituents would arise if stress would be systematically attested in positions where they would be built. But the nature of default constituents makes it extremely hard to find the contexts where their superiority might show. This is because (as shown above) default constituents arise either at the end of domains, where a stress might as well be due to End Rules, or in positions where existing stresses need to be respected, so that default constituent construction trivially brackets the stress already present (such as a heavy syllable) as a head. Another difficulty in providing crucial evidence for default non-branching constituents is that purported instances are always subject to reanalysis by reversing the head side of binary constituents. Some cases which even seem to resist such a reanalysis will be discussed in chapter 2.

The above observations indicate that binary constituents are *true* constituents, whereas non-binary constituents are not, or doubtfully so. This conclusion will provide the basis of our eventual proposal.

1.4 Eliminating non-binary constituents

In contrast to the assumptions of bracketed-grids theory discussed so far, we will claim that constituents in word stress strictly involve *two* elements which are organized into constituents by *adjunction* rules. As a result bracketed grids are impoverished, because all constituency at all levels is eliminated when it is not strictly binary. Among the victims are *non-branching constituents (also known as monosyllabic feet)* and, at the next higher level, *unbounded* constituents used in assigning main stress. The function of the former is transferred to inherent stress or *syllable weight*, the function of the latter to the constituentless End Rule. From these remarks, a version of bracketed-grids theory arises that is halfway the Halle & Vergnaud and Hayes bracketed-grids theory and the *grid-only* theory of Prince (1983). That is, we will argue in favor of (9):

```
(9) Strict Binarity Hypothesis
    Stress constituency is strictly binary.
```

Moreover, we will provide an explanation for the strictly binary nature of constituency. This resides in *metrical adjunction*, to which we will turn shortly.

To illustrate differences between our proposal and previous ones, let us compare the representation of *Ticonderoga* in (10) to its bracketed-grids representation of (6c). The differences are twofold: (i) the absence of non-branching constituency of the initial syllable, and (ii) the absence of unbounded constituency at the next-higher level. We add the example *Monongahela*, in order to illustrate an important argument for (9):

```
(10)a.          *         b.          *      line 2
       * *      *                *    *      line 1
       *(* *)(* *)          *(* *)(* *)      line 0
      Ticonderoga          Monongahela
```

The initial syllable of *Ticonderoga* derives its stress from its weight, as it contains a long vowel. As an argument supporting the redundancy of monosyllabic feet, the need for a special rule to *destress* the initial light syllable of *Monongahela* (10b) disappears. Our proposal clearly explains why heavy syllables are systematic exceptions to a destressing rule of English that is generally assumed to trim initial non-branching default constituents.

Our notation eliminates the notion of *stressless foot*, introduced in Hayes (1987), although it shares the intended insight. Essentially, a stressless foot is a constituent consisting of one light syllable (and lacking stress), see (11b):

```
(11)a.  *          b.           line 1
       (*)            (*)       line 0

      Heavy        Light
      Syllable     Syllable
```

Of course, stressless feet as such are intended to capture the fact that default constituents are normally stressless if there is no incentive for stress (such as syllable weight). But some *stipulation* to that effect is required (stresslessness must be indicated in the foot inventory), while we directly derive it from syllable weight, by QS[2]. As compared to Hayes (1987), the elimination of non-branching constituency allows one to preserve the generalization that *every stress constituent* has a (stressed) *head*. Thus, stress will remain an automatic consequence of constituency[3].

Although heavy syllables are inherently stressed, light syllables can be stressed only by being the head of a binary constituent, or by a default application of an End Rule at the lowest grid level. Therefore, stressed light syllables can only be adjacent to a stressless syllable or must be domain-peripheral. Let us now discuss rules constructing binary constituency and End Rules.

Constituents arise by adjunction of a grid element to an adjacent element at the same level. Since adjunction inherently requires exactly two grid elements, all constituency will be *binary*. Adjunction is an instantiation of a general prosodic scheme, and related to the arboreal adjunction type proposed by Hayes (1984) for phrasal rhythmic adjustment. Some term X is adjoined to Y, where (by convention) Y is the head of the new constituent, and X the subordinated (domain) element.

Adjunction of line 0 elements will be referred to as *Syllable Adjunction* as it affects place-holders. A line 0 asterisk Y adjoins to another line 0 asterisk X, resulting in a binary constituent with X as its head:

```
(12)a.                 *        line 1
        *  *    =>   (*  *)     line 0
        σX σY         σX σY
```

Both the direction into which grid-elements are adjoined and the side of the domain where the adjunction process starts may be subject to further restriction. For example, English has a left-dominant rule which applies from right to left through the domain. See (13), which reduplicates (4):

```
                                    *        *    *       *    line 1
(13)
     * * * *  * *   QS   * * * *  * *     (* *)(* *)  (* *)  line 0
     Apalachicola   =>   Apalachicola  => Apa lachi cola
```

Primary stress is assigned by the End Rule, whose peripheral application has been illustrated in (7). If a landing site at line 1 (a stressed syllable) is absent, the End Rule defaults to line 0. Default application was part of Prince's original proposal on End Rules (1983:76). In English, a default application of the End Rule arises only if neither the Quantity-Sensitivity Rule nor Syllable Adjunction produce line 1 elements, in other words, when the stress domain consists of one light syllable. This is the only available landing site for the End Rule, especially in disyllabic words with a light initial syllable, when the final syllable is extrametrical (as it usually is in English nouns, cf. Hayes 1981)[4]. In such cases, a line 2 element is located over the only column in the domain, even if this column consists of a line 0 element. We assume that a line 1 element is automatically supplied here, to avoid gaps in grid columns, cf. Halle & Vergnaud 1987:

```
(14)                                                          *       line 2
                          *                   *               *   *   line 1
   *   *               *   *               *   *              *   *   line 0
sa<tire>em   =>   sa<tire>em   =>   sa<tire>em   =>   sa<tire>em
             QS                SA                ER
```

Essentially, default application of the End Rule matches the requirement of stress languages that (lexical) words be capable of bearing a (pitch) accent, regardless of their phonological composition. The lexical stress is simply the landing site for the accent. No other way exists of making the independent notions of 'lexical word' and 'accentable' coincide except by obligatorily applying the *primary stress rule* to *all* lexical words. The same is true for any other theory, including those assuming default constituency. In a sense then, word stress theory provides the potential targets, i.e. *landing sites*, for accents.
This theory therefore has three types of stress rules: (i) rules stressing heavy syllables, (ii) adjunction rules, (iii) End Rules. The first type captures *quantity-sensitivity* as a major property of word stress systems; the second captures the *rhythmic* (bounded) properties; the third captures the *delimitative* and *culminative* properties. Clearly the second and third types of rule are not restricted to *word* stress, as they are also found in phrasal stress (Prince 1983, Selkirk 1984, Hayes 1984).
Essentially, the elimination of non-binary constituents that we propose leads to a compositional theory of word stress, where stress is a reflex of (a) syllable weight, (b) binary constituency, or (c) prominence. In fact, this is the major claim to be made in this thesis, which will be supported by analyses of the stress systems of English and Dutch.
Our prediction is that syllables outside binary feet are never stressed unless they are (i) heavy, or (ii) stressed by a default application of an End Rule at line 0. In contrast, the prediction of Halle & Vergnaud (1987), and most of its ancestor theories, is that light syllables will receive stress if they form the head of a non-branching foot. Of course, these contradictory predictions can be checked only by a confrontation with stress data. This thesis will do so by investigating the word stress systems of English and Dutch. However, we will pay some attention to other systems as well. In order to assess the effects of our proposal outside the domain which originally provided its motivation, we will inspect a number of systems frequently discussed in the literature: we will find that they support it. Nevertheless, our primary attention will be in English and Dutch.

English word stress has been a topic of continuous theoretical interest over the past decades. In Chomsky & Halle (1968, henceforth SPE), it illustrated central notions such as cyclic rule application, disjunctive ordering, and crucial variables in rules. It played a major role in non-linear stress theory from Liberman (1975) onwards to Halle & Vergnaud (1987). The English word stress system is complex, since it seems to involve more than one criterion of syllable weight; it has abundant lexically marked stress, and a complex array of cyclic stress phenomena.
Dutch word stress has received considerably less attention, at least in the international forum. Nevertheless it may boast quite interesting characteristics, in particular with respect to syllable weight. Growing current interest in the theoretical contribution to phonology, however, has brought along an increasing amount of literature as well, and we will have occasion to review it more extensively below.

1.5 Collapsing stress and destressing

In recent theories of word stress, a rule type is assumed which *deletes stresses*, or indirectly eliminates stresses by deleting the *constituent* of which these stresses are the head. This rule type is most frequently referred to as *destressing*. The commonest function of destressing is that of trimming the overgeneration of the stress rules, thus making possible a maximally general formulation of the latter. Thus, in English, destressing is applicable when a syllable can be *reduced* in spite of its being stressed in the output of the stress rules. The examples below show the application of destressing. A deletion of either stress or constituency will derive the proper output stress values:

```
(15)a.      *                *     b.              *              *
          (*   *)           (*)          (*   *        *)      (*              *)
          (*)(*   *)       * (* *)       (*)(*  *)  (*)        (*)  *    *  (*)
          ba na na => ba na na           Ka la ma zoo   =>  Ka la ma zoo
```

In (15a), destressing of the initial syllable leaves it reducible, while in (15b), destressing imposes the same effect on the second syllable.

If destressing is to play an explanatory role in theories of word stress, it may not be used in an ad-hoc way to patch up failures of stress rules without a principled basis. In order to provide such a basis, the literature proposes universal restrictions on destressing, such as the immunity of a syllable with primary stress (Hayes 1981), and obligatory adjacency of a stress next to destressed syllables, known as a *clash* (Hammond 1984).
Another inhibiting factor for destressing rules is *syllable weight*. The vowels of heavy syllables that fail to reduce, in contrast to the light syllables in (15), illustrate this:

```
(16)a.        *                     *
         (*    *)                  (*)
         (*)  (*   *)          *   (*   *)
         ban da na    =/=> ban da na

    b.                  *                          *
         (*   *         *)            (*           *)
         (*)(*     *)(*    *)         (*)  *    *  (*    *)
         Ti con de ro ga =/=> Ti con de ro ga
```

In most theories, the quantity-sensitivity shared by rules of stress and destressing has been treated as a complete coincidence. We know of only one attempt to explain the common aspects of the rule types. Before we discuss this, note that we already have in hand the explanation for the contrast between *banana* and *bandana*, or *Monongahela* and *Ticonderoga*:

```
(17)a.    *              *       b.     *              *
          *         *    *            *  *         * *     *
        *(* *)   *(* *)(* *)          * (* *)     *(* *)(* *)
        banana   Monongahela          bandana    Ticonderoga
```

Our proposal to restrict bounded constituency to binary relations makes the correct prediction that stress values of the initial syllables in (17) directly depend on their weight values.
It is Prince (1985) who addresses the Q-sensitivity of destressing, reflected by the contrast between *Kàlamazóo* and *Tìcònderóga*, in a principled manner. He proposes to formally relate destressing rules and stress rules, both being instantiations of *foot assignment*. The

difference is that stress rules respect structure (foot boundaries and stresses) laid down by earlier stress rules, while destressing rules do not. The former are subject to (18):

(18) **Free Element Condition** (FEC)
Rules of primary metrical analysis apply only to Free Elements -- those that do not stand in the metrical relationship being established; i.e. they are "feature-filling" only.

The Free Element Condition explicitizes an implicit mode of application of previous analyses. The FEC is understood to block, for example, the application of binary stress rules to that part of the domain that has already been organized into constituents, blocking (19b):

```
(19)a.                          *                *     *
         * * * *            * *(* *)          (* *)(* *)
         Alabama    =>      Alabama      =>   Ala bama

   *b.                          *                *                  *
         * * * *            * *(* *)          *((* *)*)        (((* *)  *)  *)
         Alabama    =>      Alabama      =>   A laba ma   =>     Ala ba ma
```

Destressing rules may therefore be viewed as reapplying stress rules: "destressing is the reassertion of the basic foot vocabulary in the *feature-changing* mode; that is, no longer governed by the FEC." (Prince 1985:482). As quantity-sensitivity is stated in the basic foot vocabulary, it will be a property of both stress rules *and* destressing rules. Obviously this interpretation of quantity-sensitivity presupposes (contrary to the theory of Halle & Vergnaud 1987) that rules which construct constituents can have *direct access* to syllable weight. We will return to this presupposition in due course.

An example of a foot assignment rule reapplying as a rule of destressing is the English Stress Rule. Destressing of the second syllable in (20b) is performed by the re-application of the quantity-sensitive left-headed binary foot rule, called ESR:

```
(20)a.                                                              *   line 2
                                  *    *    *             (*   *    *)  line 1
          * * * *         ESR   (*)(* *)(*)        ER     (*)(* *)(*)   line 0
        Kalamazoo          =>   Ka lama zoo        =>     Ka lama zoo

     b.            *                       *
        (*  *      *)              (*      *)
        (*)(* *)(*)       ESR     ((* *)  *)(*)
        Ka lama zoo        =>      Kala ma zoo
```

Notice how the ESR *rebrackets* the original string in a way incompatible with the input, and at the same time imposes a new head-domain relation on it. This new relation requires a *unique* left-hand head, in the form of a line 1 element on the initial syllable, and the *absence* of such a line 1 element on the second syllable. This causes the *destressing* of the second syllable. The quantity-sensitivity of the rule prohibits its application to *Ticonderoga*, where it would have to overrule an inherent stress resulting from *syllable weight* on the closed second syllable.

This seems to imply that rules of destressing have access to the source of individual stresses, since they discriminate between *weight* stresses and *binary* stresses, respecting only the former. Another way of putting this is that stress by syllable weight has a global character, since it is an *inherent* property of heavy syllables, while binary stress is *non-inherent* in the syllable carrying it, but rather forms the reflex of binary constituency. Hence, without any statement to the contrary, rebracketing rules cannot eliminate stresses due to weight but they can eliminate stresses due to the constituency they overrule. We have now arrived at a second observation favoring a *compositional* interpretion of stress:

(21) Stress rules which affect constituency, hence bracket or rebracket strings, do not alter stresses derived from syllable weight.

In fact, this observation is valid for most stress systems with syllable weight distinctions and binary (*bounded*) constituency. It does not state however, that *syllable weight* is respected by all types of stress rules. For instance, languages with syllable weight distinctions may have vowel shortening rules which result in light syllables. When the stress on the long input vowel derives from its quantity, it will be automatically lost by vowel shortening. Essentially, under these circumstances, vowel shortening applies as a *deweighting* rule. Examples of deweighting are present in English, where it affects metrical bracketing as well.

At least one rule exists in English which brackets strings of syllables, simultaneously destressing a *heavy syllable*. The stress pattern of words such as *Háckensàck* warrants this claim: they have the well-known property of having a medial syllable closed by a sonorant, and skipped by stress. We will call the rule involved the *Sonorant Stress Rule* (SSR)[5]. See (22):

```
                                                                      *
(22)                        *    *             *      *               *        *
   *   *    *       QS   *   *    *      SSR (*   *)    *        ER (*    *)    *
 Hacken<sack>em   => Hacken<sack>em     => Hacken<sack>em    => Hacken<sack>em
```

The Sonorant Stress Rule assigns bracketing since it results in a stress on the light initial syllable, which cannot be due to syllable weight. A *left*-headed binary constituent must be constructed for this stress to be realized. Furthermore, the rule is a *deweighting* rule because it makes the medial syllable susceptible to vowel reduction. The major difference between the binary ESR and the SSR is that the former respects stress by syllable weight, while the latter clearly does not for a specific type of closed syllable. This difference stems from the fact that the ESR only provides bracketing, and does not refer to syllable composition. But the Sonorant Stress Rule, as a deweighting rule, does refer to syllable composition, more precisely to short vowel syllables closed by sonorant consonants. Clearly, the complexity of the English stress system is highly increased by the Sonorant Stress Rule, since it interferes in the one-to-one relation between syllable weight and stress, which otherwise exists in quantity-sensitive systems[6].

In spite of its marked status, the Sonorant Stress Rule has interesting properties bearing directly on our Strict Binarity Hypothesis in (9): as a rule of primary metrical analysis, it respects the Free Element Condition. Consider the following.

We will interpret rules of primary metrical analysis to include *at least those operating prior to prominence assignment*. Specifically, only rules of primary analysis can feed End Rules, thus determining the position of the primary stress. Clearly, the above rule meets the criterion for being a rule of primary metrical analysis, since it *bleeds* the End Rule, which would otherwise have assigned main stress to the closed penult, as in *Adiróndack*, and other words with an additional syllable as compared to *Hackensack* (we will shortly return to the cause of this difference). But there is yet another way of showing that the Sonorant Stress Rule is a rule of primary metrical analysis: it respects the Free Element Condition:

```
(23)a.                        *    *          *   *   *             *    *
        * * *    *    QS   * * *    *   ESR  (* *)*    *    SSR  *(* *)   *
        Adiron<dack> =>    Adiron<dack> =>   Adiron<dack>  =/=>  Adiron<dack>

    b.                     * *      *        *      *            *       *
        * *  *  *     QS   * *  *  *   ESR  *(*   *)  *     SSR  (* *)  *  *
        emanci<pate> =>    emanci<pate> =>   emanci<pate>   =/=>  emanci<pate>
```

To see this, observe that the Sonorant Stress rule is blocked exactly in those cases where it would destroy an existing constituent. In (23a), it would adjoin a syllable into a preceding constituent, thereby destroying the latter, whereas in (23b) adjunction would extract a syllable out of a constituent, with the same effect. In contrast, the SSR may apply when it does not destroy constituents, as in *Hackensack* (22).

This forms a strong argument in favor of the Strict Binarity Hypothesis. As a rule of primary metrical analysis, the Sonorant Stress Rule respects constituency. However, it is only *binary* constituency that is respected (cf. 23), not '*default*' constituency (see 22). In order not to complicate the Free Element Condition in a completely ad-hoc fashion, it may be concluded that default non-binary constituency actually does not exist.

Another important conclusion is that the Sonorant Stress Rule eliminates stresses due to syllable weight, though it is a rule of primary metrical analysis. Does this imply that any pre-marked stress can be eliminated at will? The answer must be negative. There is considerable evidence from English and Dutch, as well as from other languages, that *lexically marked* stress is respected by stress rules. In English, the closed medial syllable in words such as *chìmpànzée* is respected by the Sonorant Stress Rule though it is outside a binary constituent, cf. (24) below. But how is the Sonorant Stress Rule to distinguish stresses which are due to syllable weight from lexically supplied stresses?

The key to the solution of this problem is that weight stress from QS is phonologically *derived*, whereas lexically assigned stress is part of the *lexical representation*. This distinction plays a major role in the theory of Lexical Phonology, as put forward in Kiparsky (1982), on which it will be useful to call for an explanation. This theory blocks (cyclic) rules from neutralizing lexically marked features, see (24):

```
(24)      *              * * *              *     *
        * * *    QS      * * *    SSR      (*   *) *
      chimpanzee =>   chimpanzee  =/=>   chimpanzee
```

The SSR cannot apply so as to neutralize the lexically marked stress on the medial syllable. In fact, this implies that the Elsewhere Condition (or Strict Cyclicity) is motivated independently of the Free Element Condition, even though both seem to have the function of preventing stress rules from applying to existing structure[7].

1.6 Conclusions

In the preceding sections, we have presented a general discussion of current issues in word stress theory, the ones that will take a central place in this study. We have also previewed our approach to these issues, which can best be typified as a *decomposition of word stress into three factors: binary constituency, syllable weight, and prominence*. The remainder of the chapter will sketch the developments in word stress theory over the past two decades, not so much as a history of analyses of specific stress systems, but as a way of further illustrating the basic conceptions of word stress as introduced earlier. Moreover, this discussion will provide the background for our review of the data and issues of English word stress, to be presented in chapter 1, and those of Dutch, to be presented in chapter 4.

2. Theoretical ancestors

2.1 Introduction

This section will provide a general introduction to the phenomenon that is the topic of this thesis, viz. word stress, and to the theoretical framework which we will adopt, viz. generative phonology, and in particular *metrical* phonology. We will discuss the general trends in generative stress theory over the past two decades, from SPE up to bracketed-grids theory. This will provide the apparatus necessary for a discussion of previous analyses of English and Dutch to be presented in chapters 1 and 4. The review will include aspects of phrasal stress which are indispensable to a proper understanding of the way stress has been interpreted in different theories.

2.2 Linear stress theory

The basic conception of stress as it emerges from linear theory (SPE and many following publications) is not different from other phonological distinctive features such as [+nasal] and [+high]. Being a property of vowels, the stress feature is part of the segmental feature matrix, its restriction to vowels being expressed in the rules which assign it. The only differences between the stress feature and other features stem from special conventions associated with the rules which assign it. We will discuss these below.

2.2.1 Stress as a multi-valued feature

The major deviating property of the stress feature as compared to other distinctive features is its *n-ary* rather than binary quality. This multi-valuedness is required since stress does not only involve the contrast between stressless [-stress] and stressed [+stress], but also between primary and subordinated stress levels. The positive value of the stress feature ranges over positive integers, where [1stress] denotes primary stress, [2stress] secondary stress, etc. No a priori theoretical limit is imposed on the number of stress levels. SPE claims that stress levels produced by the stress system are phonologically *'idealized'* stress values, and overly detailed distinctions may remain uninterpreted phonetically. As an example of an output stress representation, consider the phrase *absolute equality*:

```
(25)      absolute equality
          2  - 4   4  1 - -
```

In underlying representation, the feature is by convention specified as [-stress], and this value is automatically maintained in vowels that are left unaffected by the stress rules, such as those of (25). Stress rules typically assign the value [1stress], while weaker stresses generally result from (multiple) lowerings of [1stress] by a convention, the so-called Stress Subordination Convention, which we will discuss in the next section[8].

It should be kept in mind that the distinction between [-stress] and all other stress values is of great importance, and is often referred to as 'stressless' versus 'stressed'. The distinction may have local effect on the relevant vowel, as in English stressless vowels generally reduce to schwa, whereas all 'stressed' vowels retain their quality. In contrast, no local effects on vowels originate from distinctions between [2stress] and [3stress], for example.

In linear theory, quantity-sensitivity cannot be directly expressed by means of syllabic complexity, as words are essentially strings of consonants and vowels, without any internal phonological constituency. Distinctions corresponding to syllabic weight are made by reference to properties of (strings of) segments, such as the vocalic feature for *tenseness* and the *number of post-vocalic consonants*. They refer to weight by the exclusion of 'heavy' strings from the skipping term in the stress rule. If the string encountered in the word does not match this term, or if no string is present that can be skipped, stress is assigned to the first vowel encountered. This may be the vowel of a heavy string or the one remaining vowel in the domain. This so-called *disjunctive* mode of application guarantees that all lexical words, including monosyllables, have minimally one stressed vowel.

2.2.2 **Stress subordination**

In the SPE-system, culminativity, or uniqueness of primary stress, is guaranteed by a convention accompanying the application of stress rules: "when primary stress is placed in a certain position, then all other stresses in the string under consideration at that point are automatically weakened by one" (SPE p. 16-17). Consider the operation of the word stress rules in *absolute*:

```
(26) absolute
     -   - 1    Main Stress Rule
     1   - 2    Alternating Stress Rule
     1   - 3    Stress Adjustment Rule
```

The Stress Subordination Convention can operate only when a stress rule applies to a string containing positive stress values, resulting from earlier application of a stress rule. (26) contains an example of this procedure, but the situation is in fact characteristic of *cyclic* rule application, and SPE explores it in depth.
Cyclic rules apply to successively larger morpho-syntactic domains, from the smallest and most deeply embedded domains, to the largest outermost domains. Cyclic stress rules are of the following format:

```
(27)  V  =>  [1stress]  /  [ X ___ Y ]α
```

X and Y provide the segmental context of the rule (including conditioned variables in some cases), and '[...]α' indicates a syntactic domain. Furthermore, the focus vowel may be required to carry [1stress] itself, in which case the effect of the stress rule is the subordination of all other stresses in its domain. As an example, reconsider the case of *absolute equality*, the morpho-syntactic structure of which is indicated by square brackets.

```
(28)  [ [ absolute ] [ [ equal ] ity ] ]
                 1        1                (a)
                        ________
            1    2        2  1             (a)
            1    3        3  1             (b)
         __________   ____________
            2    4        4  1             (b)
      _________________________________
```

The word stress rules, indicated by (a), cyclically apply to the words *absolute* and *equality*, the latter of which has an embedded morphological domain itself. The cyclic rules marked (b) require the input vowel to be [1stress], and serve to subordinate the other stresses in the domain to it, including any other [1stress]. A vowel's resulting stress value is determined by the number of subordinations it undergoes. Therefore, the focus vowel of the final cyclic stress rule on the outermost domain ends up as the primary stressed one.
Perhaps the most prominent, empirically motivated, effect of the cyclic application of stress rules (based on observations due to very early pre-generative work by Chomsky, Halle & Lukoff 1956), *prominence relations are preserved under embedding*. This follows from the fact that cyclic stress rules cannot return to subdomains, so that the internal non-

primary stress values within subdomains are all equally weakened by stress subordination, and hence the prominence relations among them.
Subordination also preserves the basic distinction between *stressless* and *stressed*, since weakening of a positively specified stress value can only affect its stress level, but never the presence of stress as such.

2.3 **Revising SPE-theory: stress as a binary feature**

The most important theoretical innovations after SPE addressed exactly the two differences between types of stress distinction: the *absolute* distinction between stressless and stressed vowels on the one hand, and the *relative* distinction among stressed vowels on the other hand. The basic idea of Schane (1975) and Halle (1973) (in that order of writing) was that this difference should be reflected in the theory. These publications propose to change the status of the Stress Subordination Convention to being specifically associated with stress rules which take [1stress] in both their focus and their output value. A first consequence is that rules which change specifications of 'stress', i.e. word stress rules inserting [1stress] on stressless vowels, go without stress subordination. Essentially, such rules assign a binary value of [+stress], providing the anchoring points among which the compound and phrasal level 'subordinating' stress rules fix relative prominence, expressed in n-ary values. As an example, see the derivation of *absolute equality* in this framework:

```
(29)  [ [ absolute ] [ equality ] ]
          +   - +      +  + - -       (a)
          1     2      2  1           (b)
          1     3      3  1           (b)
        __________   __________
          2     4      4  1           (b)
      _____________________________
```

A strict distinction is made between (a) rules which insert [+stress], and (b) rules which take [+stress] as their input, and have numerical output values.

2.4 **Metrical theory**

2.4.1 **Stress as a relational feature**

Schane's and Halle's insights were the basis of an important theoretical innovation introduced by Liberman (1975) and Liberman & Prince (1977), which has become known as *metrical phonology*. In metrical theory, stress is seen as a property reflecting a *relation between elements*, not a property of individual elements. Prominence relations are encoded in a binary branching constituent structure, in which pairs of sister nodes are labeled Strong-Weak, or Weak-Strong. The metrical tree of our example *absolute equality* takes the shape of (30):

```
(30)             / \
                /   \
               /     \
              /       \
             /         s
            /         / \
           w         /   s
          / \       /   / \
         s   \     /   s   \
        / \   \   /   / \   \
       s   w   w w   s   w   w
       ab so lute e qua li  ty
```

The relational aspect of stress is optimally expressed by means of a weak-strong labeled tree. The labels s,w do not have an interpretation separate from one another, but denote the *two-place* relation *'stronger than'* between members of node pairs. The relative prominence of a node is interpreted from its position in the tree, as a product of its labeling and depth of embedding. Because stress is always a relation *between* nodes, there will always be a *unique* element with primary stress in each constituent, i.e. the stress only dominated by strong nodes within that constituent: the Designated Terminal Element. The DTE of *absolute* is the vowel in the initial syllable, that of *equality* the vowel in its antepenult. Therefore, as a theorem of binary branching and strong-weak labeling, each word contains a *unique* primary stress.
The subordinating stress rules of linear theory (Schane/Halle) translate into metrical theory as *tree labeling principles*. Typically, labeling depends on tree geometry, especially on the branching of nodes. Consider, for example the Lexical Category Prominence Rule, the rule that labels internally the sub-trees over *absolute* and *equality* in (30).

(31) **Lexical Category Prominence Rule**
In a pair of sister nodes $[N_1N_2]$, N_2 is strong iff it branches.

Stress subordination is a direct consequence of the notation, as well as of the preservation of prominence under embedding. Liberman & Prince demonstrate that the numerical stress values of linear theory can be obtained by the counting algorithm in (32):

(32) If a terminal node *t* is labeled *w*, its stress number is equal to the number of nodes that dominate it, plus one. If a terminal node *t* is labeled *s*, its stress number is equal to the number of nodes that dominate the lowest *w* dominating *t*, plus one.

This produces the contour 2-3-3-1 in the tree *absolute equality* for the nodes *ab, lute, e,* and *qua*. Liberman & Prince suggest an important alternative way of representing stress contours, however: the *metrical grid*, introduced by Liberman (1975) as a means of deriving rhythmic structure from metrical trees. As we have seen in section 1, the grid is a hierarchically layered representation, consisting of columns of elements, height of columns indicating metrical strength. The relation between the metrical tree and the grid is defined by the well-formedness condition (33):

(33) **Relative Prominence Projection Rule** (RPPR)
In any constituent on which the strong-weak relation is defined, the designated terminal element of its strong subconstituent is metrically stronger than the designated terminal element of its weak subconstituent.

As an example, consider (34)[9]:

```
(34)            / \
               /   \
              /     \
             /       \
            /         s
           /         / \
          w         /   s
         / \       /   / \
        s   \     /   s   \
       / \   \   /   / \   \
      s   w   w w   s   w   w
      ab  so lute e qua li  ty
      *   *   *   * *   *   *
      *             *
                    *
```

Liberman & Prince demonstrate that grids are superior to numerical SPE stress contours in two respects. First, they reflect only part of the over-differentiated n-ary values inherent to SPE stress numbers, offering a much *flatter* representation. Specifically, they do not impose prominence differences among terminal nodes that are labeled weak, i.e. nodes which are not in a relation of relative prominence in the tree. Second, grids provide a more insightful representation of *rhythmic* structure than numerical SPE stress contours because of their hierarchical nature. Importantly, grids reflect pressure for rhythmic adjustment, as in well-known cases such as *thirtéen* - *thìrteen mén*. Liberman & Prince formalize this adjustment as a reversal of a prominence relation in the tree (the Rhythm Rule), triggered by a *stress clash* - a situation of adjacent prominences in the grid, indicated below with hyphens:

```
(35)          / \                   / \
             w   \                 w   \
            /\    \               /\    \
           w  s    s             s  w    s
        thirteen men    =>    thirteen men
           *   *   *             *  *    *
               *----*            *       *
                   *                     *
```

Also, the rhythmic alternation in long words is reflected in the grid by the recurrent pattern of strong and weak beats, see (36):

```
(36)           /\
              /  \
             /    s
            /    / \
           w    w   s
          / \  / \ / \
          s w s  w s w
          Apalachicola
          * * *  * * *
          *   *    *
                   *
```

Liberman & Prince's metrical model is very well fit to capture the relational aspects of stress, as well as the culminative property. However, although we did not illustrate this, the Liberman & Prince theory was not completely relational, since the binary [+/-stress] feature, cf. (29), was maintained, in addition to trees and grids. Liberman & Prince were forced to do so because of the non-relational stressed/stressless distinction, which is present on the final syllables of *ábsolùte* and *éxcellent*. As a second argument for some non-relational aspect of word stress, consider the fact that all lexical words carry a primary stress, including monosyllables. But monosyllables cannot be stressed by any internal strong-weak labeling, and therefore require a separate specification for [+stress] in Liberman & Prince's theory.

2.4.2 **Stress as a prosodic category**

The elimination of [+/-stress] from metrical theory was proposed in the metrical frameworks of Vergnaud & Halle (1978), Selkirk (1980), and Hayes (1981), in the form of *stress feet*. These frameworks represent stress in a completely hierarchical way, eliminating the binary stress feature in favor of a purely tree-wise layered representation. Selkirk (1980) serves to illustrate this development, especially so because this theory enriches Liberman & Prince's tree notation with so-called prosodic categories[10].

Among these prosodic categories, the *foot* takes the role of substituting the segmental feature [+stress]. Each syllable that is the strong or the only member of a constituent foot is interpreted as stressed, regardless of the presence of other syllables in the foot. *Being the head of some prosodic category implies carrying the stress inherently associated with that category.* Just as the foot is the category associated with the notion of *stress*, the prosodic word is the category associated with the *primary stress*. See (37):

```
(37)a.          b.            c.            d.         M
                   M                                  / \
                   |                                 /   \
      M            F              M                 /     s
      |           /\             / \               /     / \
      F          s  \          Fs   Fw           Fw     Fw    Fs
      |         / \  \        /\    |           / \    / \   / \
      σ        σs σw σw      σs σw  σ          σs σw  σs σw  σs σw
    blues     excellent     absolute           A  pa  la chi co la
```

A prosodic constituent is said to constitute a level, and each constituent has as its terminal nodes the prosodic categories of the next-lower level. One of these terminal nodes is the unique and obligatory *head* of the category. It is either its only member or its strong(est) member. The head is uniquely determined since each prosodic category respects a *uniform direction* of branching and labeling.

The culminative aspect of word stress then follows from the requirement that the prosodic structure of each lexical word contains the categories *syllable*, *foot*, and *word*, each of which has a unique head: thus the prosodic hierarchy is *closed*. At the same time, internal strong-weak labeling of prosodic constituents captures the relational aspects of word stress in exactly the same way as in Liberman & Prince (1977).

Since each level in the prosodic hierarchy is uniquely and obligatorily headed, the theoretical *upper limit* to stress levels equals the number of categorical prosodic levels. Specifically, in word stress theory a three-way distinction arises between *stressless* syllables (weak in a foot), syllables with *secondary* stress (the head of a weak foot), and syllables with *primary* stress (the head of a foot which itself is the head of the word). Accordingly, destressing is formalized as foot deletion, because the loss of the category entails the loss of the properties of the head, hence loss of stress.

On the phrasal level, the prosodic hierarchy is extended by phonological phrases, whose terminal nodes are prosodic words:

```
(38)             Ø                  Phonological phrases (Ø)
                / \
               /   \
              /     \
             /       \
          Mw          Ms            Prosodic words (M)
          / \         / \
         /   \       /   \
       Fs    Fw     Fw   Fs         Feet (F)
      / \    |      |   / \ \
     σs σw   σ      σ  σs σw σw     Syllables (σ)
     ab so lute     e qua li ty
```

Together with the syllable and the foot, the prosodic categories *word* (M) and *phrase* (Ø) establish a closed prosodic hierarchy[11].

2.4.3 **Parametrizing tree theory**

Metrical tree theory was elevated to the status of a universal stress theory by Hayes (1981), who parametrically explored types of stress rules occurring in a wide array of different languages. At the same time Hayes strongly reduced the descriptive options of metrical theory, demonstrating that a limited amount of binary core parameters suffice to describe most stress systems of natural languages.

Importantly, he restricted the universal foot inventory to two types of stress feet: *binary* (bounded) or *n-ary* (unbounded), eliminating *ternary* feet from the inventory. Ternary feet had been assumed in Selkirk (1980) and other theories for stress placement at a ternary distance from the domain edge, such as in the antepenultimately stressed example *equálity* in English. The key to this elimination was the observation that ternary feet typically occur at the edges of domains. Its translation was the notion of *extrametricality*, essentially a device to render peripheral phonological constituents (such as syllables) invisible to stress rules (such as foot construction). When the final syllable of *equality* is extrametrical, a binary foot will reach the antepenult:

```
(39)       M
          / \
        Fw   Fs
        |   / \
        σ  σs σw  σ
        e qua li <ty>em
```

Extrametricality is subject to the *Peripherality Condition*, restricting the property to constituents (phonological or morphological) which are peripheral in the domain of the stress rules. A universal convention of *Stray Syllable Adjunction* later adjoins extrametrical syllables as weak members to the nearest foot, producing a ternary foot in (39) at the surface.

A second foot parameter, the *dominance* parameter, fixates the direction of branching. By uniformity of foot labeling, this parameter indirectly determines the side where the stressed syllable is located (left/right). Together with the boundedness parameter, this yields four types of feet:

```
(40)                  Left-dominant             Right-dominant
        Bounded
                      F                                  F
                      | \                              / |
                      σs  (σw)                   (σw) σs
        Unbounded
                      F                                          F
                      |\      \                          /      /|
                      | \      \                        /      / |
                      σs  (σw)  (σw)  . . .      . . . (σw)  (σw) σs
```

An additional foot parameter is *quantity-(in)sensitivity*, determining whether foot construction refers to syllable weight or not. Weak positions of feet in quantity-sensitive systems are subject to the following condition:

(41) The weak position of a foot may not contain a heavy syllable.

Therefore, all heavy syllables are in the head (or strong) position of a foot, hence *stressed.* Hayes proposes a geometrical way of formally capturing syllable weight distinctions. Syllables consist of *constituents*, like the *rime* and the *nucleus*, whose branching determines syllable weight. Branching is made accessible to foot assignment by means of *projection* of rimes or nuclei. In English for example, projecting rimes yields the correct weight distinction between heavy syllables, which contain a long vowel, or are closed, and light syllables, which contain a short vowel in an open syllable:

```
(42)a.  R        b.  R        c. R
       / \          / \          |
       V V          V C          V
       Heavy        Heavy        Light
```

In addition to the foot parameters *boundedness*, *dominance*, and *Q-sensitivity*, Hayes introduces a number of other parameters, such as the direction of foot construction through the stress domain (leftward or rightward), iterativity (yes/no), and the direction of branching of the word tree (left/right). English foot construction is bounded, left-dominant, Q-sensitive, leftward, and iterative, while the word tree is right-branching, basically as in the Selkirkian trees of (37).

He assumes two different types of tree labeling conventions, constrained by the universal restriction that branching nodes cannot be labeled weak (cf. 41). As the direction of branching within prosodic categories is uniform, parametric variation in labeling will only occur in pairs of non-branching nodes. The first option is to label node pairs uniformly 'left/right is strong', depending on the direction of branching. The second option is to label left/right nodes as strong if and only if they branch. This labeling convention is exemplified by Liberman & Prince's LCPR (31).

A general characteristic of Hayesian foot theory which immediately attracts attention is that it explores geometrical aspects of metrical constituent structure and properties of trees (branching etc.) to their fullest extent.

2.4.4 Grid-only theory

It was exactly the richness of tree geometry which provoked the reaction by Prince (1983) and Selkirk (1984) that has become known as 'grid-only theory'. Prince demonstrated the circularity, hence superfluousness, of metrical notions such as uniform binary branching and uniform labeling within prosodic categories. Essentially, he observed, where they are meaningful these tree-geometrical notions only serve the purpose of stressing heavy and (nearly) peripheral syllables. These functions are performed more adequately by constituentless rules which insert grid marks. Prince's idea was to elaborate on the metrical grid as introduced by Liberman (1975) and Liberman & Prince (1977), by dropping the trees from their model, and proposing a set of independent grid construction principles. Grid-only theory is a direct ancestor of bracketed-grids theory in many respects.

First, Prince proposes to capture the stress-attracting property of heavy syllables without using feet, by means of the Quantity-Sensitivity Rule (2). Essentially, quantity-sensitivity is dissociated from rhythmic aspects of word stress, where foot-based theory had combined these in a single device. Moreover, he argues that syllable weight is not to be expressed as a geometrical property of syllable-internal branching, but *moraically*. The mora, a notion with a long tradition in pre-generative phonology, is the weight unit of which light syllables have one, and heavy syllables two. Stress systems vary as to what segments may constitute the second mora in a syllable. Each mora is aligned with a grid mark on the lowest level. Quantity-sensitivity (2) then inserts a grid mark on the next-higher level onto the mora with the highest sonority. In English for example, the second mora of a syllable can be filled by both vowels (in long vowels) and consonants (in closed syllables). The first (vocalic) mora in bimoraic syllables is stressed by the Quantity-Sensitivity Rule (2):

```
(43)a. *          b. *        c.
       * *           * *          *
       m m           m m          m
       V V           V C          V
       Heavy         Heavy      Light
```

QS optimally captures the aspect of word stress as an inherent property of syllables, as a function of weight.
The function of rhythmic alternation of bounded feet is taken over by a constituentless rule of Perfect Gridding, which iteratively assigns grid marks at a binary distance from its own output and from existing stresses. PG has a direction of application (leftward/rightward), and is specified as to whether it starts its iteration with a peak or with a trough. PG is subject to the effects of syllable extrametricality, just as Hayes' foot construction. English PG is leftward and trough-initial:

```
(44)              *                      *     *            *     *     *
      * * *   * * *   PG   * * *   * * *   PG   * * *   * * *
      Apalachicola    =>   Apalachicola    =>   Apalachicola
```

Parameters of grid-only theory much resemble those of Hayesian arboreal theory in many ways, while crucially dropping the idea of constituency. Bounded systems (in Hayesian terminology) correspond to those employing Perfect Gridding in Prince's theory. Essentially, Prince accomplishes a decomposition of foot-level stress, into stress from syllable weight and stress from rhythmically motivated Perfect Gridding.
Grid-only theory provides a direct way of representing rhythmic pressure for destressing rules and stress shifts, by means of clash, or adjacency of strong elements in the grid (cf. 35).
A third rule type, in addition to QS and PG, are End Rules. These place a grid element on top of a peripheral element on a specific level, cf. (7). End Rules carry two parametric specifications, determining their dominance (Initial/Final), and their level of application. Grid elements may be inaccessible to End Rules by extrametricality. For instance, the English primary stress rule applies domain-finally to *Foot-level* (or line 1) grid marks, ignoring extrametrical elements.

```
(45)a. *                 b.        *           Word level
       *        *              *   *           Foot level
       *   *    *              *   *   *   *   Syllable level
       ab so <lute>em          e qua li <ty>em
```

End Rules accurately capture the *delimitative* and *culminative* properties of stress.

2.4.5 **Bracketed-grids theory**

Soon after Prince (1983), bracketed-grids theory emerged, which has been discussed in some detail in section 1.2. Now we have introduced its main theoretical ancestors, we can go into the motivation for its development as a model combining aspects of grid-only theory and metrical foot-based theory. Bracketed-grids theory inherits from grid-only theory the merits of grid structure as a representation of rhythm, and (in Halle & Vergnaud 1987) the idea that syllable weight manifests itself as stress by QS, in its own right, independently from constituency. However, grid structure was combined with bracketing, i.e. constituency, because of phenomena which we will summarize below.
A first step towards the bracketed-grids formalism was Hammond (1984), who proposed to collapse tree and grid into one representation. In this way, the rhythmically based

properties of grid-only representation and constituency-based properties of arboreal representation are drawn from one single representation. Hammond focuses on rules of destressing and on their being conditioned by adjacency of stresses, or *stress clash*, a typically grid-based notion.

Hayes (1984) and Giegerich (1985) showed that metrical constituency is crucial in accounting for phrasal rhythmic phenomena, like stress shift and rhythmic strengthening. Hayes (1984) argued in favor of independent functions of grids and trees, the tree being the representation in which the rhythmic adjustment is performed by node adjunction, and the grid representing the rhythmic wellformedness of the input and the output.

Word stress systems provided another source of arguments for constituent structure in stress representations. Stress constituents will correctly predict the *direction* of stress shifts after the deletion of a stressed vowel (Rappaport 1984, Al-Mozainy, Bley-Vroman, & McCarthy 1985). When a stressed vowel is deleted, its stress is not deleted with it, but moves to an adjacent syllable which belongs to the same stress constituent of which the stressed vowel had been the head. Such phenomena provide very strong evidence in favor of constituency.

As a result bracketed-grids theory emerged, essentially as a way to have the best of two worlds: grid representation and arboreal constituency. Arboreal notation was greatly impoverished, and geometrical distinctions were reduced accordingly. Binary branching and tree labeling principles dependent on this were abolished in favor of n-ary branching structures and peripheral head-marking. Constituency is represented by parentheses around grid elements, so that the virtues of the grid-only formalism are maintained. Therefore, bracketed grids combine the positive aspects of trees and grids in one representation. Our example comes out in Halle & Vergnaud's notation as below:

```
(46)                          *              line 3
         (*                   *)             line 2
         (*     )   *    (*   *)             line 1
         (*   *) (*)    (*) (*   *)   *      line 0
          ab so  lute    e qua li <ty>em
```

Halle & Vergnaud (1987) and Hayes (1987) present parametric theories of stress within the bracketed-grids formalism. The main difference between these versions of bracketed-grids theory is that Halle & Vergnaud assume that stresses can exist without constituents, as witnessed by QS and lexical accents, while Hayes basically preserves the view of earlier foot-based theory that heavy syllables receive stress only by virtue of rules that construct constituents. Essentially, Halle & Vergnaud imply that rules of constituent construction cannot have any direct access to syllable weight, while Hayes' position is that they can. In sections 1.4 and 1.5, we argued in favor of the former view, but we also claimed that rules constructing constituents must be allowed to have direct access to syllable weight information, as a marked option. This will be one of the issues of this thesis.

2.5 Conclusions

Now that we have introduced the theoretical issues of word stress theory that will be the central issues in this thesis, and also previewed our contribution to these issues, we are ready to turn to the stress systems of English and Dutch, from which we will draw evidence in favor of our compositional theory of word stress. In chapter 1, we will introduce the basic data and issues of the English word stress system, and in chapter 2 we will present our own analysis. After that, we will turn to Dutch in the chapters 3, 4, and 5.

Footnotes to chapter 0:

1 It has been demonstrated by Prince (1985) that unbounded rules applying at line 0, thus constructing *unbounded feet*, can be replaced by rules constructing *bounded feet*, into which all (stressless) syllables at the non-head side are adjoined by Stray Syllable Adjunction. Although we will not review his arguments here, we will take them to be correct and indicate the superfluousness of line 0 unbounded constituents.

2 In chapter 2, we will argue that QS is to be re-interpreted as a wellformedness condition relating syllable weight and stress.

3 However, it does away with the principle of exhaustive constituency (Halle & Vergnaud 1987), since not every syllable is incorporated into a binary constituent. Independent arguments against the assumption of exhaustive constituency have been presented by Levin (1989), on the basis of systems whose constituent constructing rules are crucially non-iterative, leaving part of the stress domain uncovered.

4 This application mode finds strong support in systems analyzed by Hayes (1987) with stressless feet and exceptionless extrametricality of syllables, such as Latin. Such systems also provide evidence for a constraint reminiscent of default line 0 application of the End Rule. Monosyllabic words are stressed, although they may be expected not to undergo stress rules by extrametricality of their *only* syllable. But as proposed by Hayes (1981), no extrametricality rule can apply marking the complete domain as exempt of stress rules. Essentially, this condition guarantees word stress to each lexical item, regardless of the rules determining the location or *landing-site* of the word stress.

5 This rule, as well as the stress data supporting it, will be discussed in chapter 1 and 2.

6 Interestingly, this relation is restored at the surface, where closed syllables skipped by the SSR are invariably reduced, hence light.

7 The redundancies between the Elsewhere Condition and the Free Element Condition are discussed in Steriade (1988), who concludes that the latter is the most generalizable of the two for stress rules.

8 A number of stress rules assign subordinated values such as [2stress], however, such as the rule assigning secondary stresses in the examples in (6).

9 Notice that (34) does not express the stressed status of *lute* and *e*. We will come back to this shortly.

10 These are claimed to be motivated independently as domains for phonological rules, a well-known example of which is 'flapping'.

11 We abstract away from the higher-level categories *Intonational Phrase* and *Utterance*. See for motivation Nespor & Vogel (1982, 1986).

Chapter 1

English word stress: the data and the issues

1. Introduction

This chapter has three purposes. First, to summarize the essential data of the complicated word stress system of English, which, for over two decades has served as a reference point of analyses of word stress of any natural language. Second, to illustrate shifts in the conception of these data as a result of theoretical developments in these two decades. Third, to provide a starting point for our analysis of English word stress in chapter 2, and, from there, that of Dutch in the chapters 3, 4, and 5. The first purpose will get its flesh-and-bones as we gradually develop the flow of this chapter, the third will naturally be clarified in due course. With regard to the second, we note the following.

1.1 Trends in analysis

Typically, analyses of English word stress contain the following three types of rule to account for word stress patterns:

- Rules inserting stresses on 'heavy' syllables and syllables located at fixed distances from word edges (stress placement) or from other stresses (stress retraction). To clarify our terminological distinction between stress *placement* and stress *retraction*, the former will be used for the mechanism(s) determining the *rightmost* stress in the word (which is also the primary stress in most cases (*Apalachicó̲la*), though not necessarily so). Stress *retraction* will be the mechanism(s) assigning any remaining stresses, most often secondary stresses (*à̲palà̲chicóla*), but the primary stress under certain circumstances (*á̲necdòte*). Both mechanisms are bounded (i.e. binary) and left-dominant, but analyses slightly disagree on Q-sensitivity. Stress placement is obviously Q-sensitive, but it is not quite clear if stress retraction is so, too.
- Rules of prominence assignment, or stress subordination, determining the prominence relations between stresses. The rules that select primary stress belong to this class, as well as the rules governing the strength relations between secondary stresses (as between the initial and medial secondary stress in *àpalàchicóla*). In most (recent) analyses, the rules of stress subordination apply consistently to the output of stress placement and retraction rules.
- Rules of destressing, eliminating the excessive output of the rules of stress placement and stress retraction. These rules wipe out stresses on syllables that do not carry primary stress, mostly light syllables that are adjacent to another stress. Destressing rules typically apply after rules of prominence assignment, but at least one rule has been proposed in the literature that feeds primary stress selection.

With respect to these three rule types, two issues have always been of crucial importance, and they take a central position in this thesis as well. The first issue concerns the extent to which placement and retraction involve similar mechanisms. Obvious similarities involve *boundedness*, and *maximality* (i.e. the property that stress rules scan the maximal syllable string compatible with their structural description). Yet, the (alleged) differences between placement and retraction as to *Q-sensitivity* (i.e. syllable weight) have stood in the way of a formal unification. It was only after originally formally complex stress rules had been decomposed into formally simpler ones, that similarities and differences became better understood. Some bounded principle, applying maximally, has been proposed as common to stress placement and retraction. That is, the Q-sensitivity has been factored out of the binary stress rules as a rule of syllable weight, whose output feeds the binary principle in at least its stress placement mode.

The second important issue is the division of labor between the rules of stress (both placement and retraction) and rules of destressing. Again, rather striking similarities exist between rule types: Q-sensitivity re-occurs in destressing, as well as a kind of boundedness. As a general trend, the balance between stress and destressing has been redressed in subsequent analyses, where destressing rules have come to account for stress patterns formerly accounted for by stress rules.

This thesis addresses these issues in the following ways. First, as to the (alleged) differences in Q-sensitivity between stress placement and retraction rules, we will show (in chapter 2) that the whole system is basically Q-sensitive. However, heavy syllables may lose their stress in positions that are *stray* (after the binary syllable adjunction rule) and directly preceded by another stray syllable. Exactly in this context the Free Element Condition allows for a leftward syllable adjunction of the heavy syllable, which is accompanied by a moraic deweighting. Second, as to the balance between stress and destressing rules, we will recast most destressing rules into the format of stress rules, in the line of Prince (1985), which explains the shared Q-sensitivity and boundedness. We will show that, within our framework, only one destressing rule remains which destroys metrical constituency laid down by an earlier stress rule.

1.2 An outline of this chapter

This chapter will be organized thematically around persistent issues in subsequent theories. A possible disadvantage may be that no analysis is presented integrally. However, we have chosen this presentation mode for the reason that it provides insight in theoretical development within the scope of single topics. To our mind, this yields a very thorough review of both themes and theories since we can follow theoretical development with several fine-mazed instruments.

The topics of this chapter are the following. In section 2, we will deal with stress placement, be it in the restricted sense of stress placement leading to primary stress. This simplification is motivated by the consideration that word-final secondary stresses are best dealt with in section 3 when discussing the primary stress retraction which necessarily accompanies final secondary stress. Section 3 on stress retraction will also review secondary stresses preceding the primary stress, a phenomenon which is analysed as being closely related to primary stress retraction in most of the literature. Prominence relations between stresses form the topic of section 4. Here the mechanisms will be discussed for imposing prominence relations on stresses laid down by placement and retraction rules, selecting primary and subordinating secondary stresses. Section 5 will review destressing and its role in stating maximally generalized stress placement and retraction rules.

In all of the sections 2-5, cyclic stress patterns will be left out of consideration. That is, we will restrict ourselves to words which do not contain embedded morphemes which, in isolation, would undergo stress rules. Because of its numerous special aspects, discussion of cyclic stress assignment, and destressing rules that apply to cyclic stress patterns, will be postponed to a separate section, viz. section 6 below.

The data to be discussed in this chapter do not include morphologically complex words derived at late lexical levels 2 or 3 (Kiparsky 1982), such as (a) compounds, and (b) words derived with affixes such as *-ness*, *-hood*, *-ish*, i.e. the *word-boundary* or *stress-neutral* affixes of Siegel (1974). That is, the domain of the generalizations made in all analyses and rules of word stress to be discussed will be the lexical level-1.

2. Stress placement

2.1 Introduction

In this section, we will review the mechanisms which subsequent theories of word stress have employed for locating the *rightmost* stress in English words, the stress which is also the primary stress in many cases. In order to keep the discussion maximally simple, we will in this section make the idealization that the rightmost stress and the primary stress coincide in all cases, an idealization which, for the moment, ignores final *secondary* stresses.

A discussion of stress placement requires reference to a distinction between two sets of vowel: short, or lax vowels (1a), and long, or tense vowels (1b) (after SPE, Liberman & Prince 1977:271):

(1) a. **Short (nontense) vowels**

pit	put	impudent
pet	putt	pong
pat	pot	

b. **Long (tense) vowels**

divine	pounce	Bermuda
obscene	moon	point
vane	vote	

Furthermore, there is a syllable weight distinction in English, which can partly be stated in terms of the distinction between short and long vowels. Heavy syllables contain a long vowel, or a short vowel which is closed by a consonant. Hence, only open syllables with short vowels are light.

The data to be discussed in this section will be presented in an order which closely follows most descriptions, and especially the categories as resulting from the analysis of Hayes (1981). Since there are overlaps between the stress placement patterns to be discussed, some words may be categorized in more than one pattern. We will signal such cases wherever the ambiguity is of interest.

The first generalization is that lexical monosyllabic words are stressed regardless of their segmental composition. See for instance the words of (2):

(2)

pít	pút	táp	tóss	líne	móon	vóte	sháke
pét	pót	hóp	súck	láne	scéne	gréen	Péte
pát	pútt	fát	réd	óunce	póint	wríte	Jó

That is, stress placement respects (3):

(3) Each lexical item has a stressed syllable.

This generalization covers all words belonging to lexical categories (N, V, A, Adv). In contrast, non-lexical items (articles, prepositions, etc.) can occur stressless.

The second class of words whose final syllable always receives a stress by stress placement consists of words whose final syllable contains a long vowel. See for instance the nouns, verbs, and adjectives of (4)[1]:

(4) a.

Tippecanóe	caréer	bazáar	magazíne
chimpanzée	Tennessée	brocáde	buccanéer
machíne	políce	kangaróo	evacuée

b. maintaín, eráse, reveál

c. supréme, obscúre, remóte

This motivates (5):

(5) Long vowels in final syllables are stressed.

Let us now turn to three different sets of data, each of which motivates a separate stress placement pattern. The distinctive character of these patterns appears only from polysyllabic words whose final syllable does not contain a long vowel, as will be clear by considering (3) and (5). Nevertheless, we will sometimes repeat words from (2) and (4) in order to bring out the unitary character of some pattern optimally.
The first set of data to be presented is polysyllabic nouns with short vowels in their final syllable:

(6) a. América	b. Arizóna	c. Atlánta	d. ánna
génesis	Pasadéna	ellípsis	Vénice
lábyrinth	Massachúsetts	galáctin	vénom
émerald	balaláika	appéndix	cábin
análysis	aróma	synópsis	vílla
aspáragus	Oklahóma	amálgam	hérald
metrópolis	Minnesóta	veránda	éffort
éverest	Monongahéla	agénda	Clárence
Minneápolis	Apalachicóla	asbéstos	Jácob
cínnamon	horízon	phlogéston	Hóuston

Stress placement in this set of words can be described as follows: stress is on the antepenult if an antepenult exists, and the penult is light (6a). Otherwise, stress is on the penult (6b-d).
This stress placement mode is shared by the suffixed nouns (7) and the suffixed adjectives (8), whose suffix contains a short vowel:

(7) a. présid+ent	b. compón+ent	c. detérg+ent	d. prés+ent

(8) a. munícip+al	b. anecdót+al	c. fratérn+al	d. pén+al
sígnífic+ant	compláis+ant	relúct+ant	léth+al
calámit+ous	desír+ous	treménd+ous	jeál+ous
facíl+ity			

Let us for the moment summarize our findings as in (9):

(9) **Stress placement I** (underived nouns, suffixed nouns and adjectives):
a. ignore the final syllable.
b. stress the antepenult (if present) provided the penult is light.
c. otherwise stress the penult.

In fact, (9) states that stress placement is Q-sensitive. This property is supported by the absence of words such as **Aríz*[ow]*na*, **átl*[æn]*ta*, with a stressless heavy penult. Another strong argument supporting the Q-sensitivity of stress placement is that loan words with primary antepenultimate stress across a closed penult do not keep their original forms, but assimilate to (6c), i.e. the English stress pattern. This is evident from Russian examples such as *Bábushka*, *Nínotchka*, which have been anglicized as *Babúshka*, *Ninótchka* (Hayes 1982).
Nevertheless, a number of exceptions to Q-sensitivity seem to exist, where stress is on the antepenult 'across' a heavy penult. Most of these words end in [I] - orthographic <y> - (10a), or in a syllabic sonorant consonant, (10b):

(10) a. fáculty	ánarchy	cóntroversy	b. cálender	cárbuncle	sálamander
áutopsy	híerarchy	óligarchy	cÿlinder	árchangel	tábernacle

As these words are of a very restricted phonological composition, they are susceptible to alternative analysis. That is, most analyses assume their final syllables to be non-syllables at an underlying level, which formally equates most of them with the words of (6,7,8d).
Furthermore, (9) states that stress placement is, in a way, *bounded* or *binary*. The rightmost stress always occurs in a three-syllable window at the right word edge. Or stated otherwise: ignoring the final syllable, the rightmost stress is on the rightmost or next-to-rightmost syllable counted from the word edge, essentially at a maximally binary distance. No words occur in this class (nor in any other) whose rightmost stress is further leftward than the antepenult, as **ámerica*.
Finally, (9) implies that stress placement is *maximal*. That is, stress is on the leftmost syllable that can be reached in conformity with Q-sensitivity and binarity. That is, stress is on the antepenult wherever it can, as in (6-8a), otherwise on the penult (6-8bcd). Maximality of stress placement can be observed especially in words ending in nominal and adjectival suffixes such as *-ent*, *-al* (7,8). Crucially, words such as **municípal* do not occur, whose rightmost stress is on a light penult preceded by another stressable element[2].
Let us now examine a second set of data, in which the three-syllable window of (9) is replaced by a two-syllable window. Consider the verbs (11) and underived adjectives (12) below:

(11)	a. devélop	b. maintáin	c. tormént	d. hóp
	astónish	appéar	usúrp	súck
	surrénder	eráse	expéct	táp
	demólish	revéal	collápse	sléep
	embárass	allów	molést	sít
(12)	a. illícit	b. supréme	c. absúrd	d. fít
	cómmon	obscúre	ovért	réd
	implícit	remóte	compléx	gréen

Clearly, this class of words follows a mode of stress placement that is different from (9). Note that (11-12a) seemingly violate maximality, as stress is on a light penult, where it might have been on the antepenult, safely within the three-syllable window. However, in the pattern (11-12) the three-syllable window has shrunk into a two-syllable window, since stress is never on the antepenult, and moreover the weight of the final syllable, instead of the penult, is relevant. Therefore, maximality is observed as stress is maximally leftward *within the two-syllable window*, see (11-12a). Second, binarity transpires even more clearly than in (9), in the form of a two-syllable window. Third, Q-sensitivity is clear from (11-12b), where final syllables with long vowels are stressed, and from the contrast between (11-12a) and (11-12c): only final syllables closed by two consonants (11-12c) count as heavy. Hence, the final consonant is ignored for the computation of the weight of the final syllable:

(13) **Stress placement II** (verbs and underived adjectives):
  a. ignore the final consonant.
  b. stress the penult (if present) provided the final syllable is light.
  c. otherwise, stress the final syllable.

In spite of the superficial differences between both modes of stress placement (9) and (13), we actually find that all of the properties of (9) discussed above are shared by (13). The only difference between (9) and (13) turns out to be the final element to be ignored: a complete syllable in (9) versus a single consonant in (13).

Stress placement II (13) extends to a number of words which are not verbs or underived adjectives. In particular, words formed with the adjectival suffixes *-ic* and *-id* (14a), and various nouns (14b) are as (11-12a), while some nouns (14c) are as (11-12c):

(14) a.	terrífic	b.	molásses	vanílla	Kentúcky	c. cemént	dessért
	Pacífic		proféssor	confétti	Mississíppi	evént	Lucérne
	intrépid		Nantúcket	Madónna	Alabáma	petárd	ellípse
	sólid		Mohámmed	banána	Tallahássee	resúlt	burlésque

The adjectival suffixes *-ic* and *-id* are, in a sense, atypical, since the regular stress placement mode for such suffixes is (9)[3].

We have found that the variation between Stress placement I and II partly depends on whether the final syllable is, or is not ignored.

So far, we have come across two circumstances under which the final syllable cannot be ignored for stress placement: (a) if it is the only syllable of a lexical item, or (b) if it contains a long vowel. But in both of these special circumstances, the three general conditions as discussed above are respected. Q-sensitivity is respected since no heavy syllable is stressless. Binarity and maximality are respected simply as there is no accessible syllable to the left of the final one.

We will now introduce the final set of data of this section, whose final stress indicates that their final syllable is taken into account, as was the case for Stress placement II. This set of data differs from (11-12) in the sense that a final consonant is also taken into account. Consider the underived nouns (15a), verbs (15b), and adjectives (15c) below:

(15) a.	guitár	Berlín	b.	acquiésce	posséss	c.	bizárre
	chiffón	Japán		haráss	omít		coquétte
	Brazíl	cigarétte		caréss	attáck		

The pattern (15) is fairly rare, but still falls within the margins of Q-sensitivity, binarity, and maximality discussed above. To see this, note that it can be simply described by (16):

(16) **Stress placement III** (idiosyncratic, mainly nouns)
  a. stress the penult (if present) provided the final syllable is light.
  b. otherwise stress the final syllable.

Pattern (15) could be extended, and made more general, by adding the nouns of (4) (long vowels in final syllables) and (2) (monosyllables). But we have chosen not to do so, because (2) and (4) are exceptionless for nouns, whereas stress placement (16) is marginal. That is, in nouns the final syllable is normally ignored (6), unless (2) it is the only syllable or (4) contains a long vowel.

In spite of its marginality, the stress placement mode III observes Q-sensitivity, binarity, and maximality within its two-syllable window. That is, the rightmost heavy syllable is stressed, and if there is no heavy syllable, stress is on the leftmost syllable compatible with the binarity requirement: the penult. Notice that if (16) were non-maximal, forms would be expected to occur such as **vanillá*, i.e. polysyllables with a stressed final light syllable. However, such forms are absent in English, or nearly so.

We find an asymmetry between two types of final heavy syllables: those with long vowels are invariably stressed - (11-12b) and (4)- while closed syllables with short vowels can be either stressless - (6) - or stressed - (11-12c).

This nearly concludes our discussion of stress placement patterns. Yet we must draw attention to a property which may seem trivial, but which has important theoretical consequences:

(17) **Disjunctivity**
No word is subject to double stress placement.

This excludes **Améríca* by (9) and (13) taken together, **devélóp* by (13) and (16), and **génésís* by all three modes together. Also, disjunctivity excludes stress placement in one and the same word according to both clauses of a single mode. This excludes **Améríca* by (9b) and (9c) taken together, etc.
To conclude our introduction to stress placement, we will summarize our findings. First, stress placement strictly obeys three restrictions:

(18) a. **Q-sensitivity** - the rightmost heavy syllable is stressed. This excludes **Aríz*[ow]*na* etc.
b. **Binarity** - stress is at most two syllables from the right word edge, optionally ignoring the final syllable. This excludes **ámerica* etc.
c. **Maximality** - stress is at the leftmost syllable compatible with other restrictions. This excludes **vanillá* etc.

Second, some lexically governed variation exists in ignoring the final syllable. That is, it is typically ignored in underived nouns and suffixed nouns and adjectives, but respected in verbs and underived adjectives. Third, the variation is suppressed in two cases: (a) lexical monosyllables, and (b) words whose final syllable contains a long vowel. Fourth, lexical variation exists in ignoring the final consonant for the computation of syllable weight. Crucial cases of final consonants being ignored only arise when final syllables are taken into account. If they are, as in (16), final closed syllables with short vowels are stressed. But if they are not, as in (13), final syllables with short vowels are stressed only if closed by two or more consonants. Fifth, we have found that words are subject to at most one stress placement mode, a situation which we referred to as disjunctivity.
In the remainder of this section, we will discuss mechanisms of stress placement available in four subsequent theories of word stress: linear theory, foot-based metrical theory, grid-only theory, and bracketed-grids theory. As representatives of these theories, we have selected SPE, Hayes (1981), Selkirk (1984), and Halle & Vergnaud (1987). In each of the following four subsections, one of these publications will be reviewed as to its contributions to stress placement and the conditions on it, in the light of our discussion in the preceding pages.

2.2 Linear theory: SPE

In linear theory, exemplified by the SPE analysis, the Q-sensitivity of stress placement is captured by the notion of *cluster*. Clusters are segment strings covering a vowel and all subsequent consonants up to the next vowel. Cluster strength is defined with respect to vowel quality (tenseness) and post-vocalic consonants[4]:

(19) a. **Weak cluster** b. **Strong clusters**

$$\underset{[-\text{tense}]}{V}\ C_0^1 \qquad\qquad \underset{[+\text{tense}]}{V}\ C_0 \quad \text{or} \quad \underset{[-\text{tense}]}{V}\ C_2$$

Stress placement is said to be governed by the *weak cluster principle*.

That is, in order to stress the rightmost strong cluster, the stress placement rules skips weak clusters, counting from the right word edge, until (a) a strong cluster is reached, or (b) no clusters remain in the domain. More precisely, all stress placement rules share the subcontext (20)[5]:

(20) **Main Stress Rule** (abstract version)

$$V \Rightarrow [1stress] \;/\; [\ X \_\_\_ \ C_o\ (\ [-tense]\ C_o^1\ )\ Y\ ]$$

As indicated by the parentheses around the weak cluster, (20) contains two subrules, the longest of which (21a) assigns stress one cluster more leftward than the shortest one (21b):

(21) a. $V \Rightarrow [1stress] \;/\; [\ X \_\_\_ \ C_o\ \ [-tense]\ C_o^1\ \ Y\ ]$

b. $V \Rightarrow [1stress] \;/\; [\ X \_\_\_ \ C_o\ \ Y\ ]$

In order to guarantee binarity, the number of the weak clusters to be skipped in (21a) is restricted to one.

Maximality follows from a convention on the application of rules which have the formal property that they can be collapsed with the help of parentheses, like the rules (21a) and (21b) can be collapsed into (20). The *disjunctive ordering convention* regulates the ordering as well as mutual blockades between subrules.

First, disjunctive ordering requires subrules to apply in an order from long to short expansions. This fixes the order between the subrules of (20) as (21a) - (21b). Second, disjunctive ordering blocks application of all subsequent sub-rules as soon as some subrule takes effect. Consequently, each word receives stress by precisely one sub-rule, the longest one compatible with its segmental composition. This produces maximality, since stress will be on the leftmost location that can be reached.

Let us now turn to the stress placement modes, which are distinguished by the values of the term Y in (20).

Stress placement I (9) is accomplished by a stress placement rule that substitutes Y by a cluster of a lax vowel optionally followed by an number of consonants.

(22) **Main Stress Rule** (underived nouns, suffixed nouns and adjectives)

$$V \Rightarrow [1stress] \;/\; [\ \ X \_\_\_ \ C_o\ (\ \underset{V}{[-tense]}\ C_o^1\ )\ \underset{V}{[-tense]}\ C_o\ \ ]$$

X	___	C_o	[-tense] V	C_o^1	[-tense] V
Am	e	r	i	c	a
Ariz	ow	n			a
Atl	æ	nt			a
	æ	n			a

Stress placement II (verbs and underived adjectives) goes by a different instantiation of (20), where the term Y is zero:

(23) **Main Stress Rule** (verbs and underived adjectives)

$$V \Rightarrow [1stress] \;/\; [\ \ X \_\_\_ \ C_o\ (\ \underset{V}{[-tense]}\ C_o^1\ )\ ]$$

X	___	C_o	[-tense] V	C_o^1
dev	e	l	o	p
maint	ai	n		
torm	e	nt		
h	o	p		

Let us now see how final stress placement in nouns (2) and (4) can be obtained from the Main Stress Rule (20). The two rules (22) and (23) are an example of a set of rules which can be collapsed by parenthesizing a portion of the longest subrule, (22) in this case. The resulting rule is (24):

```
(24) Main Stress Rule (final version)                       1
     V => [1stress] /  [  X ___ Co (( [-tense] Co ) [-tense] Co ) ]
                                            V              V
```

Notice that (24) contains a sub-rule which results from suppressing all parenthesized material, cf. (25):

```
(25) Main Stress Rule (final stress placement)
     V => [1stress] /  [  X ___ Co ]
                        capr i   ce
```

All words which do not match the longer expansions of the MSR (24) will automatically undergo (25). In this category are (a) monosyllabic nouns (2), (b) any nouns with tense vowel in their final clusters (4).

Disjunctivity (17) also follows from disjunctive ordering, essentially in the same way as maximality follows from it. As required, words cannot be subject to both (22) and (23), because these rules can be collapsed with the help of parentheses.

With respect to Stress placement III of (16), various linear analyses have been put forward. First, words such as *vanilla* (14b) require a diacritic marking which exempts them from the longest expansion of the MSR (22), and will send them through the MSR (23)[6].

A similar solution is possible for cases like *guitár* (15). A diacritic exception marking against MSR expansions (22) and (23) will guarantee final stress by MSR (25).

2.3 Foot-based metrical theory: Hayes (1981)

The foot-based metrical analysis of Hayes (1981) is characterized by the theoretical desire to break complex (linear) stress placement rules down into formally simpler ones, firmly couched in the universal parametric theory of metrical stress rules. The main results are (a) a parametrized stress placement rule, parametrically typified as Q-sensitive, bounded, and L-dominant, and (b) the proposal of a set of extrametricality rules to formalize the observation that placement modes ignore specific types of material at the word end.

Stress placement in foot-based metrical theory is radically different from linear theory, in the sense that it involves a parsing of syllables into constituents, instead of a computation of stresses by skipping syllables. The syllables skipped in linear theory are incorporated as weak elements into feet in metrical theory. Consequently, the output of stress assignment is metrical structure, not merely stresses. As we will see, this has major consequences for maximality and disjunctivity.

Hayes decomposes the stress placement mechanism into various principles, that are characterized by a setting of basically simple parameters.

Q-sensitivity is captured through the use of branchingness distinctions within the syllabic sub-constituent of the *rime*, cf. chapter 0, 2.4.3. English tense vowels (1b) are represented as sequences of two short vowels, hence as *long*. Now rimes consisting of a short vowel are *light*, whereas rimes of either a long vowel, or a short vowel plus one or more consonants are *heavy*:

```
(26)a. Light rime          b. Heavy rimes
           R                   R      R
           |                  / \    / \
           V                  V V    V C
```

The way of assigning stress to heavy syllables is to constrain the weak node of a foot with respect to syllable weight: no branching rime can occur in the weak position of a foot (see (30) and (33) below). That is, the parameter setting of the English stress foot is *Quantity-sensitive*:

(27) **English Stress Rule**
Construct a maximally binary, left-dominant, Q-sensitive foot on the rime projection, starting at the right word edge.

By (27), two types of foot (28a,b) can be constructed, where 'L' in (28a) abbreviates a light syllable:

```
(28)a.   F          b.  F
        / \             |
      σs   σw           σ
           L
```

As a general principle governing foot assignment, Hayes assumes that the *maximal* foot that is compatible with the stress rule is constructed - in fact the metrical equivalent of disjunctive ordering assumed in linear theory. Disjunctivity itself (or incompatibility between different modes of stress placement) follows from the structural incompatibility between branching and non-branching feet. Thus, the latter arise only when the former cannot be constructed.

Binarity is clear from (28a). Recall from chapter 0 that a corresponding *boundedness* parameter dictates binarity to systems which systematically limit the size of feet. That is, ternary feet are ruled out in the basic foot inventory of languages.

However, the boundedness restriction seems to pose problems as soon as Stress placement I is taken into account, as this stress placement mode reaches the antepenult in *América* etc. (6-8a). But precisely the fact that this placement pattern ignores the *final* syllable points to the Hayesian notion of *extrametricality*. Extrametricality is assigned by rule to the relevant parts of final syllables, i.e. rimes:

(29) a. **Noun Extrametricality**
Rime => [+ex] / ___$]_N$

b. **Adjective Extrametricality**
$[X]_{Suffix}$ => [+ex] / ___$]_{Adj}$

By extrametricality assignment, the ESR (27) can reach the antepenult through building a disyllabic foot before an extrametrical rime (30a):

```
(30)a.      F            b.        F           c.      F          d. F
           / \                     |                   |             |
          s   w                    |                   |             |
   A me  ri  c<a>em        A ri   zo n<a>em       At  lan t<a>em     A n<a>em
   mu ni ci  p<al>em       a nec  do t<al>em     fra ter n<al>em  pe n<al>em
```

Importantly, the extrametricality rules cannot apply so as to mark the entire stress domain extrametrical. Hence all lexical monosyllables are stressed, cf. (11-12)[7].

Later, extrametrical rimes are adjoined as weak members to the preceding foot by a universal principle of Stray Syllable Adjunction:

(31) **Stray Syllable Adjunction** (SSA)
Adjoin a stray syllable as a weak member of an adjacent foot.

Let us now discuss the analysis of Stress placement II (13). As compared to *cluster*-based linear analysis, syllable-based analysis (26) seems to miss the generalization that a final short vowel syllable counts as light if closed by one consonant, and as heavy if two or more consonants follow. Hayes deals with this by marking *word-final consonants extrametrical*, or invisible to the English Stress Rule:

```
(32) Consonant Extrametricality
     C => [+ex] / ___]word
```

This equates word-final VC with a light rime V, and word-final VCC with a heavy VC rime, producing the desired result:

```
(33)a.       F          b.        F          c.        F          d.   F
            / \                   |                    |               |
    de  ve  lo<p>em       main tai<n>em       tor men<t>em       ho<p>em
```

Hayes argues that extrametricality in English is rule-governed, even in the face of nouns that go by Stress placement II: *vanílla* (14b), or III: *guitár* (15a). These are dealt with in one of the following ways. First, as exceptions to the extrametricality rules (29a) and (32). Second, by means of feet which are part of the lexical representation. The latter means will be discussed in more detail in section 3.

2.4 Grid-only theory: Selkirk (1984)

Building on the pioneering work of Prince (1983), the grid-only analysis of Selkirk (1984) decomposes stress placement into separate rules of Q-sensitivity and binarity. In order to guarantee a certain terminological consistency, we will replace Selkirk's notions, wherever necessary, by those used by Prince (1983), as introduced in chapter 0, section 2.4.4.
The common Q-sensitivity of all stress placement modes is due to a rule which assigns a stress to heavy syllables, QS:

```
(34) Quantity-Sensitivity (QS)
     Assign a stress to a heavy syllable.
```

The binary counting device employed is a rule of Perfect Gridding which assigns stress to remaining light syllable sequences, starting at the word end:

```
(35) Perfect Gridding (PG)
     a. Right-to-left
     b. Trough-initial
```

Let us consider how these rules together produce Stress placement I. First, final consonants and syllables can be extrametrical. Second, QS assigns a stress to every heavy syllable. Third, PG assigns a stress to the leftmost of a string of stressless metrical syllables. For the sake of clarity, we illustrate only the portion of the word that is currently under attention, the portion where the rightmost stress is assigned:

```
(36)a.                         b.            *           c.       *          d.  *
  QS    *    *    *    *          *    *     *    *         *    *     *         *    *
       mu   ni   ci   p<al>em     a   nec   do   t<al>em   fra  ter   n<al>em    pe   n<al>em

             *
  PG    *    *    *    *                ---                       ---                ---
       mu   ni   ci   p<al>em
```

Importantly, PG can never skip a heavy syllable to produce **Aríz*[ow]*na*, since the rightmost stress will always be on the heavy penult.

Basically, the stress placement modes are arrived at in the same way as Hayes (1981): by extrametricality of final syllables (where Hayes uses rimes) and consonants. But in contrast to Hayes, extrametricality is assumed to be part of *lexical representation*, i.e. not assigned by rule. Apparently, Selkirk considers the number of exceptions sufficiently impressive to omit rules. In fact, this point can well be made for underived words. However, the retraction modes can still remain valid for suffixes. In order to illustrate the other two stress placement modes, let us assume that extrametricality is distributed (either by rule or lexically marked) as in Hayes (1981).

Stress placement II (13), a pattern with only consonant extrametricality, arises as below. Crucially, QS is affected by consonant extrametricality:

```
(37)a.                b.        *          c.        *         d.
    QS  *   *   *          *    *             *    *                 *
        de  ve  lo<p>em   main  tai<n>em     tor  men<t>em         ho<p>em

            *                   *                  *
    PG  *   *   *          *    *             *    *                 *
        de  ve  lo<p>em   main  tai<n>em     tor  men<t>em         ho<p>em
```

Notice that there is no rule to stress the only syllable in case (37d), a light monosyllable. Being a rhythmically motivated rule, (35) has no 'short' expansion to stress syllables analogously to the linear (21b), and foot-based (28b). Nor could (35) have a short expansion, as this would yield non-maximal stress in cases where a single light syllable follows a heavy syllable within the domain of EGE, cf. **corpóral*[8].

This implies that cases like (6-8d) and (11-12d), which in previous analyses received stress on the remaining light syllable by default application of the shortest expansion, need a separate stress rule in Selkirk's analysis. Crucially, this stress is located on an initial syllable, therefore the following rule is motivated:

```
(38) Initial Basic Beat Rule (IBBR)
     Assign a stress to a syllable in initial position.
```

It applies to the relevant cases as follows:

```
(39)a. *          b.  *
       *              *
       A<nna>em     ho<p>em
```

By the presence of rule (38) in the grammar, the fact that every English word is stressed (including light monosyllables) becomes more or less a coincidence, instead of being a direct effect of the application of the stress rules. This can be seen as a disadvantage of the analysis, though grid-only theory has a more adequate solution available to deal with (37), as was shown in chapter 0: a default application of the End Rule to the lower levels of the grid.

Finally, Stress Placement III arises in words whose final consonants and syllables are metrical:

```
(40)                    *
       *   *    QS    *   *
      guitar    =>   guitar
```

2.5 Bracketed-grids theory: Halle & Vergnaud (1987)

On the one hand, bracketed-grids theory revives constituency in stress representations. This re-opens the possibility of assigning constituents by default to remaining single syllables, as in foot-based theory (28b). On the other hand, bracketed-grids theory shares with grid-only theory decomposition of stress placement into Q-sensitivity and binarity. Therefore, bounded constituent construction rules are only *indirectly* sensitive to syllable weight, through the mediation of pre-marked stresses, assigned to heavy syllables.
In Halle & Vergnaud (1987), as in Prince (1983) and Selkirk (1984), all heavy syllables receive an inherent stress by rule. HV's version is:

```
(41) Accent Rule
     Assign a line 1 asterisk to a syllable with a branching rime.
```

These lexical stresses (HV call them lexical accents) must be respected by the bounded constituent construction rule, the *Alternator*. That is, this rule will place lexically stressed syllables in the head position of constituents.

```
(42) Alternator
     a. Line 0 parameter settings are [bounded, left, right to left].
     b. Construct constituent boundaries on line 0.
     c. Locate the heads of line 0 constituents on line 1.
```

This pair of rules yields the Stress placement I pattern (9) as follows:

```
(43)      a.              b.        *       c.      *        d.
    (41)     * * *  *       * * *  *          *   *    *         *   *
             Ameri<ca>em    Arizo<na>em      Atlan<ta>em       A<nna>em

               *                *                 *              *
    (42)     *(* *)  *      * *(*)  *         *  (*)   *       (*)   *
             Ameri<ca>em    Arizo<na>em      Atlan<ta>em       A<nna>em
```

We will illustrate only briefly the other two stress placement modes, since these follow from extrametricality in parallel ways as in previous analyses[9].

```
(44)a.                b.      *        c.      *        d.         *
         * * *              *   *            *  *            *   * * *
       develo<p>em        maintain          guitar          Tippecanoe

          *           b.      *        c.      *        d.         *
        *(* *)              *  (*)           * (*)           *   * *(*)
       develo<p>em        maintain          guitar          Tippecanoe
```

3. Stress retraction

3.1 Introduction

So far, we have presented a highly idealized picture of English word stress, suggesting that words have only one stress (the primary stress), located on the rightmost stressable syllable. However, this idealized picture is untenable in the face of the following observations. First, the primary stress may be *followed* by a secondary stress on the final (hence rightmost stressable) syllable, which of course implies that the primary stress itself is not located on the rightmost stressable syllable (as in *ánecdòte* or *àdiróndàck*). Second, in words that are long enough, the primary stress may be *preceded* by one or more secondary stresses (as in *Càlifórnia*, or *àpalàchicóla*). These phenomena are called *stress retraction*, as they involve the assignment of stresses as calculated from a stress that is located more rightward in the word, in a way retracting leftward from stresses functioning as landmarks[10].

The first type of stress retraction mentioned above will be referred to as *primary* stress retraction, since the retracted stress surfaces as primary stress, whereas the second case will be referred to as *secondary* stress retraction, since the retracted stress surfaces as a secondary. These retraction types have several aspects in common, especially as to conditions on the number and composition of syllables that are skipped.

Before we discuss stress retraction patterns, however, we will clarify the notion of *secondary stress* as used in the literature, since this is of considerable importance to our discussion.

3.1.1 **The concept of secondary stress**

Secondary stresses are motivated by several types of evidence, the most important being the absence of *vowel reduction*, and the ability to carry a *pitch accent*. Let us discuss these diagnostics below.

Generally, vowels which have a secondary stress do not reduce (*àlabáma, cànteen, ánecdòte, àdiróndàck*), whereas stressless vowels easily reduce (*àlabáma, ánecdòte, políce*). Vowel reduction as a process obscures the quality of unstressed vowels. The output of vowel reduction is a central vowel, i.e. schwa [∂] or [I], depending on dialect and segmental environment. Reduction is subject to performance factors such as word frequency and the predictability of a word in discourse contexts. Fidelholtz (1967, 1975) provides a detailed survey of the most important of these performance factors, as well as segmental factors. An important segmental condition is the hampering effect of vowel tenseness (or length). Crucially, prevocalic and word-final non-low vowels never reduce: cf. *buffalo, macaroni*, cf. footnote 2, versus non-final *various*. This can be attributed to an exceptionless lengthening (tensing) rule. Many of such tense vowels are stressless, as can be inferred from stress placement, so that it must be tenseness, not stress, which blocks their reduction.

Keeping the above refinement in mind, the presence versus the absence of vowel reduction offers a fairly reliable criterion for a vowel's stress value. We will call this the *irreducibility* criterion.

The irreducibility criterion for secondary stress can be supplemented by the *accentability* criterion. The syllable with the primary stress itself of course is a candidate for carrying a pitch accent, and in fact it always will carry one in the citation form, when the word forms an utterance on its own. Pitch accents may also occur on a sub-set of the syllables with secondary stress. But all have to be located on stressed, non-reduced syllables that precede the primary stress. Accentability can be observed in isolated words like those below, where potential accents are indicated by a '&' mark (cf. Vanderslice & Ladefoged 1972, Bolinger 1986, Gussenhoven 1989):

```
(45)  &   &         &   &         &            &        & &
     California    Alabama    Apalachicola    Chinese
```

When embedded in phrases, under certain rhythmic conditions, these words can even be realized *without* a pitch accent on the syllable with primary stress, the only pitch accent of the word being on the initial syllable.

This is the case, for instance, in *Chìnese fóod* and *Càlifornia wíne* (see Hayes 1984, Bolinger 1986, Gussenhoven 1989).

Opinions differ which criterion distinguishes stressed syllables from stressless ones. As to restrictiveness, the accentability criterion is no doubt stronger than the irreducibility criterion since not every irreducible syllable can carry a pitch accent. For instance, although the initial syllables of *obese* and *Montana* cannot reduce, both are non-accentable (**òbese cát, *Mòntana cówboy*). *Obese* and *Chinese* then clearly require some accentability distinction.
But notice that acceptance of accentability as the sole criterion for stress will completely obscure the condition governing (ir)reducibility. Apart from the stipulation that some inaccentable syllables reduce while others do not, no principled way remains to describe the regularities in reduction that can otherwise be ascribed to stress distinctions. This especially applies to cases where reducibility is not directly related to either position in the word or to syllable weight. For instance, the fact that the second and fourth syllable of *Apalachicola* are reducible, while third syllable is irreducible, becomes a complete mystery. This contrast cannot be due to syllable weight (all syllables being light - open and containing a short vowel), nor to accentability. Clearly, the contrast requires some reducibility distinction.
This suggests the conclusion that instead of a single distinction stress versus stressless, two hierarchically related distinctions are in order, referred to as accentability and irreducibility. The hierarchical relation resides in the former implying the latter[11].
Nevertheless, most of the literature assumes a relatively abstract notion of stress, indirectly affecting reducibility and accentability. The main reason for this approach is the fact that it is the most generalizing. That is, as we will see in this section on stress retraction, iterative stress assignment allows for a very generalizing stress assignment procedure. The mapping of the output of this procedure to the actual reducibility and accentability of syllables is then a fairly simple affair. Let us investigate what diagnostic role is played in this model by the reducibility and accentability of syllables.
On the one hand, reducibility implies the *absence* of stress, in addition to the segmental factor that the reduced vowel be *short*. This renders the reducible syllables a subset of the set of stressless syllables[12].
On the other hand, accentability implies the *presence* of stress, next to various positional factors. For instance, stresses following the primary stress are non-accentable (*ánecdòte*), and so are stresses located between other stresses (*àpalàchicóla*). Thus, accentable syllables form a subset of the set of stressed syllables. The issue how to select accentable syllables from the set of stressed syllables will be discussed in more detail in section 4 on prominence.
In sum, this view presents an *indirect* account of the observation that accentability implies irreducibility. The implication is indirect since accentability implies stress, which in its turn implies irreducibility. This relatively abstract notion of stress is assumed as correct in most of the literature to be discussed in this section. In what follows, the main criterion for stress will be the weaker criterion of irreducibility, not accentability.

3.1.2 Primary stress retraction

So far, we have discussed the quantity-sensitive mechanism which places the rightmost stress in English words. And in all cases, this rightmost stress surfaces as the primary word stress. However, the distribution of primary stress is more complex than suggested so far. To be more precise, cases occur, such as *árchìve* and *ánecdòte*, where the rightmost stress is *subordinated* to a primary stress on the penult or antepenult. Here, the secondary stress on the final syllable is regular to the extent that it is predicted by the stress placement rules, but irregular to the extent that it is not realized as the primary stress.

To see the basic unity between the occurrence of primary and secondary stress in such cases, note that the stress on long vowels in word-final syllables can either be realized as primary (*caprí̱ce, Tennessé̱e*) or as secondary (*árchìve, ánecdò̱te*). Put differently, it is the stress level (primary or secondary) which varies, not the presence of stress as such.

Stress retraction in disyllabic words is regular in nouns, and in verbs ending in the suffixes *-ize* and *-ate*. Stress is normally retracted to a heavy syllable (46ab), but cases occur of light syllables being stressed (46c), cf. the disyllabic words of (46):

```
(46)a. árchìve   mángròve      b. móhàir   rótàte       c. sátìre   Héttìte
       árgÿle    báptìze          tíràde   óràte           éssày    Sámìte
       mémbràne                   mícròbe                  cáthòde  líthòid
```

These retraction patterns can be seen as the equivalents of the shortest expansions of the stress placement modes, cf. (6-8d), (11-12d).

Oehrle (1972) observed that in disyllabic nouns the location of primary stress is correlated with the strength of the initial cluster, as most words of the segmental type *satire* (46c) appear in a non-retracted form:

```
(47) paróle   manúre   políce   lamént
```

Primary stress retraction is more common in trisyllabic or longer words. The presence of additional syllables, as compared to (46), raises the question whether syllables are skipped regardless of their weight, and what is the maximum number of syllables to be skipped. Four different retraction modes can be distinguished on the basis of these criteria, namely Strong retraction (49), Weak retraction (51), Sonorant retraction (53), and Long retraction (56), all to be discussed below. As was the case with stress placement, some overlap occurs between the patterns.

The Strong retraction pattern is exemplified by a set of underived nouns in (48a), verbs in (48b), and underived adjectives in (48c):

```
(48)a. ánecdòte      b. récognìze   exácerbàte     c. ábsolùte
       húrricàne        désignàte   manípulàte        érudìte
       páradìse         cáterwàul   elíminàte         mánifèst
       mágistràte       sátisfÿ     emáncipàte        dífficùlt
       pédigrèe         tácitùrn    legítimìze
```

These words have a *secondary stress* on their final syllable, while their primary stress is two syllables to the left, regardless of the segmental composition of the skipped penult. This is clear from such examples as *anecdote* and *recognize* in (48). Strong retraction is therefore a Q-insensitive style of retraction, and can be formulated as below:

```
(49) Strong retraction (underived nouns, verbs, underived adjectives)
     If there is a stress in the final syllable,
     a. stress the antepenult (if present),
     b. otherwise stress the penult.
```

Case (49a) accounts for (48), and case (49b) for (46). Strong retraction is binary and maximal, according to (49). It shares these properties with stress placement. However, (49) cannot be compared to any stress placement mode, as stress placement is always Q-sensitive.

Apart from Q-insensitive Strong retraction, *Q-sensitive Weak retraction* occurs. Clearly, Weak retraction derives its name from the fact that it obeys the weak cluster principle. Its distinctive property over (49) is that is checked in case the penultimate syllable is heavy (50ab):

(50) a. aráchnòid	b. salamándròid	c. pyrámidòid	d. líthòid
refráctory	annivérsary	prómissòry	mémory
stalágmìte	archimándrìte	molýbdenìte	Sámìte
eléctròde		pálinìde	cáthòde
peróxìde		cýanìde	nítrìde

It typically occurs in words derived by *learned* nominal or adjectival *suffixes* with a long vowel, such as *-oid*, *-ory*, *-ite*, *-ode*, *-ide*. Words ending in the disyllabic suffix *-ory* (*refract+ory*, *promiss+ory*, *mem+ory*) seem to violate the generalization on primary stress retraction that the *final* syllable has a (secondary) stress, as noted before. However, the final /i/ in the suffix is analysed under most accounts as an underlying glide /y/ (cf. SPE). Then the long vowel in the suffix will be stressed exactly like the one in *-oid* etc. The reduced suffix vowel in *-ory* when directly after a stressed syllable (*refráct<u>o</u>ry*, *mém<u>o</u>ry*) is accounted for in most analyses by a post-stress destressing rule, to be discussed in section 513.

Importantly, Weak retraction never retracts primary stress to a light syllable if another syllable to the left is available: **ar*['æ]*nòid*. This characteristic matches *maximality* of stress placement, cf. (18c). In spite of its relative rareness, Weak retraction matches Stress placement III, the idiosyncratic mode (16) found in underived nouns. The only difference is the fact that Stress placement III uses the word end as its starting point, and retraction the next stressed syllable:

(51) **Weak retraction** (underived nouns, suffixed nouns and adjectives)
If there is a stress in the final syllable,
a. stress the antepenult (if present) provided the penult is light.
b. otherwise stress the penult.

Of course the crucial difference with (49) resides in (51a). The clause (51b) generalizes Weak retraction to words such as *lithoid*, cf. (50d). This allows for the generalization that retraction depends on specific suffix types (such as *-oid*, etc.), not on the morphological basis to which the suffixes are adjoined. Different patterns can be the reflex of a single retraction *mode*.

A third stress retraction pattern must be reviewed, a pattern that has always been given much special attention in the literature. It involves a mixture of Strong and Weak retraction, as well as a type of Q-sensitivity referring to a special type of heavy syllable. Earlier we observed that suffixes such as *-oid* and *-ory* elicit Weak retraction, cf. (50). Although Weak retraction is quite regular for these suffixes, one context occurs in which Strong retraction is the norm. In words with two syllables preceding the suffix, a medial syllable can be skipped if it contains a short vowel closed by a sonorant. The full pattern is given in (52) below, where the cases (52b, c,d,e) are repeated from (50), and (52a) is the new (and crucial) case:

(52) a. hélminthòid	b. aráchnòid	c. salamándròid	d. pyrámidòid	e líthòid
désultòry	refráctory	annivérsary	admónitòry	cúrsory
árgentìne	smarágdìne	elephántìne	acétamìde	quínìne
árgentìte	stalágmìte	archimándrìte	molýbdenìte	sámìte
cávalcàde	òjíbwày	Gìrilámbòne	pálinòde	sátìre

As is clear from the examples at the bottom line of (52), the pattern extends to underived nouns whose final syllable contains a long vowel[14]. Stress is retracted to a heavy penultimate syllable if this syllable is closed by an obstruent (instead of a sonorant), as in (52b), or preceded by either two or no syllables (instead of one), as in (52c) and (52d). This type of primary stress retraction will be called *Sonorant retraction.* Actually, Sonorant retraction can be formulated as an extended version of Weak retraction:

```
(53) Sonorant retraction (underived nouns, suffixed nouns, adjectives)
     If there is a stress in the final syllable,
     a. stress the antepenult (if present) provided
        - the penult is light, or
        - the penult is VSon and preceded by exactly one syllable,
     b. otherwise stress the penult.
```

The Sonorant retraction pattern (53) will play an important role in our analysis in chapter 2, where we will prove it to be much more general than usually supposed. Usually, the pattern is derived by regular *Weak retraction*, as motivated by (52bcd), followed by the *destressing* of the sonorant-closed medial syllable in (52a). Therefore, instead of Sonorant retraction, the term *sonorant destressing* is often used.

So far, we have only discussed cases of primary stress retraction where the final secondary stress is irregular in its stress *level*, not in its being stressed as such. That is, the final secondary stress was always analysable as being due to a regular stress placement mode, such as (9) or (13). But stress retraction can also proceed from a final secondary stress which results from an irregular stress placement mode, such as Stress placement III. Recall that such irregular stresses can be located in nouns on final closed syllables which contain short vowels (but never on final short vowels).

In spite of the rather unpredictable nature of the final stress, primary stress retraction is fairly regular. The retraction pattern encountered is the Sonorant retraction pattern (53), cf. (54):

```
(54)a. Háckensàck b. Monádnòck  c. Adiróndàck  d. Mamáronèck  e. ínsèct
       álgernòn     eléctròn      Agamémnòn       pósitròn        prótòn
       pálimpsèst   Hopátcòng     Kalimántàn      Saskátchewàn    gýmnàst
       hóttentòt    Aquídnèck                     Escúminàc       pársnìp
```

In conformity with Stress placement III, no cases of retraction occur with a secondary stress on a final short vowel.

The final type of primary stress retraction to be discussed is so-called *Long retraction*, which involves a distance of two stressless syllables between the primary stress and the final secondary stress. Retraction of this type is extremely rare. Examples are given below - verbs in (55a), nouns in (55b), and adjectives in (55c):

```
(55)a. péregrinàte  b. rígamaròle  c. hallúcinatòry
       amélioràte      cátamaràn      manípulatòry
       detérioràte     húllabalòo     artículatòry
```

Although Long retraction is a marginal phenomenon, it strictly respects Q-sensitivity in the following sense: the first stressless syllable in the interstress interval cannot be *heavy*. That is, next to *Saskátchewàn* (54d), no words such as **Sáskatchewàn* occur. This observation directly matches the absence of **átl*[æ]*nta* in the Stress placement I paradigm (9), with the only difference being that the point of reference is the final stress, not the word edge. We can formulate Long retraction analogously to (9):

```
(56) Long retraction (rare across categories)
     If there is a stress in the final syllable,
     a. ignore the penult,
     b. stress the pre-antepenult (if present) provided the antepenult
        is light,
     c. otherwise stress the antepenult.
```

Notice that whereas (56) is extremely rare, the corresponding placement pattern (9) is very common. This difference will later be related to the fact that three-syllable windows result from *extrametricality*, an option that is not available word-internally.

This concludes our review of basic cases of primary stress retraction. We have discussed the following four retraction modes: Strong retraction (*récognìze*), Weak retraction (*aráchnòid*), Sonorant retraction (*hélminthòid*), and Long retraction (*péregrinàte*). Although this may seem self-evident, we reiterate that primary stress *retraction* has a (semi-) Q-sensitive mode, in Weak and Sonorant retraction, but stress *placement* is always Q-sensitive. Next to retraction as in *ánecdòte*, no placement as in **átl*[æ]nta occurs, where a heavy penult is skipped, and the final syllable is *stressless*. Hence, primary stress retraction across *heavy syllables* is limited to words with a *final stress* (which surfaces as secondary). This will turn out to be the central observation on which most analyses of retraction are based, as will be shown in the remainder of this section.

3.1.3 Secondary stress retraction

The above discussion deals with secondary stresses which follow the primary stress (by retraction to the left). However, English words that are long enough exhibit one or more secondary stresses *preceding* the primary stress. We will now discuss the distribution of such stresses. As we will see, many similarities exist between primary and secondary stress retraction. The most important of these are: (a) a limited distance between stresses, which never exceeds two stressless syllables, and (b) conditions on syllable weight of the stressless syllables in between stresses. Secondary stress retraction involves a complex array of patterns, many of which have been originally discussed in Fidelholtz (1967).

Basically, secondary stresses alternate rhythmically, as is illustrated by the words below:

(57) a.	àlabáma	àrizóna	b.	Pòpocàtepétl	hàmamèlidánthemum
	Mìnnesóta	pànoráma		àpalàchicóla	ònomàtopóeia

This binary alternation appears to be insensitive to syllable weight, since heavy syllables are generally skipped:

(58)	sèrendípity	àlexánder	Mòlybdénum	Cònestóga
	Mòzambíque	guàrantée	àmbuscáde	gòrgonzóla

In the terminology introduced in the preceding section, these cases are analogues of strong (Q-insensitive) retraction, cf. (49).

Nevertheless, (exceptional) cases occur of medial heavy syllables being irreducible. Such cases can be seen as the secondary stress analogues of Weak retraction of primary stress (51) and Stress placement III (15):

(59) chìmpànzée   ànàlgésia

Clearly, in words with an uneven number of syllables preceding the main stress, binary alternation cannot be maintained. In words with only one syllable before the primary stress, the following, nearly exceptionless secondary stress pattern exists. Heavy initial syllables bear secondary stress (60ab), and light initial syllables are stressless (60c):

(60)a. càntéen bènzíne òctóber pòntóon b. tÿphóon èiléen òhío Dàytóna c. políce banána manípulàte terrífic

Interestingly, (60c) implies that secondary stress retraction as opposed to stress placement and primary stress retraction, has no 'default' case to stress remaining light syllables[15].
Words with *three* syllables before the primary stress obey the following interesting set of generalizations.
First, the initial syllable is stressed if the second syllable is light. Such cases, which display two stressless syllables between stresses, can be viewed as the secondary stress analogues of Long retraction, cf. (56):

(61) àbracadábra Wìnnepesáukee Kàlamazóo Mùlligatáwny Tàtamagóuchi rìgamaróle Tìppecanóe hùllabalóo

This initial secondary stress shows up regardless of the weight of the *third* syllable, which may be stressless (62a) or bear a stress (62b):

(62)a. Kìlimanjáro Nèbuchadnézzar b. ròdomòntáde Hàlicàrnássus

The secondary stress on the third syllable in (62b) has a parallel in Weak primary stress retraction: *àdiróndàck, àgamémnòn, sàlamándròid* in (52c) and (54c).
Second, if the second syllable in the sequence of three is *heavy*, it is always stressed (**Tìconderóga*). In such cases, the initial syllables go by the rule of (60): heavy ones are stressed (63ab), light ones are stressless (63c):

(63)a. Cònstàntinóple phàntàsmagória b. Tìcònderóga Dòdècanésus c. Monòngahéla Atàscadéro

Secondary stress retraction has gradually been theoretically integrated with primary stress retraction (discussed in section 3.1.2), and stress placement (discussed in section 2). This is understandable from the perspective that secondary stress retraction closely resembles primary stress retraction and stress placement. Specifically, all such types of stress assignment (a) place restrictions to the number of stressless syllables following a stress (maximally two), which points to a bounded stress assignment mechanism, and (b) stress heavy syllables followed by stressless syllables, which points to some interaction between quantity-sensitivity and the bounded mechanism. This interaction is illustrated quite straightforwardly by the context which is excluded both in stress placement (64a) and stress retraction (64bc):

```
(64)a. *
       *  *  *
       σ  σ  σ
          H
```

b. *átlanta c. *Sáskatchewàn d. **Tìconderóga*

No heavy syllable can be stressless before another stressless syllable.

The integration of three types of stress assignment into a generalized stress retraction mechanism will be the topic of section 3.2 below. The purpose of this section will be specifically to show that two steps are necessary to arrive at generalized stress retraction. First, prominence (primary versus secondary stresses) must be separated from stress (stressed versus stressless). In this way, prominence can be superimposed on the stresses laid down by prominence-insensitive iterative stress assignment rules, whose formulation will then be quite simple. Second, the mechanism of Q-sensitivity must be separated from the bounded mechanism. This allows for the identification of the bounded mechanism underlying both Strong and Weak retraction. Nevertheless, it will be shown that the exact relation between Strong and Weak retraction remains problematic in all analyses. We will now turn to the ways in the developments of these ideas in the literature, departing from SPE.

3.2 Stress retraction in SPE-type linear theory

3.2.1 Primary stress retraction

Schematically, secondary stress to the right of the primary stress is derived in SPE by actual retraction of primary stress. In the structural descriptions of primary stress retraction rules, a primary stress occurs produced by a stress placement rule such as the MSR (25). The retraction consists of assigning [1stress] to a vowel at a restricted distance from this landmark and the automatic subordination of the latter to [2stress] due to the Stress Subordination Convention (see chapter 0)[16]. See (65) for illustration:

```
(65) [ -    1 ] Main Stress Rule (25)
       1    2   primary stress retraction rule
```

To account for Strong retraction in words like those of (48), stress is retracted quantity-insensitively (i.e. across any cluster) by the so-called Alternating Stress Rule (ASR), whose basic form is (66):

```
(66) Alternating Stress Rule
     V => [1stress]  /   [ X ____ Co    V Co       V      Co ]NAV
                                               [1stress]
```

The ASR is ordered after the MSR, so that the final [1stress] mentioned in (66) is provided by the MSR expansion (25). The ASR retracts primary stress to the antepenult across a cluster of any strength:

```
(67)              anecdote       anticipate
      MSR (25)       1                    1
      ASR (66)  1    2               1    2
```

Weak retraction, cf. (51), is obtained by another primary stress retraction rule, the so-called Stressed Syllable Rule. The SSR retracts stress to the antepenult across a weak cluster, otherwise to the penult if (a) the cluster is strong or (b) there is no antepenult[17]:

```
                                                   1
(68) Stressed Syllable Rule
     V => [1stress] /  [  X ___ Co ([-tense] Co) [1stress] Co  ]
                                      V             V
```

Simplicity arguments lead Chomsky and Halle to the conclusion that the SSR (68) cannot follow expansion (25) of the MSR[18]. Hence the MSR cannot assign the final [1stress] required by the SSR, and a special stress placement rule is required, the so-called Tense Suffix Rule, which is now the first rule of the subgrammar TSR-SSR-MSR(25)-ASR[19]:

(69) **Tense Suffix Rule**

$$\begin{array}{l} \text{V} \\ [+\text{tense}] \end{array} \Rightarrow [1\text{stress}] \; / \; [\,\text{X} + \underline{\quad}\; C_0\,]$$

The restriction of the TSR to tense vowel suffixes such as *-oid* is meant to keep underived words (*anecdote* etc.) from a ride through the SSR, and thereby from incorrect Weak retraction. Conversely, Strong retraction in words on *-oid* etc. is excluded by the disjunctive order between the SSR and the MSR (25), cf. footnote 18. Thus, the SSR's output cannot be incorrectly fed back into the MSR (25) and ASR:

(70)

	a. arachnoid	b. salamandroid	c. pyramidoid	d. lithoid
TSR	1	1	1	1
SSR	1 2	1 2	1 2	1 2
MSR (25)	blocked	blocked	blocked	blocked
ASR	n.a.	n.a.	n.a.	n.a.

Thus the situation arises that each stress retraction rule requires its own stress placement rule - there are two tandems: TSR-SSR and MSR-ASR.

Even though the SPE analysis works in an impressive amount of cases, its generalizations are too sweeping to lack exceptions. These are accounted for by diacritic features for (sub)rules, which are either part of the lexical representation or are assigned by redundancy rules.

First, by ordering the TSR before the SSR, the analysis makes the claim that all tense vowel affixes elicit Weak retraction. This is not always true, however, especially for the verbal tense vowel suffixes *-ize*, *-ate* (*récogn+ìze*, *désign+àte*, cf. 48b), which elicit Strong retraction. The solution is to exclude such verbs from the TSR, so that they are sent through the MSR (25) and the ASR.

Second, by producing stress retraction in underived words through the ASR, which strictly retracts to the antepenult, there is no way to derive the retracted primary stress in disyllabic words such as *árchìve*, cf. (46). The prediction is that underived disyllabic words with a final long vowel have final stress by the MSR(25), cf. (4). Even though such words have final stress in the majority of cases, it is simply too restrictive to completely exclude initial stress. As a simple solution to this problem, Halle & Keyser (1971) and Ross (1972) proposed to parenthesize the cluster in the ASR (66), thereby allowing retraction to the first vowel of *archive*.

Third, the SPE analysis lacks a mechanism for stress placement on weak final clusters consisting of a lax vowel and a single consonant. But as was shown in (54), such clusters can be idiosyncratically stressed. SPE accounts for *Strong retraction* from such unpredictably stressed vowels (*Háckensàck* etc.) by a negative marking for the long sub-rule of the MSR (22), thereby invoking the MSR(25) and the ASR[20].

Exception marking fails, however, for *Weak retraction* from unpredictably stressed *non-tense* vowels (*Monádnòck, ínsèct*, cf. 54b,e); for retraction in such words to follow the SSR, the final stress would have to be assigned by a rule ordered prior to the SSR. Clearly, the TSR cannot do this (being essentially a redundancy rule governing final [1stress] on *tense suffix* vowels). Ross (1972) and Halle & Keyser (1971) argue that in such cases, [1stress] is *lexically* present on the final vowel, thereby triggering Weak retraction by the SSR. This accounts for *Monádnòck* and *ínsèct*:

```
(71)        Monadnock        insect
 Lexicon        1               1
 SSR          1  2            1  2
```

Basic work on these data has been done by Fidelholtz (1967) and Ross (1972). They show stress on final lax vowels to be partly predictable from the following consonant(s). Basically, lax vowels followed by one or more non-dental obstruents have stress. These sub-generalizations may be expressed in rules, applying in the same way as the TSR.
These later adaptations of the SPE analysis yielded a complex system of stress placement and retraction rules, amended by many lexical markings considering retractions, which together serve to express some basically simple generalizations i.e.: (a) tense vowels attract stress, (b) Strong retraction depends on a final stress, (c) specific tense vowel suffixes trigger Weak retraction, (d) the remaining tense vowel suffixes trigger Strong retraction, (e) (long) underived words with final tense vowels go by Strong retraction. The complexity of this rule system was precisely the reason for Halle (1973) to collapse the ASR and SSR into a single retraction rule, enriched with lexical markings that govern Strong and Weak retraction modes. His proposal will be discussed in section 3.3.

3.2.2 Secondary stress retraction

We have seen that linear theory accounts for primary stress retraction, by actually retracting the primary stress from final primary stresses produced by stress placement rules. Secondary stress retraction is dealt with in SPE in a much different way, viz. by rules assigning 'pre-subordinated' values [2stress] to vowels leftward of primary stress. These rules are called Auxiliary Reduction Rules, since they function to protect vowels against vowel reduction. Since these rules insert [2stress] they do not trigger the Stress Subordination Convention, so that their effects are strictly local. Schematically, the situation we find in long words is depicted below[21]:

```
(72) # ...  [2stress]     ...   [1stress]            ...    ([2stress]) #
            secondary          primary stress               secondary stress
            stress by          by MSR, or stress            by MSR/TSR, point
            Aux. Red.          retracted by SSR/ASR         of stress retraction
```

We will discuss two of these Auxiliary Reduction Rules, called II(a) and II(b). The Auxiliary Reduction Rule II(a) applies in conformity with the weak cluster principle. It assigns the initial secondary stress in cases such as *àlabáma* (57a), *Cònestóga* (58), *Wìnnepesáukee* (61), and *Kìlimanjáro* (62a), and the one on the second heavy syllable of *Tìcònderóga* (63). To this end, it skips a cluster of any type preceding the primary stress, and then (optionally) another *weak* cluster which precedes it:

(73) **Auxiliary Reduction Rule II(a)**

$$V \Rightarrow [2\text{stress}] \;/\; \#\; [-\text{stress}]_0 \;\_\_\_\; C_0 \;([-\text{tense}]\; C_0)\; \overset{1}{V}C_0 \;[1\text{stress}]$$

A secondary stress will fall minimally two, and maximally three clusters away from the primary stress. In *Wìnnepesáukee* and *Kìlimanjáro*, the sequence of clusters preceding the primary stress matches the longest expansion, by its weak leftmost skipped cluster. But in *Tìcònderóga* and *Cònestóga*, the shortest expansion is selected since no weak cluster occurs in the relevant position:

```
(74)  a. Winnepesaukee    b. Kilimanjaro    c. Ticonderoga    d. Conestoga
  ESR              1                1                   1                1
  ARRII   2        1          2     1              2    1           2    1
```

The parenthesized weak cluster and its maximal skipping of two clusters resemble both the quantity-sensitive MSR (24) and the SSR (68). Chomsky & Halle are dissatisfied with the fact that a weak cluster is involved in all of these rules, since they are formally unrelated. The similarity "is not a merit of this grammar but rather indicates a defect either in the analysis or in the underlying theory. As matters stand now, we are unable to formulate a generalization that covers both the rule of primary stress assignment and the rule of secondary stress assignment, despite the near identity of context in the two rules." (SPE, p.115). Illustration of the similarity of the MSR, SSR, and ARRII(a) is in (75), where 'W' is a weak cluster, 'S' a strong cluster, and 'X' any cluster:

```
(75)              X    (W) X                    S     X           X  X
      MSR     al úm    in   um    #        Atl ánt   a    #       lég end #
      SSR      p ér    egr in    àte      Sask átch e    wàn     dés ign àte
      ARR      W ìnn   ep   es    áukee     Tic ònd   er óga     Còn est óga
```

The second subrule of the ARR, II(a), assigns [2stress] to the vowels of word-initial strong clusters at any distance from the primary stress. It is no genuine stress retraction rule, as it does not refer to a stress to the right.

(76) **Auxiliary Reduction Rule II(b)**

$$V \Rightarrow [\text{2stress}] \;/\; \#\, C_o \left\{ \begin{array}{c} \underline{\quad}\; C_2 \\ \left[\begin{array}{c} \underline{\quad} \\ +\text{tense} \end{array} \right] \end{array} \right\}$$

This rule assigns a stress to the pretonic vowels of *cà̲ntéen* and *tÿ̀fóon* (60ab), as well as the initial vowels of *Cò̲nstàntinóple* and *Tì̲cònderóga* (63ab), which directly precede a secondary stress resulting from the ARR II(a). Obviously (76) misses the generalization that strong clusters are a class on their own, instead of simply being the complement of weak clusters, as suggested by the *disjunction* in (76). Clearly, clusters are uncapable of reflecting the class-like behavior of heavy syllables.

3.3 Iterative stress retraction

3.3.1 Introduction

In the early seventies, versions of linear theory developed in which the mechanisms of stress placement, stress retraction, and secondary stress were integrated into one iterative stress assignment rule. Schane (1975) formulated the idea behind iterative stress rules as follows: "The set of rules applies to the whole word, starting from the end of the word and working to the beginning. Where more than one rule is applicable the starting domain of each subsequent rule is the place in the word where the previous stress was assigned." Two major reasons for the development of iterative stress rules are the following.

First, there is the theoretical desirability to formally reflect the similarities between stress placement, primary and secondary stress retraction, which had already been noticed in SPE, but had been left unexpressed by an SPE formalism because of its distinction between rules which assign primary and secondary stress. Second, there is the major insight that the distribution of stressed vowels can be assessed fairly independently from their eventual prominence values, primary or secondary. This idea invited a separation between rules providing a binary value of [+/-stress], and rules imposing numerical prominence values upon binary stresses, selecting the primary stress and subordinating remaining stresses to a secondary level.

As a trend, primary and secondary stress retraction have gradually been integrated with stress placement into iterative stress assignment. This in its turn led to an increased role of destressing rules, primarily to trim the overgeneration of stresses in left-peripheral positions, where the iterative rule reaches the edge of the domain. As a result of these developments iterative stress assignment has become an integral part of the metrical analyses after Liberman & Prince (1977).

3.3.2 **Schane (1975) and Halle (1973)**

The main theme of Schane (1975) and Halle (1973) (the former preceding the latter in real time) is the following question: What happens if the assignment of [+stress] is separated from (or precedes) the assignment of numerical values of these binary stresses? The result at the end of this discussion (Liberman and Prince 1977) is one iterative [+stress] rule applying from right to left through the word, with a number of ordered subrules.

Schane (1975) provided the basis for later metrical analyses by his idea to separate the assignment of [+stress] from the assignment of levels of stress. His rules for imposing numerical stress values [*n*stress] on the output of rules that assign the binary value [+stress] will be discussed in detail in section 4. Here we will discuss the rules for [+stress].

By eliminating reference to stress level from the stress rules, Schane was able to formally relate stress placement and all stress retraction by means of their common rule format, i.e. V => [+stress] / X ___ Y. This allowed him to solve part of SPE's retraction problems mentioned earlier in section 3.2.2. Recall that a parenthesized weak cluster appears in at least three SPE rules: the Main Stress Rule (24), Stressed Syllable Rule (68), and Auxiliary Reduction Rule II(a) (73). The problem is that rules that assign primary stress (MSR and SSR) are formally unrelated to rules assigning secondary stress, such as the ARR II(a)[22]. Schane brings about a formal relation between them by collapsing all into the set of subrules below:

$$\text{(77)}\quad V \Rightarrow [+\text{stress}]\ /\ \_\_\_\ (\dot{V}C_0)^1 \left\{ \begin{array}{l} \dot{V}C_0\ \# \\ +\ [+\text{stress}]C_0 \\ VC_0\ [+\text{stress}] \\ \# \end{array} \right\} \begin{array}{l} \text{a. MSR (22)} \\ \text{b. SSR (68)} \\ \text{c. Aux Red IIa (73)} \\ \text{d. MSR (23)} \end{array}$$

Crucially, the subrules a-d are conjunctively ordered, since they can be collapsed by braces. This is important since the placement subrules (ad) can now feed retraction subrules (bc). Note that the ASR (representing Strong retraction) is not integrated with (77).

In Schane's footsteps, Halle (1973) further integrates rules of primary and secondary stress retraction, by including Strong retraction. As a first step all final stress which feeds stress retraction, i.e. lexical stress, the Tense Suffix Rule, and MSR-(25), is assigned by one general final stress placement rule, the so-called Primary Stress Rule (PSR). Essentially, it is the [+stress] analogue of SPE's MSR-(24), generalized to 'irregular' final stress placement.

Stress retraction now takes the form of the Stressed Syllable Rule (78), which retracts stress across maximally two clusters, the first of which must be weak[23]:

(78) **Stressed Syllable Rule**

$$V \Rightarrow [+\text{stress}]\ /\ [\ X\ \_\_\_\ C_0\ (W)\ (VC_0)\ [+\text{stress}]\ C_0\ Q\ ]$$

This retraction rule abbreviates the four subrules given below:

```
(79)a. [ X ___ Co W VCo [+stress] Co Q ]   cátamaràn      Wìnnepesáukee
    b. [ X ___ Co   VCo [+stress] Co Q ]   Háckensàck     àlexánder
    c. [ X ___ Co W     [+stress] Co Q ]   Saskátchewàn   Ticònderóga
    d. [ X ___          [+stress] Co Q ]   aráchnòid      chimpànzée
                                           salamándròid   Halicàrnássus
                                           árchìve        càntéen
```

The analysis reflects the important fact (noted earlier) that retraction never skips a sequence of a strong cluster plus a light cluster. We have *Saskátchewàn, Tìcònderóga*, but never **Sáskatchewàn* or **Tìconderóga.*

The remaining context types are all attested, be it to different degrees of 'markedness'. Halle assumes *redundancy rules* to state subregularities in the distribution of contexts over lexical classes.

For example, underived words predominantly follow Strong retraction (79b), but words with tense vowel suffixes often follow Weak retraction (79d). Words like *salamándròid* (52c,54c), *Halicàrnássus* (62b), *aráchnòid* (50a), and *chimpànzée* (59) require negative diacritic marking for all subrules except for (79d). Furthermore, subrule (79a) is the unmarked choice for secondary stress retraction, cf. (61), but highly marked for primary stress retraction, cf. (56).

So far, the analysis covers all cases of stress retraction from stresses laid down by the stress placement rule (PSR). However, the analysis does not yet cover further leftward stress retraction, in the form of initial stresses, leftward of the ones assigned by the SSR. Examples of words in which three stresses occur are given in (80) below, partly repeated from (59), (63), (62b), (57b), (52b), (54d), and (52c):

```
(80)a. chìmpànzée   b. Tìcònderóga    c. Hàlicàrnássus   d. àpalàchicóla
       òjíbwày         Sàskátchewàn      sàlamándròid       pàrallélogràm
```

The so-called Initial Stress Rule assigns initial stress to such words:

(81) **Initial Stress Rule** (ISR)
$V \Rightarrow [+stress] \; / \; [\; C_o$ ___

Notice that the ISR is not a genuine retraction rule, since it does not mention a stress to the right. In this sense, it much resembles the SPE Auxiliary Reduction Rule II(b) (76), with the major difference that it does not refer to cluster strength. We will now turn to the consequences of this simplification.

One of the major side-effects of the SSR and ISR is their overgeneration in initial pretonic weak clusters which should be stressless. Words such as *police* (60c) will receive an initial stress by the shortest expansion (79d) of the SSR, which automatically applies to all contexts in which longer expansions (79abc) are inapplicable. Furthermore, words such as *Monongahela* (63c) will be automatically stressed by the ISR (81).

For this reason, Halle's analysis needs a special rule to remove stress from weak pretonic clusters. This destressing rule, to be discussed in section 5, is the first clear example of a rule of destressing trimming the overgeneration by stress rules, in order to arrive at the maximally generalized statement of the latter, i.e. the SSR and ISR. In this sense it is of importance to the red line through the analyses (and one of our central topics in chapter 2): the redressing balance between stress and destressing rules[24].

Some example derivations are presented below:

```
(82)     a. salamandroid  b. Halicarnassus   c. manipulate   d. Monongahela
  PSR               +                +               +                 +
  SSR          +    +            +   +           +   +            +    +
  ISR     +    +    +        +   +   +         + +   +          + +    +
 Later
 rules    3    1    3        3   3   1         - 1   3          - 3    1
```

Halle's analysis improves the less generalizing SPE account, which follows the reverse strategy of stressing initial strong clusters by the ARR-II(b) (76), leaving weak clusters stressless. As was remarked above, this account fails to express the overall class-like behavior of strong clusters, listing these by means of a conjunction.

3.3.3 Liberman & Prince (1977)

The metrical analysis of Liberman & Prince (1977) is the next major step in the program initiated by Schane and Halle, which led to the complete separation of [+/-stress] and prominence levels. Here we will not review LP's formalization of the latter in metrical trees, a topic to be taken up in section 4, and restrict ourselves to the assignment of [+stress].

In this respect LP continue the trend set in previous work by Schane and Halle, aimed at a formal unification of stress placement and retraction. They accomplish this by formulating the first *iterative* stress rule, the so-called *English Stress Rule* (ESR)[25].

```
(83) English Stress Rule (iterative version)
     V => [+stress] / ___ C_o (V(C))_a (    V       C_o)_b (     V        X)_c #
                                         <-long>_d          [+stress]
     Conditions: ~c => d; ~a, ~b under certain morphological and lexical
                 circumstances.
```

In its initial application - when the term labeled *c* cannot be matched - the ESR places stress Q-sensitively, at maximally three clusters from the right word edge. On every subsequent application, the rule feeds on its own output - the term *c* being matched by a stress assigned by a previous application - accomplishing retraction. Retraction *modes* arise by suppressing the terms *a* (a weak cluster) and/or *b* (any cluster). This suppression is subject to lexical diacritic marking (~*a*, ~*b*) on suffixes or individual words. When no terms are suppressed, the Long mode arises. Suppressing *a* yields the Strong mode, and suppressing *b* the Weak mode:

```
(84) a. Long mode:     ___ (W) (VC_o) [+stress] C_o
     b. Strong mode:   ___     (VC_o) [+stress] C_o
     c. Weak mode:     ___ (W)        [+stress] C_o
```

Retraction modes are complex, as they can be expanded into disjunctively ordered subrules. Partly the subrules are shared by different retraction modes, as for instance holds for the short subrules which contain no parenthesized terms. The bundling of partly overlapping subrules into retraction modes captures the basic unity underlying different stress patterns that occur in the paradigms of individual suffixes. LP thus capture the generalization that retraction modes are *constant properties* of the stress paradigms of suffixes[26].

Another important generalization discussed earlier is that stress rules can never skip two syllables the first of which is strong (**átlanta*, **Tìconderóga*, **Sásketchewàn*). The ESR reflects this, because the first of two clusters skipped must be a weak cluster (term *a*).

Stress placement shares both suppressable terms *a* and *b* with retraction, implying different *stress placement modes*. As we saw earlier in section 2, such differences exist. That is, nouns and suffixed adjectives (6-8) go by the 'Long mode' of Stress placement I (9), while stress placement in verbs and underived adjectives (11-12) is governed by ~b, the 'Weak mode' of Stress placement II (13). The double suppression of the terms *a* and *b* is motivated in stress placement by ultra-short expansions: *Adirondà̱ck, Mamáronèck, guitár,* cf. Stress placement III (15-16)[27].

Iterative stress assignment has become an integral part of most metrical analyses of English stress after LP, the main exception being Selkirk's (1980) non-derivational hence non-iterative and non-directional account.

3.3.4 **Kiparsky (1979)**

Kiparsky (1979) makes an important contribution to stress retraction by drawing attention to the *Sonorant retraction* pattern (53), and proposing an analysis for it. His analysis involves a *destressing* rule applying to the output of LP's Weak retraction mode (84c). This destressing rule has the remarkable property of being ordered *prior* to the rule assigning the primary stress.

The words in (52b-e) follow the Weak mode, as is usual for words derived by nominal and adjectival long vowel suffixes. Clearly, the special type of retraction is located in the words in (52a), which unexpectedly go by the Strong mode. Assuming that words in *-oid* etc. indeed retract stress by the Weak mode, iterative stress assignment by the ESR (83) yields:

```
(85)a helminthoid  b arachnoid  c salamandroid  d pyramidoid  e lithoid
       +   +   +      + +   +      + - +   +       + + - +       +  +
```

The correct generalization - attributed by Kiparsky to G. Gane - is that the syllables to be skipped are closed by sonorants, and located between two stresses, cf. (52a). No syllables can be skipped that are closed by an obstruent (52b), or preceded by a stressless vowel (52c).

Kiparsky translates this generalization into a destressing rule applying to an interstress sonorant-closed syllable. This destressing rule, which he calls Sonorant Destressing, is stated below:

```
(86) Sonorant Destressing
     V => [-stress] /    [+stress] Co ___ [+son] C [+stress]
                       d      e      s   u     l   t      o      ry
```

Crucially, Sonorant Destressing applies prior to prominence assignment. If it were to follow prominence assignment, the vowel it would have to destress would *carry primary stress*, precisely like the penults of the remaining words in the retraction paradigm (52). Destressing the primary stress is an option generally denied to destressing rules. Ordering (86) prior to the primary stress rule has the advantage of feeding it, so that it is explained why primary stress occurs on the first vowel of *desultory*. Anticipating our discussion of destressing in section 5, its ordering prior to the primary stress rule makes Sonorant Destressing an a-typical example of this class of rules.

3.4 Stress retraction in foot-based metrical theory

3.4.1 Introduction

Metrical theory after LP eliminated the feature [+stress], transferring its function to the prosodic category *foot*. Iterative stress assignment thus metamorphized into the construction of a prosodic layer of feet of specific size and segmental composition. Apart from foot geometry, the central issue consisted of translating notions from linear theory, such as the convention of disjunctive ordering and directionality, into foot-based theory. The first foot-based analysis to be discussed, Selkirk (1980) radically rejects precisely these notions. Instead, she proposes a *non-derivational* analysis in which stress is completely lexically specified, be it within the margins of *foot templates* which function as redundancy conditions on *possible stress patterns*. Rejecting Selkirk's assumptions, Hayes (1981) proposes a derivational metrical analysis couched within a universal parametric framework. His main contributions to English stress retraction are (a) eliminating the Long (ternary) mode in favor of the (binary) Strong and Weak modes, and (b) providing a principled basis for the distribution of the latter, with the help of extrametricality.

3.4.2 Selkirk (1980)

Selkirk (1980) argues that lexical diacritics as those assumed by LP and previous analyses seriously undermine the assumption that English stress is rule-based, an assumption made in all literature discussed so far. In particular, if diacritics can freely govern the distribution of patterns of stress placement and retraction, what is the role that remains for the rules that are claimed to produce these patterns? The derivational key notion that is proposed as the strongest piece of evidence favoring stress rules, viz. the principle of *disjunctive ordering*, is directly threatened by lexical marking, as this has the power to overrule any ordering it implies. In fact, marking a form for not undergoing the long expansions of a rule in a way equals the direct marking of stress of the vowel which is stressed by the shortest expansion (cf. *Monádnò̲ck*, 54b).

Instead, Selkirk argues that English word stress is completely lexically specified in a form governed by foot templates that essentially function as *redundancy conditions*, expressing generalizations about the relation between syllable weight and stress patterns which as Selkirk claims are simply obscured in analyses based on rule diacritics:

```
(87)a. Light syllables are stressless word-finally and before a stressed
       syllable, unless word-initial.
    b. Syllables with a long vowel are stressed.
    c. Closed syllables with short vowels freely occur either stressed
       or stressless.
```

The first generalization, which was discussed earlier as *maximality* in relation to (15), (51), and (53), is especially interesting, because it is missed by analyses based on rule diacritics. If a diacritic can serve to (exceptionally) place stress on a final *closed* syllable with a short vowel (*díplomà̲t*), no principle prevents the same marking on a final *open* syllable with a short vowel (**sófà̲*). According to (87a), light syllables are also stressless in *medial pretonic* positions. In a stress diacritic account, this is difficult to express again as there are no generalizing means to set apart the merely exceptional *forms* (*vaní̲lla*, cf. 14ab) from the never occurring ones (**vaníllàt*). Finally, (87a) states that *initial* pretonic syllables can be stressed. Two types can be distinguished: words with an initial primary stress (*sátìre*, *Héttìte*, cf. 46), and the rare words with an initial secondary stress (*ràccóon*, cf. footnote 15).

The generalizations (87b), (87c) imply an asymmetry among the two types of heavy syllables, which were treated on a par in earlier work. While long vowels have inherent stress according to (87b), closed syllables with short vowels can be freely stressed or stressless - (87c). Closed syllables with short vowels indeed vary as to their stress values, as is clear from comparing (48) to (50a), and (52a) to (52bc). However, the variation does not occur in at least two contexts discussed above: (a) initially before stress, as in *càntéen* (60a) not **cantéen*, (b) before a stressless syllable as in *Atlánta*, not **átlanta*, and in **Tìcònderóga*, not *Tìconderóga*. In this respect, (87c) is an inaccurate simplification.
Selkirk claims that the distribution of stresses is variable within the margins of the above generalizations, to be seen as lexical redundancy rules, and stated as *templates* with the form of metrical stress feet:

```
(88) Monosyllabic Stress Foot   Disyllabic Stress Foot   Stress Superfoot
     a. F   b. initial in D_F,          F                       F
        |           F                  / \                     / \
        σ           |                σs   σw                 Fs   σw
        |           σ                      |                       |
     {CVC1}                              CVC0                    CVC0
     {CVV }
```

The monosyllabic template a. disallows light syllables, except domain-initially (template b.). The disyllabic and stress superfoot templates disallow long vowel syllables in weak positions, while closed syllables with short vowels are allowed in all positions of all feet.
Disjunctivity and directionality play no role whatsoever. Disjunctivity boils down to the mutual incompatibility of prosodic structures, since a syllable cannot be simultaneously part of two incompatible feet. Because the distribution of feet is free, no *ordering* is required between longer and shorter feet - analogously to the derivational principle that longer expansions apply first. In derivational analyses, such *maximality* in the ordering of expansions serves to skip a non-initial light syllable, if a stressable syllable precedes. In (88), this function is obtained by the condition that monosyllabic feet cannot dominate a light syllable, except initially.
After Selkirk (1980), derivational notions such as maximality and the retraction modes seemed to be in need of justification. Hayes (1981) offers a proposal to this effect.

3.4.3 **Hayes (1981)**

Hayes (1981) presents a derivational analysis of English stress within a universal parametric theory of word stress, cf. chapter 0, section 2.4.3. Partly as an answer to Selkirk's criticism, Hayes goes on to improve on earlier derivational analyses of stress retraction in three respects. First, the distribution of retraction modes is made less arbitrary and derived from the independently motivated rules of extrametricality. Second, Sonorant Destressing is exploited maximally, eliminating more counter-examples to Weak retraction as compared to Kiparsky (1979). Third, (Long) retraction by ternary feet is eliminated in favor of purely binary feet, again with the help of a destressing rule.
As the key to the distribution of retraction modes, Hayes deals with the Weak and Strong retraction modes by different stress rules distinguished in terms of Q-sensitivity. Weak retraction results from the Q-sensitive English Stress Rule (27), while Strong retraction results from a second bounded rule, the iterative Q-insensitive *Strong Retraction Rule.*
Recall from section 2.3 that the Q-sensitive English Stress Rule ignores extrametrical rimes, to reach the antepenult in cases like *América*, cf. (30). This stress placement pattern will automatically account for Weak retraction as well, as in *pyrámidòid* and *aráchnòid* in

(50), if the extrametricality rules (29) can only apply to stressed final syllables in addition to the stressless syllables of (30). If we indeed abstract away from the final secondary stress on long vowel suffixes, the ESR - on its initial application - will correctly yield (89):

```
(89)a.  F              b.     F             c.  F
        |                    / \                |
     ellips<oid>em     pyramid<oid>em      lith<oid>em
```

The ESR erects a Q-sensitive foot on the right edge of the domain, while ignoring extrametrical material. In both stress placement and retraction the ESR assigns the *rightmost* foot of the domain. Extrametricality (29) therefore provides a distributional criterion for Weak retraction: since it is restricted to nouns and derived adjectives, so is Weak retraction. This prediction matches the well-known observations discussed earlier in relation to (50).

Let us now turn to the stress on the extrametrical long suffix vowels of (89). To assign such stresses, a special rule of Long Vowel Stressing is required, which much resembles SPE's Tense Suffix Rule (69)[28]:

```
(90) Long Vowel Stressing
     VVCo #   =>   VVCo #
                   |
                   F
```

The necessity of LVS next to the ESR is somewhat suspicious, however, as both assign a foot to a final heavy syllable. Hence generalization (87b) made by Selkirk (1980) is much of an accident in Hayes (1981).

A second source of final secondary stress next to LVS are *lexical feet*, intended to represent unpredictable stress in closed syllables with short vowels, cf. (54):

```
(91)a.        F        b.       F        c.        F
              |                 |                  |
         Hottentot        Monadnock       Adirondack
```

Lexical feet imply that word stress is not fully derivational, requiring a residue of stress diacritics in the form of pre-marked feet. They are the analogues of lexically marked [1stress], [+stress] in linear theory.

Let us now turn to Strong retraction, occurring in classes complementary to the ones undergoing Weak retraction: verbs and underived adjectives. Recall that these categories are not subject to extrametricality (29), making their final syllables accessible to the application of the ESR, cf. (33). The final secondary stresses in verbs of (48b) like *récognìze, antícipàte*, must then be due to the ESR (27), instead of LVS (90), even though the stress level is *secondary* instead of primary. This means that Strong retraction involves a form of foot assignment different from the ESR, whose domain is leftward of that of the ESR. Strong retraction will be assigned by an iterative Q-insensitive *Strong Retraction Rule*:

```
(92) Strong Retraction Rule
     Form quantity-insensitive, left-dominant feet, going from right to
     left across the word.
```

This rule directly accounts for Strong retraction in verbs in *-ate, -ize* by simple ordering after the ESR: the latter erects a non-branching foot over *non-extrametrical* final heavy rimes, and the SRR retracts leftward:

```
(93)a. SRR SRR ESR      b. SRR ESR    c. SRR ESR
        | / \ |            / \  |         |  |
       manipulate        designate      rotate
       legitimize        recognize      baptize
```

Thus, from the assumption that verbal long vowel affixes are metrical, their status as Strong retractors follows. Crucially, the ESR and the SRR are *different* rules, not two subrules of some generalized rule, as proposed by LP[29].

Disallowing ternary feet, the analysis seems to be over-constrained by ruling out Long retraction: *péregrinàte* (55). However, Hayes shows that most of the relevant data can be obtained from an alternative analysis, partly phonological, partly morphological: underlying glides are invoked in *detérioràte* etc., and stress-neutral affixation in *hóspitalìze* etc. Only a small residue resists such analysis, words like *cátamaràn*, (55b).

Let us now consider the arguments for an *iterative* SRR.

First, the bounded iterative SRR directly accounts for the alternating pattern of secondary stresses before primary stress, cf. (57), (58):

```
(94) SRR    SRR  ESR
     / \    / \   | \
    A pa la chi co:la
```

The SRR also captures the fact that syllable weight is typically ignored by secondary stress, particularly when occurring immediately before the primary stress, cf. (58):

```
(95)  SRR     ESR
      / \     / \
     se ren di pi <ty>em
```

This automatically derives much of what is usually lexically marked for the Strong mode in earlier analyses. Secondary stresses in medial heavy syllables at *uneven* distances from primary stress (*Hàlicàrnássus* (62b), *chìmpànzée* (59)) must of course be due to some other source, presumably lexical feet, since such syllables are skipped by the SRR. Clearly, Hayes takes issue with Halle's idea that *èlephántìne* and *Hàlicàrnássus* reflect one uniform *Weak retraction* paradigm (51), as illustrated in (50) and (62b).

Second, Hayes agrees with Halle (1973) in assigning secondary stresses by the SRR to any initial syllable, regardless of its weight:

```
(96)a. SRR ESR  b. SRR  SRR  ESR      c. SRR ESR  d. SRR  SRR  ESR
        |   |       |   / \  |\           |  |        |   / \  | \
       can teen    Ti con de ro <ga>em   po lice     Mo non ga he <la>em
```

And as in Halle (1973), any overapplication to light syllables (96cd) will be trimmed through a destressing rule (to be discussed in section 5 on destressing).

Third, as we have seen earlier in 3.1.3, secondary stress retraction is partly sensitive to syllable weight, especially in sequences of three syllables before the primary stress, the second of which is heavy (63). Since such a heavy syllable is located at a binary distance from primary stress, it will be correctly stressed by the Q-insensitive SRR: see *Tìcònderóga* (96b,d). In such cases, LP's Long retraction mode can simply be replaced by a bounded mechanism.

But crucial instances of long secondary stress retraction are provided by words with a *light* second syllable in a sequence of three, such as *Wìnnepesáukee*, cf. (61). As these are treated on a par with *Ticonderoga* by the Q-insensitive SRR, it is (incorrectly) predicted that they surface with a secondary stress on their second syllables: **Wìnnèpesáukee* etc. As in (96cd), a destressing rule is in order to account for the surface absence of secondary stress. Clearly, the distinction between *Tìcònderóga* and *Wìnnepesáukee* requires the relevant destressing rule to be Q-sensitive. The QS destressing rule will be discussed in section 5. As in (96cd), a destressing rule allows the formulation of a maximally generalized stress rule. We will now turn to a third instance of this strategy: Sonorant Destressing.

The Sonorant retraction pattern makes the only systematic deviation from Weak retraction in words derived with nominal and adjectival long vowel suffixes (52). Precisely this observation led Kiparsky (1979) to analyse the pattern as basically an instance of Weak retraction, the output of which is subject to a Sonorant Destressing rule (86). Hayes generalizes Sonorant Destressing to underived nouns (52, 54), otherwise unexplained exceptions to Weak retraction. The first type of underived noun matching the paradigm has a final long vowel syllable, with a stress due to Long Vowel Stressing: *cávalcàde* (52a). The second type has an unpredictable final stress - a lexical foot: *Háckensàck* (54a).

Kiparsky's rule translates into Hayes's metrical foot notation as a *foot deletion* rule:

```
(97) Sonorant Destressing
     F => Ø  /  F  ___  F
                |   |
                    R
                   / \
                  /___\
                 V [+son]
```

Notice how Kiparsky's requirement that the focus stress be surrounded by two stresses translates into foot-notation as branchingness conditions on the focus foot and the preceding foot.

```
(98)a. SRR ESR LVS    b. SRR ESR LVS     c. SRR ESR  LVS
        |   |   |         | |    |           / \ |     |
       helminth<oid>em      arachn<oid>em     salamandr<oid>em
```

Remnant rimes of destressed feet are adjoined to the preceding foot by Stray Syllable Adjunction (31):

```
(99)    F F   F               F       F              F     F
        | |   |         (97)  |       |       SSA   / \    |
      desult<ory>em ==> desult<ory>em ==> desult<ory>em
```

The net effect is that *desultory*, *helminthoid* etc. enter the primary stress selection rule in a shape identical to strong retracting *désignàte*.

This analysis of retraction is a considerable improvement over earlier accounts, eliminating much arbritrary lexical marking. Furthermore, it preserves the generalization discussed in 3.1.2 that Strong retraction depends on a stress on the final syllable, whatever its source: the ESR (in verbs), LVS (in nouns and derived adjectives), or lexical feet (in unpredictably stressed final syllables).

In spite of its general accuracy the present analysis requires lexical exception markings, for various reasons. First, stressed extrametrical rimes need lexical feet (91). Second, some nouns display Strong retraction across obstruent-closed rimes, cf. *ánecdòte* (48a). These are exceptions to Noun Extrametricality (29a), hence derivationally identical to verbs such as *designate*. Third, the mirror image case is Weak retraction in verbs - *imprégnàte*, cf. footnote 13. These require a lexically extrametrical rime, rendering them derivationally identical to nouns such as *aráchnòid* (50)[30]. Fourth, Sonorant Destressing has some exceptions, such as *cylíndròid*, cf. footnote 14.

3.5 Stress retraction in grid-only theory

Grid-only theory yields a completely new analysis for stress retraction. The difference with foot-based metrical analyses is that heavy syllables all receive stress by QS (34), so that Strong and Sonorant retraction involve rules of stress *shift* or stress *deletion*. Essentially, grid-only theory has no proper way of skipping heavy syllables by some binary rule.

Stress placement and retraction basically result from the same rules, which have been discussed in section 2.4. Q-Sensitivity (34) stresses heavy syllables, and Perfect Gridding (35) stresses light syllables at even distances from other stresses, running from right to left through the word. A third rule, the Initial Basic Beat Rule (38), is motivated by stresses on initial light syllables at an uneven distance from other stresses - *sátìre* from (46c), and (exceptional) *ràccóon* from footnote 15.

Taken together, these stress assignment rules account for a large portion of the patterns of stress placement and retraction attested in English. Especially Weak retraction (51) is unproblematic. Example derivations run as:

```
(100)  a.     *    *        b.        *       c.     *
            * *    *           * * *  *          *   *
  QS (34)   arachn<oid>em     pyramid<oid>em    lith<oid>em

                                 *    *
                               * * *  *
  PG (35)   ---               pyramid<oid>em       ---

            * *    *           * *    *          *   *
            * *    *           * * *  *          *   *
  IBBR(38)  arachn<oid>em     pyramid<oid>em    lith<oid>em
```

The extrametrical long vowel suffix *-oid* regularly undergoes QS, because QS is blind to syllable extrametricality, cf. section 2.4. This is a clear improvement over Hayes (1981), where additional mechanisms must be invoked to place a secondary stress on heavy extrametrical syllables, either by LVS (90) or lexical feet (91). QS throughout the domain is far more generalizing.

The second field where this set of rules achieves satisfactory results is 'weak' secondary stress retraction (57), (59), (60), (62b), (63):

```
(101)a.         *    b. *  *  *  c. *  *   d. * *    *    e.    *
QS(34) * * *  * * *     *  *  *     *  *      * *  * * *    * * *  *  *
       Apalachicola   chimpanzee   canteen   Ticonderoga   Halicarnassus

       *   *    *       *  *  *     *  *      * *    *      *   *  *
PG(35) * * *  * * *     *  *  *     *  *      * *  * * *    * * *  *  *
       Apalachicola   chimpanzee   canteen   Ticonderoga   Halicarnassus

IBBR(38) ---             ---        ---         ---             ---
```

Of course, secondary stress is also analysed as basically Q-sensitive by the presence of QS. Since all heavy syllables are stressed, some must be destressed in specific contexts. In Selkirk's analysis, *sèrendípity* (58) and *Kìlimanjáro* (62a) require a destressing, but segmentally parallel *chìmpànzée* (101b) and *Hàlicàrnássus* (101e) must be marked for not undergoing it. The idea is that the lexical variation in the stress values of closed syllables is better captured by destressing rules only, than by a mixture of rules of stress retraction and destressing. To see this, note that marking a syllable for not undergoing destressing does not equate, qua outcome, marking this syllable for stress. The difference resides in the fact that lexical stresses can potentially be on light syllables, and annihilate Maximality (18c). Exception marking against destressing is a much weaker device, since it can never result in Maximality violations. Therefore, removing lexical variability from the stress assignment rules directly yields the strong generalization (87a) of Selkirk (1980), that stressed light syllables do not occur in non-initial pretonic positions. Such stresses can simply never arise from the application of any of the set of QS (34), PG (35), IBBR (38). And since there is no rule to assign stress, lexical exceptions to destressing simply cannot occur.

Let us now turn to a more problematic side of grid-only analysis: Strong retraction of primary stress. The advantages booked in Weak retraction of primary and secondary stress are counter-balanced by the fact that heavy syllables which are to be skipped in surface patterns are stressed as well. This implies that *Strong retraction* requires either destressing or movement of primary stress from a heavy syllable.

Quite surprisingly, Selkirk (1984) has nearly neglected Strong retraction. Although Selkirk addresses destressing in some detail, she does not analyse any type of Strong retraction except for Sonorant retraction (53), which is formalized as a movement of a grid element on the level of primary stress (following Halle & Vergnaud 1981):

```
(102) Sonorant Retraction
         *                   *
      *  *  *     =>     *   *   *
      *  *  *            *   *   *
      σ  σ  σ            σ   σ   σ
        / \                 / \
       /___\               /___\                 ┌+son  ┐
        CVR                 CVR              (R = └+cons┘)
```

As is clear from its formulation, this rule is ordered *after* main stress selection. Selkirk chooses this ordering to completely separate the rules that *change* grid structure (stress deletion, movement) from rules which *construct* grid structure. (102) feeds a destressing rule deleting the stress from the medial syllable, and which also destresses the medial syllable in *serendipity* etc., cf. (58). Stress movement is a typical grid-only way of accounting for retraction across heavy syllables. It is accompanied by severe problems, however.

First, distinguishing primary stress retraction and destressing falsely predicts the existence of exceptions to the latter only: **hélmìnthòid*, especially so because the destressing rule books numerous exceptions in secondary stress: *chìmpànzée* etc. cf. (59).

More severely, *Strong Retraction*, cf. *récognìze* (48), must be formulated so that it un-generalizingly restates the stress context of the Sonorant Retraction rule (102), with (a) a final secondary stress that (b) is adjacent to the target stress and (c) is directly preceded by secondary stress. Strong retraction would differ from Sonorant Retraction only in its segmental context and perhaps in category-based conditions. Although Selkirk remains silent on the issue of Strong retraction, a grid-only analysis based on primary stress retraction misses the generalization that retraction *as such* moves a stress from the stressed penult to the stressed antepenult. Put differently, a retraction of primary stress obscures the structure-preserving nature of the resulting configuration: primary stress is always on the last metrical beat. This generalization must be restated - as a coincidence - in each retraction rule.

Without stress movement, no proper way of deriving the destressing effect remains, since destressing is generally denied the power of *deleting* the primary stress. The only generalizing alternative would be a destressing rule applying before primary stress selection, amounting in effect to Kiparsky's analysis. In itself, this alternative would not run against the several inherent advantages of a grid-only analysis, in particular the uniformity in stressing heavy syllables.

3.6 Stress retraction in bracketed-grids theory

Halle & Vergnaud (1987) (henceforth HV) propose an analysis of stress retraction sharing properties with both Hayes (1981) and Selkirk (1984). Their central idea is that quantity-sensitive stress and quantity-insensitive stress result from different phonological strata. For the sake of clarity, we slightly simplify HV's theory of strata and cyclicity. Essentially, phonological rules are marked for being applicable in either of two strata, a *cyclic* one and a *non-cyclic* one. Although the parallel is not complete, 'cyclic' and 'non-cyclic' rules may be compared to rules that in earlier theories (Kiparsky 1982 etc.) were assumed to be applicable at the lexical 'level-1' and 'level-2', respectively. Rules of the cyclic stratum ('level-1') include the Accent Rule (41), Alternator (42), and a rule selecting the primary stress. Crucially, all secondary stresses, including those from the Accent Rule, are wiped out at the end of the cyclic stratum. The Alternator then reapplies in the non-cyclic stratum, without being fed by the Accent Rule, so that syllable weight does no longer affect the secondary stress pattern. We will present this analysis, and also show how HV employ it to derive Strong primary stress retraction.

Let us first discuss secondary stress retraction, since it is the least complex part of the analysis. As shown in section 2.5, stress placement shares with the grid-only analysis of Selkirk (1984) the effectuation of syllable weight through the Accent Rule, Selkirk's QS (34). Line 1 grid elements assigned by the Accent Rule are respected as pre-marked heads by the Alternator. For reasons which will soon be made clear, we select a set of examples slightly different from (101) to illustrate the output of the Accent Rule (41) and Alternator (42):

```
(103)a.         *    b.   *       c. *  *   d. *  *   *   e.     *  *
  (41) * *  * * * *     * *  * * *   *  *      *  * * * *    * * *  * *
       Apalachicola    serendipity  canteen   Ticonderoga   Kilimanjaro

  (42) *    *    *      *  *  *      *  *      *  *    *     *    *  *
      (* *)(* *)(**)   (*)(*)(**)*  (*)(*)    (*)(* *)(**)  (* *)(*)(**)
       Apalachicola    serendipity  canteen   Ticonderoga   Kilimanjaro
```

After primary stress has been assigned, all secondary stresses are eliminated, including those from syllable weight. That is, Stress Conflation erases heads on line 1 (and consequently the constituents on line 0) which do not culminate in a head on line 2:

```
(104) Stress Conflation
      Conflate lines 1 and 2.
```

(104) is the last rule of the cyclic stratum. In the non-cyclic stratum, the Alternator (42) reapplies, filling in new secondary stresses:

```
(105)a       *                     *                     *       line 2
      (*  *  *)               (    *)               (*    *) *    line 1
      (*)(*)(* *)*   (104)    * * (* *)*  (42)     (* *)(*)(* *) line 0
      se rendipity    =>     serendipity    =>      serendi pity

    b     *                      *                     *         line 2
      (*  *)                  (  *)                 (*  *)         line 1
      (*)(*)         (104)    * (*)       (42)     (*)(*)         line 0
      canteen         =>     canteen        =>      canteen
```

Basically, the non-cyclic Alternator operates identically to Hayes' SRR, in a Q-insensitive fashion. Since HV take Strong retraction as basic in secondary stress retraction, we selected *sèrendípity* and *Kìlimanjáro* as examples where no surface stress occurs on medial closed syllables. The stressed counterparts *chìmpànzée* and *Hàlicàrnássus* must in some form be exceptional in the HV analysis. Let us see what form this exceptionality takes.
Stresses from syllable weight can leak to the non-cyclic stratum, if the word in which they occur is an exception to Stress Conflation (104). Then all secondary stresses will be fed into the non-cyclic Alternator which, respecting existing structure, must apply vacuously. Essentially then, Q-sensitive secondary stress patterns are a *marked* option next to Q-insensitive secondary stress patterns. This solution has the advantage of circumventing Selkirk's objection against lexical stress marking to the effect that light syllables in any position could be stressed, cf. section 3.4.2. The objection does not apply to HV's analysis since all secondary stresses, including those exceptionally carried over to the non-cyclic stratum, are rule-based stresses, as for instance stresses on heavies[31].
Let us now discuss primary stress retraction. For Strong retraction (cf. 49), HV retain non-cyclic stress movement. The difference with Selkirk (1984) is therefore that primary stress is retracted to a secondary stress laid down by the non-cyclic Alternator, i.e. Q-insensitive secondary stress.

```
(106) Rhythm Rule
      In a constituent C composed of a single word, retract the right
      boundary of C to a position immediately before the head of C,
      provided that the head of C is located on the last syllable of C
      and that it is preceded by a stressed syllable.
```

The Rhythm Rule moves the primary stress to the first available stress on the left, laid down by the non-cyclic Alternator. Together this gives the effect of Strong retraction:

```
(107)a.        *                  *                 *                *        line 2
       (*   *   *)          (      *)         (*      *)       (*   )  *      line 1
       (*)(*)(*)     =>      * * (*)    =>    (* *)(*)    =>   (* *)(*)       line 0
       designate (104) designate (42) designate (106)designate

     b.            *                 *                 *               *      line 2
       (*   *     *)        (          *)     (*   *      *)    (*   *  )  *  line 1
       (*)(* *)(*)  =>      * * * (*)   =>    (*)(* *)(*)  =>  (*)(* *)(*)   line 0
       manipulate           manipulate        manipulate        manipulate

     c.      *                  *                 *                *          line 2
       (*   *)             (   *)            (*  *)            (*)  *         line 1
       (*)(*)         =>    * (*)       =>   (*)(*)       =>   (*)(*)         line 0
       rotate              rotate            rotate            rotate
```

Now that Strong retraction has been analysed, Weak retraction appears to pose problems again: if secondary stresses on heavy syllables laid down by the Accent Rule are eliminated by Stress Conflation, how could stress ever be retracted following the weak mode? Halle & Vergnaud propose that Weak retractors again constitute lexical exceptions to Stress Conflation, so that the stress output of the cyclic Accent Rule can survive into the non-cyclic stratum. The Rhythm Rule (106) retracts stress to the penult:

```
(108)a.        *                 *         b.         *                 *        line 2
       (*   *   *)          (*   *)  *         (*       *   *)      (*       *)  *   line 1
       (*)(*)(*)     =>     (*)(*)(*)          (* *)(*)(*)    =>    (* *)(*)(*)      line 0
       Monadnock   (106) Monadnock             Adirondack  (106) Adirondack
```

HV's analysis eliminates the need for two separate, ordered stress rules as the ESR and the SRR in Hayes (1981). Moreover Sonorant Destressing is rendered superfluous in underived words (*cávalcàde*), since these regularly undergo Stress Conflation (104) and Rhythm Rule (106). But this advantage is bought at the heavy expense of overgeneralization. The total absence of words such as *Adírondàck*, regularly derivable by (104) and (106), is a complete coincidence under this analysis. Put differently, the Sonorant retraction pattern (53) is simply lost for underived words.

Let us now consider Weak primary stress retraction. For Weak retracting suffixes such as -*oid*, -*ite*, -*ory*, retraction is claimed to be governed by the affix, not by systematic exception marking to Stress Conflation. Halle & Vergnaud propose that these affixes form words consisting of two stress domains, the stem and the suffix: [*mollusc*][*oid*]. As both domains culminate in line 2 stresses, Stress Conflation will not apply. In the non-cyclic stratum, primary stress assignment and the Rhythm Rule (106) apply at the highest available level, at line 2 instead of line 1:

```
(109)                                   *                   *        line 3
             *        *               (    *   *)         (    *)  *   line 2
         (*    *)    (*)   primary    (*    *)(*)         (*    *)(*)   line 1
         (*)(*)      (*)    stress    (*)(*)(*)    (106)  (*)(*)(*)    line 0
        [mollusc]  [oid]     =>      molluscoid    =>    molluscoid
```

This re-establishes the need for *Sonorant Destressing* in words ending in such double-domain suffixes, because stresses on sonorant-closed rimes will now reach the non-cyclic stratum. Sonorant Destressing is presented as a rule deleting an interstress line 1 grid element over sonorant-closed rimes, fairly close to the versions (86), (97) by Kiparsky (1979) and Hayes (1981). The main difference is that the rule incorporates the information that destressing only applies to trisyllabic words, by word boundaries at line 0:

```
(110) Sonorant Destressing

        * => . /     *  ___  *   line 1
                   # *   *   * # line 0

        where # represents a word boundary
        Condition: ___ dominates a rime ending with a sonorant.
```

Sonorant Destressing applies in the non-cyclic stratum after the Rhythm Rule (106), hence to a line 1 grid element which culminates in the (then retracted) primary stress. The deletion of a line 1 element culminating in a line 2 grid element results in a leftward shift of primary stress:

```
(111)          *                  *                     *              line 3
       (   *     *)        (    *)   *                 (*)        *    line 2
       (*    *)  (*)       (*)(*)   (*)                (*)       (*)   line 1
       (*)(*)   (*)  (106) (*)(*)   (*)   (110)        (*)  *    (*)   line 0
       helminthoid    =>   helminthoid     =>          helminthoid
```

The Sonorant retraction pattern (53) is therefore accounted for in words affixed with double-stress-domain suffixes, as in (109), although it is lost in underived words.

3.7 Conclusion

Summarizing, stress placement and stress retraction have become more and more related mechanisms in subsequent analyses. Quite interestingly, the partial unification of placement and retraction has become possible by a decomposition of Q-sensitivity and boundedness. That is, in the analyses in the (bracketed) grids frameworks, heavy syllables are stressed by one rule, whereas alternating stresses are assigned by another. This leaves the question how to suppress the overgeneration of Q-sensitivity for the purposes of Strong and Sonorant retraction. As it turns out, no entirely satisfactory solutions have been found. Selkirk (1984) fails to capture the generalization that all retraction modes retract the primary stress from the final syllable to the last metrical stress, ignoring destressed heavy syllables. Halle & Vergnaud (1987) buy the distinction between the Weak and Strong retraction patterns at the severe expense of losing the Sonorant retraction pattern in underived nouns. Therefore, it seems that after all, the Hayes (1981) analysis has the advantage of capturing Weak and Strong retraction by formalizing Q-(in)sensitivity as properties of the foot construction rules themselves, the ESR and SRR. But as we have seen, this loses the generalization that heavy syllables throughout the domain (especially extrametrical heavy syllables lying rightward of the ESR's domain) are stressed precisely because they are heavy. Therefore, we conclude that the distribution between the retraction modes has been left unexplained on essential points.

4. **Primary stress and word-internal prominence relations**

4.1 **Introduction**

Prominence, or the relative strength of stressed syllables, is reflected both (a) in the contrast between primary stress and secondary stresses, and (b) in strength differences between secondary stresses. Prominence patterns have been analysed by radically different means in subsequent theoretical frameworks, cf. chapter 0. In SPE-type linear theory, it was the numerical side of the n-ary stress feature. In later linear analyses, n-ary stress was formally separated from binary [+stress], at least in the rules assigning it. Metrical theory eliminated the unitary linear representation, formalizing prominence in strong-weak relations in the tree. Subsequent metrical theories employed grids instead of the s-w labeled tree, formalizing prominence by the relative height of grid columns. But before reviewing the literature, let us first discuss the generalizations that govern prominence patterns in English words.

First, *primary stress* is near the word end - on the rightmost stressed syllable, optionally ignoring the final syllable. Therefore, in case the rightmost stress is not in the final syllable, it is the primary stress (112c). Otherwise, i.e. if the rightmost stress is on the final syllable, the primary stress can either be on the final syllable (112a), or on the rightmost stressed non-final syllable (112b)[32]:

(112)	a. *Final syllable*	b. *Non-final syllable* (stress follows)	c. *Non-final syllable* (no stress follows)
	chìmpànzée	òjíbwày	Mòntána
	rhòdomòntáde	àdiróndàck	ànacónda
	àfghànistán	àntícipàte	àntíquity
	Pòpocàtepétl	pàralléllogràm	ànthropólogy
	Tìppecanóe	périgrinàte	Wìnnepesáukee

Exceptions, where the primary stress is followed by a non-final stress - forms like *Ládefòged* - are so scarce that they are mostly ignored in any published analysis[33].

Second, prominence differences exist between *secondary stresses*. These stress levels are referred to in the Trager-Smith system (Trager & Smith 1951), on which SPE stress values are based, as *ternary* and *quaternary* stress. The validity of four stress levels in the description of English has been questioned in the literature (see for instance Vanderslice &

Ladefoged 1972). Still, we employ the ternary-quaternary notation simply as a means of denoting rhythmic differences between secondary stresses, without necessarily sharing the theoretical assumptions underlying the four-level notation. Given this clarification, the relative prominence of secondary stresses in longer words can be notated as in (113):

```
                                                              4 3    1
(113)a. 3   4 1         b. 3   4     1     c.  3  4  1    d.  3 4    1
      Halicarnassus        Apalachicola      chimpanzee      Ticonderoga
```

As is shown in (113), the first in a sequence of two secondary stresses preceding primary stress is generally the strongest. However, in words such as *Ticonderoga*, where secondary stresses are on the initial and second of three syllables preceding the primary stress, an optional variant 4-3-1 may arise.

We will now discuss accounts of these two issues in subsequent analyses. The general theoretical trend is the following. As a first step from the n-ary stress feature of SPE, Vanderslice & Ladefoged (1972) *notationally* separated the binary stress feature from accentually relevant prominence features. Schane (1975) separated prominence *assignment* from [+/-stress] assignment into formally different blocks of stress rules. That is, the n-ary prominence values were superimposed on the output of binary stress rules. Metrical theory (Liberman & Prince 1977) radically separated the two, maintaining a *segmental* [+stress] value, but shifting prominence to the domain of *relational* tree representation. Prominence became a completely *relational* concept, as represented arboreally in the form of strong-weak relations between nodes. Arboreal representation led to an insightful reformulation of Schane's prominence assignment principle, relating tree labeling to branching. The elimination of the linear [+/-stress] feature in favor of stress feet (Vergnaud & Halle 1978, Selkirk 1980) re-established the distinction in terms of prosodic levels, or categories, in metrical trees, prominence structure dominating foot structure. The principles of uniform tree labeling, and labeling based on tree geometry, were shown to be arboreal artefacts of prosodic primitives by Prince (1983), who proposed End Rules and extrametricality as the core mechanisms of prominence assignment in grid-only theory instead. The theoretical advantage was that both are subject to peripherality theory, which provides narrow constraints on prominence patterns. After metrical constituency had re-established its reasons for inclusion in bracketed-grids theory (Halle & Vergnaud 1987), peripherality remained the key notion as to prominence phenomena, be it integrated into the concept of unbounded constituent.

4.2 Prominence in linear theory

4.2.1 Prominence as a by-product of stress retraction

Much has been said already here about prominence assignment in a SPE-like linear framework. Let us nevertheless recapitulate the essence. As shown in sections 2.2 and 3.2, SPE derives primary stress by the same rules that place and retract stress i.e. the MSR (24), SSR (68), and ASR (66), which assign [1stress] to vowels which may be stressless. All of these are accompanied by the Stress Subordination Convention, weakening every stress outside the focus by 1 degree. Crucially, the SSC guarantees that prominence patterns are preserved under embedding, especially in cyclic derivations, to be discussed in section 6.

Its second function is to make stress retraction leave a 'stress trace' on the vowel from which it retracts the primary stress, in the form of a *secondary* stress. We have also seen that secondary stresses that *precede* the primary stress usually do not result from stress subordination of an [1stress], but are inserted as [2stress] by separate Auxiliary Reduction Rules (73) and (76). Typical derivations run as follows:

(114)

	anticipate	Ticonderoga	arachnoid
Stress placement rules	1	1	1
Stress retraction rules	1 2	n.a.	1 2
Auxiliary Reduction Rules	2 1 2	2 2 1	n.a.
Stress Adjustment Rule	3 1 3	3 3 1	1 3

Nevertheless, the SPE analysis was unsatisfactory in several respects. First, it failed to reflect the generalization that (primary) stress retraction always retracts stress from the *final* syllable. Second, it involves two different means of subordination: (a) the Stress Subordination Convention, (b) the Auxiliary Reduction Rules, inserting 'pre-subordinated' stresses. Obviously, the latter problem is inherent to the format of stress rules which govern the presence of stress as such (stressed-stressless) as well as the prominence relations between stresses (primary-secondary etc.).

4.2.2 **Separating binary and n-ary stress**

Vanderslice & Ladefoged (1972) notationally decompose SPE's n-ary stress values into binary factors. Their feature [+/-heavy] replaces the function of the distinction between [*n* stress] (*n* being specified) and [-stress], that is, between 'stressed' and 'stressless'. All numerical distinctions expressed in the n-ary SPE feature are expressed by binary features. The relation between different binary features is implicational. That is, if a syllable is [+accent], or accentable, it must be [+heavy]. There is no distinction made between accentable syllables as to primary or secondary stress. That is, more than one syllable with [+accent] can appear in one word (cf. 45). Any prominence differences between [+accent] syllables are left outside the scope of word stress rules, and delegated to the domain of intonation.

Schane (1975) provided the basis for metrical analyses by imposing n-ary prominence values on the binary [+stress] output of stress placement and retraction rules. Stress subordination became the function of a new type of stress rule, with integer stress values as its input. The *Detail Rule* performs this function in the following way.

First, it promotes the rightmost [+stress] in the domain to the integer value [1stress], optionally ignoring a word-final [+stress]. Second, it subordinates all remaining occasions of [+stress] in the word to integer value [3stress]:

(115) **The Detail Rule**

$$[+\text{stress}] \Rightarrow \left\{\begin{matrix}[1\text{stress}]\\ [3\text{stress}]\end{matrix}\right\} \;/\; [\;X \_\_\_ \;Y\; (VC_0)\;]$$

Where Y means any number of stressless syllables

The Detail Rule exactly generates the three primary stress locations of (112). The longest expansion, including the parenthesized term, assigns primary stress to the rightmost [+stress] in a non-final syllable. That is, if the parenthesized cluster contains [-stress], case (112c) arises, while if it contains [+stress], case (112b) arises. Final primary stress (112a) results from the short expansion[34].

By (115), primary stress can only be retracted from the *final* syllable, a generalization left unexpressed in SPE, where the fact must be stated in repetition by two different rules - the ASR (66) and the SSR (68).

Moreover, (115) captures the relation between the prominence patterns of morphologically related pairs such as those below. That is, the members of each pair share [+/-stress] structure, while the rightward prominence shift in the second member results from the stressless cluster following the rightmost stress:

```
          +  -  +              +  -  +           + +
(116)a. devastate      b. telegraph      c. icon
          1     3              1     3           1 3

          +  -  +              +  -  +           + +
        devastation       telegraphic        iconic
          3     1              3     1           3 1
```

Halle (1973) shows that Schane's Detail Rule can be regarded as a member of a larger class of stress subordinating rules. By minimally changing the binary [+stress] value into the integer value [1stress], the Detail Rule can be put into the category of rules which take [1stress] both in their input and output, a class to which the *Compound Stress Rule* and *Nuclear Stress Rule* belong as well. This is the class of rules whose application is accompanied by the Stress Subordination Convention.

Although we will not discuss the patterns of compound and phrasal stress for which the CSR and NSR are designed, example (29) from chapter 0 will help to illustrate the preservation of prominence under embedding, which is a typical effect of the Stress Subordination Convention.

Halle goes on to demonstrate that stress subordination in words can even be collapsed with the CSR and NSR. Crucially, the Detail Rule shares with the CSR the property of selecting the *rightmost non-final* [1stress] in a stress domain, while subordinating all other instances of [1stress] to a [2stress] value. An additional subordination from [2stress] to [3stress] results from the NSR, which selects the rightmost [1stress] in a domain, subordinating all other values:

(117)	Halicarnassus	Adirondack	anticipate	Ticonderoga
	1 1 1	1 1 1	1 1 1	1 1 1
CSR	2 2 1	2 1 2	2 1 2	2 2 1
NSR	3 3 1	3 1 3	3 1 3	3 3 1

Apart from the contrast between primary stresses and secondary stresses, the strength differences between secondary stresses (113) must also be analysed. Schane (1975), elaborating on the insight from SPE that such differences have a *rhythmic* origin, proposes a second prominence-affecting rule. His *Rhythm Rule* subordinates the second in a sequence of three stresses, the last of which is the primary stress:

```
(118) Rhythm Rule
      [3stress] => [4stress] /  [3stress] ___ [1stress]
```

This rule produces the 4-3-1 prominence patterns that have been illustrated in (113), except for the optional 3-4-1/4-3-1 pattern of (113d).

4.3 **Prominence in metrical theory**

4.3.1 **Labeling based on branching**

Schane's and Halle's idea of decomposing stress into (a) a binary value, assigned by rules of stress placement and retraction, and (b) an n-ary value, assigned by rules that are accompanied by stress subordination, is at the root of metrical phonology. Liberman & Prince (1977) translate the Detail Rule and the accompanying subordination into the domain of *tree labeling* principles. Let us first compare some examples of tree representation to similar examples of linear structures of (117), and then see how the trees are actually built:

```
(119)a.      / \     b.     / \    c.     /\    d.      /\
            w    \         /   \         / s          /  s
           /\     \       /     \       /  /\        /  / \
          s   \   s       w     s      /  s  \      /  w    s
         / \   \ / \     / \   / \    /  / \  \    /  /  \ / \
         s w w  s  w    s w s  w      w  s w w     w s  w s w
        Halicarnassus   Adirondack    anticipate  Ticonderoga
         + - +  +  -    + - +  +      +  + - +     + +  - + -
```

The rule which labels pairs of sisters in these trees has local access to the branchingness of the nodes involved:

(120) **Lexical Category Prominence Rule**
In the configuration [N_1N_2], N_2 is strong iff it branches.

The location of primary stress as indicated by the LCPR coincides with that produced by the long expansion of the Detail Rule (115), illustrated by (112bc). That is, the rightmost terminal node in a metrical tree will be labeled weak because it is always a *righthand non-branching* node. The cases of final stress (112a), however, fall outside the LCPR (120).
For this reason the LCPR is amended with a list of exceptions which take final primary stress (cf. 11bc, 12bc, 14c, 15). These are marked with a feature [+F], essentially functioning as a branching node in the LCPR. The costs of these amendments to the LCPR essentially equal the costs of lexical marking that is otherwise required to select the short expansion of the Detail Rule.
A more general theory of tree geometry is required in order for the LCPR to properly assign prominence to other nodes than the rightmost terminal node. In particular the relation between segmental stresses and metrical trees needs to be established. We will discuss this relation in a step-wise fashion, and find out how LP build trees such as (119).
First, in constructing trees over sequences of segmental stress values, an interaction must be assumed between the (relational) labeling and the non-relational feature of [+/-stress], which takes the shape of (121):

```
(121)   *S
         |
     [-stress]
```

Therefore, vowels skipped by stress assignment must be metrically weak, which can be checked against the trees in (119) above.
Second, tree construction follows the footsteps of [+stress] assignment: each time assignment of [+stress] produces a sequence [+stress][-stress] ([-stress])*, a sub-tree - or *foot* - results, whose internal labeling is dictated by (120) and (121). In (123a) below, it is shown that each time a foot is built during the leftward sweep of the stress rules through the word, it is joined with the existing structure. Also, any single [+stress], which cannot form a *binary* tree on its own, as in (123b), is incorporated into the tree as soon as the stress rule has assigned [+stress] to its left, so that a new sub-tree can be formed.

```
(122)a.                                         /\
                                               /  \
                                              /    s
                              /  \           /    /  \
                             w    s         w    w    s
              / \           /  \ / \       / \ /  \ / \
              s w           s  w s w       s w s  w s w
     Apalachicola   =>  Apalachicola   =>  Apalachicola
              + -           +  - + -       + - +  - + -
     b.                                        /\
                                              /  \
                                             w   s
                            /  \           / \ /  \
                            s  w           s w s  w
     Adirondack     =>  Adirondack     =>  Adirondack
            +               +  +           + - +  +
```

Since the stress rules scan the word leftward, the supra-foot structure will become *right-branching*. Now the tree geometry and LCPR correctly locate primary stress on the rightmost non-final stressed vowel.

Prominence differences between secondary stresses can be obtained from the tree in two different ways. The first is to relate prominence levels and *depth of embedding* by means of the algorithm (32) of chapter 0 to mimick SPE-like numerical values. This yields a 2-3-1 contour in (122a) and, more generally, in each word with a sequence of secondary stresses preceding primary stress. But it fails to explain the varying secondary stress patterns of words like *Ticonderoga* (119d), noted above.

The second way (preferred by LP) is to derive prominence levels from the tree in the form of the metrical grid. Grids are projected from trees by the Relative Prominence Projection Rule (33) of chapter 0. As opposed to the counting algorithm just mentioned, the RPPR allows some variation in secondary prominence contours, because it leaves unspecified differences in strength between any two nodes which are no DTE's in a pair of sister nodes. Therefore, since the initial two stresses of *Ticonderoga* in (119d) are no DTE's of sister nodes, the RPPR licences all grids below:

```
(123)a.                   b.           *        c.           *
                *               *      *                *    *
         * *    *               * *    *              * *    *
         * *  * * *             * *  * * *            * *  * * *
        Ticonderoga            Ticonderoga           Ticonderoga
```

The actual realization will then depend on rhythmic factors: "The break-up of equal stresses into some kind of alternating pattern seems very natural in the case of constituent-initial sequences, "upbeats" so to speak [...]" (1977:327). Nevertheless, it remains unclear why only words of the type *Ticonderoga* (113d) exhibit such variation, while words such as (113abc) do not.

Kiparsky (1979), who was the first to observe the relevance of rhythmic variation in *Ticonderoga*, proposes a tree-only account in an attempt to eliminate redundancies between trees and grids. In the absence of grids, he argues that the variation arises from optionality in the branching direction of the word tree: uniformly left- or right-branching:

```
(124)a.    /\     b.    /\
          / s           w \
         /  /\         /\  \
        /  w  s       / s   s
       /  /\  /\     /  /\ /\
       w s  w s w    w s  w s w
      Ticonderoga   Ticonderoga
       + +  - + -    + +  - + -
```

To derive prominence patterns from the tree, the counting algorithm (32) of chapter 0 is assumed. This makes the initial secondary stress the strongest in (124a), and the second secondary stress in (124b).

The neutralization of prominence variation in words with any other type of stress sequences is produced by the Rhythm Rule, a tree-only version of Schane's Rhythm Rule (118), relabeling pairs of sister nodes:

```
(125) Rhythm Rule
                                     Conditions:
       / \            / \       a constituent 1 is not an unstressed syllable
      w   \          w   \      b it may not produce     / \
     / \   \        / \   \                             s   w
    w   s   s  =>  s   w   s                                / \
    1                                                      s   w
```

Crucially, the Rhythm Rule is blocked in *Ticonderoga* (124b), where it would produce the offending configuration mentioned in condition b. But it neutralizes prominence in all other left-branching word-trees with embedded subtrees labeled w-s, i.e. (113b), while (113a,c) already have the correct labeling by the LCPR:

```
(126)a.                               b.       /  \
           /\                                 w    \
          /  \                               /\     \
         w    \                             s  \     s
        / \    \                           / \  \   / \
       s   w    s                          s  w  w  s  w
      chimpanzee                          Halicarnassus
        +  +   +                           +  -  +  +  -

                                                 /\                   /\
    c.    /\              /\             d.     w  \                 w  \
         w  \            w  \                  / \  \               / \  \
        /\   \          /\   \                /   \  \             /   \  \
       / s    s        /  w   s              w     s   s          s     w   s
      / / \  / \      /  / \ / \            / \   / \ / \        / \   / \ / \
     w s   w s w     s s   w s w            s w s  w s w        s w s  w s w
    Ticonderoga =>*Ticonderoga             Apalachicola  =>  Apalachicola
     + +   - + -     + +   - + -            + - +  - + -        + - +  - + -
```

The RR and its conditions are motivated independently by phrasal rhythm, where a similar word-internal stress shift can be induced by a following word: *thirtéen-thìrteen mén*. Analogously, condition b. is motivated by the absence of shift in *Montàna ców* (**Mòntana ców*).

4.3.2 Extrametricality in primary stress assignment

Hayes (1981) shows that the relatively complex LCPR can be replaced by a much simpler tree labeling convention: "Right nodes are strong". The irrelevance of final terminal nodes for primary stress is simply another effect of *rime extrametricality*, cf. (29), percolated upward to feet:

```
(127)a.        /\               b.     /\
              s  \                    s  \
             / \  \                  / \  \
            w   s   w               w   s   w
           / \  |   |               |  / \  |
          Adiron<dack>em           pyramid<oid>em
```

Adjoining extrametrical feet to the word tree by Stray Adjunction yields correct results without provisions in nouns and suffixed adjectives, the categories which undergo the extrametricality rules (29).

But final secondary stress is also a property of many (trisyllabic) verbs (*cáterwàul*) and underived adjectives (*ábsolùte)* with heavy final syllables, cf. (48bc). Their final syllables must be *metrical* in order to be stressed by the ESR. These require a rule of *Late Extrametricality* applying *after* foot construction, and *before* word tree construction:

(128) **Late Extrametricality**
Subject to the Peripherality Condition, mark rimes as extrametrical when they are preceded by a branching foot.

LP's amendments to the LCPR now translate as lexical markings to (128).

Extrametricality also provides the solution to a problem that arises if both the LCPR and Kiparsky's optional branching direction of word trees are assumed. LCPR and free branching together (incorrectly) predict that words like *àdiróndàck* have an optional variant **ádiròndàck*, from a *left*-branching tree (129a) in addition to the (correct) right-branching tree (129b). But if the final foot is extrametrical, a uniform right-dominant tree labeling will always correctly generate penultimate primary stress on the last *metrical* foot, regardless of direction of branching (129c):

```
(129)a.     /\            b.    /\            c.    /\
           s  \                /  s                s  \
          / \  \              /  / \              / \  \
         _s__w__w__        _w__s__w__         _w__s___w___
         / \ |   |         / \ |  |           / \ |    |
         Adirondack        Adirondack         Adiron<dack>em
```

4.4 Prominence in grid-only theory

Hayes' maximally simple word tree labeling rule - "right nodes strong" - casted doubts on the necessity of a binary branching word tree. Prince (1983) shows that prominence assignment is radically simplified if trees are abolished in favor of *End Rules* in the grid, promoting the first or last stress at a level, while ignoring extrametrical stresses:

```
(130)a.   *          b.     *          c.      *           d.         *
          * *            *  *  *            *  *   *              *   *   *
          * * *  *       * * *  *           * * *  *              * * *  *  *
          Ameri<ca>em    Adiron<dack>em    pyrami<doid>em     Halicarnassus
```

Most importantly, both the End Rule and extrametricality are subject to *peripherality*, i.e. the requirement that only the initial or final element at some level can be affected (i.e. be extrametrical, or be promoted). Since prominence is located on the last metrical beat, the English End Rule is indexed for the Domain *End.*

The mirror-image End Rule may account for prominence differences between *secondary* stresses, since crucially initial stresses are *peripheral* too:

```
(131)                                                *
                   *                   *             *
        *     *    *                   *     *       *
        * * * * * *                    * * *  * * *
        Apalachicola          =>       Apalachicola
```

This poses the technical problem of ordering both End Rules so that the *right*-peripheral word stress survives as the highest one.

Selkirk (1984) provides a solution to this problem by distinguishing the *culminative* function of the End Rule, which assigns primary stress, from the *rhythmic* function of Beat Addition (or Add X), which assigns initial secondary stress. End Rules are so-called *Text-to-Grid Alignment Rule*s. These *construct* grids, and have *syntactic* domains. Beat Addition belongs to a class of *Grid Euphony Rule*s (rhythmic grid-*modifying* rules), which lack syntactic domains. GE-rules always respect the output of TGA-rules:

(132) **Textual Prominence Preservation Condition**
Within a cyclic domain, a grid position assigned by a TGA rule on the third metrical level or above is always (minimally) more prominent than any other prominence on that level.

Beat Addition on the initial beat in *Apalachicola* will be accompanied by an automatic raising of the primary prominence assigned by the End Rule. The output structure of *Apalachicola* (131) reflects this.
Selkirk provides a new solution for varying secondary stress patterns in *Ticonderoga*. Because grids crucially lack constituency, an account based on direction of branching is impossible. Nevertheless, Kiparsky's output filter (125b) can easily be translated into a grid configuration, so that a means of inhibiting Beat Addition is obtained. The *Montana* filter will be violated by applying Beat Addition as in (133b):

```
(133)a. Montana Filter    b.                      *
                                   *       *      *
        *  *                * *    *       * *    *
           * *              * *  * * *     * *  * * *
           * * *          Ticonderoga => Ticonderoga
```

But if Beat Addition were completely blocked by the filter, the existing variation would still not be accounted for. Selkirk now argues that Beat Addition is only hampered by the Montana filter (133), not blocked, as the input grid *itself* contains a rhythmically ill-formed sequence: two equal beats, a so-called situation of *lapse*, require rhythmic promotion of the initial one. The compromise between this requirement and the Montana filter is an *optional* application of Beat Addition, preserving both the input and output of (133). But Beat Addition is obligatory in all other forms (113a-c), where the Montana Filter does not interfere.

4.5 Prominence in bracketed-grids theory

Bracketed-grids theory re-introduces constituency in the grid, but still treats prominence much like grid-only theory, by means of peripherality, be it applied to *unbounded constituents*, instead of End Rules.
Halle & Vergnaud (1987) assign primary stress by means of a rule which constructs a right-headed unbounded line 1 constituent, with its head on line 2. The rules are in (134):

(134) a. Line 1 parameter settings are [unbounded, right].
b. Construct constituent boundaries on line 1.
c. Locate the head of the line 1 constituent on line 2.

The rule set (134) applies as shown in (135):

```
(135)                                                        *     line 2
      *    *    *           (*    *    *)         (*    *    *)    line 1
     (* *)(* *)(*)*  (a-b)  (* *)(* *)(*)*   (c)  (* *)(* *)(*)*   line 0
      Apa lachicola   =>     Apa lachicola    =>   Apa lachicola
```

However, Halle & Vergnaud (1987) weaken the function of peripherality as compared to Prince (1983), since they reject extrametricality as a means of obtaining retracted primary stress patterns such as (112b). Instead they use primary stress retraction by the Rhythm Rule (106), cf. section 3.6. This analysis loses the close connection between primary prominence and peripherality, because (106) must explicitly mention the final syllable, making peripherality more or less a coincidence.

Distinctions among secondary stresses arise in a fairly complex way. The prominence preservation effect (initial rhythmic beats preserve primary stress) is obtained by copying the unbounded constituent (134a-c) to a next higher level. This will provide a line 2 constituent and a head at line 3. The initial beat is then inserted at line 2 over the initial or the second syllable, by a special rule of Stress Enhancement:

```
(136) Stress Enhancement
                *                  line 2
      * => *    / [(SYL) ___       line 1
```

The parenthesized initial syllable serves the function of obtaining the varying (non)-initial secondary prominence in *Ticonderoga*. The line 2 grid element is placed either over the initial or the second syllable:

```
(137)a.                          *                          *     line 3
                  *          (         *)          (*         *)     line 2
          (*  *   *)         (*  *     *)          (*  *      *)     line 1
          (*)(* *)(* *) copy (*)(* *)(* *)  (136)  (*)(* *)(* *)     line 0
          Ticonderoga    =>  Ticonderoga     =>    Ticonderoga

     b.                          *                          *     line 3
                  *          (         *)          (   *      *)     line 2
          (*  *   *)         (*  *     *)          (*  *      *)     line 1
          (*)(* *)(* *) copy (*)(* *)(* *)  (136)  (*)(* *)(* *)     line 0
          Ticonderoga    =>  Ticonderoga     =>    Ticonderoga
```

As will be clear from (137), there is little or no role for the lefthand boundary of the unbounded line 2 constituent, questioning the necessity of the unbounded constituent itself. Moreover, this solution loses the major generalization that Stress Enhancement is always accompanied by prominence preservation, because these are formulated as separate rules.

4.6 Conclusions

Prominence assignment (the selection of primary stress and the rhythmic differentiation between secondary stresses) has gradually been separated from stress assignment (placement and retraction). The advantages of the separate prominence assignment rules are clear. They apply to strings of stressed and stressless syllables, assigned by *independent* rules. Hence, the generalization that the last metrical stress in the word is selected as primary stress can be captured in an optimal way. The key notion that governs primary stress selection is *peripherality*, a constraining factor in both extrametricality and End Rules. Prominence differences between secondary stresses are usually accounted for by a rhythmically motivated rule. It is formulated mostly as an insertion of a (near-) initial beat, which respects the location of the primary stress.

5. **Destressing in underived words**

5.1 **Introduction**

Destressing rules have always taken a quite prominent place in analyses of underived words. Trimming the overgeneration of stress rules, they allow for a maximally generalized formulation of the latter. Of course, destressing rules can only fulfil this function - without running into circular arbitrariness - given a constrained theory of destressing rules as such. This section will be devoted to proposals to that effect.

In earlier sections we have already discussed some rules of destressing in their function of generalizing the formulation of retraction rules. Most importantly, Sonorant Destressing (86, 97, 102, 110), essentially regularizes words such as *hélminthòid* (52a) as cases of Weak retraction (51). We have also touched on a destressing rule eliminating the initial pretonic stress resulting from iterative retraction in words such as *ma̲nipulate*, *Mo̲nongahela* (cf. 60c, 63c). Finally, we noticed the necessity of destressing in post-tonic position for *-ory* and *-ary*, cf. *refracto̲ry* (50a). Here we will discuss the required destressing rules in more detail. In section 6 on the stress cycle, the function of destressing will be extended to the elimination of certain cyclic secondary stresses, but here we will focus on destressing in underived words, or more specifically, words which do not have cyclic derivations.

All analyses from SPE to Halle & Vergnaud (1987) have employed a special block of destressing rules to accomodate the output of the stress rules with the contexts of vowel reduction. The reasons for discrepancies between a vowel's stress value as assigned by rule and its surface stress value as evident from its reducibility are various and different across analyses, although the general function of generalizing the stress rules persists. What is a *skipped* vowel in one theory may well turn out a basically stressed but *destressed* vowel in another theory. Since the targets of destressing rules depend so much on theoretical assumptions about stress rules, a set of basic data is hard to present.

Nevertheless, some destressing contexts reoccur in most analyses. These will be introduced here in an order from Post-Stress Destressing, the Arab Rule, to Pre-Stress Destressing. Sonorant Destressing has already been discussed in section 3 on primary stress retraction, mainly because it determines the location of primary stress, an atypical property for a destressing rule.

As the first example of a destressing context assumed in most analyses, let us discuss post-tonic destressing of *-ory*, *-ary*. In American English, the vowel of these suffixes is unreduced and long, unless the primary stress immediately precedes[35]:

```
(138)a. láudatòry        b. mémo̲ry      (cf. memórial)
        prelíminàry         óva̲ry       (cf. ovárian)
        prómissò̲ry          cúrso̲ry
```

The most generalizing analysis of such cases is to assign stress to the suffix vowel by the standard rules, regardless of the preceding material (which is invisible anyway, assuming leftward iteration), apply Weak retraction as in (51), and destress the suffix vowel in case it is post-tonic.

Another set of reduced post-tonic syllables is often analysed as being due to destressing. Word-final syllables with short vowels before non-dental obstruents are normally stressed, cf. (54) and (139abc), but they can reduce after a *light* syllable (139d):

```
(139)a. Báobàb        b. Cántàb    c. á:hàb    d. ára̲b
        Mamáronèck       cóntèxt      Kó:pèk      Dére̲k
```

Typically, (139d) is analysed as the product of some 'Arab' destressing rule.
As we said earlier, the class of destressing rules requires constraints on its application to have an explanatory function with respect to the stress rules. Some proposals to that effect have been made. For example, the post-tonic destressing contexts discussed so far share the property that a stress clash (a situation of adjacent stresses) is eliminated. In a number of analyses - most explicitly in Hammond (1984) - this property is given the status of a condition on destressing rules.
As a general trend, destressing rules have been allowed a wider scope ever since SPE. The major reason for this resides in the tendency to generalize and constrain the format of stress rules.
For example, iterativity led to exhaustive application of stress rules to the stress domain, motivating a rule of initial pretonic destressing of light syllables in cases like *políce* (60c) and *Monòngahéla* (63c). As was touched upon in footnote 15, most Romance prefixes behave as light syllables for initial pretonic destressing, regardless of their weight[36]:

(140) a.	condénse	b. diréct
	advánce	remóve
	absúrd	belíeve

In this context, light syllable destressing is nearly exceptionless, but still a number of negative and positive exceptions occur:

(141) a.	ràccóon	b. Vermónt
	bàssóon	Berlin
	sèttée	Kentucky

Light, irreducible pretonic syllables as in *ràccóon* (141a) are negative exceptions to initial pretonic destressing. Closed reducible syllables as in *Vermónt* (141b) form a class of positive exceptions. LP ascribe the latter to a low-level coalescence of a vowel and the following sonorant into a centralized vowel.
As a second example of a destressing rule motivated by some generalized stress assignment rule, Hayes' elimination of Long retraction in favor of strictly binary stress rules motivated a rule to destress the second light syllable of *Winnepesaukee* (61).
Let us now turn to the literature on destressing, which we will review mainly from the viewpoint of destressing rules as means of regularizing stress retraction paradigms. As will be shown, this function gradually increases from SPE to recent analyses.

5.2 Post-tonic destressing rules in linear theory

Destressing rules in SPE perform the double function of destressing and laxing their focus vowel. The rationale behind this is that destressing only serves to prepare stressed vowels for reduction, a rule which takes stressless *lax* vowels as its input[37].
SPE destressing rules are word-level rules. This allows expressing the generalization that the primary stress of a word never reduces, even though its numerical stress value may be subordinated infinitely in the phrasal cycle.
Destressing is part of the Auxiliary Reduction rules, which bridge the discrepancies between the output of cyclic stress rules and the actual distribution of reduced vowels. Auxiliary Reduction II (73, 76) is the counterpart of destressing, assigning [2stress] to vowels to protect them against reduction, and fully accounting for the distribution of reduced vowels in the part of the word preceding the primary stress. Since in underived

words no stress can precede the primary stress, destressing is limited to vowels that *follow* the primary stress, vowels whose stress has been *subordinated* by stress retraction.

Now consider the SPE version of the destressing rule mentioned earlier in relation to (138b), a sub-rule of the Auxiliary Reduction I:

(142) **Post-Stress Destressing**

$$\text{V} \Rightarrow \begin{bmatrix}\text{-stress}\\ \text{-tense}\end{bmatrix} \; / \quad [\text{1stress}]\ \text{C}_0 \ \_\_\_ \ \text{C}_0\ \text{V}\ [\text{-stress}]_0\#$$

It destresses non-final post-stress vowels - mostly in *-ary* and *-ory* - that have served as the retraction point for the Stressed Syllable Rule (68). Therefore, (142) serves two essential functions. First, it relates the stressed and stressless surface forms of the suffixes *-ary* and *-ory*. Second, it supports the generalization that Weak stress retraction (51) takes a stressed vowel as its point of reference.

The important contribution of Ross (1972), elaborating on work by Fidelholtz (1967), is the introduction of the *Arab Rule*, a destressing rule that accurately predicts reduction in final lax vowel clusters (139d). Since the context of reduction is easier to state than the complementary context of secondary stress, Ross's solution was to regularly apply the final stress rules to all, and destress (139d) by a special *Arab Rule*:

(143) **Arab Rule**

$$\begin{bmatrix}\text{V}\\ \text{-tense}\end{bmatrix} \Rightarrow [\text{-stress}] \; / \; \begin{bmatrix}\text{V}\\ \text{1stress}\\ \text{-tense}\end{bmatrix} \text{C}_0^1 \ \_\_\_$$

Notice that the Arab Rule is, in a sense, doubly quantity-sensitive. It requires a lax vowel in the focus and a weak cluster in its context.

5.3 Pre-Stress Destressing and exhaustive retraction

The function of destressing in analyses of stress retraction was further enlarged when Halle (1973) introduced retraction across the entire word. The first vowel of a word will always be stressed by the Initial Stress Rule (81), the Stressed Syllable Rule (78), or the Primary Stress Rule. Again, it is simpler to state the context of reduction (60c) and (63c) than the context of stress. Only *pretonic* vowels in *weak clusters* can reduce. In SPE, precisely these vowels were exempted from secondary stress by Auxiliary Reduction II(b) (76). Halle proposes the destressing rule below:

(144) **Initial Pre-Stress Destressing**

$$\text{V} \Rightarrow [\text{-stress}] \; / \; \#\ \text{C}_0 \begin{bmatrix}\_\_\_\\ \text{-long}\end{bmatrix} \text{C}\ [\text{1stress}]$$

Apart from its sensitivity to cluster strength, an interesting aspect of this destressing rule is that it actually refers to the *binary* value of [1stress] so that it applies before both primary and secondary stresses. Recall that in Halle's system stresses are all equal until subordinated by the Detail Rule (or more precisely, the Compound and Nuclear Stress Rule). This circumstance invites the ordering of destressing (144) prior to stress subordination. In fact this is what Halle assumes. Essentially, Halle claims the destressing rule to be blind to prominence values. Evidence for this ordering comes from primary stress retraction in disyllabic words, cf. (46, 47), as observed by Oehrle (1972). This pattern follows from ordering Initial Pre-Stress Destressing before primary stress selection, since destressing bleeds primary stress selection here:

```
(145)          a.  argyle     b. police
     Stress        1  1          1 1
     (144)         n.a.          - 1
      CSR          1  2          - 1
      NSR          1  3          - 1
```

As will be illustrated in section 6 on the stress *cycle*, this view runs into serious problems, and we will conclude that destressing crucially requires prominence information, which forces its ordering after rules of prominence assignment.

5.4 Early metrical theory

In the metrical theory of Liberman & Prince (1977), destressing affects the binary value [+stress], as in Halle (1973). However, in contrast to Halle, LP order destressing after prominence assignment, or metrical structure. They show that destressing rules can be radically simplified by elimination of all context information about adjacent stresses. This result arises by transferring conditions on destressing to prominence, in particular the condition (121) against strong nodes over stressless vowels.

This constraint prohibits the destressing of vowels dominated by strong nodes: i.e. (a) primary stress, (b) secondary stresses corresponding to *strong* nodes in branching feet. For example, the pre-stress condition on Halle's Initial Pre-Stress Destressing (144) can be omitted, because the constraint (146ab) that the destressed vowel be *weak* suffices:

```
(146)a.        b.          /\       c.              d.  /\        e.
                          / s           /\             / s
                         / / \         /  \           /  /\
                        / w   s       w    s         w   s \
      /\               / /\  / \     / \  / \       / \  / \ \       /\
      w s             w s  w s w     s w  s w       s w  s w w       s  w
     police          Monongahela      Alabama       odontology       essay
      + +            + +   - + -      + - + -       + -  + - -       +  +
```

Initial Pre-Stress Destressing (144) and Post-Stress Destressing (142) are now collapsed into one destressing rule:

```
(147) English Destressing Rule
          V         => ⎡-stress⎤ /   # <XV>b Co ___ < Co= >c  (C) V
      [<+long>a]       ⎣-long  ⎦
                                     Condition: a => (b v c)
```

This rule destresses (a) long medial vowels in *-ory*, *-ary* etc., cf. (138b), (b) short initial vowels, cf. (60c), and (c) vowels in Romance prefixes, cf. (140).

In the course of discussing initial destressing, LP suggest an important alternative diagnostic for [+stress] in addition to vowel reduction: a vowel's potential to participate in a stress shift by the *Rhythm Rule* (recall the remarks on secondary stress in section 3.1.1). Stress never shifts to a stressless pretonic syllable: *Chìnese fóod* and *thìrteen mén* versus **mə̀roon swéater*. LP explain this reluctance on the basis of constraint (121) against strong stressless vowels. As the Rhythm Rule is a relabeling of nodes in the tree (similarly to Kiparsky's formulation in (125)), it cannot shift prominence to a [-stress] vowel. This is to say that initial destressing in *maroon* bleeds the Rhythm Rule.

In spite of their success in eliminating [+stress] from the context of Pre-Stress Destressing, LP run into some trouble when applying the same approach to Post-Stress Destressing (142): *cúrsəry - prómissòry*, cf. (138). The long vowel in *-ory* is followed by a [-stress] vowel. Hence, it is predicted to be the strong node in a foot, by applying the procedure of constructing metrical structure discussed in section 4.3.1. Therefore the suffix vowel is expected to be *immune* to destressing. LP's solution is to make *-y* in *-ory* extrametrical for [+stress] assignment. No binary foot can now be formed over the final two syllables. This leads to both correct tree labeling by the LCPR - primary stress is not on the final stress - and a weak node over the suffix vowel required for destressing[38]:

```
(148)a.              b.      /\
          /\               s   \
         /  \             / \   \
        s    \           s   \   \
       / \    \         / \   \   \
       s  w   w         s w   w   w
     cursor<y>      promissor<y>
       +   +  -           + -   +  -
```

Now, it is *incorrectly* predicted that destressing applies to *promissory* as well. In order to obtain the strong node required, a special rule breaks up the long foot of *promissory* into two binary feet. Clearly this rule serves no other purpose than to block reduction in *promissory*, and must therefore be described as *ad hoc*. This in its turn, casts doubts on LP's claim that destressing is blind to contextual [+stress][39].

LP's conclusion that *all* destressing rules are sufficiently constrained by arboreal prominence was criticized by Kiparsky (1979). He argues (see again section 3.3.4) that at least one [+stress]-sensitive destressing rule is ordered *before* tree construction: Sonorant Destressing (86), so that it cannot have access to prominence information. In the absence of prominence, (86) crucially requires a stressed vowel on both sides of the focus. The conclusion is therefore that LP's claim is untenable.

5.5 **Foot-based metrical theory**

The important contribution of Selkirk (1980) is the introduction of a format of destressing in a theory lacking [+stress]: foot deletion, or *Defooting*. LP's constraint (121) blocking destressing of strong vowels, translates into the foot deletion format as the requirement that a deleted foot be both weak and non-branching. The remaining syllable once dominated by the deleted foot is readjoined to the word tree (by Stray Syllable Adjunction) as a weak, reducible syllable:

```
(149)     / \                        |                   /\
          Fw Fs   Defooting          F     Adjunction   / Fs
          |  |                       |                 /  |
          σ  σ                   σ   σ                 σw s
         po lice        =>      po lice      =>       po lice
```

Hayes (1981) translated various linear destressing rules into this metrical format: Post-Stress Destressing (142), Pre-Stress Destressing (144), and the Arab Rule (143). We will review all his metrical versions, with the exception of Sonorant Destressing (97), which has been reviewed before in section 3.4.3 on stress retraction. Apart from formulating these, he considerably extends the function of Post-Stress Destressing in order to eliminate Long retraction of secondary stress.

One of his contributions in the field of destressing is a constraint on foot deletion rules:

```
(150) Strong Foot Condition
      No foot in strong metrical position may be deleted.
```

In this way, the label *weak* can be removed from feet in defooting rules.

This statement does not prohibit destressing of *strong syllables* in weak feet, as opposed to LP's filter (121). As we saw earlier, the latter is over-restrictive here in the face of Post-Stress Destressing, a rule which affects branching feet in destressing the post-tonic vowels in *-ory* and -ary (138). And it is exactly this destressing rule which is used by Hayes to generalize secondary stress retraction. Once again, the balance between retraction and destressing is redressed. Let us see how this is achieved.
Post-Stress Destressing serves the important function of eliminating the long (or ternary) retraction mode in secondary stress in favor of the strictly *binary* iterative Strong Retraction Rule (92). Recall that this rule produces secondary stresses on even distances from the primary stress. However, three syllables preceding the primary stress generally form a dactylus if the second syllable is open, cf. *Wìnnepesáukee* (61).
Hayes invokes a metrical version of SPE's Post-Stress Destressing (151):

```
(151) Post-Stress Destressing (PoSD)
      F => Ø  /  F  ____
                 |   /\
                 R               Condition: R is an open rime.
```

Crucially, the condition excludes the destressing of a foot headed by a closed syllable, leading to **Tìconderóga* (63ab)[40].
After (151), Stray Syllable Adjunction adjoins the remnants of a deleted foot to the preceding foot. An example derivation of *Winnepesaukee*:

```
(152)     / \                / \                  /\
         /   s              /   \                /  \
        /   /  \  (151)    /     \    SSA       /    \
      _w___w____s__      _w_______s___      ____w______s___
       |  / \  / \        |      / \           / \\   / \
      Winnepesaukee      Winnepesaukee      Winnepesaukee
```

SSA makes the initial, originally non-branching, foot into a ternary, branching foot.
The Strong Foot Condition (150) blocks PoSD (151) in *Mamáronèck* and *canáry*:

```
(153)a.     /\               b.
           s  \                     /\
          / \  \                   /  \
        _w__s___w__              _w__s_
         | /  \  |                | / \
       Mamaro<neck>em            canary
```

An important difference between linear and arboreal destressing rules is that the latter require supplementary principles, such as Stray Syllable Adjunction, to interpret demoted syllables in their output as metrically weak. And for SSA to apply properly in cases of destressing it needs the additional constraint that its output is *maximally structure-preserving*, or that it conforms to the *left-headed foot format as produced by stress rules*. This is motivated by (152), where right-ward adjunction would incorrectly leave the initial non-branching foot directly before another foot, and thereby susceptible to further initial destressing:

```
(154)     / \                / \                / \     (146)       /\
         /   s   (151)      /   \    SSA       /  /\     SSA       / /\
        /   / \   =>       /     \   =>       /  / /\    =>       / / /\
      _w___w___s___      _w_______s___      _w__/_/__s__      ___/_/_/__s__
       |  / \ / \         |      / \         |  / /  / \        / /  /  / \
      Winnepesaukee      Winnepesaukee      Winnepesaukee    Winnepesaukee
```

As compared to the required output of SSA in (152), viz. a ternary foot, the initial foot in (154) ends up as non-branching and directly preceding another foot. This implies that it would be incorrectly predicted to be removable by (155):

```
(155) Pre-Stress Destressing
      F => Ø  /  ___ F
      |
```

The structure-preserving requirement on Stray Syllable Adjunction is clearly necessitated by the circumstance that (155) cannot distinguish a following *head-initial* foot, as in *police* (149), from a following *weak-syllable-initial* foot, as in (154). In this sense, the foot-based format of (155) misses the generalization that destressing is indeed pretonic, i.e. applies only in the context of adjacent stresses. This point will become quite important in later work by Hammond (1984).

Notice that also an additional extrinsic ordering between PoSD (151) and PSD (155) is required to bleed the latter by the former. The input in (152) fully matches the structural description of PSD, and has to be destroyed by both PoSD and SSA in order to become immune to incorrect destressing.

Finally, the *Arab Rule* (143) translates as below:

```
(156) Arab Rule
      F => Ø /  F ___
                |  |
                R  R
                | / \
                 V  Co
```

The nonbranching foot preceding the focus must contain a light syllable, while the focus foot itself must be non-branching and contain a syllable with a short vowel. Clearly, (156) is *doubly Q-sensitive.*

5.6 Grid-only theory

The grid-only format of destressing consists of *beat deletion.* Since constituency is absent, a major advantage of grid-only theory is that foot pruning, syllable re-adjunctions, and labeling conventions can all be dispensed with. Even more importantly, grid-only theory reveals the generalization that destressing rules function so as to avoid adjacent stresses, or clashes. Although implicitly present in Prince (1983), the latter point has been fully developed only in the grids-and-constituents framework of Hammond (1984), to be discussed in section 5.7.

Selkirk (1984) exploits the maximally simple format of beat deletion to collapse into one rule the functions of Hayesian Pre-Stress Destressing (151), Arab Rule (156), and the function of Strong Retraction Rule (92) in Strong secondary stress retraction (58), (62a). These rules share the property of producing stressless heavy syllables. Although the Hayesian rules pose different weight conditions on syllables in their focus and context, Selkirk apparently regards these as less relevant, compared to the resulting generalized destressing rule. Here, different syllable weight conditions are integrated into a general hierarchy[41]:

```
(157) Monosyllabic Destressing (MD)
                              Conditions:
      *                       a. if σi = CV, then obligatory
      *   =>   *              b. if σi = CV[+cons], then optionally and "often"
      σi       σi                          [+son ]
                              c. if σi = CV[+cons], then optionally and "seldom"
                                           [-son ]
```

Apart from being guided by a syllable weight scale[42], (157) is lexically governed. Compare (158), in which closed syllables destress (examples from 58, 62a, 139d, 6a, and 141b), to (159), in which similar syllables in (nearly) analogous positions do not destress (examples taken from 59, 62b, 139b, 54a, and 60a):

```
(158)a.   *    *         b. *      *       c. *          d.  *          e.   *
          * *  * * *        * * *  * *        * *            * *  *          *  *
        serendipity        Kilimanjaro        Arab          cinnamon      Kentucky

(159)a.    *  *  *       b. *   *  *        c. *  *      d. *      *      e. *  *
           *  *  *          * * *  *  *        *  *         * *    *         *  *
        chimpanzee         Halicarnassus      Cantab        Algernon      canteen
```

Although the collapsing of closed syllable destressing is attractive, it is clearly less accurate than the individual rules whose function it has to take. For instance, MD (157) does not reflect the radically different status of (158a), which is quite regular/unmarked, as compared to (158e), which is highly irregular/marked.

None of the focus syllables of (158a-e) occurs directly before a stressless syllable. This is no accident, because according to the generalizations as to Q-sensitive stress assignment discussed earlier, no heavy syllable can be stressless when preceding another stressless syllable, cf. (64). Selkirk attributes this generalization to a rhythmically motivated constraint which says that no rule may produce a (rhythmically ill-formed) sequence of stressless syllables:

```
(160) Alternation Maintenance Condition (AMC)
      *
      * *  =/=>  * *
      σ σ        σ σ
```

The AMC limits destressing to pretonic and final syllables, i.e. those which are not followed by a stressless syllable.

Nevertheless, there is a destressing process which violates the AMC. The stressless light second syllable of *Wìnnepesáukee* (61) must result from such a destressing process because it is originally stressed by PG (35), analogously to foot-based Post-Stress Destressing (151).

```
(161)a. Abracadabra Rule      b.          *                    *
        * *          *            *  *    *             *      *
        *  *   =>    *  *         *  * * *  *           *  * * *  *
        σ CV         σ CV         abracadabra    =>    abracadabra
```

Selkirk proposes that (161) may overrule the AMC, because its Structural Description is more specific, by its reference to a light syllable. This account does not strike us as fully adequate, however, because it misses the generalization that a light syllable can be stressless before another stressless syllable, not only in secondary stress retraction, but also in stress placement (*América*) and primary stress retraction (*péregrinàte*), cf. (6a) and (55).

5.7 Hammond (1984)

Somewhat paradoxically, the *grid-only* idea that destressing rules apply to adjacent stresses is elaborated in the *bracketed-grids* framework of Hammond (1984). Hammond combines the advantages of Hayesian foot-based analysis of stress assignment with the grid-only style of conditioning rules of destressing. As discussed earlier, the former has the advantage that it easily captures Strong retraction by the Strong Retraction Rule (92), whereas the latter allows an insightful formulation of the context of destressing rules, i.e. *clash.*

Hammond criticizes Hayes (1981) for the arbitrariness of the format of destressing rules, which allows for notation of non-existing, and in fact non-existable foot deletion rules. For instance, no evaluation measure distinguishes a (natural) rule affecting an initial *branching* foot from an unnatural rule affecting an initial *non-branching* foot. Clearly, the existence of the latter type, i.e. Pre-Stress Destressing (155), is natural in the light of its removing a stress directly followed by another stress, i.e. a clash.

In order to repair this defect, Hammond proposes to introduce into tree-notation the possibility to directly refer to stressed syllables or *heads of feet*. His so-called lollipop-notation minimally changes Hayesian tree-notation by temporally aligning DTE's and their daughter DTE's[43]:

```
(162)a.    /|      b. | \       c.   /  / |
         _/_o___     _o__\___    ___/__/__o____
          | |\        |  |\        |  |\  |\
          o-o \       o--o  \      o--o \ o \
         banana      cursory      abracadabra

(163)a.   /  |    b. |  \       c.   /   / |
        _/___o___   _o___\___    ___/___/___o__
         |\  |\      |\   |\       |\  |\   |\
         o \ o \     o \  o \      o \ o \  o \
        Alabama      auditory     Apalachicola
```

The advantage of this notation is that each head-of-a-foot is directly accessible for reference by destressing rules. Destressing is triggered by clashes, indicated by hyphens. Then, the following condition holds:

(164) **Clash Resolution Hypothesis**
All destressing rules must apply so as to eliminate adjacent DTE's.

The CRH rationalizes much of the essentially arbitrary restrictions on foot-branching that occur in the Hayesian defooting rules (151), (155), (156). Actually, the CRH renders reference to the shape of context feet and focus feet superfluous. This invites to proceed with an important step, collapsing Pre- and Post-Stress Destressing:

(165) **Bidirectional Destressing**
Delete a foot.

Although diversity of syllable weight conditions on the original rules seems to preclude this step, Hammond claims that no reference to weight is required in destressing itself. Weight conditions are transferred to the *vowel reduction* rule, which is limited to *light* rimes. Let us now examine the consequences of this approach for various destressing rules step by step.

Obviously, identical reducibility predictions result from the original and from the current analysis in the case of Pre-Stress Destressing. That is, restricting either the destressing rule or the vowel reduction rule to light syllables suffices to distinguish (60c)-(63c) from (60ab)-(63ab). For example, the pretonic heavy syllable in *càntéen* (60a) will be unreduced either because it is stressed - the traditional approach - or because it is stressless but heavy - Hammond's approach.

The predictions as to accentability are different for these strategies, however. Since heavy syllables will be destressed exactly as light ones, a new type of *stressless unreduced* syllable arises. That is, a three-way distinction arises between stressed unreduced, stressless unreduced, and stressless reduced syllables. This eliminates the well-known one-to-one correspondence between stress and irreducibility.

But notice the following: independent evidence for the implied stress distinction among unreduced syllables comes from the phrasal Rhythm Rule - essentially (125) - a rule which exhibits lexically governed variation precisely among heavy syllables in pretonic position, cf. section 3.1.1:

```
(166)a. bambóo  - bàmboo cúrtain        b. forlórn   - *fòrlorn hópe
        Chinése - Chìnese chéckers         obése     - *òbese cát
```

As a post-lexical rule, the phrasal Rhythm Rule is not expected to show lexical exceptions, and moreover, the limitation to pretonic syllables cannot be explained by it. Hammond argues that the initial syllables in (166b) normally undergo destressing, eliminating the stress required for a Rhythm Rule's landing site. The words in (166a) are simply exceptions to destressing. Their initial stress licences Rhythm. Analyses equating unreduced and stressed syllables simply cannot express this distinction[44].

Instead of a two-way implication between stress and vowel reduction, an implication chain between reduction, stress and phrasal rhythm arises:

```
(167) reduced vowel => stressless syllable => phrasal rhythm blocked
      phrasal rhythm allowed => stressed syllable => reduction blocked
```

However, Hammond's idea that syllables have to be light (in addition to being stressless) in order to be reducible, raises problems in relation to other destressing rules than Pre-Stress Destressing, and even in relation to some retraction rules. Let us first summarize these.

It seems that this analysis incorrectly precludes the reduction of *heavy* syllables which become stressless by *destressing* in Hayes (1981). Three Hayesian rules destress heavy syllables and render them reducible: Post-Stress Destressing (151) destresses long vowels as in *-ary*, *-ory* (138b). Sonorant Destressing (97) and the Arab Rule (156) both destress closed syllables. Furthermore, the problem must be solved concerning how to reduce closed syllables (58) and (62a) which are stressless simply by being placed in a weak position of a foot by Strong Retraction (92). Hammond attacks these issues as follows.

First, he splits up vowel reduction into an early rule, which applies Q-insensitively, and a late rule, which applies Q-sensitively. Early vowel reduction will reduce heavy syllables that are footed as weak by Strong Retraction. Furthermore, stressless sonorant-closed syllables, produced by Sonorant Destressing, arise sufficiently early in order to fall victim to early vowel reduction as well.

Second, he trades the Arab Rule for lexical marking. Closed syllables as destressed by the Arab Rule (139d) are stressless by extrametricality as assigned by (29). The complimentary set of stressed syllables, (139a-c), require lexical feet. This solution clearly misses the generalization as captured by the Arab Rule, since the latter set of lexical feet is quite *arbitrary* as compared to the former set of stressless syllables.

Third, the output of Post-Stress Destressing will undergo a vowel laxing rule to make them fit the Q-sensitive format of Late Reduction. A first step to this goal is the observation that long vowels are destressed only medially, as in destressing of *-ary*, *-ory*. This motivates a rule of Medial Laxing to shorten stressless vowels:

(168) **Medial Laxing**

```
|
V: => V  /  σ ___ σ
```

The function of this rule resembles well-established traditional rules which *lengthen* final and pre-vocalic stressless vowels as a protection against vowel reduction. These low-level vowel length adjustment rules serve to adjust vowel length (essentially *syllable weight*) to directly affect reducibility. Hammond's assumption that late vowel reduction is Q-sensitive fits very well into this analysis.

Hammond's essential claim that destressing is quantity-insensitive runs into problems, however. In contrast to the secondary retraction pattern (61-63), this claim predicts that the weight of the second in a sequence of three syllables before primary stress is irrelevant to destressing:

```
(169)a.  /   /|           /    |       b.   /  / |           /    |
        /   / |          /     |           /  /  |          /     |
      _/___/__o____    _/______o____     _/__/___o__      _/______o__
       |  |\  |\        |\ \   |\         | |\   |\        |\ \   |\
       o--o \ o \       o \ \  o \        o-o \  o \       o \ \  o \
      Winnepesaukee => Winnepesaukee     Monongahela  =>  Monongahela
```

Words with the segmental skeleton of *Winnepesaukee* have reducible second syllables, as is correctly predicted by (169a). Words with the segmental skeleton of *Monongahela* have reducible initial syllables, which does not match the output of (169b), although derived analogously to (169a). Here Hammond's analysis makes the incorrect prediction that in *Monongahela*, the initial syllable is stressed. We see that the required distinction between removing the initial non-branching foot and the second branching foot can only be due to the *syllable weight* of the second foot's head.

5.8 Prince (1985)

As discussed in chapter 0, Prince (1985) proposes that destressing rules are actually reapplying foot construction rules. Stress rules - or rules of primary metrical analysis - can only affect free elements - as stated in the Free Element Condition (18) of chapter 0. Destressing rules share the format of foot construction, but are no longer governed by the FEC[45]. Therefore, they can reorganize syllables into new feet. This hypothesis is supported by English word stress, according to Prince. Let us discuss the evidence, starting with the similarities between rules of stress and destressing which motivate their common format.

Prince's main observation is that stress rules and destressing rules conspire so as to place *heavy* syllables in *stressed* positions and *light* syllables in *stressless* positions. The Q-sensitive foot construction rule for stress placement - essentially the ESR (27) of Hayes (1981) - requires a light syllable in its stressless non-head position. Two destressing rules - Pre-Stress and Post-Stress Destressing - explicitly exclude heavy syllables from destressing. Other stress rules - such as the Strong Retraction Rule (92) - are Q-insensitive. But crucially, no stress rule or destressing rule puts only light syllables in stressed positions, or only heavy syllables in stressless positions.

Apart from Q-sensitivity, stress and destressing rules share *binarity* by organizing syllables into binary feet: unorganized syllables by means of foot construction rules, and previously organized syllables (remnants of deleted feet) by Stray Syllable Adjunction.
Not presenting a full analysis of English word stress, Prince addresses brief comments to Hayes' destressing rules. Post-Stress Destressing is interpreted as a reapplication of the Q-sensitive, L-dominant English Stress Rule:

```
(170)  [a][braca][dabra]  ===>   [[abra]ca][dabra]
       [Mo][nonga][hela]  =/=>  *[[Monon]ga][hela]
```

It is not easy to recognize destressing as a case of foot construction, since the head of the resulting foot coincides with an already existing head: the one to which the destressed syllable readjoins. Typically, the condition that destressing applies under stress clash renders its effect of creating a new foot's head vacuous.
Sonorant Destressing and the Arab Rule are L-dominant as well:

```
(171)a. Sonorant Destressing: [Ha][cken][sack] ==> [Hacken][sack]
     b. Arab Rule:            [A][rab]         ==> [Arab]
```

Nevertheless, both are Q-sensitive in ways unknown under the rules of primary metrical analysis. The former treats VSon rimes as light, and VObs as heavy, the latter restricts its head position to light rimes. Furthermore, Sonorant Destressing affects the position of primary stress, this in contrast to other destressing rules. These properties form complications for the hypothesis that destressing rules are in fact reapplying stress rules.
Pre-Stress Destressing is typified parametrically as Q-sensitive and R-dominant.

```
(172)a. [A][meri]ca ===> [[Ame]ri]ca    b. [can][teen] =/=> *[canteen]
```

R-dominance clearly poses another problem for Prince's hypothesis, as no R-dominant rules of primary metrical analysis occur in English.
Furthermore, adoption of Hayesian foot construction implies an asymmetry in the distribution of Q-sensitivity: whereas rules of primary metrical analysis are Q-sensitive on their first iteration only - by the ESR (27) - destressing rules are QS throughout the domain.
We may then conclude that Prince has initiated an extremely interesting attempt to formally relate English stress and destressing, but that its elaboration requires much additional analysis. This will be executed in chapter 2 below.

5.9 Halle & Vergnaud (1987)

Halle & Vergnaud (1987) introduce the concept of the *'stress well'* to deal with destressing, and implicitly replace the Clash Resolution Hypothesis of Hammond (1984): "every stressed syllable automatically induces a well under a syllable adjacent to it, provided that the stress of the latter is of lesser magnitude than the stress of the former". Essentially, each syllable is marked as a stress well, which is (a) adjacent to a stressed syllable (b) which is dominated by a element of a higher level than the highest element over the syllable itself. The positions of stress wells are indicated in (173) by 'w'[46]:

```
(173)  *               *              *       line 2
       * * *       *     * *      *     *  *  line 1
       * * * *     * *   * * *    * * *   * * line 0
       American   serendipity    elementary
       w   w w       w     w w      w     w w stress wells
```

The stress well serves to locate the victims of destressing, much in the same way as is the case for the combined Clash Resolution Hypothesis (164) and Strong Foot Condition (150). Now destressing can be formulated Q-sensitively as in (174):

(174) **Stress Deletion**
Over a stress well, delete asterisks on line 1 and above, provided that the well is assigned to a syllable with a nonbranching rime or to a Latinate prefix.

As we have seen in section 3.6, the non-cyclic Alternator (42) crucially resembles the output of Hayes' Strong Retraction Rule (92), so that the functions of destressing to be dealt with closely resemble those of Hayes' analysis. Essentially, these functions are summarized as Hammond's Bidirectional Destressing (165): the rules of Pre-Stress and Post-Stress Destressing. Therefore, the Q-sensitivity of Stress Deletion (174) comes as no surprise.
Analogously to Hammond's analysis, medial reducible long vowels must be shortened. This shortening rule is formulated (without reference to stress) as applying to medial syllables over a stress well. In contrast to the ordering proposed by Hammond (1984), HV's shortening rule feeds destressing. Crucially, HV's ordering presupposes shortening to refer in advance to the rhythmic context of destressing (i.e. the stress well), and not to the (more local) stress specification of the vowels involved.

5.10 Conclusions

As a general trend, destressing rules have been given a wider scope ever since SPE. The major reason for this resides in the tendency to generalize and constrain the stress rules. Claims about stress rules have become increasingly dependent on destressing rules, which took over more and more functions of stress assignment rules. Sonorant Destressing is the best example of a destressing rule functioning as an actual retraction rule, as it affects primary stress placement. At the same time, this property makes it anomalous under any restrictive view of destressing rules. As to the relation between stress and destressing, a promising idea was presented by Prince (1985), who hypothesized that destressing rules recapitulate stress rules, be it unrestricted by the requirement not to affect any material organized by earlier stress rules. Prince's hypothesis is clearly supported by the fact that both rule types can be typified by identical parameters such as quantity-sensitivity, binarity, and dominance. But Prince's paper leaves other properties of destressing unexplained: Sonorant Destressing's affecting the position of primary stress, and its weight restriction involving sonorants, the absence of right-dominant stress rules in English (in contrast to the presence of right-dominant Pre-Stress Destressing), and asymmetries between the application domains of Hayesian Q-sensitive rules: stress rules on the first iteration only, and destressing rules throughout the domain.

6. Cyclic word stress assignment

6.1 Introduction

A central topic in English word stress is the *stress cycle*. Our interest in this topic is that cyclic stress phenomena make possible an increased understanding of many theoretically relevant issues such as the relation between retraction rules and destressing rules, and the question whether stress rules have the power to wipe out pre-existing metrical structure. SPE and most analyses after assume that stress assignment rules apply to successively larger embedded domains of words with morphologically nested structure. Consider the following examples:

(175) a.	[còndèns]átion	vs.	[còmpensát]ion
b.	[consìder]átion	vs.	[clàssifi]cátion
c.	[dispéns]ary	vs.	[móment]àry
d.	[stàndardiz]átion	vs.	[èmàncipát]ion
e.	[hòspitaliz]átion	vs.	[ìndiscrìminát]ion

Notice that the stress patterns of the righthand members of these pairs are essentially equal to those of (segmentally similar) underived words.
But the stress retraction patterns of the lefthand members of the pairs are different, and seem to depend on the stress patterns of the embedded morphemes. The relevance of their embedded stress domain is evident from the contrasts between members of these pairs, which are segmentally and morphologically nearly similar words.
In *còndènsátion* the unreduced second syllable matches the primary stress of *condénse*; the stressless second syllable in *còmpensátion* reduces, as it does in *cómpensàte*. In *consìderátion*, the secondary stress on the second syllable matches the primary stress in *consíder*; *clàssificátion*, derived from *clássifỳ*, lacks this secondary stress. The primary stress in *dispénsary* matches the one of *dispénse*, as do the primary stresses in *mómentàry* and *móment*. The stressless second syllable of *stàndardizátion* matches its counterpart in *stándardìze*; in *èmàncipátion*, the second syllable has a secondary stress, coinciding with the primary stress in *emáncipàte*. Finally, the absence of secondary stress on the third vowel of *hòspitalizátion* matches the stressless penult of *hóspitalìze*; and in *ìndiscrìminátion*, the stressed third vowel matches the primary stress of *ìndiscríminàte*.
The stress retraction patterns of the left-hand derived words in (175) deviate from those of segmentally similar underived words as well.

(176) a.	[còndèns]átion	vs.	sèrendípity
b.	[consìder]átion	vs.	Wìnnepesáukee
c.	[dispéns]ary	vs.	désultòry
d.	[stàndardiz]átion	vs.	Tìcònderóga
e.	[hòspitaliz]átion	vs.	àpalàchicóla

In more theoretical terms of stress retraction, *condensation* deviates from Strong retraction (49) as in underived *sèrendípity*, *consideration* from Long retraction (56) as in *Wìnnepesáukee*, *dispensary* from Sonorant retraction (53) as in *désultòry*, while *standardization* deviates in its Q-insensitive retraction across a closed syllable, which is respected in Long retraction (56), as *Tìcònderóga*. In *hòspitalizátion* (derived from *hóspitalìze*, itself derived from *hóspital*) the alternating pattern of secondary stress as in *àpalàchicóla* is absent.
Essentially then, the central topic of analyses of the stress cycle that will be reviewed in the following sections, is how the stress retraction rules, motivated for underived words, can be blocked in cyclically derived words. There has been a clear development from

stating such blockades in the stress (retraction) rules themselves towards factoring them out into a separate subtheory of cyclic rule application, important contributions to which were presented in Kiparsky (1979, 1982).
The crucial observation is that whereas stress retraction may be blocked in morphologically derived words, stress placement usually is not. As an illustration of this, consider the derived word *ìnstrumèntálity* below:

```
(177)a. ínstrument        [ìnstrumént]al
     b. ìnstruméntal      [ìnstrumèntál]ity
```

The word is doubly derived, as is shown. It consists of *instrumental* and the suffix *-ity*; the internal morpheme *instrumental* itself consists of a morpheme *instrument* and the suffix -*al*. Stress placement in both derived words *instrumental* and *instrumentality* is completely regular in terms of Stress placement I (9) for suffixed adjectives and nouns. The primary stress, however, is located on a syllable which belongs to an internal morpheme in each case, which indicates that stress placement can freely access an embedded morpheme (across a morpheme boundary) in locating a stressed syllable.

So far, we have introduced sets of data where stress retraction patterns of morphologically derived words depend on the stress patterns of their embedded words. But apart from stress retraction, prominence patterns in derived words also partly depend on those of embedded words. The crucial set of data providing evidence for the stress cycle shows a preservation of prominence patterns under embedding. Recall from section 4.1 that in underived words such as *Tìcònderóga* (113d), optionality exists between the secondary stress patterns 3-4-1 and 4-3-1. Cyclically derived words with identical stress sequences are claimed by Kiparsky (1979) to have the 4-3-1 pattern only, however:

```
         3 4     1   ~    4 3     1           4   3     1
(178)a. Ticonderoga      Ticonderoga       b. [sensational]ity
        Srirangapatnam   Srirangapatnam       [iconoclast]ic
```

The internal prominence relations in the embedded words *sensational* and *iconoclast* carry over to the derived word: again this is a situation which points to the stress cycle.
The above evidence for cyclicity based on secondary prominence patterns is slightly obscured, however, by the fact that types of morphologically derived words with 'binary' stress sequences different from (178b) occur only with the 'non-cyclic' secondary stress pattern 3-4-1:

```
          3   4    1            3         4  1            3     4  1
(179)a. [condens]ation     b. [instrumental]ity    c. [artificial]ity
```

This situation is reminiscent of the situation in underived words (113ac), where exactly the same neutralization towards 3-4-1 occurs. Apparently, the rhythmic tendency to place the two strongest stresses as far as possible apart, overrules the 'cyclic' tendency to preserve the prominence relations under embedding.

In the face of this strong evidence in favor of the stress cycle, cases of cyclically stressed vowels being *reducible* at the surface are mostly attributed to *destressing* rules. In th[illegible] sense, destressing rules have a function similar to the function discussed in section 5, [illegible] generalizing and formally simplifying the stress assignment rules, by factoring [illegible] contexts where their effects do not show for independent reasons. We will [illegible] primary contexts where stresses of cyclic origin are assumed to be wiped out by destressing rules.

In the first place, cyclically stressed medial pretonic open syllables reduce, regardless if the vowels are long (180ac) or short (180bd) or if a stress precedes (180ab) or not (180cd):

(180) a.	expláin	-	èxplanátion	b.	Japán	-	Jàpanése
	deríve	-	dèrivátion		atómic	-	àtomícity
c.	rètrográde	-	rètrogradátion	d.	pèriódic	-	pèriodícity
	cívilìze	-	cìvilizátion		épigràm	-	èpigrammátic

Secondly, cyclically stressed initial pretonic light syllables reduce[47]:

(181)	átom	-	atómic	sólid	-	solídify
	párent	-	paréntal	ácid	-	acídic
	órigin	-	oríginal			

Analysis of such cases has always been an integral part of theories of the stress cycle in English. A general trend has been to split up an originally single destressing rule into several components. In the first place, the loss of prominence in most of (180) was attributed to rhythm, and analysed by such rules as Kiparsky's Rhythm Rule of (125). Secondly, the loss of vowel length in (180ac) was ascribed to a medial shortening rule, sometimes fed by rhythm. Essentially, the cases of (180) were all transposed into cases similar to those of (181): non-prominent pretonic light syllables. This decomposition of destressing into rhythm, shortening, and the Pre-Stress Destressing rule assumed as early as SPE, forms another central development to be reviewed in the following sections.

6.2 The SPE stress cycle

SPE motivates cyclicity by secondary stress patterns such as in (175ab). Since the required secondary stress patterns are incompatible with the output of the Auxiliary Reduction Rules II (73) and (76), as motivated for secondary stress preceding primary stress in underived words, cf. section 3.1.3, no good alternative to cyclic stress assignment is available in SPE.

Cyclic stress rules like the MSR (24) and ASR (66) apply to successively larger domains, where applications on outer cycles cause a lowering of stresses present on inner cycles by the Stress Subordination Convention:

(182)	[[condens]ation]		[[compensat]ion]		[[consider]ation]	
MSR	1			1	1	
ASR	-		1	3	-	
MSR	2	1	2	1	2	1
ASR		-		-		-

In many cases, however, the output of cyclic rule application does not match the attested secondary stress pattern. The word-level Auxiliary Reduction rules, some of which have been discussed in earlier sections in (73-76), serve to shield the central hypothesis of cyclicity against potential counter-examples. The two most important classes which require adjustment are the following.

First, surface secondary prominence relations between stresses assigned by cyclic rules deviate from those that are predicted by simple cyclic application. More specifically, the distribution of secondary stresses preceding the primary stress tends to be 3-4-1, cf. (179).

The correct pattern is derived by weakening pretonic [2stress] to [3stress], and strengthening the leftmost [3stress] to [2stress] by the Auxiliary Reduction Rule II (73)[48]:

```
(183)            [ [ [instrument] al] ity ]
    MSR              1
                     ___________
    MSR              2       1
                     _________________
    MSR              3       2     1
                     _______________________
    Weakening        3       3     1
    Aux Red II (73)  2       3     1
    Later rules      3       4     1
```

Second, vowels that have been assigned stress by cyclic stress rules may fall victim to vowel reduction. For pretonic vowels to reduce, they must occur in initial weak clusters (*atómic<átom*) or in medial open syllables (*èxplanátion<expláin, rètrogradátion <rètrográde*). The rule involved is a sub-rule of the Auxilary Reduction Rule I, and a predecessor of what later became known as Pre-Stress Destressing, cf. (144), (147), (155):

(184) **Pre-Stress Destressing**

$$V \Rightarrow \begin{bmatrix}\text{-stress}\\ \text{-tense}\end{bmatrix} \;/\; \langle VC_0\rangle \begin{bmatrix}\underline{\quad}\\ \alpha\text{stress}\\ \langle\text{+tense}\rangle\end{bmatrix} \overset{1}{C_0}\; (=C_0) \begin{bmatrix}\beta\text{stress}\\ V\end{bmatrix}$$

where ß is 1, 2, or 3, α is weaker than ß.

The parenthesized morpheme boundary plus consonant string exempts vowels in Romance prefixes from the requirement of occurring in open syllables, cf. (140). The condition requires the trigger vowel to be a stress peak in the proper sense: at least [3stress], and stronger than the focus vowel. Some examples of ß=1 are below:

```
(185)              [[atom]ic]    [[explan]ation]      [[retrograd]ation]
    MSR              1                1                       1
                     ___          _________            ___________
    MSR              2 1              2   1                   2   1
                     _______      _______________      ____________________
    Weakening        3 1              3   1                   3   1
    Destressing      - 1              -   1                   -   1
    Other rules      - 1          3   -   1            3      -   1
```

Two more complex examples of ß being lower than [1stress] follow:

```
(186)             [[[component]ial]ity]            [[compensat]ory]
    MSR                  1                  MSR               1
                                            ASR        1      2
                     ___________
    MSR                  2 1                           ____________
                     ________________       MSR        2      3   1
    MSR                  3 2     1          SSR        3   1  4   2
                     ______________________            _________________
    Destressing          - 2     1                     -   1  -   2
    Other rules        3 - 3     1                     -   1  -   3
```

Clearly, the use of complicated numerical variables of stress numbers is a disadvantage of SPE's n-ary representation of stress. This problem has been attacked in Schane (1975) and Halle (1973), however, who decompose SPE-stress values into a binary and a numerical value.

6.3 Schane's non-cyclic theory

The formal separation of binary segmental stress and n-ary prominence (section 3.3.2) prompted Schane (1975) to challenge the assumption of cyclic rule application. The 'cyclic' contrast between *condensation* and *compensation* is ascribed to a morpheme boundary preceding *-ate* in the former. This boundary is included in the SSR (68), which then retracts stress by the weak cluster principle in (187a). The Strong retraction rule, the ASR (66), is extended so as to retract stress from non-final stresses, as in (187b):

```
(187)               a. condens+at+ion   b. compensat+ion
   MSR                              +                +
   SSR                          +   +
   ASR                      +   +   +           +    +
   Detail Rule  (115)       3   3   1           3    1
   Rhythm Rule  (118)       3   4   1           3    1
```

The initial stresses are due to a generalized ASR, which retracts stress from non-final syllables, and across one-syllable spans. The Detail Rule (115) is followed by the Rhythm Rule (118), which accounts for the 3-4-1 pattern in *condensation.*
Secondary stresses in *emàncipátion*, *solìdificátion*, derived cyclically in SPE, arise by the generalized SSR in exactly the same way as primary stress in *emáncipàte* and *solídifỳ*. Their anti-Rhythm-Rule 4-3-1 pattern is produced by another detail rule which assigns [4stress] to vowels if immediately followed by [3stress].
Schane's generalized retraction indeed eliminates the SPE-type evidence (175ab) for stress rules to apply cyclically. Nevertheless, cyclicity remained a standard assumption after Schane (1975), fresh arguments for it being presented only by Liberman & Prince (1977) (based on [+stress]-assignment) and Kiparsky (1979) (based on prominence).
Schane's non-cyclic analysis fails to make the major generalization that such stress patterns systematically correlate with those of the embedded words. As Liberman & Prince (1977:301) remark: "Even if it could be argued that weak retraction is the 'unmarked' mode for complex words, and therefore need only be stipulated once for the entire class, the argument from lost generalization still has force; with a cycle to transmit to the whole word the features that its parts earn on their own, the fact that suffixes like *-al*, *-ous*, *-ive*, *-age*, etc. induce weak retraction when stressed follows directly from the fact that the ESR treats them quite normally when they end a constituent; no lexical stipulation is required, general or specific, to guide the stressing of such suffixes and the words they belong to."

6.4 Halle's prominence-independent destressing rules

Without explicit refutation of Schane's (1975) arguments for non-cyclic analysis, Halle (1973) assumes the set of rules assigning binary stress values - PSR (24), SSR (78), and ISR (81) - to be cyclic. The difference between this analysis and SPE, however, is that stress subordination is restricted to domains minimally the size of a word. Therefore *prominence* information cannot be cyclically transferred, as was the case in SPE, cf. (186). In contrast to SPE, there is a stage in the derivation where solely binary stresses, and no prominence values are present. Halle intends to show that it is at this stage where destressing applies.
As we saw earlier in section 5.3, the empirical advantage of this idea is that Pre-Stress Destressing can bleed prominence assignment in *políce* (145), capturing Oehrle's generalization (46-47). The theoretical advantage of it is that the SPE destressing rule (184) can be considerably simplified by eliminating reference to prominence:

(188) **Pre-Stress Destressing**

$$V \Rightarrow \begin{bmatrix}\text{-stress}\\ \text{-long}\end{bmatrix} \ / \ \ \# <XV>_a \ C_o \begin{bmatrix}\underline{\quad\quad}\\ <\text{-long}>_b\end{bmatrix} \ C \ [\text{1stress}]$$

Condition: if not a, then b.

Rule (188) is an expanded version of the Initial Pre-Stress Destressing rule (144). The present rule destresses long medial vowels (*explanation* 180ac). The condition limits destressing of long vowels to these medial positions. Examples of destressing in derived words are (189):

(189)	[[compensat]ory]	[[[atom]ic]ity]
Stress	1 1 1 1	1 1 1
Destress	- 1 - 1	1 - 1
CSR	- 1 - 2	2 - 1
NSR	- 1 - 3	3 - 1

But as was shown by Zonneveld (1976), ordering destressing prior to the CSR has negative consequences. Especially, it produces incorrect results in word-initial sequences of three syllables when the second of these cannot undergo Pre-Stress Destressing, so that it becomes the trigger of initial destressing. This yields **condènsátion*, **arìstócracy*:

(190)	[[condens]ation]	[[aristocrat]y]
Stress	1 1 1	1 1 1 1
Destress	- 1 1	- 1 1 1
CSR	- 2 1	- 2 1 2
Other rules	- 3 1	- 3 1 -

Zonneveld proposes to order Pre-Stress Destressing after the prominence assignment rules, an ordering which is independently required for Post-Stress Destressing (142), in order to avoid **Hàlicárnassus*, cf. (191a):

(191) a.	[Halicarnassus]	b.	[Halicarnassus]
Stress	1 1 1	Stress	1 1 1
Post-SD	1 1 -	CSR, NSR	3 3 1
CSR, NSR	3 1 -	Post-SD	blocked

The main conclusion is that destressing needs prominence information. A second conclusion is that word stress rules are ordered in three blocks: (a) Primary Stress Rules, (b) Stress Lowering Rules, (c) Destressing Rules.

6.5 Early metrical theory

6.5.1 Liberman & Prince (1977)

An important proposal of Liberman & Prince (1977) is that the assignment of metrical structure automatically follows the assignment of [+stress]. As discussed in section 4.3.1, this proposal has two major advantages. In the first place, it adapts tree geometry (direction of branching) to the direction in which the linear stress rules scan the word. This w[illegible] automatically select the primary stress in the right-periphery, by LCPR- labeling. Seco[illegible] viewing metrical structure assignment as an automatic effect of [+stress] assig[illegible] explains a major property of stress assignment, viz. disjunctivity (17). Sin[illegible] metrical structures are inherently incompatible, so must be the [+/[illegible] underlying them.

According to LP, the stress cycle constitutes a maximally simpl[illegible] lexical redundancy: the dependency between [illegible] in the underived words they contain. But if [+stress]-assignment is cyclic, then so is metrical structure assignment, as it is an automatic effect of the former. This consequence of the model runs into three serious problems, however, as LP argue. Let us now discuss these.

First, since [+stress]-assignment freely crosses morpheme boundaries in cyclic derivations, parts of trees will be changed accordingly:

```
(192)                         /\
                             / s
           /\               / / \
           s w              w s  w
        [[atom]ic]    =>   [atomic]
           + -              + + -
```

However, the integrity of metrical structure assumed by LP is clearly incompatible with this destruction of cyclic metrical structure.

Second, cyclic assignment of metrical structure predicts that prominence relations assigned during previous cycles are preserved into later ones:

```
(193)                                   /\
                                       /  \
                                      /    \
          /\                         w      s
         /  \                       / \    / \
         w   s                      w  s   s  w
     [[condens]ation]   =>   [[condens]ation]
        +   +                   +   +   +   -
```

This counters the observation (discussed above) that various types of derived words (179abc) do not exhibit the expected cyclic secondary stress pattern 4-3-1, but match those of underived words 3-4-1 (113abc).

The third problem is closely related to the second one. As was discussed earlier in section 5.4, LP claim that metrical prominence is a necessary type of information for destressing (LP essentially adopt Zonneveld's conclusion) and even a *sufficient* one. Particularly, filter (121) blocks destressing of vowels dominated by strong nodes. But if prominence is carried over cyclically, it will incorrectly block destressing of the medial vowel in *explanation* (180ac), since it carries the label *strong*.

For all these reasons, LP choose to wipe out metrical structure at the beginning of each new cycle while crucially preserving the [+stress] specifications:

(194) **Deforestation**
Before applying any rules on a cycle, erase all prosodic structure in the domain of that cycle.

This solves the three problems noticed above as follows.

First, since the metrical structure assigned in a previous cycle will be erased at the beginning of a new cycle, no problems as to disjunctivity (17) will arise.

Second, words with a cyclic history have metrical structures that would also result in underived words with the same segmental stresses. Hence *condensation* will - correctly - end up with the same metrical structure as underived *chimpanzee* (113c).

This locates the contrast between *condensation* and *compensation* in their segmental stress specifications instead of in their metrical structures:

```
(195)a.                       /\        b.                          /\
                             /  \                  /\              /  \
                            w    s                s  \            w    s
        /\                 /\    /\              /\   \          /\    /\
       w  s          =>   s  w  s  w            s  w  w    =>   s  w  s  w
   [[condens]ation]    [condensation]        [[compensat]ion]  [compensation]
      +  +               +  +  +  -             +  -  +  -        +  -  +  -
```

Third, the problem with destressing in *explanation* etc. is solved simply because the node over the medial vowel is *weak*. Notice that destressing by (147) in *condensation* (195a) is blocked, because the focus vowel does not occur in an open syllable (it is followed by two consonants).

LP notice a disadvantage of Deforestation. Long retraction (84a) across the stressed vowel of *consíder* in *consìderátion* would incorrectly result in a ternary foot. Since this stressed vowel would be weak in the resulting structure, it is falsely predict to destress by (147):

```
(196)                                      /\                     /\
                                          w  \                   w  \
              /\                         /\   \                 /\   \
             / s           (194)        s  \   s               s  \   s
            / / \          (84b)       / \  \ / \    (147)    / \  \ / \
           w  s w                      s  w w s  w            s  w w s  w
       [[consider]ation]   =>        [consideration]  =>    [consideration]
           +  + -                      +  + - +  -            +  - - +  -
```

This problem is solved by slightly adjusting the iterative ESR (83). The weak cluster in the Long retraction mode (84a) is now required to contain a *stressless vowel*. Therefore it can no longer skip the second vowel of *consideration*, and vacuously re-stresses it. The resulting metrical structure (197) effectively prevents destressing, since the vowel will be dominated by a *strong* node.

```
(197)                                                    /\
                                         /\             / s
                                        /  \           / /  \
                                       w    s         / w    s
              /\                      / \  / \       / / \  / \
              s  w                    s w s  w       w  s w s  w
     [consideration]   =>      [consideration]  =>  [consideration]
        +  + - +  -               +  + - +  -          +  + - +  -
```

Exactly as is required, the weak prefix vowel in *con-* can be destressed.

6.5.2 **Kiparsky (1979)**

Kiparsky (1979) takes issue with LP's Deforestation convention (194), claiming that both [+stress] specifications and metrical structure carry over to subsequent cycles. The evidence consists of two sets of data, which were actually discovered by Kiparsky as being relevant to the cycle.

As we have seen in section 4.3.1, Kiparsky attributes the variability in the secondary stress patterns of underived words (113d) to optionally left- or right-branching word trees. The variability is neutralized by the Rhythm Rule (125) in underived words with different segmental stress sequences. The variability lacking in *sensationality* (178b) can be taken as evidence that only the left-branching word-tree is present, the one which maximally resembles the word tree of the embedded word *sensation*:

```
                                                        /\
(198)                                                  / s
                                                      /  /\
            /\                /\                     /  / s
           / s               / s                    /  /  /\
          / / \             /  /\                  /  w   s \
         /  s  \           /   s \                /  / \ /\  \
        /  / \  \         /   / \ \              w  s  w s w w
       w  s  w  w  =>    w  s  w w       =>    [sensationality]
     [sensation]al     [sensational]ity          +  +  -  + - -
       +  +  -  -        +  +  - -
```

If LP's Deforestation convention had been applied here, free direction of word tree branching would have (incorrectly) predicted variability.

The second type of evidence for cyclic metrical structure assignment consists of words such as *dispénsary* (176c), which segmentally match the structural description of Sonorant Destressing (86), yet fail to undergo it. Their primary stress is located on the same vowel as is the case in their embedded parts, cf. *dispénse*. Crucially, the contrast between *dispénsary* and *désultòry* in (176c) can only be due to different metrical structures, because the segmental [+stress] strings are identical for both cases. LP's Deforestation (194) predicts that Sonorant Destressing freely applies in *dispensary*, since no strong node is available to block it:

```
(199)a.                            / \
                                  /   \
                     (194)       s     w
          /\         stress     / \   / \
         w  s        (86)      s   w  s  w
      [dispens]ary    =>     [dispens]ary
        +    +                 +   -  + -
```

Sonorant Destressing also provides an argument against LP's claim that metrical structure assignment is an automatic effect of [+stress]. The argument runs as follows.

Sonorant Destressing needs to refer to the *prominence* of the focus vowel in the internal cycle. This implies ordering after [+stress] assignment. On the other hand, Sonorant Destressing must be ordered *before* metrical structure assignment, which would result in primary stress on the focus vowel, cf. *refráctory* (50a), and an undesired rule blockade by LP's filter (121):

```
(200)                          /\
                              / s
                             / / \
                            w s   w
    [desultor<y>]   =>   [desultor<y>]   => Sonorant Destressing blocked
      + +   +   -          + +   +   -
```

Therefore, Sonorant Destressing must be ordered in between assignment of [+stress] and metrical structure assignment. This contradicts LP's claim that metrical structure is assigned automatically, along with [+stress] assignment.

Two conclusions can be drawn: (a) metrical structure carries over in the stress cycle, (b) metrical structure assignment is a separate rule, and no automatic effect of [+stress]-assignment. Therefore Kiparsky is faced with the problem of accounting for the phenomena covered by LPs rejected assumptions, as discussed in 6.5.1: (a) disjunctivity, (b) neutralized prominence patterns, (c) medial destressing.

With respect to disjunctivity (17), Kiparsky proposes an observationally adequate, but theoretically mysterious solution. He notes that existing metrical structure is overruled where it can form a polysyllabic feet over strings of the type [+stress][-stress]([-stress]), cf. (201).

```
(201)a.                              /\              b.
            /\                      /  \
           / s                     w    s
          / /\                    / \   /\                          /\
         /  s \                  /   s  s \                        / s
        /  / \ \                /   / \ / \ \          /\         / / \
       w  s  w w               w  s  w s  w w          s w        w s  w
  [sensational]ity =>  [sensational]ity             [atom]ic => [atom]ic
     +  +  - +  - -        +  +  - +  - -             + +  -       + +  -
```

In contrast, existing structure cannot be reorganized at the supra-foot level (202a):

```
(202)          /\                           /\
              /  \                         / s
             /    \                       / / \
            w      s                     / /   s
           / \    / \                   / /   /\
          /   s   s  \                 / w    s \
         /   / \ / \  \               / / \  / \ \
        w   s  w s  w w              w s  w s  w w
  [sensational]ity =/=>  [sensational]ity
     +  +  - +  - -         +  +  - +  - -
```

Accordingly, Kiparsky proposes to restrict metrical structure assignment so that it cannot destroy supra-foot structure.

Second, the uniqueness of the 4-3-1 contour in the *sensationality* class can be explained by the Rhythm Rule (125), reversing the word-internal prominence relations in all other classes, and producing 3-4-1 contours:

```
(203)                             /\                 /\
                                 /  \               /  \
                                w    s             w    s
          /\                   /\    /\           /\    /\
          w s                  w s   s w          s w   s w
  [condens]ation   =>  [condensation]   =>   condensation
    +   +                +   +   +  -         +   +   +  -
```

The Rhythm Rule extends to words with different stress sequences such as *ìnstrumèntality* and *àrtificiálity*. Since these derivations run precisely as those of underived words, we refer to (126) by way of illustration. Crucially its rhythmic condition singles out *sensàtionálity* as the only type which preserves its embedded prominence relations.

Third, destressing in *explanation* is fed by the Rhythm Rule essentially as in (203). And as required, it also bleeds destressing of the initial prefixes in *condensation* (203), as this becomes strong.

However, phrasal applications of the Rhythm Rule are in their turn bled by prefix destressing: **èxact chánge*, **bènign túmor*, cf. section 3.1, by the removal of [+stress] from non-prominent vowels. This classical ordering paradox is resolved by assuming the Rhythm Rule to be *cyclic*: word-level prefix destressing is sandwiched in between its word-internal and phrasal applications. In the framework of those days this implied cyclicity of metrical structure assignment as well, since no non-cyclic (word-level) rules were ordered before the block of cyclic rules.

6.6 Hayes (1981)

Hayes (1981) attacks the problems which are posed to Kiparskyan analysis when the feature [+stress] is eliminated in favor of foot structure. A purely metrical foot-based analysis implies that the segmental feature [+stress] cannot be invoked to block stress retraction rules in cyclic derivations. This has the following consequences.

First, if stress is carried over cyclically, it can only reside in foot structure. Now the question arises which feet must be respected in the course of the cyclic derivation, and which need not. Kiparsky's solution to this problem required reference to both [+stress] and metrical feet. Recall that new metrical structure can only be constructed of sequences consisting of [+stress][-stress]([-stress]). But because in foot-based theory, no reference can be made to [+stress], the major problem is how to accomplish the same distinction.

To illustrate the problem, consider the contrast between *fràternizátion* and *emàncipátion* (175d). The absence of secondary stress on the second syllable in the former example is related to the stress of the base word. This can only be analysed in foot-based terms by arranging this syllable to be the weak element of a foot in the internal cycle, and by keeping this stress foot outside the scope of the retraction rules on the outer cycle. Then the central problem of accounting for these cyclic stress patterns resides in blocking the Strong Retraction Rule (92) from reassigning a binary foot over the second and third syllable:

```
(204)     SRR ESR                    SRR   SRR   ESR
          / \  |                      |    / \   / \
      [standardize]ation =/=> *[standardization]
```

Since the output is identical to the metrical structure of *Tìcònderóga*, destressing of the second syllable will be blocked. In a Kiparsky-type analysis the answer to the problem is easy: no foot with a [+stress] as its weak node can overrule an existing foot. But a foot-based analysis cannot make a similar statement as "feet are to be respected", since there are many cases where existing feet must be overruled, cf. (201).

Another side of the same coin is how to block reapplication of the SRR in *condensation*, in order to avoid a stressless second syllable:

```
(205) SRR ESR                        SRR    ESR
       |   |                         / \    / \
      [condens]ation      =/=> [condensation]
```

Hayes' answer to the problem is as follows. He stipulates that the SRR cannot overrule existing foot structure. SRR's respect for structure can be made up as well from *pròpagándìze*, as derived from *pròpagánda*, and the non-occurrence of **propágandìze*:

```
(206)     SRR ESR             SRR SRR ESR
          / \ |                 | / \  |
       [propagand]ize  =>  [propagandize]
```

However, the *ESR* must crucially be capable of overriding existing feet:

```
(207)  ESR          ESR
       / \         | / \
     [atom]ic =>  [atom]ic
```

From the empirical point of view, this analysis of cyclic blockades of stress rules is fairly adequate. However, theoretically it is completely mysterious why specific stress rules are allowed to destroy metrical structure, whereas others are not. Kiparsky (1982) tackles this problem.

6.7 Kiparsky (1982)

Cyclic blockades were first placed into a more general perspective than the stress rules proper by Kiparsky (1982), in the form of the theory of Lexical Phonology. Although it is not our aim to explicate this theory here in any detail (Archangeli 1984 and Kaisse and Shaw 1985 present surveys of it), one of its major goals is to explain the fact that cyclic neutralization rules are generally blocked from changing feature values present in underlying lexical representations.

Kiparsky's explanation for blockades of English cyclic stress rules is found in the ESR and SRR being *cyclic* rules. His solution improves on Hayes (1981) in two respects. First, it explains blockades of cyclic stress rules by general principles instead of by stipulating these application modes in specific rules. Second, it shows empirical advantages in the form of covering cases where stress retraction (SRR) is allowed to overrule metrical structure, as opposed to Hayes' prediction. Let us first sketch the theory of Lexical Phonology that Kiparsky proposes.

Cyclic rules can only overrule lexically distinctive features in *derived contexts*, i.e. those contexts which arise from combination of morphemes or from a prior application of a phonological rule. This generalization has been confirmed by many types of neutralizing cyclic rules, including non-stress rules (Mascaró 1976, and references in Kiparsky 1982, 1985). The Elsewhere Condition accounts for disjunctive ordering between cyclic rules, as well as for blockades of cyclic rules in *underived contexts*, formerly ascribed to the Strict Cycle Condition (Mascaró 1976).

(208) **Elsewhere Condition** (Kiparsky 1982:136-137)
Rules A, B in the same component apply disjunctively to a form Ø if and only if
(i) The structural description of A (the special rule) properly includes the structural description of B (the general rule)
(ii) The result of applying A to Ø is distinct from the result of applying B to Ø.
In that case, A is applied first, and if it takes effect, then B is not applied.

According to Kiparsky, the output of cyclic rules is 'frozen' and retained as lexical information at the end of each cycle. Distinctive information becomes an integral part of the *identity rule* of the lexical item, mapping the lexical entry onto itself. In this way, lexical items can be treated as lexical rules whose structural description may well be more specific than the one of a lexical rule which potentially applies to it. Let us now see what predictions follow from this model concerning the application of metrical stress rules.

First, stress rules are free to construct metrical structure on their first pass through the domain. Obviously, where no metrical structure is present, it cannot function to block rules which assign it. Second, the stress rules are blocked when their output is distinct from the metrical structure laid down on earlier cycles. For example, the SRR (92) cannot apply so as to overrule the feet on the internal cycle of *condensation*. To be more precise, the output of the stress rules on the internal cycle is frozen into an identity rule. This renders the internal cycle immune to rules applying on the outer cycle, such as the SRR:

```
(209)   |   |            existing (lexically supplied) foot structure
      [condens]ation
         \ /             potential output foot structure of the SRR
```

Crucially, the structural description of the SRR is not matched in (209) by a combination of morphemes, as it is properly included in the identity rule. Nor does the match result from the application of a previous rule. Therefore it is blocked.
In contrast, both the ESR and the SRR can overrule a cyclically supplied foot if a morpheme boundary occurs in the application context:

```
(210)a.   ESR                   ESR          existing foot structure
          / \              b.   / \
       [mental]ity           [solid]ify
             \ /                   \ / |
             ESR                  SRR ESR    arising foot structure
```

Since the syllables combined into a foot are located on different sides of a morpheme boundary, a derived context arises, in which the cyclic stress rules can override lexically frozen foot structure.
Notice that (210b) constitutes a counterexample to Hayes' claim that the SRR cannot override existing structure. In Hayes' analysis, *-ify*, being a verbal suffix, retracts stress by the SRR. Here Kiparsky's theoretical improvements go hand in hand with empirical improvements.
The reverse case would be a blockade of the ESR in an underived context. Kiparsky sets up crucial examples with the help of lexical feet:

```
(211)a.   LEX          SRR ESR            b.      LEX                ESR
          / \            | / \                     |                  | \
       Alabama   =/=>  *Alaba<ma>em          Monadnock  =/=>  *Monad<nock>em
```

Lexical feet (see section 3.4.3) belong to lexical representation, hence to the identity rule that maps the lexical entry onto itself. Since no combination of morphemes is involved, the ESR is blocked in *Alabáma*. In *Monádnòck,* Stray Syllable Adjunction cannot adjoin the extrametrical syllable to a preceding foot, since this would conflict with the lexical foot marked on it.
A third advantage of the analysis is that it allows collapsing the ESR and SRR. The crucial observation is that the ESR can be formulated as a more specific version of the 'Elsewhere case' SRR. First, the ESR refers to the end of the domain, as opposed to the (iterative) SRR. Second, the ESR is Q-sensitive, as opposed to the (Q-insensitive) SRR:

```
(212) Assign maximally binary S W feet from right to left,
      where W may not branch in env. ___].
```

Therefore the ESR and SRR are in the relation required between A and B of (208), from which their disjunctive ordering follows automatically.
Although forming an impressive account of the data, Kiparsky's analysis meets a problem in dealing with the ESR's application in words such as *original*. Here the foot to be constructed is properly included in the inner cycle, as will be clear from (213):

```
(213)    ESR
         / \         existing foot structure
      [origin]al
           \ /       arising foot structure
           ESR
```

We will return to this issue in chapter 2.

6.8 Halle & Vergnaud (1987)[49]

Halle & Vergnaud (1987) propose a new theory of the cycle, motivated in particular by properties of stress rules of systems other than English[50]. Its major features are the following. Each cycle involves a recording of stress information on a new autosegmental *stress plane*. Each successive stress plane has access to the segmental contents of previous planes in addition to the segmental content of the affix which elicits the plane. Stress is assigned on each plane as if it were an underived word, so that the planes do not have access to stresses of other planes. The crucial difference with earlier theories of the stress cycle is that stress is not automatically transferred from inner to outer cycles, but that a language-specific *stress copy rule* transfers stresses between planes. This step is motivated because Halle & Vergnaud present stress systems where the stress cycle is crucial, but where no overt cyclic secondary stresses can be found at the surface. The language-specific stress copy rule can be illustrated by an example from English.

Three planes are associated with *instrumentality* after Stress Conflation (104) in the cyclic stratum (for presentational reasons, the planes have been represented next to each other below):

```
(214)a.  *             b.         *       c.                *        line 2
        (*     )           (         *)         (               *)      line 1
        (*    *)*           *     *(*)  *        *     * * (* *)*       line 0
         instrument          instrumental         instrumentality
```

The stress copy rule (215) applies as the first rule in the non-cyclic stratum, yielding (216):

```
(215) Copy line 1 asterisks from previous stress planes.
```

```
(216)a.  *             b.         *       c.                *        line 2
        (*     )          (*         *)        (*         *   *)      line 1
        (*    *)*           *     *(*)  *        *     * * (* *)*       line 0
         instrument          instrumental         instrumentality
```

These copied stresses are respected by the post-cyclic Alternator (42) exactly as stressed heavy rimes are respected by the cyclic Alternator:

```
(217)a.  *             b.         *       c.                *          line 2
        (*     ) *        (*         *)        (*         *   *)  *     line 1
        (*    *)(*)       (*    *)(*   *)      (*    *)(*)(*)(* *)      line 0
         instrument         instrumental         instrumentality
```

This analysis elegantly solves the problems associated with the cyclic application of the ESR and SRR, originally noted by Hayes (1981). What is more, it accounts for Kiparsky's remaining problem case *oríginal*: no other stress is copied from the stress plane of *órigin* than the initial one, and this is simply destressed in the non-cyclic stratum (by a rule to be discussed below):

```
(218)a.  *        b.      *         line 2
        (*)          (*   *)  *     line 1
        (* *)*       (*)(*)(* *)    line 0
         origin       or ig inal
```

Other cases present severe problems, however. For the cyclic primary stress in [illegible] to be copied to the successive plane of *manìpulátion*, it surely must [illegible] itself. But recall from section 3.6 that Halle & Vergnaud [illegible] (which retracts primary stress in *-ate* verbs) in the [illegible] Rhythm Rule is non-cyclic, how [illegible]

This ordering is forced, since the Rhythm Rule is fed by the non-cyclic Alternator, which skips heavy syllables as the associated stresses have at that point fallen victim to cyclic Stress Conflation (104):

```
(219)       *                           *            *                     *
        (*  *  *)  Stress         (     *) Alter-  (*    *)  Rhythm   (*  ) *
        (*)(*)(*)  Conflation      * * (*) nator   (* *)(*)  Rule     (* *)(*)
         designate    =>          designate   =>   designate    =>    designate
```

Notice that there is no way out in ordering the Rhythm Rule after Stress Conflation in the cyclic stratum, since then it lacks a proper landing site, crucially supplied by the non-cyclic Alternator. Therefore, the Rhythm Rule is feed by the non-cyclic Alternator, which in its turn is fed by the Stress Copy Rule. This implies that the 'cyclic' secondary stress in *manìpulátion* is left unexplained

It logically follows from this that Strong retraction, viz. Halle & Vergnaud's non-cyclic Alternator, actually cannot be ordered in the non-cyclic stratum. Clearly, this rules out the attempt to account for the distribution of retraction modes by means of (non)cyclic strata. This in its turn implies that exactly the problems noticed earlier for Selkirk's grid-only analysis in sections 3.5 and 6.8 re-enter the scene with the same force.

6.9 Conclusion

The basic issue in the literature on stress patterns of morphologically complex words is how to capture the fact that these patterns may depend on the stress patterns of their embedded morphemes. The assumption that the stress rules apply cyclically, to successively larger morphological domains, essentially yields the correct results, but leads to a number of new questions. First, the stress pattern of embedded morphemes does not always surface in the form of secondary stresses. Second, rules of stress placement and retraction on outer cycles behave ambiguously as to the stress output of inner cycles: while they may respect it, they may also partly destroy it. The answers to these questions that are usually given involve destressing rules, and a theory of cyclic rule blockades. The destressing rules required are essentially the same as motivated for underived words. Hence, the most interesting aspect of cyclic phenomena is their being blocked in certain contexts. As was shown, these blocking contexts have become more and more integrated with the theory of Lexical Phonology (Kiparsky 1982). The central idea is that stresses assigned on inner cycles behave as part of lexical representation for rules applying on outer cycles.

7. Conclusion

The central issues in the literature on English stress, as discussed in this chapter, are (a) the similarities and differences between placement and retraction rules, and especially the distribution of the retraction modes, (b) the generalized formulation of stress rules with the help of destressing rules, (c) the separation of rules of stress assignment and prominence assignment, (d) the blockade of cyclic stress rules in a set of contexts.

As we see it, two major questions remain after reviewing these issues, one with respect to the distribution of the stress retraction modes, and one with respect to the relation between rules of stress and destressing. We have shown that the other issues, a separation between stress assignment and prominence assignment, and cyclic blockades, have resulted into some form of agreement among analysts - which is not to say that these issues have been 'solved'. We will now review the remaining problems, mentioned above.

A central question which needs an answer after the review of analyses of English word stress is how to explain the distribution of the retraction modes. The problem, persistent in the literature, affects the complex behavior of heavy syllables with respect to stress rules. Basically two positions appear to be tenable. The first is to assume heavy syllables to be stressed only by binary counting stress rules, instead of by rules assigning 'stress by weight'. This account allows for Q-insensitive stress rules as well, in order to account for Strong retraction. Hayes (1981) restricts the Q-sensitive rule to the first iteration, while iteratively skipping heavy syllables by the Q-insensitive rule in an alternating fashion. The problem with this account is that it requires additional machinery to stress those heavy syllables which are, by definition, out of reach of the binary stress rules: Long Vowel Stressing and lexical feet. The latter also function to stress extrametrical syllables and those exceptionally stressed heavies that are skipped by the stress rules, but should be stressed. These additional devices fragmentize and reduplicate a basically unitary phenomenon: the tendency for heavy syllables to be stressed.

The second position as to stress retraction is to assume heavy syllables to be basically stressed, having them destressed by a mixture of primary stress movement and destressing. This position is typical of grid-only theory (Prince 1983, Selkirk 1984) and characterized by the mirror image problem of Strong retraction. Next to highly generalized stress rules of syllable weight (QS) and binarity (Perfect Gridding), special rules are required to retract primary stress from incorrectly stressed heavy syllables onto preceding stresses. However, each stress retraction rule must restate the condition that main stress cannot be retracted further backward than the antepenult. This obscures a more general, independent phenomenon that primary stress is posited at the last metrical stress of the word.

Partly as an attempt to solve both types of problems, Halle & Vergnaud (1987) regulate the Weak and Strong retraction modes by appealing to the cyclicity of the former and the noncyclicity of the latter. They combine the device of grid-only theory - the Accent Rule - and the constituency constructor of foot theory - the Alternator - to have the best of both worlds. However, as we have seen, their attempt fails in the face of the fact that the output of the *non-cyclic* Alternator - a Strong retraction pattern - crucially carries over in *cyclic* secondary stresses. This is to say that the question as to the retraction modes is still open.

An answer to the first question must evidently address the interaction between syllable weight, binary stress rules, and prominence assignment. Our analysis of English stress to be presented in chapter 2 intends to throw new light on these traditional problems.

The second question to be answered, closely related to the first, is how to characterize the relation between rules of stress and destressing in English, or how to explain their common properties as well as their differences. The history of the theory of English word stress reflects that claims about stress assignment have become increasingly dependent on destressing rules, which have taken over more and more functions of stress assignment rules. Sonorant Destressing is the best example of a destressing rule functioning as an actual stress retraction rule, as it affects primary stress placement. At the same time, this property makes the rule anomalous under any restrictive view of destressing.

Returning to the question concerning the relation between stress and destressing, a highly promising answer was given by Prince (1985), who hypothesized that destressing rules recapitulate the stress rules, be it unrestricted by the requirement not to affect any material organized by earlier stress rules. Prince's hypothesis is clearly supported by the fact that both rule types can be characterized by identical parameters such as quantity-sensitivity, binarity, and dominance.

But Prince's paper leaves other properties of destressing unexplained. First, Sonorant Destressing feeds primary stress assignment, and has an atypical weight restriction

involving sonorants. Second, right-dominant stress rules are lacking in English, whereas a right-dominant Pre-Stress Destressing rule is present. Third, various asymmetries exist as to the domains in which Hayesian rules are Q-sensitive: stress rules are so on the first iteration only, while destressing rules are so throughout the domain.
We will continue our discussion of these two issues in the next chapter, where we will attempt to find new answers, and partly improve on earlier answers.

Footnotes to chapter 1:

1 Recall that we abstract away from the possibility of secondary final stress in this section. In section 3, we will demonstrate that the final stress on long vowels in final syllables is always present, either as a primary or as a secondary stress.

2 In spite of the *long* (phonetically *tense*) vowel in their final syllable, many words are stressed according to Stress placement I:

```
(i)a. búffalo     b. albíno      c. commándo
      bróccoli       macaróni       chiánti
```

The standard analysis of these words is to assume *underlying short* (non-tense vowels) which are lengthened (tensed) by a rule affecting word-final non-low vowels. This rule explains the surface absence of short (phonetically lax) non-low vowels in this position.

3 In *cátholic*, *árabic*, *pólitic*, *lúnatic* stress is placed by (9).

4 A refinement is in order. The position of stress indicates that the underlined consonant strings in *álgebra*, *lúdicrous*, *éloquent* etc. count as single consonants at the edge of a weak cluster. Hence an optional liquid or glide is added to (19a).

5 For presentational reasons, we have slightly simplified most of the linear stress rules to be discussed in this chapter.

6 In SPE, such words are assumed to have underlying geminate consonants following the vowel in the penult, which will formally equate them to the cases of (6c).

7 Notice that the extrametricality rules (29) predict non-final stress in all polysyllabic nouns and derived adjectives, regardless of the segmental composition of the final rime. This issue will be dealt with in section 3 on retraction.

8 To see this, consider an example with the suffix *-al*, which consistently places stress by Stress placement I, i.e. is extrametrical itself:

```
(ii)                      *                     *  *
       *   *   *    QS    *   *   *      PG     *  *  *
     corpor<al>em   =>  corpor<al>em     =>   corpor<al>em     (*corpóral)
```

9 Actually, Halle & Vergnaud propose an alternative to consonant extrametricality in Stress placement II - *develop* (11-12a), which will not be discussed here. Hence, (44) slightly deviates from the source.

10 This iterative, self-feeding property is of course known from other phenomena in natural languages, such as harmony processes.

11 Vanderslice & Ladefoged (1972) advocate such a model, where accentability translates as [+/-accent], irreducibility as [+/-heavy].

12 This indirect relation between reducibility and stresslessness has been introduced in SPE.

13 A number of verbs displays the Q-sensitive retraction pattern (50a), such as *imprégnàte*, *defálcàte*.

14 Some rare exceptions to the pattern are *cylíndròid*, *odóntòid*, *tridéntìne*, *Laértès*.

15 Romance prefixes generally reduce, even if they contain heavy syllables:

```
(iii)a. con+víct    b. pro+tést
        per+mít        de+féct
```

Also, a number of words with unreduced light pretonic syllables occur:

```
(iv) ràccóon   bàssóon   tàttóo   sèttée
```

We will come back to these cases in section 5 on destressing.

16 This [2stress] surfaces as [3stress], by the Stress Adjustment Rule, which, however, will not be discussed.

17 Chomsky & Halle include another parenthesized cluster in (68) to account for (Long) primary stress retraction, as in *peregrinate* (55).

18 That is, the SSR (68) and MSR (24) are disjunctively ordered, since the latter can be collapsed with the former by parentheses.
19 Here we somewhat simplify the SPE analysis, which accounts for Weak retraction in words ending in disyllabic suffixes, especially *-ory*, by different means. Stress placement in such cases is not performed by the Tense Suffix Rule, but by expansion (25) of the MSR feeding the SSR. The details of this solution are irrelevant to our present purposes, however.
20 Negative markings for the MSR (22) are independently required for non-retracted final primary stress in *guitár*, *acquiésce*, cf. (15).
21 The [2stress] eventually surfaces as [3stress], by the Stress Adjustment Rule.
22 As has been remarked above, the Stressed Syllable Rule (68) shares the parenthesized weak cluster with the MSR (24) since the former can be collapsed with the latter by means of braces.
23 Actually Halle's rule mentions [1stress] instead of [+stress]. We have presented the rule as below to express the relation to Schane's rule format. Differences between Schane's and Halle's rule formats will be discussed in section 4.
24 As we will see later, this destressing rule is independently motivated for cases involving cyclic stress assignment.
25 The first condition prevents the ESR from skipping long vowels in final syllables in its initial application.
26 Notice however, that LP do not distinguish the retraction mode that was introduced as Sonorant retraction earlier, cf. (53).
27 Somewhat surprisingly, no attested retraction mode corresponds to suppressing *both* terms. Hence no stressed affix *consistently* retracts stress to the immediately preceding cluster, regardless of its segmental composition.
28 Extrametrical LVS feet are later adjoined as weak feet to the word tree, which yields the same effect as primary stress retraction.
29 Notice that the *metrical* verbal affix *-ate* does not have primary stress. This is so because it is made extrametrical by a special rule ordered before the primary stress rule. Such extrametricality with respect to prominence will be discussed later.
30 Actually, verbs like *defálcàte* are doubly exceptional, since they do not undergo Sonorant Destressing (97).
31 Nevertheless Halle & Vergnaud allow for lexically marked stress in *Mississippi* (14b), making their analysis vulnerable again to Selkirkian criticism by allowing lexical stresses on non-initial pretonic light syllables. See also Hammond (1987) for a criticism of lexical stress in combination with Stress Conflation.
32 Essentially, these generalizations are due to Schane (1975).
33 Two classes of words systematically show this pattern. First, words ending in *-y* - such as *mélanchòly* - can be analyzed by underlying glides, as has been discussed in section 2.1. Second, words in *-ative* - such as *límitàtive* - can be analysed by extrametricality of the complex suffix *+ative*, cf. Hayes (1981).
34 We have slightly simplified the parenthesized term, which in Schane's original version contains an additional optional glide /y/, in order to correctly stress words such as *mélanchòly* etc., cf. fn. 33x
35 In British English, the suffix vowels may be reduced even when the primary stress does not directly precedes it.
36 But some Romance prefixes, such as *trans-*, never destress.
37 Logically, the laxing part of a destressing rule can be made part of independent rules, as we will see later.
38 Actually, LP introduced *extrametricality* into phonological theory before it was developed into a central notion by Hayes (1981).
39 Nanni (1977) presents a similar analysis for words ending in the suffix *-ative*.
40 Note, however, that (151) falsely predicts destressing of long vowel syllables in such position, as **Dòdecanésus* (63b).
41 Hayes' Strong Foot Condition (150) translates as a constraint against deleting *strong* beats, i.e. those aligned with a beat on the second level. This is why MD (157) does not refer to beat strength.
42 These three strengths of syllable were proposed earlier in Travis (1983).
43 See for the notion D(esignated) T(erminal) E(lement) chapter 0 section 2.4.1.
44 This idea can be traced back to Liberman & Prince (1977:285).
45 Exempting destressing from the FEC does not lead to across-the-board application, for Prince assumes destressing to be subject to conditions such as the Clash Resolution Hypothesis and Strong Foot Condition.
46 Halle & Vergnaud do not indicate any constituent structure in the representations that serve to illustrate destressing, presumably because they assume constituency to be irrelevant to destressing.

47 As in underived words, long pretonic vowels are irreducible, as in cíte-cìtátion. Reducible cases (schemátic is related to sch[e:]me) are rare, and must be assumed to undergo a minor shortening rule.
48 The initial stronger stress does not necessarily have a cyclic source: in *condensation*, it is solely due to the Aux. Red. Rule II (73).
49 We do not discuss the stress cycle in Selkirk (1984), since it does not contribute crucial aspects to the present discussion.
50 In particular, the Basic Accentuation Principle in Vedic.

Chapter 2
A unifying analysis of English stress and destressing

1. A sketch of the analysis

1.1 Introduction

In the preceding chapter, we have seen that syllable weight affects the location of stresses in English in a complicated way, both in the rules of stress and in the rules of destressing. We concluded that no analysis so far has satisfactorily dealt with the distribution of the retraction modes, nor with the obvious similarities between stress and destressing. Crucially, these difficulties reside in the interaction between syllable weight and binary counting rules, such as foot assignment rules, Perfect Gridding, or line 0 constituent construction rules. In English, syllable weight obviously has two faces. On the one hand heavy syllables are best interpreted as basically stressed, but on the other hand surface stress values of especially closed syllables are crucially context-sensitive, a conclusion motivated by the patterns of skipping closed syllables, which have been discussed in chapter 1. Most importantly, such patterns extend to primary stress retraction patterns (of Sonorant retraction and Strong retraction). This shows that, if heavy syllables are basically stressed, at least some closed syllables can be *destressed* prior to the assignment of primary stress. Since rules applying before primary stress assignment are, in the terms of Prince (1985), rules of primary metrical analysis, an important question arises with respect to the Free Element Condition. This question can be formulated as follows: if heavy syllables are heads of constituents after the first pass of the binary counting rule through the domain, what licenses the destruction of these constituents prior to primary stress assignment? Furthermore, what is the explanation for the fact that such constituent destruction shows contextual sensitivity for stresses, as exemplified by the Sonorant Destressing context?

Given this background, we are now in a position to formulate the thesis of this dissertation, and the two major claims that will be presented in support of it. Our central goal will be to demonstrate that word stress compositionally reflects three properties: (a) binary constituency, (b) syllable weight, and (c) prominence. That is, these three properties are essentially autonomous, whereas interactions between them arise by their merging in the bracketed grids representation of stress. We will support this view by presenting evidence for the following two major hypotheses. First, we claim that metrical constituency is strictly binary, a claim to which we will refer as the Strict Binarity Hypothesis. Evidence for this claim is in the consistent behavior of 'monosyllabic feet' as stray syllables. We will propose that strict binarity is a consequence of the format of constituent construction: metrical adjunction. Second, we will conceptualize Q-sensitivity as a wellformedness condition governing the relation between syllable weight and stress. That is, stress values and syllable weight directly correspond.

In this dissertation, we will examine the consequences of the above view and related hypotheses for two closely related languages, English and Dutch. The current chapter will be concerned with the former, and chapters 3, 4, and 5 with the latter. In order to make maximally clear the theory of stress and destressing that will be developed here, we will first sketch this theory in broad outline in the sections 1.2 to 1.5 below.

1.2 Binary constituents

First, binary constituents arise by the adjunction of elements in the bracketed grid. Adjunction within words is an instantiation of a general metrical adjunction scheme, of which Rhythmic Adjustment (Hayes 1984) constitutes the phrasal reflex. As adjunction is an operation between two elements, as well as the only way of creating constituents, metrical constituency will be strictly binary, and no non-branching or unbounded constituents occur.

Adjunction is restricted to adjacent grid elements, a requirement which can be derived from a general principle that discontinuous constituents are excluded, implicitly assumed in any version of metrical theory.

The standard metrical assumption that adjoined elements are weak (Hayes 1981, 1984) will be translated into our bracketed grids framework as the condition that the column over an adjoined element be less high than (or subordinated to) the one over the adjunction target.

The special case of metrical adjunction with which we will be concerned most in this chapter is Syllable Adjunction, which adjoins grid elements of line 0, i.e. syllable place-holders. In English word stress, the direction of Syllable Adjunction is leftward, so that left-headed binary constituents arise. The head position in a constituent follows from the direction of adjunction:

```
(1) Syllable Adjunction (English)
    Adjoin a line 0 element (i.e. a syllable place-holder) leftward.

                   *       line 1
    * *    =>    (* *)     line 0
    σ σ           σ σ
```

In the resulting constituent the leftmost syllable is 'stressed', as the column over it culminates in a line 1 element. The rightmost syllable is stressless, since the column over it culminates in a line 0 element. The difference in height between the columns follows from the condition that was discussed above, that the column over an adjoined element be less high than the one over the adjunction target. Therefore, adjunction of an element on line 0 will induce the assignment of an element on line 1 over the element that is the adjunction target.

Syllable Adjunction (1) applies iteratively, from right to left, through the domain. Probably, iterativity and directionality are parametrically determined. Levin (1989) provides strong motivation for the iterativity parameter (originally proposed in Hayes 1981). Directionality has been a parameter in metrical theory ever since word stress is being analysed by parametric options.

As a rule of primary metrical analysis, Syllable Adjunction is subject to the Free Element Condition of Prince (1985), cf. chapter 0, (18). This condition will prevent adjunctions of syllable place-holders which extract these out of existing constituents during the iteration through the word. Therefore, each left boundary inserted by (1) is taken as the point of departure of a new adjunction.

Syllable Adjunction is sensitive to the extrametricality of syllables in its domain of application. That is, the place-holders of extrametrical syllables cannot be adjoined leftward by (1). Illustration of this adjunction mechanism is relatively straightforward. Throughout this chapter we will use a shorthand bracketed grids notation as employed by Hayes (1987). In this notation, heads of constituents are indicated by asterisks '*' on the same line in the grid as where the constituent is located. Corresponding non-heads are indicated by single dots '.':

```
(2)a.   . . . .            . .(* .)          (*.)(* .)
        Alabama       =>  Alabama       =>  Alabama

   b.    . . .              .(* .)
        banana        =>  banana        =>  blocked by FEC

   c.   . . . .            .(* .) .
        Ameri<ca>em   =>  Ameri<ca>em   =>  blocked by FEC
```

As shown in (2), Syllable Adjunction proceeds leftward through the word, organizing strings of syllables into binary constituents. The derivation of *banana* in (2b) shows that when a single syllable place-holder remains at the left edge of the domain, the initial syllable is stressless. The same is illustrated by the derivation of *America* in (2c), where the domain of Syllable Adjunction is redefined by extrametricality of the final syllable. The constituentless status of such syllables will turn out to be instrumental in explaining Q-insensitive retraction patterns of English, such as Sonorant retraction, as will be shown below.

1.3 **Syllable weight**

Second, consider the Q-sensitivity of the English stress system, which is accounted for in the following way. First, a weight distinction will be assumed between light syllables (i.e. open syllables with short vowels) and heavy syllables (i.e. syllables with long vowels and closed syllables). This distinction will be interpreted moraically, for reasons which will soon be made clear. For the mora theory of syllable weight, we refer to Hyman (1985) and Hayes (1989). In moraic theory, the distinction of weight is represented as below:

```
(3)a.  σ      b.    σ         c.    σ
       |            |\              |\
       m            m m             m m
     / |          / |/            / | |
    Co V        Co V            Co V C
    light        heavy          heavy
              (long vowel)     (closed)
```

A wellformedness condition (4) states that heavy syllables are stressed (i.e. their place-holder is an asterisk '*', not a dot '.'):

(4) Inherent stress by syllable weight

```
    *
    σ
    |\
    m m
```

The wellformedness condition (4) takes the function of earlier rules to assign stress to heavy syllables: Q-Sensitivity (Prince 1983, Selkirk 1984, cf. chapter 0 (2)), or the Accent Rule (Halle & Vergnaud 1987, cf. chapter 1 (41)). Importantly, (4) can be interpreted in two ways. First, it states that if a syllable is bimoraic, then it is stressed. Second, it states that if a syllable is stressless, then it is light. The second interpretation is not the common one in metrical theory, but we will show that it is crucial for our goals.

The stress value of light syllables is not covered by (4). It will be determined in either of the following ways. First, since we will assume that stress representations are *minimal*, light syllables are stressless unless indicated otherwise. Examples of this have been shown in the remaining initial syllables in (2bc). Second, light syllables will be stressed when their place-holder is the head of a constituent, as shown in (2). In this case, the stress representation is minimal as well, but within the margins of the requirement that the heads of constituents be stressed. Consequently, light syllables must be in the head-position of a binary constituent in order to be stressed, hence must be followed by a stressless syllable. This claim is confirmed almost without exception by the facts, cf. chapter 1, section 2.1 and 3.1.

Finally, the wellformedness condition (4) governs metrical syllables and extrametrical syllables alike. In this respect we follow Selkirk (1984), whose QS (cf. chapter 1 (34)) has a similar insensitivity to metricality or extrametricality of syllables. However, *consonant* extrametricality is relevant to syllable weight, as was proposed in Hayes (1981) and Selkirk (1984). That is, an extrametrical word-final consonant will lead to the weight value 'light' of the final syllable if it is the only consonant after a short vowel (cf. chapter 1, section 2.3). Both consonant and syllable extrametricality will be considered to be lexically marked properties, and considerable sources of variation in the stress values of final syllables, again following Selkirk (1984).

Let us now discuss the relation between Syllable Adjunction (1) and the wellformedness condition (4). Syllable Adjunction adjoins a syllable place-holder, or a 'line 0 asterisk' in Halle & Vergnaud's terminology. Adjunction is (indirectly) restricted by the wellformedness condition (4). As an adjoined line 0 element is automatically subordinated to the line 0 element to the left, adjunction of a heavy syllable would lead to the loss of stress of the heavy syllable, which violates condition (4). For this reason, Syllable Adjunction is automatically restricted to the adjunction of light syllables, so that it is indirectly Q-sensitive, much like Halle & Vergnaud's Alternator (cf. chapter 1 (42)).

The application of Syllable Adjunction to a string which contains heavy syllables is illustrated in (5). We follow the notational convention of Hayes (1987) to indicate light syllables by 'v' and heavy syllables by '-':

```
(5)a.   .  .  *    *              (*  .) *    *
        v  v  -    -              v  v  -    -
        A di ron <dack>em    =>   A di ron <dack>em

   b.    *  *   .  *  .             * (*   .)(*  .)
         -  -   v  -  v             -  -   v  -  v
        Ti con de ro ga      =>   Ti con de ro ga

   c.    .   *    *
         v   -    -
        Ha cken <sack>em     =>   blocked
```

Where syllables remain outside binary constituents, their stress value simply equals the value that they have by their inherent weight, as can be seen in (5). In this sense, stress is a truly compositional property, determined both by constituency and syllable weight.

As will be clear from (5c), Syllable Adjunction (1) is not sufficient to account for the surface stresslessness of the medial heavy syllable, and the surface stress of the initial light syllable. As we have learnt from our discussion of stress retraction in chapter 1, stress rules may skip heavy syllables in certain cases: this seems to imply that inherent stress values as determined by (4) are overruled. In particular, short vowel syllables closed by sonorant consonants may lose their inherent stress, and consequently their weight. Let us now be more precise about the mechanism which causes this effect.

We propose that the complex relation between syllable weight and stress in English is (largely) caused by the presence of a Syllable Adjunction rule which *has direct access to the weight of syllables to be adjoined.* The rule adjoins place-holders of syllables of specific weight classes, to be more precise, closed short vowel syllables. For this reason, we will call it the Closed Syllable Stress Rule. It replaces the rules that in earlier analyses are called Sonorant Destressing, chapter 1 (97), and the Arab Rule, chapter 1 (156), as well as the bounded Q-insensitive Strong Retraction Rule assumed in Hayes (1981), chapter 1 (92), and some other analyses. Obviously, this rule is marked in the sense that it has direct access to syllable weight, but we claim that this markedness is a reflection of the complexity of the stress-weight relation in English word stress.
The rule is stated below[1]:

```
(6) Closed Syllable Adjunction
    Adjoin the place-holder of a closed short vowel syllable leftward.
```

Rule (6) has a destressing effect on the closed short vowel syllable it adjoins, and consequently a deweighting effect, caused by the wellformedness condition (4). Let us illustrate its application by the continuation of the derivation (5c) in (7):

```
(7)   .   *   *             (*   .)   *
      v   -   -              v   v    -
    Hacken<sack>em   =>   Hacken<sack>em
```

The deweighting imposed on the medial syllable can be represented in a moraic framework, cf. Hyman (1985), Hayes (1989), as follows[2]:

```
(8)    σ              σ
       |\             |
       m m    =>      m
     / | |          / | \
   Co  V C        Co  V  C
```

The second mora position is eliminated, and its contents - a consonant - adjoined to the one remaining mora position. The deweighting of the medial syllable in (7) is reflected at the surface by its reducibility, or even by its status as a syllabic sonorant[3].
Since closed syllables can be stressless only by the application of Closed Syllable Adjunction, this amounts to the claim that at the surface a stressless closed syllable must be an adjunct, hence must be preceded by a stressed syllable. This result is correct almost without exception for non-final syllables, where consonant extrametricality does not interfere. As we will see in section 5, basically the same result is correct for final syllables, when effects of consonant extrametricality are taken into account.
Notice that we have not indicated in (6) the condition that the adjoined syllable be surrounded by stresses, as is the case for the context of Sonorant Destressing in various analyses discussed in chapter 1, cf. (86), (97), (102), (110).
However, there is no need for stating this condition in the rule itself, because it is a consequence of the Free Element Condition if (6) is just ordered after Syllable Adjunction (1). The FEC forbids the incorporation into constituents of elements that are already parts of constituents.
The effect is that (6) cannot apply so as to (a) adjoin leftward a syllable place-holder that is the head of a binary constituent, and (b) adjoin a syllable place-holder leftward to another place-holder that is the weak element of a binary constituent. Consequently, (6) can apply

```
(201)a.                         /\                 b.
           /\                  /  \
          / s                 w    s
         / /\                / \   /\                         /\
        /  s \              /  s   s \                       / s
       /  / \ \            /  / \ / \ \         /\          / / \
      w  s  w w           w  s  w s  w w        s w         w s  w
  [sensational]ity => [sensational]ity       [atom]ic => [atom]ic
    +  +  - +  - -      +  +  - +  - -        + +  -       + +  -
```

In contrast, existing structure cannot be reorganized at the supra-foot level (202a):

```
(202)          /\                          /\
              /  \                        / s
             /    \                      / / \
            w      s                    / /  s
           / \    / \                  / /   /\
          /  s    s  \                / w    s \
         /  / \  / \  \              / / \  / \ \
        w  s  w s  w w              w  s  w s  w w
  [sensational]ity =/=> [sensational]ity
    +  +  - +  - -          +  +  - +  - -
```

Accordingly, Kiparsky proposes to restrict metrical structure assignment so that it cannot destroy supra-foot structure.

Second, the uniqueness of the 4-3-1 contour in the *sensationality* class can be explained by the Rhythm Rule (125), reversing the word-internal prominence relations in all other classes, and producing 3-4-1 contours:

```
(203)                            /\               /\
                                /  \             /  \
                               w    s           w    s
        /\                    /\    /\         /\    /\
       w  s                  w  s  s  w       s  w  s  w
  [cọndẹns]ation   =>  [cọndẹnsạtion]    =>   condensation
    +   +                +  +  +  -           +  +  +  -
```

The Rhythm Rule extends to words with different stress sequences such as *ìnstrumèntality* and *àrtificiálity*. Since these derivations run precisely as those of underived words, we refer to (126) by way of illustration. Crucially its rhythmic condition singles out *sensàtionálity* as the only type which preserves its embedded prominence relations.

Third, destressing in *explanation* is fed by the Rhythm Rule essentially as in (203). And as required, it also bleeds destressing of the initial prefixes in *condensation* (203), as this becomes strong.

However, phrasal applications of the Rhythm Rule are in their turn bled by prefix destressing: **èxact chánge*, **bènign túmor*, cf. section 3.1, by the removal of [+stress] from non-prominent vowels. This classical ordering paradox is resolved by assuming the Rhythm Rule to be *cyclic*: word-level prefix destressing is sandwiched in between its word-internal and phrasal applications. In the framework of those days this implied cyclicity of metrical structure assignment as well, since no non-cyclic (word-level) rules were ordered before the block of cyclic rules.

6.6 Hayes (1981)

Hayes (1981) attacks the problems which are posed to Kiparskyan analysis when the feature [+stress] is eliminated in favor of foot structure. A purely metrical foot-based

```
(12)                       *
        .  *               *  *
        v  -               v  -
      sa<tire>em   =>    sa<tire>em
```

Arguably, the heavy final syllable is extrametrical, since it does not receive prominence by (10). Notice that segmentally similar cases occur where such a syllable does receive prominence (*police* etc., cf. chapter 1, (47)). But in spite of the lexical variation in this respect, which will be ascribed to variation in syllable extrametricality, each word receives a primary stress. For this reason, we will assume that the End Rule applies by default to the lowest level in the bracketed grid in (12), and that a line 1 element is automatically supplied in such cases, to fulfil the requirement that grid columns are 'closed', cf. Halle & Vergnaud (1987).

1.5 **Stress versus destressing**

Let us now discuss the relation between stress and destressing rules in our theory. We will pursue the idea proposed in Prince (1985), which is to view rules of destressing basically as stress rules applying in the feature-changing mode, i.e. no longer governed by the FEC, cf. chapter 0, and chapter 1, section 5.8. Prince advances an analysis of English stress and destressing which is rather sketchy, and in need of elaboration, as we showed before.

We have already eliminated the need of Pre-Stress Destressing, as will be clear from the stress values of the stray light initial syllables in (2bc), as compared to the one of the heavy initial syllable in (5b). These stress values follow straightforwardly from assumptions made so far, in particular the assumption that constituency is strictly binary, and the assumption that syllable weight is reflected in inherent stress, by (4). Moreover, we have discussed in some detail the way in which Sonorant Destressing and the Arab Rule translate into our framework: as left-dominant Syllable Adjunction rules restricting the weight of the adjoined syllable. It was shown that Closed Syllable Adjunction is subject to the Free Element Condition, which excludes it from the set of destressing rules in the sense of Prince (1985). This solves the problem in earlier accounts (starting with Kiparsky 1979), that Sonorant Destressing affects metrical structure while feeding primary stress assignment, cf. chapter 1, sections 3.3.4 and 5.8.

However, we have shown also that Closed Syllable Adjunction (6) can eliminate stresses due to inherent weight, and consequently, eliminate syllable weight itself. In this sense, Closed Syllable Adjunction is a rule of destressing after all. Nevertheless, this does not violate the Free Element Condition, as the FEC only governs the structural relations between elements (i.e. constituency), not their values itself (i.e. stresses). On the other hand, Closed Syllable Adjunction may lead to stress on the syllable whose place-holder is the landing site of the adjunction, as illustrated in (7). In this sense, the adjunction rule is a stress rule as well. We see then that the traditional classification of rules of stress and destressing becomes somewhat vague, and had better be replaced by Prince's more accurate distinction between rules of primary metrical analysis and rules of metrical reanalysis, where only the former are subject to the Free Element Condition.

This leaves us with one genuine rule of metrical reanalysis, Post-Stress Destressing, proposed originally in Hayes (1981) in order to eliminate the Long mode in favor of strictly binary stress retraction, cf. chapter 1, section 5.5. Actually, we already have the rule to effectuate this reanalysis: if we assume that Syllable Adjunction (1) applies at the lexical stratum level-1 as a rule of primary metrical analysis, it may re-apply at the lexical stratum level-2 in its function of Post-Stress Destressing, cf. chapter 1 (151). As pointed out by Prince (1985), PoSD shares three properties with the English Stress Rule, cf. chapter 1 (27): (a) left-dominance, (b) boundedness, and (c) Q-sensitivity. These similarities carry over to our framework. That is, the properties (a) and (b) are obvious for (1), and property (c) is effectuated indirectly.

An important advantage of formalizing destressing as Syllable Adjunction is that its conditions can be stated in terms of structural relations between the adjoined syllable and the landing site. It will be shown that essential constraints on destressing are reducible to constraints on node adjunction, such as the Maximality Principle motivated in Hayes (1984) for phrasal Rhythmic Adjustment, and the Strong Domain Principle of Kager & Visch (1988).

1.6 Contents of this chapter

The exposition will take the following line. The purpose of section 2 is to show that the contexts of Sonorant retraction and Strong retraction are largely identical, and that the residue of Strong retraction can be subsumed under the Arab Rule. This implies that Strong retraction can be eliminated altogether, and be replaced by three 'quantity-sensitive' primary stress rules: (a) the Light Syllable Stress Rule (formerly the English Stress Rule), (b) the Sonorant Stress Rule (formerly Sonorant Destressing) (c) the Arab Stress Rule (formerly the Arab Rule). The latter two will be collapsed into the Closed Syllable Stress Rule.

Section 3 introduces the separation between binary constituency and syllable weight that is crucial in our theory. We will present arguments for the claim that the Closed Syllable Stress Rule is a rule of primary metrical analysis, and from this we will draw the conclusion that non-branching feet deleted by the analogous destressing rules in previous analyses actually do not occur. Crucially, this argument involves the Free Element Condition. We will introduce a wellformedness condition to provide stress values for stray syllables, i.e. those which singly occupy a non-branching foot in earlier analyses. Finally, we set out to assess the effects of our theory on various stress systems, some of which are alleged examples of the necessity of non-branching feet. We show that, as far as we see, alternative analyses are possible within our framework, and that in fact various systems can be better analysed under our assumptions.

Section 4 is devoted to the consequences of our theory for English word stress, especially the effects of our elimination of non-branching feet. These effects turn out to be positive. First, the problems with respect to the former Sonorant Destressing rule are solved, since the new proposal does not violate the Free Element Condition. Second, the rule of Pre-Stress Destressing can be eliminated. Third, primary stress will be assigned to light syllables that are single in the stress domain by a default application of the End Rule.

Section 5 addresses extrametricality, and we will show that the basic insights of Hayes (1981) and Selkirk (1984) carry over to our analysis. Also, we will show that the retraction properties of suffixes are better expressed in terms of their phonological composition (syllable weight) than in terms of their lexical category. Section 6 will summarize the results as to primary metrical analysis.

Section 7 will present an analysis of the phenomena referred to as the stress cycle. Arguments will be presented for the claim that each stress cycle is recorded on a different autosegmental plane (as is proposed in Halle & Vergnaud 1987). The mechanism for carrying over stresses between cyclic planes will not be stress copying, however, but will consist of merging of cyclic stress planes, constrained by the Elsewhere Condition of Kiparsky (1982). We will show that the latter analysis meets various problems which can be circumvented with a slightly adapted definition of 'distinctiveness' of metrical representations in our framework.

In section 8 the formalism of Syllable Adjunction will be introduced for destressing contexts. Constraints on destressing will be proposed and evaluated in various destressing contexts. It will be shown that syllable weight and binary constituency interact in ways which support relative independence between both. Section 9 addresses destressing by loss of prominence. Section 10 and 11 are devoted to the effects of syllable weight adaptations on stress. We will examine destressing by weight decreases and stressing by weight increases, respectively. In section 12 we will give an analysis of internal and external rhythmic behavior of words, especially with respect to the phrasal Rhythm Rule. Finally, section 13 summarizes the results of the chapter.

2. Strong retraction as closed syllable destressing

Analyses such as Hayes (1981) treat the retraction properties of words and suffixes as a function of their lexical category. More specifically, verbal long vowel suffixes such as *-ate*, *-ize* are assumed to govern Strong retraction, cf. chapter 1 (49), while nominal and adjectival long vowel suffixes such as *-ine*, *-oid* are assumed to govern Weak retraction, cf. chapter 1 (51). Here, we will show that better generalizations can be made, which do not involve category membership, however, but which do involve (a) the phonological composition of syllables to be skipped in retraction and (b) the position in the word of syllables to be skipped in retraction. We will show that these new generalizations are actually independently motivated in terms of rules of destressing, viz. Sonorant Destressing and the Arab Rule. These results will then be generalized to secondary stress retraction. This eliminates the need for a separate Q-insensitive Strong Retraction Rule.

The traditional claim behind categorial distinctions of retraction modes (as presented explicitly by Hayes 1981, and assumed by others) is that retraction from verbal long vowel suffixes is genuinely strong, whereas retraction from nominal and adjectival long vowel suffixes is typically weak, but strong in exactly one context: that of Sonorant retraction, cf. chapter 1 (53). Crucially, this context is more specific than that of Strong retraction in two respects:

(a) Sonorant retraction can only skip syllables with short vowels which are closed by a sonorant consonant (while Strong retraction can skip any type of short vowel syllable, or perhaps even syllables of any weight);

(b) Sonorant retraction requires a stress directly preceding the focus (while Strong retraction applies regardless of the preceding types of structure, typically none).

The third difference between the two retraction principles involves their applicability to different word classes:

(c) Strong retraction in its function of primary stress retraction is restricted to verbs and underived adjectives (whereas Sonorant retraction as primary stress retraction also applies to nouns, and to suffixed nouns and adjectives).

Also, Strong retraction determines secondary stresses in all categories (while Sonorant retraction will never determine secondary stress).

We will now evaluate the validity of each of the above claims against a large set of examples, which were drawn from Kenyon & Knott (1944) and other relevant literature (such as Fidelholtz 1967 and Nessly 1974). We will conclude that a distinction between Strong retraction and Sonorant retraction can hardly be upheld in the face of the facts, and must actually be replaced by new and better generalizations.

2.1 Syllable weight and retraction of primary stress

It is claimed that retraction in verbs completely ignores the weight of skipped syllables, while Sonorant retraction is restricted to syllables composed of a short vowel and a sonorant consonant. This claim is based on words such as in (13-14), cf. chapter 1 section 3.1.2:

```
(13)a. álternàte      b. cónfiscàte     c. sálivàte
       concentrate       coruscate         ideate
       contemplate       designate         obligate
       demonstrate       devastate         immunize
       standardize       legislate         satirize
       exercise          recognize         excavate
       compensate        satisfy           anodize

(14)a. désultòry      b. reféctory      c. advísory
       legendary         directory         elusory
       argentine         smaragdine        quinoidine
       helminthoid       asbestine         anhydride
```

In the examples of verbal retraction in (13) syllables of different composition are skipped: respectively a short vowel plus a sonorant, a short vowel plus an obstruent, and a long vowel. The difference claimed with nominal and adjectival retraction is based on words such as in (14bc), where retraction across a short vowel plus obstruent, or across a long vowel, is blocked.

However, when confronted with large numbers of examples, the status of these claims is weakened considerably. In the first place, retraction proves to be less category-dependent than assumed traditionally. In the second place, retraction modes prove to be largely governed by the type of syllable to be skipped. In the third place, most of the words supporting nominal and adjectival Weak retraction are of a kind hardly ever encountered by native speakers of English.

The standard observation that Strong retraction across short vowel plus obstruent is rare among nouns and adjectives can be reinterpreted as an observation about (a) the rarity of word-internal VObs syllables as such and (b) the fact that this syllable type is represented best among low-frequency nouns and adjectives. The generalization covering retraction across VObs most accurately is the Arab Rule, cf. chapter 1 (156), be it subject to much lexical variation.

The standard observation that Strong retraction across short vowel plus obstruent is common in verbs is obviously based on the obstruent /s/, an atypical obstruent in terms of retraction behavior. Syllables closed by /s/ are precisely those skipped best in nominal and adjectival retraction as well.

Finally, retraction across underlyingly long vowels does not support the distinction between retraction in verbs and other categories.

In the following sections, we will illustrate the generalizations given below:

```
(15)a. Retraction across VSon is wide-spread across lexical categories.
    b. Retraction across VObs is slightly more restricted, and governed
       by the context of the Arab Rule.
    c. V/s/ shares the retraction properties of light syllables.
    d. Retraction across underlying VV is lexically diffuse.
```

2.1.1 Retraction across short vowel plus sonorant consonant

Retraction across VSon is very pervasive in the lexicon, making up the bulk of retraction across a heavy syllable. A selection of verbs (16a) and nouns/adjectives (16b) which go by this mode are given below:

(16) a.

álternàte	exercise
concentrate	compensate
contemplate	reconcile
demonstrate	fraternize
advertise	caterwaul
enterprise	flabbergast
altercate	consternate
emendate	enervate
fecundate	hibernate
commentate	dissertate
masturbate	ostentate

b.

désultòry	serpentary	ampersand
dysentery	secondary	cavalcade
repertory	incensory	Bazalgette
voluntary	brigantine	abelmosk
inventory	gabardine	Samarkand
offertory	argentine	misanthrope
promontory	turpentine	batterfang
columbary	levantine	cummberbund
commentary	valentine	nightingale
prebendary	columbine	jabberwock
segmentary	saturnine	Ingersoll
adversary	infantile	Athelstan
legendary	mercantile	Ethelbert
momentary	Mackintosh	Hackensack
pigmentary	pimpernel	gubbertush
sedentary	Somerset	Hottentot
voluntary	Arkansas	

As compared to the large number of Sonorant retractors, a much smaller number of words display Weak retraction (17) or vacillation between both retraction modes (18). Most of these words are infrequent, which makes retraction across VSon in (16) even more salient[5]:

(17) a.

defálcate	prolongate
elongate	remonstrate
incurvate	incarnate

b.

effróntery	semanteme	Turgenev
quaternary	prehensile	Kilmarnock
allantoid	spatangoid	Hamilcar
odontoid	tridentine	Laertes
alumni	Fernandez	

(18) a.

adumbrate	inculpate
compensate	innervate
contemplate	inundate
demarcate	objurgate
exculpate	promulgate
expurgate	aggrandise
inculcate	amortize
infiltrate	enfranchise

b.

peremptory
recondite
tripartite
helminthoid
cylindroid
Byzantine

We conclude that in words with medial VSon syllables, retraction across VSon appears to be the regular case for all categories in spite of some exceptionality (mainly in *verbs*). Note that such verbal weak retractors constitute *double* exceptions in those analyses which assume both Strong retraction and Sonorant retraction.

2.1.2 Retraction across short vowel plus obstruent

If there is one class of syllables which, according to the authors mentioned earlier, distinguishes verbal retraction from nominal and adjectival retraction, it must be VObs. Two observations that must be made when inspecting relevant words, however, are (a) their small number, (b) the high proportion of low-frequency words among them. Hence, care must be taken when interpreting the distribution of examples across retraction modes. The obstruent /s/ will be ignored now, as it deserves a discussion of its own.

Only twenty examples of Strong retraction appear to exist, most of which are non-verbs, i.e. nominal/adjectival (19b). Actually, there are only five verbs with retraction across VObs (19a)[6]:

(19) a.	désignàte	b.	ánecdòte	gelignite (BE)	Arbuthnot
	recognize		assignat	refectory (BE)	insectary
	solipsize		asymptote	stalactite (BE)	
			monophthong	stalagmite (BE)	
	diagnose		palimpsest	trajectory (BE)	
	impregnate (BE)		paroxysm		

The small number of verbs in this retraction class is quite unexpected from the point of view that Strong retraction is typical of verbs[7]. What renders the words of (19) more or less a class is not their lexical category, but the fact that their initial syllables are *light*. That is, the generalization that can be made much resembles the well-known *Arab Rule*, cf. chapter 1 (156). The exceptions are *ímpregnàte* (BE), *díagnòse*, *árbuthnòt*, and *ínsectàry*. The latter word can well be interpreted as a stress-neutral affixation based on *ínsèct*.
However, an initial light syllable is no sufficient condition for Strong retraction across VObs, but only a necessary condition. Moreover, we find that the majority of words with this segmental structure undergoes Weak retraction (see also Nessly 1974:446), for all word classes.
When considering Weak retraction, a very probable reason for the claimed difference between verbal and nominal/adjectival retraction is revealed: the latter constitute the majority by far (20b). Notice however, that a non-verbal majority is simply not unique to Weak retraction, as we saw the same situation in (19)[8]:

(20) a.	erúctàte	b.	diréctory	arachnoid	autochton
	delectate		redemptory	ellipsoid	electron
	dephlegmate		trajectory	gelignite	decathlon
	humectate		preceptory	stalactite (AE)	pentathlon
	reluctate		emictory	stalagmite (AE)	Melanchthon
			refectory	molybdite	delicti
	impregnate		inductory	smaragdine	Trubetskoy
			perfunctory	ulexine	Ojibway
			olfactory	peroxide	Aquidneck
			consectary	hydroxide	Penobscot
			electary	dioxide	Hopatcong
			phylactery	projectile	Afognak
			refractary	electrode	Monadnock
				anthracnose	
				galactose	

Many can be 'stress-neutrally' related to an embedded morpheme (as for instance *diréct*, *redemption, trajéct, erúct, refráct, aráchne, ellípse, projéct, óxide*, maybe also *úlèx*)[9].
Clearly, nouns and adjectives form the majority of both weak and strong retracting forms. Because Weak retraction as such is more frequent than Strong retraction, the impression that nouns and adjectives follow Weak retraction may well arise. This standard observation can thus be related to two individual tendencies.
The data presented so far justify the following conclusions about the primary retraction patterns words containing VObs:
a. Strong retraction is not restricted to verbs, as more cases of Strong Retraction occur among non-verbs. However, Strong retraction seems to be restricted by the requirement

that the initial syllable be light. Hence, the proper generalization is better made in terms of the Arab Rule than by lexical category.
b. However, in absolute numbers, Weak retraction is more frequent than Strong retraction across lexical categories. This high proportion must be relativized to the fact that some allow for stress-neutral analysis.

2.1.3 **Retraction across short vowel plus /s/**

Retraction across V/s/ is common in verbs (a) and nouns/adjectives (b). It even seems as if we are dealing with a light syllable, the /s/ being part of the following onset. Clearly, the weight of the initial syllable is irrelevant for retraction, as stress is easily retracted to heavies.

(21)a.	dévastàte	b.	mónastèry	Augustine	Ernestine
	coruscate		magistery	Hellespont	ambuscade
	legislate		registrary	Florestan	fortescue
	orchestrate		laurustine	Stanislaus	Wenceslaus
	satisfy		Palestine	pemiscot	atmosphere
	confiscate		Philistine	haruspex	
	illustrate		magistrate	Philostrate	
	obfuscate		balustrade	manuscript	
			decistere		

Obviously then, analyses that take Weak retraction to be basic must mark a considerable number of nouns and adjectives to be simply exceptional. This is a bad result, as it is not Strong retraction, but Weak retraction which is the rare mode across categories[10]:

(22)a.	sequéstràte	b.	consístory	molluscoid	hydrastine	haruspex
	degustate		asbestine	diphosgene	intestine	Hydaspes
	inviscate		asbestose	apostate	intestate	phlogiston
						Orestes

In addition to being low-frequent, many of (22) can be related to their embedded morphemes: *sequéster*, *consíst*, *asbéstos*, *phósgene*, which even further reduces the number of relevant examples.
Clearly, /s/ is more like a sonorant than an obstruent with respect to stress retraction. How to deal with the behavior of /s/?
The first option is to assume /s/ to be a genuine closing consonant, and let the Arab Rule deal with Vs. Clearly, this solution is not optimal, since in some cases the context of the Arab Rule is not matched by the presence of an initial heavy syllable, cf. (21). Moreover, 'Arab retraction' is lexically quite restricted for syllables with other obstruents than /s/, as shown in 2.1.2.
The second option is to consider medial /s/ to be part of the onset of the following syllable in primary syllabification, so that the preceding syllable would be light for the purposes of stress assignment. A stress-dependent rule (of a type proposed by Kahn 1976) would resyllabify /s/ as an ambisyllabic consonant to the preceding stressed syllable. This solution works well in order to derive the surface syllabification of /s/, and what is more, it receives some independent support from stress placement:

(23)	órchestra	magistral	ministrant	protestant
	pedestal	minister	registrant	talisman

All of the above words are problematic for quantity-sensitive stress placement if /s/ closes the preceding syllable[11]. The only disadvantage of this solution is that it renders cases as (24) unexplained violations of maximality, cf. chapter 1 (18c).

```
(24) orchéstral   phlogíston   illústrative
     abýsmal      illústrate   confíscatory
```

These facts point to syllable structure as being lexically marked to a certain extent.
The conclusion of this subsection remains unaffected by these issues however, as we have shown that retraction across /Vs/ is not governed by lexical category.

2.1.4 **Retraction across long vowels**

There are some factors that obscure observations about Strong retraction across long vowels. First, many suffixes may trigger vowel shortening in the morpheme to which they adjoin. Therefore, what appears as retraction across a long vowel may turn out to be vowel shortening, triggered by an affix, followed by Weak retraction across the resulting light syllable. Second, it turns out that cyclic interactions occur with stressed long vowels in embedded words. Weak retraction to a long vowel can therefore also be analyzed as respecting the stress of the embedded word. Nevertheless, we will assess the share of proper Strong retraction.
As a first superficial observation, it may appear that both retraction modes occur before suffixes: Strong retraction in (25), Weak retraction in (26). The a.-examples are verbs, the b.-examples are non-verbs:

```
(25)a. sátirìze (sátìre)          b. márgravìne (márgràve)
       memorize (mem+ory)            migratory   (migrate)
       anodize  (anode)              sapphirine  (sapphire)
```

However, all of (25) may involve stress-neutral suffixation (level-1 'cyclic' suffixation or perhaps level-2 suffixation), followed by medial shortening of a long vowel. It will be clear that all of (26) may well be cases of stress-neutral suffixation too:

```
(26)a. enthró:nìze (enthró:ne)    b. adví:sory (adví:se)
                                     perfumery (perfume)
```

Another superficial source of Weak retraction in this segmental type is stress-neutral prefixation, where the prefix adjoins as a weak element:

```
(27)a. transmí:gràte (mí:gràte)   b. perchló:ràte (chló:ràte)
       relocate      (locate)        bichromate   (chromate)
       dehydrate     (hydrate)       anhydride    (hydride)
       dislocate     (locate)
       remigrate     (migrate)
       transmigrate  (migrate)
```

Therefore, we have to define what unambiguous cases of Weak and Strong retraction would have to look like. Proper Weak retraction would be established by the presence of stress on a long vowel which does not correspond with a stress on the same long vowel in an embedded word, such as *anódìze* in (25). Quite surprisingly, such cases seem to be absent among suffixed words. But some occur among underived words:

```
(28) Azórès     Wyoming      Eneas    Bolivar  Mahopec
     Aroostook  synephrine   abdomen  Eothen   Potomac
```

Proper Strong retraction seems to occur, however. The absence of stress on a vowel that is both stressed and long in a related word is a common feature of all of the suffixed words of (29)[12]:

```
(29)a. fátigàte   (fatí:gue) sublimate (sublime)   b. ámmonìte   (ammó:nia)
       implicate  (imply)    immunize  (immune)       loyolite   (loyola)
       obligate   (oblige)   iotize    (iota)         magnesite  (magnesium)
       salivate   (saliva)   maturate  (mature)       trapezoid  (trapeze)
```

But do these cases really warrant the claim that *-ate*, *-ize*, etc. trigger Strong retraction across long vowels? The answer must be negative, since there is an alternative explanation in the form of a lexically governed rule of *medial shortening*, independently motivated by suffixes which are regular stress placers by the weak cluster principle.

For a start, notice that the real problem posed by the words of (29) is their overruling a cyclically assigned primary stress in the base word. Underlying long vowels are unique in this respect, as a cyclic primary stress is consistently respected in words with a similar morphological structure, but with a closed syllable instead of a long vowel in medial position (*infírmary-infírm*, *dispensary-dispense*, *fecundate-fecund*, *eructate-eruct*, etc., cf. chapter 1 section 6.1)[13]. Quite interestingly, similar cases of 'Strong retraction' across a long vowel occur in words derived by stressless suffixes as *-ent*, *-ence*, *-al*[14]:

```
(30) cónfident   (confíde)   aspirant    (aspire)     relative   (relate)
     pertinence  (pertain)   sustenance  (sustain)    reside     (resident)
     abstinence  (abstain)   coincidence (coincide)   president  (preside)
     maintenance (maintain)  admirable   (admire)     monotonous (tone)
     comparable  (compare)   vaginal     (vagina)     applicant  (apply)
     ignorant    (ignore)    homophonous (phone)
```

Obviously, Strong retraction does not come into consideration here, because these suffixes place primary stress strictly according to the weak cluster principle for closed syllables (*parent-parental* etc., cf. chapter 1, section 6.1).

The suggestion of Myers (1987) is that words such as (29) and (30) have undergone 'Sonorant Destressing':

```
(31)    Sonorant Destressing (Myers 1987:504)
        .
        .             *
        *  =>   *  /  *  ___
                         σ
                        / \
                       V  [+son]
```

This formulation involves two essential modifications with respect to Kiparsky (1979) and Hayes (1981), which have been discussed in chapter 1, section 3.3.4 and 3.4.3: (a) it can destress syllables with long vowels - [+son] may be the second mora of a long vowel, and (b) it can destress the primary stress. Property (b) clearly fails in the face of examples such as *infirmary*, *dispensary*, etc. (cf. chapter 1, section 6.1).

What is worse, Myers' rule predicts that, next to long vowels, sonorant consonants can be skipped in words suffixed with *-ent*, *-al* etc. (**dépendent* etc.). However, such forms are absent even among non-cyclic cases (**fráternal*)[15]. As far as we can see, this situation opens two options.

First, to postulate underlying short vowels in *fátigàte* and *cónfident*, thus giving up the lexical relation between these words and their embedded parts. The plausibility of such a

solution surely depends on the degree to which the (once derivational) relationship between the two has lost its transparency, and the segmental structures of the words have drifted apart.
The second option is to allow for a lexical vowel shortening rule, which would be triggered by the long vowel suffix. Such a solution would have the drawback of being incompatible with well-established insights about the nature of vowel shortening, which say that long vowels shorten after resyllabification of a consonant from a following *stressless* syllable (for a discussion and analysis, see Stampe 1973, Myers 1987). Clearly, a shortening rule triggered by stressed long vowel suffixes such as *-ate*, *-ize*, *-ite*, *-oid*, would run against this result. What is more, words as those below, in which the short vowel occurs in the prefixed form, also argue against it (some have been taken from Myers 1987):

```
(32)a. ímmigràte   (mígràte)   b. ímpotent   (pótent)
       emigrate    (migrate)      infinite   (finite)
       approbate   (probate)      impious    (pious)
       reprobate   (probate)      infamous   (famous)
       conglobate  (globate)      acclimate  (climate)
```

However, the relevant shortening rule may be related to Medial Laxing, proposed by Hammond (1984) to shorten medial vowels to feed Q-sensitive vowel reduction. Crucially, the alternations occur in cases where long vowels become medial by a morphological operation (the adjunction of a suffix or a prefix). Then Medial Laxing applies in conformity with the Elsewhere Condition, cf. chapter 1 (208), as it is restricted to 'derived environments'[16].
To wind up, it appears that the retraction behavior of long vowels is hard to assess in the face of alternative explanations. Probably the best account is an affix-governed medial shortening rule applying in a derived environment. However, no evidence whatsoever has been found to support the category-bound status of the Strong and Weak retraction modes. This conclusion supports our central hypothesis that retraction modes are essentially independent of word class.

2.1.5 Conclusions

The overall conclusion of the preceding sections is that evidence for a category-based distinction between the Strong and Weak retraction mode, as assumed in a considerable portion of the literature, is weak. Instead other factors seem to operate, such as the influence of the closing consonant in closed syllables, the Arab generalization, and a shortening process governed by affix, next to many unpredictable cases.

2.2 Primary stress retraction and reference to preceding stress

The second distinction between Sonorant retraction and Strong retraction which is assumed by Hayes (1981) and others is the additional contextual condition in the former that a stress immediately precede the focus, cf. chapter 1, section 3.4.3. The actual cases presented in the literature all have the preceding stress on the *initial* syllable. The iterative stress rule produces a default stress in this position, as it runs against the edge of the domain, cf. chapter 1 (98)[17]. From this stress condition on Sonorant retraction, distinctions follow as between ***légendàry*** and ***èleméntary***, or ***álgernòn*** and ***àgamémnòn***, cf. chapter 1, (52, 54).
On the other hand, Strong retraction is not contextually conditioned by a preceding stress; in fact it never could, since it scans stretches of the domain which have not yet been

organized by earlier stress rules (as in Hayes 1981 etc.), or it is preceded by a rule of Stress Conflation eliminating every secondary stress assigned earlier (as Halle & Vergnaud 1987 propose, cf. chapter 1, section 3.6).

Crucial potential facts supporting the difference between Sonorant and Strong retraction as to stress context must be strong retracting verbs with the segmental composition of *elementary* and *Adirondack*. All verbs of this segmental type (as far as occurring in Kenyon & Knott) are in (33) below, categorized into Strong (33a), Weak (33b), and Long (33c) retraction:

```
(33)a. exácerbàte       b. mètamórphìze    c. mónophthongìze
       subalternate        orientate          orientate
                           reincarnate        tergiversate
                           propagandize
                           sycophantize
```

The pair of verbs in (33a) has the hard duty to support a category-based distinction between Sonorant retraction and Strong retraction. Clearly, it fails in this respect, by number and the presence of (33b) and (33c). Unfortunately, examples of (33) do not unambiguously clarify the actual retraction properties of this segmental type, since alternative stress-neutral analyses are obvious. The verbs of (33a) may be related to their embedded parts *ácerbàte* and *álternàte* by the same prefixation process as can be witnessed in *in+fíltràte, trans+mígràte*. In (33b), *reincárnàte* is related to *incárnàte* by prefixation, while *pròpagánda* provides the basis for a suffixed verb. Finally, (33c) contains stress-neutral suffixations on the basis of *mónophthòng* and *órìent*[18]. This leaves no cases of Strong retraction, and very few cases of Weak and Long retraction. Actually, the Weak mode is a plausible option among the remaining cases, since the stress is retracted to the penult in both *òriéntàte* (*órìent*) and *sỳcophántìze* (*sỳcophànt*). While *mètamórphìze* may be argued to have the morphological composition *meta+morph+ize*, this is insufficient a base for calling it a case of stress-neutral retraction. The remaining long retractor *térgiversàte* does not help to remove the impression that all verbs of (33) are of little relevance, because of low frequency of use, stress-neutral analysis, or morphological opacity.

Summarizing: the alleged cases of Strong retraction (33a) are harder to defend against a competing stress-neutral analysis, than are the alleged cases of Weak (33b) and long (33c) retraction.

Turning to non-verbs, Weak retraction is the norm without exception. Here, Weak retraction to a long vowel is quite possible (34b)[19]:

```
(34)a. aliméntary      quadripártìte    b. Massapéquòd     c. Benedíctìne
       anniversary     adamantine          Archimedes         Aniakchak
       complementary   elephantine         epicycloid         Wladiwostok
       complimentary   labyrinthine        Eniwetok
       documentary     archimandrite       Memphremagog
       elementary      salamandroid        cacoethes
       regimentary     Agamemnon           anticyclone
       rudimentary     Adirondack          Venizelos
       sedimentary     Kalimantan          Massachusetts
       parliamentary   Girilambone         Mendelyeev
       testamentary    Epaminondas         Wampanoag
```

We are now in a position to make the strong claim that no words of the type **Agámemnòn* occur in English. This is a very important observation, which will actually serve as a starting point of our analysis.

2.3 Conclusions

Retraction within the domain of three syllables, the rightmost of which is heavy, simply does not yield evidence to support category-boundedness of retraction modes. Instead, Weak retraction is dominant across lexical categories. Apparent verbal strong retractors find a plausible analysis in stress-neutral affixation (25-27) or vowel shortening (29-32), which, if correct, completely removes Strong retraction from this segmental type, as the phenomenon is absent already in non-verbs (33). If the latter conclusion holds, the promising generalization results that *all primary stress retraction* is constrained by the same conditions, all known from Sonorant Destressing:

a. a preceding stressed syllable;
b. a following stressed syllable;
c. restrictions as to syllable weight.

That is, apart from segmental conditions, Sonorant retraction and Strong retraction can be collapsed, if only the Arab Rule is assumed to govern Strong retraction across obstruent-closed syllables. The syllable weight conditions on retraction have been shown to be as follows:

a. the segmental condition of Sonorant retraction (VSon);
b. the segmental conditions of the Arab Rule (VC, where a light stressed syllable precedes).

2.4 Secondary stress retraction

In the preceding sections we have demonstrated that the distinction between Sonorant and Strong retraction with respect to primary stress retraction lacks a firm empirical basis. This prompted us to re-assign the functions of Strong retraction to two rules: a Sonorant retraction rule, and a generalized Arab Rule.

However, this move has an important second aspect, viz. its consequences for the distribution of secondary stress. If heavy syllables can be made stressless by falling victim to Sonorant retraction or to the Arab Rule, secondary stress patterns must of course follow the conditions on these rules. This implies that secondary stress is (a) quantity-sensitive and (b) stress-sensitive. However, these properties conflict with earlier views, which have been discussed in chapter 1, section 3.

Many analyses (most explicitly Hayes 1981) assume secondary stresses to be assigned by a Q-insensitive Strong Retraction Rule, running leftward from the primary stress. It follows that closed syllables cannot receive a secondary stress at an uneven distance from the primary stress, unless in initial position. However, medial heavy syllables at uneven distances from primary stress may well have secondary stress, cf. chapter 1 (59), (62b). Two contexts are relevant (in bracketed-grids notation):

```
(35)a.          *          b.               *
          (*)    (*)             (*   .)      (*)
          σ ____ σ               σ   σ ____   σ
        chimpanzee               ro  do  mon  tade
```

If secondary stresses are really due to Sonorant retraction and the Arab Rule, sensitivity to stress on preceding syllables must be demonstrated. More specifically, stressless heavies are predicted to occur exclusively in the context (35a), where a stress directly precedes the focus.

In each of the next sections the behavior of one specific syllable type in the above contexts will be investigated. Long vowels will be left out of the picture as underlying length is extremely hard to demonstrate in underived words.

2.4.1 **Short vowel and sonorant**

Medial stressless VSon syllables occur in the inter-stress context (35a) in a large number of words, of which (36a) gives only a selection. As compared to the large number of stressless cases, only a small number of such examples contains a stressed syllable in the relevant position, a nearly exhaustive list of which is given in (36b):

(36) a.	ámpersànd	meningitis	b.	ànàlgésia	odontology
	Argentina	Monongalia		anthelmintic	ostentation
	ascertain	Mozambique		chimpanzee	ostentatious
	cavalcade	opportune		epencephalon	philharmonic
	clementina	parenthetic		incantation	sustentation
	Clytemnestra	Pennsylvania		infundibulum	Texarcana
	dissertation	philanthropic		Istanbul	Tutankhamen
	gabardine	repercussion		mesencephalon	Wilhelmina
	gorgonzola	sacerdotal			
	guarantee	Samarkand			
	importune	serendipity			
	Ivanhoe	simultaneous			
	laryngitis	tarantella			
	malversation	volunteer			
	melancholia	Wyandot			

Clearly, Sonorant retraction will yield the correct results here, if a certain amount of exceptionality is accepted. Words such as *chìmpànzée* are entirely parallel to *defálcàte*, *odóntòid* in (17), the difference residing in the extrametrical final syllable of the latter. Genuine minimal pairs are *àmpersánd-ámpersànd*, *àrgentína-árgentìne*, *clèmentína-clémentìne*, and *mèlanchólia-mélanchòly*.

Examples containing medial pretonic context (35b) are less numerous. Nevertheless, the overall picture favors the claim that VSon syllables are stressed in this context - see the examples of (37), some of which have been presented earlier in chapter 1 (62b)[20]:

(37) a.	èlecampáne	b.	èlephàntíasis	pericarditis
	elephantiasis		endocarditis	pithecanthropus
	Kilimanjaro		eoanthropus	rodomontade
	paraphernalia		Halicarnassus	violoncellist
			paleontology	elecampane (BE)

Obviously, the distribution parallels the situation occurring in primary stress retraction (34). Clearly the interpretation of this result must be relativized due to the low frequency of use of the above words, but in any case the prediction that medial pretonic heavies are stressless cannot be upheld. Instead, the Sonorant retraction pattern proves to be relevant again.

An interesting group consists of words arising from adding a suffix to a base which ends in the stressless suffix *-ent*. Interestingly these words typically exhibit a secondary stress on the pretonic syllable:

(38)	àrgumèntátion	sàcramèntárian
	ìnstrumèntárian	sèdimèntátion

Clearly, the secondary stress cannot be lexically marked on the base, as it does not surface in *argument* etc. Therefore it must be due to regular secondary stress assignment, presumably applying as to does in underived words.
Fidelholtz (1967:19-21) proposes to assign secondary stress to the heavy medial pretonic syllables of the words in (38b) by generalizing the rule which assigns secondary stress to heavy initial pretonic syllables:

(39) "We observed above that the type of syllable before the primary stress is irrelevant: it is in general skipped over whether it is strong or weak. Now, we see, as above, that ,elephan'tiasis is regularly stressed, since the secondary stress rule skips the third syllable. Note however, that the third syllable often does not reduce: (*),elephan'tiasis. [...] We must find some way of assigning stress to that syllable. As far as I can see, there are two essentially different ways to handle this, with little evidence at present adducible for either one over the other. We will see below [...] that we need a rule assigning secondary stress to a vowel in initial position before two consonants, or before any number of consonants if the vowel is tense, the stress assigned by this rule subject to a late, late post-mortem rule reducing the vowel anyway if the word is of frequent enough occurrence. But note that if we modify this rule so that either a preceding word boundary or unstressed vowel is sufficient for a vowel to receive stress before two consonants, we will be able also to handle *elephantiasis*:

```
elefæntiæsis
         1
     2   1        (*cas'cade rule)
     3   1        (2 =>  3 / 1 rule)
2    3   1        (secondary stress rule) "
```

Fidelholtz regards stress on medial pretonic heavy syllables to be as basic as is the stress on initial pretonic syllables, *cànteen*, cf. chapter 1 (60ab). Consequently, words with reduced pretonic heavies such as *Kentucky*, cf. chapter 1 (141b) - and *Kilimanjaro*, cf. (37a), also chapter 1 (62a), are equally marked with respect to regular unreduced cases.
The distribution indicated by Fidelholtz directly falls out the Sonorant retraction pattern if this is extended to secondary stress. A derivation of rodomontade, to which we will return in section 2.6, captures this:

```
(40)                                                        *
        . . *  *         (* .)(*)(*)          (* .)(*)(*)
      rodomontade   =>   rodomontade    =>    rodomontade
```

Sonorant retraction is blocked in the same way as it is in *salamandroid*, *Agamemnon*, etc., cf. (34a) We will return to the stressless cases (37a) later.

2.4.2 **Short vowel and /s/**

Reduction of inter-stress syllables closed by /s/ appears to be general:

```
(41) ambuscade      anesthesia     Aristophanes    Atascosa
     balustrade     Conestoga      forestation     jurisdiction
     ministerial    neurasthenia   Palestinian     registration
```

This supports the hypothesis of section 2.1.3 that /s/ is syllabified as the onset of a following syllable. Words with reduced pretonic syllables are extremely rare:

(42) dàmariscótta stereoscopic

No unreduced pretonic syllables seem to occur.

2.4.3 Short vowel and obstruent

Turning to obstruents, we now predict that the Arab Rule sufficiently characterizes the context of reduction. Words which contain a reduced interstress VObs syllable should have a *light* initial syllable (43a), while words with a *heavy* initial syllable should not allow reduction of their interstress VObs syllable (43b):

(43) a.	álexánder	surreptitious	b. dèlèctátion
	arithmetic	Mazatlan	caoutchouc
	collectania	molybdenum	ticktacktoe
	Epictetus	Phyloctetes	Timbucktoo
	Erechtheum	phylloxera	Tutankhamen
	resignation		

Counterexamples hardly occur. Two words (44a) display reduced VObs syllables in spite of their initial heavy syllables, and one more word (44b) has an unreduced VObs in spite of its initial light syllable[21].

(44) a.	ìndìgnátion	b. ànàxágoras
	diagnosis	

Words containing a VObs syllable in medial pretonic context are very rare. One reducing case (45a), and a small number of non-reduced cases (45b) seem to occur[22]:

(45) a.	Nèbuchadnézzar	b. ànimàdvérsion	diaphragmatic
		apophthegmatic	paradigmatic

Of course, it is hardly possible to interpret (45) as either supporting or opposing our prediction concerning the Arab Rule. Nevertheless, the words of (43) clearly do provide such evidence.

2.4.4 Secondary stress in medial closed syllables: conclusions

The matrix below summarizes our findings with respect to secondary stress in medial closed syllables:

(46)

	intertonic	**pretonic**
V Son	typically reduced	typically unreduced
V Obs	reduced according to the Arab context	unclear
V s	reduced	reduced

The first conclusion is that much lexical variation exists, especially in medial interstress positions. This points to either (a) lexical marking of secondary stresses in this position, or (b) lexical exception marking on rules of destressing. In any case, the lexical variation conforms to regularities involving *syllable weight*. Intertonic sonorant-closed syllables are predominantly stressless: the Sonorant retraction pattern. Intertonic obstruent-closed

syllables are stressless only if the preceding syllable is light: the Arab retraction pattern. This points to the correctness of the first option, according to which the presence of secondary stress in these positions is lexically marked, and not the absence.
The second conclusion is that such lexical variation is largely absent in medial pretonic positions where no stress precedes. Here, syllables tend to be stressed if heavy, a tendency matching the obligatory stress found in this position in the case of primary stress retraction, as we have shown in section 2.2. The tendency for heavies in this position to be stressed also matches the tendency for initial pretonic heavy syllables to be stressed, cf. chapter 1 (60ab). This argues against analyses of secondary stress by quantity-insensitive means, because such analyses can only treat these nearly obligatory occurrences of medial pretonic secondary stress by lexical marking, thus in fact denying the systematic nature of the phenomenon, and especially its relation to primary stress retraction.

2.5 Strong retraction as destressing

In the preceding sections, we have attacked the assumptions underlying a Strong Retraction Rule, cf. chapter 1 (92), by showing that retraction is sensitive to both syllable weight and - unexpectedly - to stresses lying in the stretch of the domain not yet covered by its (leftward) application. This forces the conclusion that the pattern of stressed and unstressed syllables underlying prominence patterns is assigned not in one, but in *two* passes.
Let us see what the consequences of these generalizations would look like in the analysis of Hayes (1981). First, if stress retraction refers to a preceding stress, the latter must be provided by a stress rule applying earlier. Hayesian analysis will do so if on the first pass syllables are exhaustively organized into bounded constituents by a left-dominant, Q-sensitive rule. This rule, an iterative version of the English Stress Rule of Hayes (1981), cf. chapter 1 (27), will be called the Light Syllable Stress Rule:

(47) **Light Syllable Stress Rule** (LSSR)
Going from right to left through the word, form left-dominant feet whose weak nodes cannot dominate a heavy syllable.

As a result, each heavy syllable forms the head of a foot. A light syllable can only be the head of a foot if directly preceding a non-head light syllable, or by forming a default foot in word-initial position. The LSSR results in the structures given below, where heavy syllables have been indicated by '-', and light syllables by 'v':

```
(48)a. (*)(*.)(*)     b. (*)(*)  (*)     c. (*)(*)(*)      d. (*  .)(*)(*)
        v  vv  -          -   -   -         v  -  -           v v   -  -
       manipulate        concentrate       designate          orientate

    e. (*)(*  .)(*  .) f. (*)(*)(*  .)   g. (*  .)(*)(*)   h. (*)(*)
        v  v v  v v        -  -  - v         v v   -  -        -  -
        abracadabra       gorgonzola         rodomontade      canteen

    i. (*)(*  .)(*  .) j. (*  .)(*  .)(*.) k. (*  .)(*  .)  l. (*)(*)
        v  - v·  - v       v v  v v  -v       v v  v v         v  -
       Monongahela        Apalachicola        Alabama          police
```

These outputs are subject to two destressing rules, Sonorant Destressing and the Arab Rule, before prominence assignment applies. Both rules are repeated below for convenience:

(49) a. **Sonorant Destressing** b. **Arab Rule**

```
a.  (*) => .  /  (*) ___         b.  (*) => .  /  (*)  ___
                      σ                              σ    σ
                      |\                             |    |\
                      m m                            m    m m
                      | |                            |    | |
                      V Son                          V    V C
```

Both Sonorant Destressing and the Arab Rule eliminate a post-stress non-branching foot dominating a syllable of the form VC, where V is a short vowel and C is a consonant. The latter consonant must be a sonorant if the preceding foot is headed by a heavy syllable. Sonorant Destressing will apply to (48bf), and the Arab Rule to (48cg)[23].
The destressing rules are followed by Stray Syllable Adjunction to the preceding foot:

```
(50)a. (*)(*) (*)     SD  (*) .  (*)     SSA (*  .) (*)
       concentrate    =>  concentrate    =>  concentrate

    b. (*)(*)(*)      AR (*). (*)        SSA (* .)(*)
       designate      => designate       =>  designate
```

In contrast, Sonorant Destressing and the Arab Rule are blocked in all other cases of closed syllables. In *Monongahela* (48i) the focus foot is branching, in *orientate* (48d) and *rodomontade* (48g) the preceding foot is branching, and in *canteen* (48h) there is no preceding foot.
This analysis, though certainly an improvement on the original analysis of Hayes (1981), is still problematic in certain important respects. In the following sections, these problems will be discussed, and attempts towards a solution will be made, which will be elaborated in section 3.

2.6 The problem, and a hint at a solution

Given our preliminary analysis of stress retraction, which is no more than just a slight adaptation of Hayes (1981), two related questions arise. The first question is why English should have *cyclic* destressing rules which *feed prominence assignment*, and therefore must be rules of primary metrical analysis. The second question is why these destressing rules are entitled to involve operations which are generally speaking illegal for rules of primary metrical analysis: viz. *overruling existing metrical constituency*. The constraint which appears to be violated is Prince's Free Element Condition, repeated below from chapter 0 (18):

(51) **Free Element Condition**
Rules of primary metrical analysis apply only to Free Elements - those that do not stand in the metrical relationship being established; i.e. they are "feature-filling" only.

Obviously, an answer to the problem such as: "destressing rules apply to footed syllables since they are not rules of primary metrical analysis", essentially renders the Free Element Condition vacuous. Simply shadowing a rule of stress as a rule of destressing (the English *Destressing* Rule) would suffice to remove the complete empirical content of the FEC.
The real problem, then, is how to avoid this operation to occur with respect to Sonorant Destressing and the Arab Rule. The answer which we will give is in the spirit of the FEC, and we will try to demonstrate that both rules are "feature-filling" in the most genuine sense of the word. That is, we will show that the terms *'stress rule'* and *'destressing rule'*

are completely arbitrary with respect to these rules, and should be replaced by '*rules of primary metrical analysis*' and '*rules of metrical reanalysis*', in the line of Prince (1985). As a first observation, notice the following common effects of (49ab):

```
(52)a. a non-branching foot is removed;
    b. a non-branching foot precedes the focus;
    c. the resulting foot is binary;
    d. the weight of the syllable dominated by the focus foot is
       restricted.
    e. the location of the primary stress is affected.
```

The binarity and weight conditions (52cd) were interpreted by Prince (1985) to indicate that destressing, like stress assignment, involves foot assignment, cf. chapter 1, section 5.8. In both cases, a syllable of a certain weight is joined with another syllable into a binary foot. However, Prince did not take into account the properties (52ab) and especially (52e), which together distinguish Sonorant Destressing and the Arab Rule from destressing rules such as Post-Stress and Pre-Stress Destressing. We suggest that these properties are significant diagnostics of rules of primary metrical analysis, and will now set out to explain their co-occurrence in the rules.

The non-branching constituents mentioned in Sonorant Destressing and the Arab Rule contain precisely those syllables to which destressing, taken as foot assigment, applies. In order to escape the verdicts of the Free Element Condition, these non-branching feet are in some way to be interpreted as not "in the metrical relationship being established" (cf. the FEC). The conclusion can only be that the metrical relationship involved is a binary relationship between two syllables within a branching foot. Let us for the moment accept this conclusion, whatever reason it may have, and reformulate it as below:

```
(53) Free elements are all syllables occurring outside branching feet.
```

This provision suffices to regularize Sonorant Destressing and the Arab Rule as rules of primary metrical analysis, hence as 'stress rules', not 'destressing rules'. Their application is blocked in the contexts of (54) below, since they would affect *non-free* elements here:

```
(54)a. (*)(*.)(*.)        (* .) .(* .)      b. (* .)(*)(*)       (*)(*.)(*)
       Monongahela   =>  *Monongahela          Adirondack   =>  *Adirondack
```

This allows us to simplify the formulation of Sonorant Destressing and the Arab Rule. Since no reference needs to be made to the foot structure of the focus foot, nor of the context feet, they can both be formulated as foot assignment rules, in the vein of Prince (1985):

(55)a. **Sonorant Stress Rule**
`Assign binary left-dominant feet whose weak node is a syllable of the type VSon.`

b. **Arab Stress Rule**
`Assign binary left-dominant feet whose weak node is a syllable of the type VC, and whose strong node is a light syllable.`

An important advantage of formulating the former destressing rules as in (55) is that a leftward so-called '*structure-preserving*', application of Stray Syllable Adjunction, as assumed by Hayes (1981), chapter 1 section 5.5, can be dispensed with. Structure-preservingness better be expressed as a property of foot assignment rules that must be stated anyway: left-dominance.

Now let us take a look at the relation between the Light Syllable Stress Rule (47) and the two rules affecting closed syllables (49ab). The only remaining difference between them is the restrictiveness of the weight conditions on the syllables affected by the various rules. The LSSR (47) is maximally restrictive, demanding light syllables in weak position. The Sonorant Stress Rule and the Arab Rule (156) are somewhat less restrictive, allowing for closed syllables which contain a short vowel and a consonant of a more or less specific type. Essentially, all rules can be interpreted as selecting a certain class of syllable types as light, according to the scale below[24]:

(56) **syllables counted as light**	**V**	**VSon**	**VObs**	**VVC$_0$**
Light Syllable Stress Rule	+	–	–	–
Sonorant Stress Rule	+	+	–	–
Arab Stress Rule	+	+	+	–

Since it is very hard to find cases in which the ordering between the Sonorant and Arab Stress Rule is crucial, it is tempting to collapse both rules into a Closed Syllable Stress Rule by factoring out the extra condition on the Arab Stress Rule requiring a preceding light syllable[25].

(57) **Arab Condition**
Stressless VObs syllables require a preceding light syllable.

The resulting situation is stated below:

(58) a. **Light Syllable Stress Rule**
Assign binary left-dominant feet whose weak node is a light syllable.

b. **Closed Syllable Stress Rule**
Assign binary left-dominant feet whose weak node is a syllable which contains a short vowel.

The Closed Syllable Stress Rule uses its own specific weight definition, distinguishing short vowel syllables and long vowel syllables, different from the usual (moraic) one of (3). Although both definitions are well-known universally, the English stress system may be called *marked* since it recognizes both definitions of syllable weight simultaneously. This result implies that the English stress system is quantity-sensitive throughout, but by two different weight measures. These weight measures are distributed throughout the stress domain by ordering of the specific rules which refer to them.

3. Separating binary constituency and syllable weight

Our principal aim in this section will be to derive the definition (53) of 'free element' from deeper principles. That is, we will show that the non-branching feet that are overruled by the Closed Syllable Stress Rule are non-distinct from stray syllables. Non-branching constituents will be eliminated and their function in representing stress will be transferred to syllable weight. Foot-level stress can then be decomposed into two primitives: (a) constituency and (b) syllable weight, where the Free Element Condition governs the assignment of the former only.

3.1 A proposal: the Strict Binarity Hypothesis

If, according to our proposal presented in chapter 0, non-branching feet are eliminated, a way must be found to relate a stray syllable's stress value to its weight. A proposal which can be seen as a step toward this goal is the 'Revised Parametric Metrical Theory' of Hayes (1987), and especially the notion of 'stressless foot' which forms part of it.

Hayes proposes a foot inventory in which a non-branching foot's stress value depends on the weight of the syllable that it contains. The new type of constituent made use of is a so-called *stressless foot*. See for example the Moraic Trochee in (59):

```
(59)                         (* .)                        (* .)               (* .)
        Moraic Trochee: Form m m   if possible, where  m m   is either  v v

         (*)               (.)
        or -  ; otherwise form v .
```

The Moraic Trochee is motivated for stress systems such as Palestinian Arabic (Kenstowicz 1981, 1983) and Cairene Arabic (McCarthy 1979). Hayes claims both Arabic dialects to have the same iterative foot-construction rule, i.e. (59). This rule scans the domain from left to right, so that when a single light syllable will remain at the right word edge, a stressless foot is formed:

```
(60)  (* .)(* .)(.)
       v v  v v  v
      saja rátu hu
```

The crucial difference between the systems, according to Hayes, lies in main stress assignment, especially in the presence or absence of a rule of foot extrametricality. Both systems employ a final End Rule, locating the rightmost accessible stress. Therefore, both systems place the main stress on the antepenult in (60) above. However, Palestinian has a rule of foot extrametricality, so that the rightmost stress will be promoted to primary stress, ignoring any stresses in the rightmost foot. This is not clearly apparent from (60), since the extrametrical foot is stressless anyway, but it will appear when the final foot contains a stress (61a). The Cairene system consistently promotes the rightmost stress to primary stress, which will be in the final foot except when it is stressless (60). The difference therefore appears only when the final foot is stressed:

```
(61)a. Palestinian                    b. Cairene

        *                                      *
       (* .)  (* .)                      (* .)(* .)
        v v    v v                        v v  v v
       dára <bato>em                     kata bítu
```

The stressless foot allows for an analysis in which both systems differ by a single parameter, i.e. foot extrametricality (yes/no). In contrast, an analysis lacking stressless feet must assume foot extrametricality in Palestinian, but also a complex main stress assignment rule in Cairene, which is sensitive to the branching of final feet.

Hayes' foot inventory clearly weakens the restriction that every foot contains a stressed syllable, which is arguably a sub-case of a relation between constituents and heads that has a much wider scope than metrical theory.

However, the stress values of stray syllables are directly proportional to their weight. As constituency is redundant, the first argument for eliminating non-branching feet is obtained. The Moraic Trochee, for instance, translates into the strictly binary foot inventory (62):

```
(62)a. (* .)      b.  *      c.  .
        v v           -          v
```

This representation eliminates redundancies in Hayes' foot inventory, as the stress values of individual monosyllabic elements directly match their weight. In order to guarantee this, the wellformedness condition (63) will be assumed:

```
(63) The default stress value of a syllable is determined by its weight.
```

This means that heavy syllables will be stressed, and light syllables will be stressless, unless specific conditions - such as a binary foot template - overrule these default specifications. Languages which do not distinguish degrees of syllable weight fulfil (63) in a trivial sense. Languages which do distinguish weight differences, however, can override the basic interdependence of weight and stress only by special means, such as constituents for stressing light syllables.

Let us see how the cases above can be analysed under these assumptions. The crucial examples are repeated below in our notation:

```
(64)    Palestinian                          Cairene

   a.   *              b.      *          c.        *         d.        *
        (* .)  (* .)      (* .)(* .) .       (* .)(* .)          (* .)(* .) .
         v v    v v        v v  v v  v        v v  v v            v v  v v  v
        dára <bato>em     saja rátu hu       kata bítu           saja rátu hu
```

As will be clear, Hayes' account remains basically unaffected. The only difference is that in Palestinian, foot extrametricality will be simply blocked when the final foot is *non-peripheral*, by the Peripherality Condition of Hayes (1981). This leaves the rightmost branching foot in (64b) unaffected, as it is not peripheral. Therefore, the status of the final syllable in (64bd) as a foot is non-essential.

Our hypothesis that bounded constituents are strictly binary amounts to the empirical claim that monosyllabic feet are never crucially referred to in stress systems. Further research must indicate if this prediction is universally correct - we will initiate such an attempt in following sections. Indeed, crucial evidence for constituency has been found in binary feet, for instance in the migration of stress in a binary foot whose stressed vowel is deleted (cf. Rappaport 1984, Al-Mozainy, Bley-Vroman, and McCarthy 1985, Halle & Vergnaud 1987). And in analyses of bounded systems, monosyllabic feet are frequently deleted at the end of the derivation, playing no crucial role whatsoever in the analysis.

A purely theoretical reason for assuming default non-branching feet in earlier theories is the assumption that the domain of stress rules is exhaustively parsed into feet (cf. Hayes 1981, Halle & Vergnaud 1987 etc.). But as Levin (1989) demonstrates, exhaustivity is justified on an intuitive, rather than an empirical basis.

Apart from exhaustivity, the major motive for introducing non-branching feet in Selkirk (1980) was in order to transpose the feature [+/-stress] from segmental theory in a one-to-one relation to metrical theory. This transposition took the form of the prosodic category foot. However, as we intend to show, there is evidence that the category stress should be interpreted *compositionally* in terms of three types of properties. The relevant properties are (a) syllable weight (b) binary constituency, and (c) prominence. Properties of monosyllabic feet will be shown to follow directly from their being (a) non-constituents (b) whose stress value is equal to their inherent weight, or (c) in specific cases to their prominence.

Compositionality of stress accounts for the relative independence of the three constituting properties across languages. Stress systems do indeed differ parametrically along these properties. Systems can have syllable weight contrasts or not, that is, they can be quantity-sensitive or -insensitive. In a quantity-sensitive system, all heavy syllables are stressed. Systems can exhibit binary constituency or not, corresponding to the boundedness parameter. In systems with syllable weight contrasts, conflicts between stress by weight and stress by binary constituency are usually avoided. That is, heavy syllables typically occur either outside binary constituents or in the head position of constituents. More will be said about boundedness in following sections. As a third parametric option, systems can have one unique primary stress in each word or not. Although extremely rare, systems have been reported in which all stresses are equally strong. Tübatulabal would constitute such a case (Voegelin 1935, as cited in Prince 1983).
Stress assignment thus reflects the general compositionality of stress as such.
First, in languages exhibiting weight contrasts, heavy syllables will be inherently stressed, by the wellformedness condition (63). This function is taken over in different theoretical frameworks by mechanisms reviewed in chapter 1, section 2, such as Projection of rimes (Hayes 1981), Quantity-Sensitivity (Prince 1983), or the Accent Rule (Halle & Vergnaud 1987).
Second, stress may be assigned by construction of binary constituents, where some sub-parameters specify dominance, iterativity, and direction. Third, stress may result from End Rules, as proposed by Prince (1983). We will now turn to the consequences of our proposal to bounded systems.

3.2 Consequences for bounded systems

Elimination of non-branching feet is supported by the stress systems of Creek, Garawa, Passamaquoddy, Warao, Winnebago, Yapese, and several other systems.
A good example is Passamaquoddy (Stowell 1979), whose stress pattern is stated informally in (65), taken from Prince (1983):

```
(65)a. If the penult is heavy, it bears primary stress.
    b. Otherwise, if the antepenult is heavy, it bears primary stress
    c. Otherwise, when both penult and antepenult are light, primary
       stress falls on whichever one of them is separated by an odd
       number of syllables from the last heavy syllable in the word or,
       lacking a heavy syllable, the beginning of the word.
```

The system is left-to-right iambic with an extrametrical final syllable ('@' denotes schwa):

```
(66)a.                     *       b.       *          c.           *
      (. *)(.*)*(. *)  *   *         (.*)(. *).          *(. *)(.*)
       v v v - - v -   -   -          v v v v v           - v - v v
      w@m@k@sewal@kikwehta<hal>em    w@m@s@n@m@<n@l>em   el@kil@k@<p@n>em
```

Only heavy non-foot penult syllables (66a) attract primary stress, since stressless non-feet light penults (66b) are ignored by the End Rule.
A second example is Yapese. Stress is antepenultimate only if the word ends in a sequence of a heavy and a light syllable. An iamb does the job here:

```
(67)a.  *  .    b. (.  *)   c. (. *)
        -  v        v  -        v v
       saalap     magpaa      pa?ag
```

Since no binary foot can be erected in (67a), the End Rule automatically selects the penult for primary stress.

Analyses which allow for non-branching feet typically assume a *quantity-determined* foot here (a quantity-sensitive foot whose head must dominate a heavy syllable). A Q-determined trochee is erected over *saalap*, and in *magpaa* a default stress foot arises over the heavy last syllable. Final stress will be assigned to *pa?ag* by the End Rule (right), defaulting to the syllable level:

```
(68)a.  *          b.      *      c.      *
        (*  .)           . (*)          . *
        -   v            v  -           v v
        saalap         magpaa          pa?ag
```

Since the End Rule's landing site in (68c) does not correspond to stress resulting from footing, McCarthy & Prince (1986) propose feet in which internal labeling is based on syllable weight. A trochee is assigned to *pa?ag*, whose internal labeling is reversed because of the lightness of the righthand syllable. Our proposal simply avoids such complications.

Finally, consider Winnebago (Hale & White Eagle 1980). Winnebago has main stress on the third syllable from the word beginning. Secondary stress is on every syllable on an even distance following the primary stress. Final syllables crucially remain stressless when on an uneven distance from the primary stress. The initial syllable is made extrametrical, and Quantity-insensitive iambs are constructed left-to-right:

```
(69)a.         *              b.             *
           (. *)(.*)                     (.  *).
            σ σ σ σ                       σ  σ σ
      em<ha>akitujik              em<ho>chichinik
```

Uneven final syllables remain stressless, because they are not heads of feet.

To see the way in which our theory handles alleged cases of monosyllabic constituents, let us consider the well-known systems of Maranungku and Tübatulabal. In Maranungku (Tryon 1970, as cited in Hayes 1981), main stress is on the initial syllable and secondary stress on syllables on even distances from the main stress. Final syllables have a secondary stress when 'even', a fact captured in most analyses by a monosyllabic default trochee (70b):

```
(70)a. *                    b.  *
      (* .)(* .)(* .)          (* .)(* .)(*)
       welepenemanta           langkarateti
```

However, since main stress is invariably on the initial syllable, we may as well assign main stress first, and apply iambs from left to right[26]:

```
(71)a. *                    b. *
       * (. *)(.*) .           *  (.*)(. *)
       welepenemanta           langkarateti
```

This slightly complicates the analysis, but in view of the fact that the option of assigning main stress before secondary stress must be included universally anyway, the costs are not too high[27].

Tübatulabal (Voegelin 1935) has a far more complex stress system. See the informal description in (72), taken from Prince (1983):

```
(72)a. Final syllables are always stressed.
    b. Long vowels are always stressed.
    c. Some stresses are fixed in certain morphemes.
    d. In a stretch of short-voweled syllables not stressed by (a) or
       (c), stress alternates right to left.
```

The system is typically analysed as right-to-left iambic, for the double reason that (a) final syllables are invariably stressed and (b) initial light syllables are stressed only at an even distance to the first stress to the right. See (73)[28]:

```
(73)a. (. *)(. *)    b. (*)(.*)(. *)(. *)   c. (. *)(*)   d. (. *)(*)(.*)
        v v  v v          v v  v v -  v v       v -  v        v -  v v v
       witaNhatal        witaNhatalaabacu       haniila       waSaagahaja
```

Our present theory offers a change of perspective, though. As in the case of Maranungku, inverting the dominance parameter will give an equivalent result. We make use of the invariable stressing of the final syllable, a *peripheral* syllable as before in Maranungku, to apply an End Rule (Right) before feet are constructed. A right-to-left moraic trochee will suffice:

```
(74)a. .(*  .)*     b. (* .)(* .) * . *    c. . *  *    d. . * (* .)*
       v v  v v        v v  v v  - v v        v -  v       v -  v v v
      witaNhatal      witaNhatalaabacu       haniila      waSaagahaja
```

This concludes our remarks on bounded systems in universal stress theory. Upon first sight, our theory can handle systems which have been analysed before as crucially supporting non-branching constituents, mostly by inverting the dominance parameter. On the other hand it yields clear advantages in some other systems too, as we have seen. Let us now turn to the consequences of our proposal for unbounded systems.

3.3 Consequences for unbounded systems

As Prince (1985) has demonstrated, unbounded feet can well be replaced by bounded feet into which all (unstressed) syllables are incorporated by a generalized form of Stray Syllable Adjunction. Essentially, Prince decomposes unboundedness into independently motivated principles. We will not review his arguments here, but restrict ourselves to reviewing the analysis of Prince (1983), implying that no constituency at all needs to be invoked in the analysis of unbounded systems. The main consequence of this conclusion to our theory is of course that it allows eliminating any other types of constituents than binary ones.

We will go into another aspect of Prince (1983) relevant to our present goals, namely default application of the End Rule to lower levels in the grid. Let us first review the analysis of Prince (1983) for the two main forms of Q-sensitive unbounded systems, whose stress patterns are stated below:

(75) **Default-to-Opposite**
  a. Primary stress is on the *first* heavy syllable, otherwise on the *final* syllable if no heavy syllables are present.
  b. Primary stress is on the *last* heavy syllable, otherwise on the *initial* syllable if no heavy syllables are present.

(76) **Default-to-Same**
  a. Primary stress is on the *first* heavy syllable, otherwise on the *initial* syllable if no heavy syllables are present.
  b. Primary stress is on the *last* heavy syllable, otherwise on the *final* syllable if no heavy syllables are present.

We will illustrate the analysis of only the cases (a) of (75-76), since the cases (b) simply involve a mirror-image analysis.

Default-to-Opposite system (75a) is analysed by QS, which stresses all heavy syllables, and two End Rules. The first End Rule applies at 'foot level' to promote the final syllable of the word. The second End Rule is the one which assigns primary stress, locating the first stress in the word. In the derivations below, QS has already been applied:

```
(77)a.                                                 *
            *     *     ER(F)       *     *   *  ER(I)       *     *   *
        * * * * * * * *  =>     * * * * * * * *   =>     * * * * * * * *
        v v - v v - v v         v v - v v - v v          v v - v v - v v

    b.                                                               *
                        ER(F)                 *  ER(I)               *
        * * * * * * * *  =>     * * * * * * * *   =>     * * * * * * * *
        v v v v v v v v         v v v v v v v v          v v v v v v v v
```

Notice that in (77b), the first stress in the word simply happens to be on the final syllable. The Default-to-Same system (76a) lacks the End Rule(F) to place a final foot-level stress. There is only the End Rule(I), which will locate the first heavy syllable in (78a) exactly as in (77a). But in (78b), where no stresses are present since the word contains no heavy syllables, it applies by default to the *syllable level*:

```
(78)a.                              *
            *     *     ER(I)       *     *
        * * * * * * * *  =>     * * * * * * * *
        v v - v v - v v         v v - v v - v v

    b.                  ER(I)   *
        * * * * * * * *  =>     * * * * * * * *
        v v v v v v v v         v v v v v v v v
```

The most restrictive way of assigning main stress in words without heavy syllables is by means of the same End Rule which is in order for words containing heavies. The only controversial aspect of this analysis is that it does not meet the criterion of assigning "main stress consistently to the foot-row, without illegitimate, unsanctioned peeking across hierarchical levels." (Prince 1985:475). However, since we do not know of empirical arguments supporting this criterion, it is motivated purely on theory-internal grounds. These would do if no competing considerations were at stake. We claim that such considerations exist, however, since a theory which allows for default application of the End Rule to lower levels in the grid allows for the important generalization that constituency is *strictly binary*. We will now turn to the issue what may be the cause of strict binarity.

3.4 **Binary constituent construction as Syllable Adjunction**

Arguing for strictly binary constituency may be one thing, to explain it is another. In this section we will develop the hypothesis that metrical constituents arise by *Syllable Adjunction*, a rule that forms binary feet and presupposes precisely two elements. The adjoined syllable is weak by convention, hence the stressless element of the resulting constituent. The syllable that is adjoined to will be the stressed element. Our major reason for introducing adjunction as a formal means of deriving binary constituents is that adjunction rationalizes the strict binarity that we have argued to be characteristic of stress constituents, and which will be formulated below:

(79) **Strict Binarity Hypothesis**
Stress constituents are strictly binary.

The notion of Syllable Adjunction that we will introduce is related to a type of metrical node adjunction developed in Hayes (1984). Hayes shows that two types of phrasal rhythmic prominence adjustment (rhythmic shift and rhythmic strengthening) can be collapsed into one single rule, which is presented below:

(80) **Rhythmic Adjustment**
In the configuration ... X Y ... DTE ..., adjoin X to Y.

For a detailed justification of (80) we refer to Hayes (1984) and Kager & Visch (1988). For our present purposes, it will suffice to mention that (80) collapses two arboreal operations: the Rhythm Rule (Kiparsky 1979) in (81a), and Beat Addition (Giegerich 1985) in (81b):

```
(81)a.     / \              / \         b.  / \            / \
          w   \            w   \           /   s          w   \
         / \   \          / \   \         /   / \        / \   \
        w   s   s   =>   s   w   s       w   w   s  =>  s   w   s
        X   Y  DTE       X   Y  DTE      X   Y  DTE     X   Y  DTE
```

Rhythmic Adjustment is an adjunction scheme whose Structural Description mentions three terms: the adjacent nodes X and Y, and a DTE (Designated Terminal Element) to the right. Since by convention, an adjoined node is weak with respect to the node to which it is adjoined, the labeling of the resulting trees automatically follows.
Crucially, the adjunction of one metrical node to another involves the creation of a *new constituent*, as becomes clear from the formalized definition of adjunction below (cf. Hayes 1984:68, fn. 11):

(82) In the configuration ... X ... Y ..., where X and Y are metrical nodes, adjoin Y to X means:
a. Replace X with a new constituent X′ of the form [X Y]. X′ retains the old labeling of X and is internally labeled s w, by convention.
b. Delete the original copy of Y. Prune any nonbranching nonterminal nodes that may result.
The adjunction of X to Y is defined analogously.

Analogously to (82), we propose that binary constituents are formed by the adjunction of syllable place-holders.

(83) **Syllable Adjunction**
In the configuration ... X Y ... , adjoin Y to X, where Y is a syllable place-holder.

In order to clarify the formal status of (83), we will demonstrate its application both in the expanded bracketed grids notation (84a), and in the shorthand notation (84b), in a step-wise fashion, following the formal instructions of (82). Syllable Adjunction organizes the syllable place-holders (line 0 elements) corresponding to syllables into a binary foot. By convention, the adjoined syllable is weak, or subordinated to the syllable that is the target of the adjunction. This implies that the latter will be stressed:

```
(84)a.                                       *                          *
        * *   replace   (* *)  *   label   (* *)  *    delete     (* *)
        X Y     =>       X Y   Y    =>      X Y   Y     =>         X Y

     b. . .             (. .)  .           (* .)  .               (* .)
        X Y     =>       X Y   Y    =>      X Y   Y     =>         X Y
```

The formal definition of adjunction mentions a *new constituent (82a)*. For this reason, it may be more precise to refer to Syllable Adjunction as *incorporation*, avoiding the standard interpretation of adjunction as Chomsky-adjunction. However, we will maintain the adjunction terminology in order to adhere to the original proposal of Hayes (1984).
Obviously, apart from theoretical arguments, we have not given *empirical* arguments for our claim that stress constituents result from adjunction. However, such arguments exist and they will be presented when discussing destressing in section 8. The main argument that will be presented there is that reapplication of Syllable Adjunction (83) as a 'rule of metrical reanalysis' (Prince 1985) is restricted by the same set of conditions that govern Rhythmic Adjustment (80), in particular the Maximality Principle of Hayes (1984).

4. Binary constituency in English stress

4.1 Introduction

We will now show that the elimination of monosyllabic constituents has favorable consequences for English stress. To do this, we will demonstrate that all alleged functions of monosyllabic feet can be transferred to other principles, most prominently syllable weight. Let us therefore take the step from the intermediary analysis presented in section 2.6 to our final analysis.

4.2 Replacing the bounded stress rules with Syllable Adjunction

Our first proposal is to replace the bounded stress rules (58ab), viz. the Light Syllable Stress Rule and the Closed Syllable Stress Rule, with versions of the Syllable Adjunction schema (83).
Before doing so, let us for expository reasons see what foot-inventories would be defined by the two bounded stress rules, under the assumption that constituents are strictly binary:

```
(85)a. Light Syllable Stress Rule     b. Closed Syllable Stress Rule

        (* .)     .     *               (* .)      .     *
         σ v      v     -                σ -       v     -
                                           VC
```

As required by the wellformedness condition (63), the stress values of *stray* syllables are directly proportional to their weight. Notice that the two inventories overlap for the stress values of *stray syllables*. These values are just the default values of syllables of different weights, as defined by (63) above. On the other hand, the stress value of the closed syllable in *adjunct* position in (85b) does not match (63). We will come back to the consequences of this mismatch directly below.
The step we can now make is to restrict the effects of the rules in (58) to the binary constituents in the foot inventories, by formulating them as Syllable Adjunction rules:

(86)a. **Light Syllable Adjunction**
Adjoin the place-holder of a light syllable leftward.

b. **Closed Syllable Adjunction**
Adjoin the place-holder of a closed short vowel syllable leftward.

Of course, (86b) is subject to the Arab Condition (57), so that in fact it consists of two subrules, which we will refer to as the Sonorant and the Arab Stress Rule.
According to the formalization of Syllable Adjunction in (83), the rules will have the following effects, Light Syllable Adjunction as in (87ab), and Closed Syllable Adjunction as in (87cd):

```
(87)a.  . .       (* .)     b.  * .       (* .)
        v v  =>    v v          - v  =>    - v

    c.  . *       (* .)     d.  * *       (* .)
        v -  =>    v v          - -  =>    - -
        VC         VC           VC         VC
```

We have now reached our goal of implementing the stress rules of (85) as Syllable Adjunction rules but there are still two problems to be solved. First, the system is redundantly Q-sensitive. The 'default stress value' for stray syllables, given by the default convention (63), states that heavy syllables will be stressed, and essentially so does Light Syllable Adjunction, as it leaves stresses on heavy syllables unaffected. As a result, the basic weight distinction between monomoraic light syllables and bimoraic heavy syllables is specified *twice* in the grammar.
Second, Closed Syllable Adjunction leads to a stressless heavy (closed) syllable. Actually, the wellformedness condition (63) stating that heavy syllables are stressed is restricted to the default values of syllables *outside* constituents, so that no real contradiction exists. But it would be more generalizing to extend the relation between syllable weight and stress beyond stray syllables, to any type of syllable regardless of its position.
These problems can be solved by eliminating reference to light syllables in Light Syllable Adjunction, and imposing a wellformedness condition on the relation between syllable weight and stress values implying that the adjunction of a heavy syllable is accompanied by a *deweighting*. That is, we will re-interpret the relation between Light Syllable Adjunction and Closed Syllable Adjunction as one between a general Syllable Adjunction rule, which does not refer to syllable weight, and a specific Syllable Adjunction rule, which does refer to syllables with short vowels.
Let us first introduce the wellformedness condition (88), which relates moraic syllable weight (Hyman 1985, Hayes 1989) and stress values:

(88) **Inherent stress by syllable weight**

```
     *
     σ
     |\
     m m
```

This convention, which replaces (63), says that every heavy syllable is stressed, and consequently, that every stressless syllable is light. It differs from Q-Sensitivity, chapter 0 (2), or the Accent Rule, chapter 1 (41), by its status as a *wellformedness condition*. That is, a bimoraic syllable is *inherently* stressed instead of being aligned with a stress only once in the derivation by the application of a rule such as QS. As a result, Light Syllable Adjunction, the basic footing rule of English, can be simplified to the version below:

(89) **Light Syllable Adjunction**
Adjoin a syllable place-holder leftward.

The simplification is achieved by the dynamic interpretation of (88). As we have assumed above, a syllable whose place-holder is adjoined by (89) is always subordinated to the target of the adjunction, hence stressless cf. (84). Therefore, if a heavy syllable's place-holder were adjoined by (89), it would entail a contradiction as to the wellformedness condition (88), which states that bimoraic syllables are inherently aligned with a level-1 element, i.e. a stress. It follows that reference to syllable weight can be eliminated from (89). For ease of reference, the rule will retain its name.

This eliminates the redundancy problem, but obviously introduces the new problem that Closed Syllable Adjunction does exactly what Light Syllable Adjunction is unable to do, i.e. destressing heavy syllables.

We propose that Closed Syllable Adjunction can have this effect because, as a universally marked option, it directly refers to the composition of the syllables it adjoins, i.e. *syllables with short vowels*, in contexts described earlier in (55). The markedness of the rule lies in its direct access to syllable weight, but this markedness essentially reflects the complexity of the stress-weight relation in English word stress. Clearly a similar statement must be made in any theory of English stress that is to account for the surface distribution of stresses, and especially the Sonorant retraction pattern, which we have motivated in depth in section 2.

Since we have introduced (88) as a general wellformedness condition that relates syllable weight and stress values, we have to assume that Closed Syllable Adjunction actually imposes a *weight reduction* on the syllables which it destresses. This deweighting is reflected at the surface by the reducibility of the affected syllable, or even its status as a syllabic sonorant. Deweighting can be represented in a moraic framework as follows:

```
(90) σ             σ
     |\            |
     m m    =>     m
   / | |         / | \
  Co V C        Co V C
```

The second mora position is eliminated, and its contents - a consonant - are adjoined to the one remaining mora position. A further step into the status of syllabic sonorant would involve the subsequent deletion of the vocalic position, given a certain sonority (syllabicity) minimum of the remaining post-vocalic consonant.

Our proposal amounts to the prediction that a stressless closed syllable must be an adjunct, hence must be preceded by a stressed syllable. This is correct for non-final closed syllables almost without exception, as we have shown in section 2.2 above. In section 5, we will show that it is correct as well for final syllables, if the effects of consonant extrametricality are taken into account.

4.3 Closed Syllable Adjunction and the Free Element Condition

The elimination of non-branching feet is exactly the result needed for the application of Closed Syllable Adjunction in conformity with the Free Element Condition. No syllables which are enclosed by a constituent can be affected by CSA, cf. (91b,c):

```
(91)a.  *   *   *     b. . (* .)(* .)   c. (* .) *  *
        -   -   -          v  - v  - v      v v  -  -
       concentrate       Monongahela       Adirondack

       (*   .)  *        (* .) .(* .)       . (* .) *
        -   v   -         v -  v - v        v  v -  -
       concentrate      *Monongahela      *Adirondack
```

Note that CSA respects constituency by the Free Element Condition, but results in actual destressing in (91a), eliminating inherent stress from the heavy medial syllable. Obviously, the elimination of stress should not be, and actually cannot be blocked by the FEC, since a free element is affected.
Moreover, the Elsewhere Condition, cf. chapter 1 (208), cannot block CSA from applying to *concentrate*, as the stress is clearly of a *derived* nature, being predictable on the basis of syllable-internal structure. So in fact no general conditions on the application of stress rules will prevent the destressing effect that is required.
In contrast, the Elsewhere Condition will block CSA if it is to wipe out a *lexical stress*, which is exactly what is required for cases such as those below:

```
(92)a.       *               b.      *            c.     *
        incar<nate>em          chimpanzee             arach<noid>em
   QS
        *    *    *               *   *   *            .  *     *
        incar<nate>em          chimpanzee             arach<noid>em
   End
   Rule      *                            *               *
        *    *    *               *   *   *            .  *     *
        incar<nate>em          chimpanzee             arach<noid>em
```

Lexical stresses appear to be the most simple way of representing stress in unpredictable positions, thus blocking Closed Syllable Adjunction.
In order to partly meet Selkirk's (1984) objection to lexical stress marking, cf. chapter 1 section 3.5, we assume an additional redundancy condition, which restrict lexical stresses to *heavy* syllables.

```
(93) No light syllable can be lexically stressed.
```

The cost of this is a slight redundancy with respect to wellformedness condition (88), which leaves light syllables stressless anyway.

4.4 Non-branching feet and 'stress' in English

4.4.1 Introduction

Now that we have eliminated non-branching feet, we must see if all their functions can be taken over by alternative means in our framework. First we will summarize these functions, and after that we will show how these translate into our framework.
Metrical theory ever since Selkirk (1980) takes non-branching feet to be constituents as much as branching feet, essentially for three reasons.
First, non-branching feet represent "stress" in the direct observational sense of *irreducibility*. Contrasts between (94) and (95) are interpreted as supporting non-branching feet, cf. chapter 1 section 3[29]:

(94)a.	(*)(*) **can**teen **ty** coon	b.	(*)(*) gym**nast** ve **to**	c.	(*.)(*)(*) rodo**mon**tade	d.	(*)(*)(*) chim**pan**zee de**tai**nee
(95)a.	.(*) **po**lice **ba**lloon	b.	(* .) tem**pest** mo**tto**	c.	(* . .)(*) Tippe**ca**noe Winne**pe**saukee	d.	(* .)(*) gua**ran**tee ca**val**cade

The second function of non-branching feet is to provide landing sites for the End Rule, or an unbounded constituent assignment rule, which places primary stress (in 96a,c the final syllables are extrametrical)[30]:

```
(96)a.      *              b.       *          c.  *
       (*  .)(*)(*)         (*  .)(*)            (*)  (*)
        Agamem<non>em       cavalcade           gym<nast>em
       Massape<quod>em      Tennessee           sa<tire>em
```

The third function of non-branching feet is to provide a stress referred to in left-dominant destressing rules such as Sonorant Destressing, the Arab Rule, and Post-Stress Destressing, cf. chapter 1, section 5:

```
(97)a. (*)(*)  (*)       b. (*)(*)   c. (*)(*.)(*)
       helminthoid           Arab       Tippecanoe

       (*    .) (*)          (*  .)     (*  .  .)(*)
       helminthoid           Arab       Tippecanoe
```

The function of non-branching feet in Sonorant Destressing and the Arab Rule has been shown to be an artefact of the Free Element Condition for medial instances of CSA. As will be seen in section 8 on destressing by reapplication of Syllable Adjunction, Post-Stress Destressing can do without foot-status of the landing site as well.

It can be shown that the stress properties of non-branching feet can be expressed by different means, principally syllable weight, since mostly, stressed non-branching feet contain *heavy syllables*. Surface-stressed light syllables in non-branching feet are restricted to a small number of word-initial cases.

4.4.2 Non-branching feet and vowel reduction

The function of non-branching feet in blocking vowel reduction can be performed by syllable weight as well. The crucial observation is that irreducible non-prominent pretonic syllables are typically *heavy*[31]:

```
(98)a.      *      b.          *       c.          *      d.          *
       (*)(*)         (*)(*.)(*.)        (*.)(*)(*)          (*)(*)(*)
        -  -           - - v  - v         v v -  -            -  -  -
       càntéen        Tìcònderóga       ròdomòntáde         chìmpànzée
```

Conversely, where a weak non-branching foot is assigned in 'traditional' foot theory, it is typically deleted at the end of the derivation if the only syllable it dominates is light. The destressing rule involved, Pre-Stress Destressing, makes pretonic light syllables susceptible to vowel reduction:

```
(99)a.      *            *   b.          *                  *
       (*)(*)         . (*)      (*)(*.)(*.)        . (*.)(*.)
        v  -          v  -        v  - v - v        v  - v - v
       políce => políce          Monòngahéla => Monòngahéla
```

The deleted weak monosyllabic feet are a consequence of the principle of exhaustive footing, essentially rooted in the notion of iterative stress assignment (Halle 1973), cf. chapter 1 section 3.3.2.

Under the present proposal, the need for a Pre-Stress Destressing rule is eliminated. Light syllables which are not the head of a binary foot are by their weight inherently stressless:

```
(100)a.  . *      b.  . (* .)(* .)
         v -          v  - v  - v
        police        Monongahela
```

That is, the observation below falls out of our notation:

(101) Pretonic non-prominent syllables are stressed iff they are heavy.

We will come back to prominent non-branching feet in sections 9 and 12.
Let us now discuss the cases where (101) seems to be violated. Two types of cases must be distinguished: (a) irreducible pretonic light syllables (b) reducible pretonic heavy syllables, cf. chapter 1 (141). The following discussion draws on the results of Fidelholtz (1975).
The first exceptional class is a residue of irreducible initial pretonic light syllables:

(102)	r**à**ccóon	suttee	bassoon	august	caffeine
	vamoose	Rockette	cafe	trapeze	

The examples of (102) form exceptions to the strong generalization that pretonic light syllables reduce. We will take them as (rare) exceptions to the vowel reduction rule itself.
A second small class of examples violating (100) consists of reducible pretonic heavy syllables. Such initial reduction of closed syllables is restricted to words of considerable frequency (Fidelholtz 1975):

(103) a.	**as**trónomy	b.	V**er**mónt	Berlin	**Ken**túcky
	escape		Carnarvon	thermometer	September
	asparagus		Charlotte	sincere	Manhattan

These words seem to raise the problem that closed syllables are reduced even when their weight would make then inherently irreducible. However, as can be seen in (103), most of the reducing initial pretonic heavies consist of short vowel plus /s/ or /r/ (Fidelholtz 1975:203). The former can be considered cases where the closing /s/ is (re)syllabified to the onset of the following syllable, leaving the initial syllable light, as proposed in Kahn (1976). In the latter cases, the weight of the initial syllable reduces by a process of sonorant coalescence (Liberman & Prince 1977:299), which, we submit, applies at level-2, or even post-lexically. We will come back to it in section 10.5.
This will do as well for a small number of words (104) in which a medial pretonic closed syllable is reduced, repeated from (37a):

(104) pàraphernália   elecampane   Kilimanjaro   elephantiasis

In their susceptibility to gradient factors, initial pretonic syllables sharply contrast with intertonic syllables, which reduce obligatorily:

(105) "Cf.[...] words like *'Arkan,sas*, *'nightin,gale*, *,apos'tolic*, *'repe'tition* [cf. *repeat*], to see that vowels *between* stressed syllables reduce irrespective of consonant clusters, tenseness, or frequency." (Fidelholtz 1975:202)

The contrast in optionality of vowel reduction between medial intertonic and other positions points to the fact that Closed Syllable Adjunction results in the lightness of closed syllables in the adjunct position of binary constituents:

```
(106)  *
      (*   .)  *
       -   v   -
       Arkan<sas>em
```

By being light, such syllables reduce automatically. In contrast, cases such as (103) show optionality as to reduction, since their deweighting has a different origin, and is due to a low-level rule.

4.4.3 Non-branching feet and prominence

There is only one class of cases in which non-branching feet over light syllables are landing sites for the rule of primary stress. This class consists of words whose initial syllable has the primary stress and is immediately followed by a final syllable with secondary stress[32]:

```
(107) sátìre   alloy   rabbi    Hittite  Danube
      essay    ally    febrile  Samite
```

The initial syllable of such words is always the only candidate for main stress, the only other potential candidate, the final syllable, being excluded by extrametricality. In section 3.3 above, we followed Prince (1983) by assuming default prominence assignment on the syllable level when no stresses on the 'foot' level are available. This assumption suffices to place main stress on the remaining metrical syllable in the words of (107), without assuming a non-branching foot intermediating between the syllable-level and the prominence level:

```
(108)                        *
        .   *                *   *
        v   -                v   -
        sa <tire>em    =>    sa <tire>em
```

Therefore, no constituency is required to account for the assignment of primary stress by the End Rule.

4.5 Conclusion

We have shown that at least two functions of monosyllabic feet can well be taken over by different means in our framework. First, we have shown that local stress distinctions as made by weak monosyllabic feet follow directly from syllable weight. Actually, this eliminates the need for a Pre-Stress Destressing rule. Second, monosyllabic feet are not required for the purposes of Sonorant Destressing (nor the Arab Rule), since the corresponding rule in our analysis, Closed Syllable Adjunction, being a rule of primary metrical analysis, makes the required distinction by the Free Element Condition. Third, where a light monosyllabic feet serves as a landing site for the End Rule, we assume default application to line 0 elements. Crucially, such cases only arise when the (metrical) domain of the End Rule consists of one light syllable. There are some functions of monosyllabic feet that have not been taken into account yet: (a) their function as a stress in the lefthand context of Post-Stress Destressing (*Winnepesaukee*), which we will discuss in section 8, (b) their function in word-internal prominence shifts (*adaptation*), which we will discuss in section 12, (c) their function in stress distinctions in final closed syllables (*gỳmnàst-témpest*), which we will discuss in section 5.

5. Extrametricality

So far we have remained silent on extrametricality. We have assumed, more or less implicitly, that extrametricality affects Syllable Adjunction the same way as it affects the English Stress Rule of Hayes (1981), chapter 1 (27). That is, extrametrical syllables are ignored by rules constructing constituents. This yields the required effect that in words such as *America*, a binary rule can reach the antepenult (109a):

```
(109)a.      *             b.          *
         . (*   .)   .         (*   .) *       .
         A me ri <ca>em         A ri zow <na>em
```

We have also implicitly assumed that syllable extrametricality does not affect weight interpretation (88), so that heavy extrametrical syllables can have a subsidiary stress (Selkirk 1984). This assumption is crucial in cases such as *Adiróndàck, ánecdòte*.
However, *consonant* extrametricality *does* affect the weight of syllables in final positions (Hayes 1981, Selkirk 1984). This is what accounts for the penultimate stress in words such as *Nantúcket*, cf. Stress Placement II in chapter 1 (13).
One issue that needs further discussion is the fact that final closed syllables display three-way stress variation: they can have (a) primary stress (*cigarétte*), (b) secondary stress (*cígarètte*), or be stressless in two types of cases (*Nantúcket, párapet*). These four possibilities result from combining the two types of extrametricality:

```
(110)a.         *    b.  *              c.      *         d.  *
        (*   .) *       (*   .)  *          *  (*    .)        (*    .)  .
        ci ga rette     ci ga <rette>em   Nan tu cke<t>em     pa ra <pe<t>>em
```

Let us now discuss consonant extrametricality in somewhat more detail. As shown by Ross (1972), words with a final closed short vowel syllable display variation in the presence of final subsidiary stresses, if the final cluster consists of one (typically sonorant or dental) consonant (111), or two dental consonants (112). We may assume that this variation resides in consonant extrametricality. The case of double extrametrical dental consonants appears to violate the peripherality requirement on extrametrical material, but we submit that homorganic consonant clusters with shared dental place features behave more as one cluster in at least this respect than other consonant clusters (cf. Borowsky 1987):

```
(111)a.  *            ócelòt           b. *            ócelot
         *   *                            *  .
       pro <ton>em                        i <ro<n>>em

(112)a. *             óperànd          b. *            élephant
        *    *                            *    .
       gym <nast>em                     tem <pe<st>>em
```

But in other consonant clusters than those consisting of two dentals, no variation exists. This follows from the fact that such clusters cannot be extrametrical as a whole:

```
(113) *
      *    *
     con <tac<t>>em
```

Finally, the cases that originally motivated the Arab Rule in Ross (1972), cf. chapter 1 section 5.1, will result from Closed Syllable Adjunction, cf. (114a). Actually, the Sonorant retraction sub-case of Closed Syllable Adjunction provides an alternative derivation for words such as *iron* of (111b), cf. (114b):

```
(114)a.  .   *        (*   .)      b.  *   *     (*   .)
         A rab   =>   A rab              i ron => i ron
```

We see that stress contrasts on final closed short vowel syllables can be made without the help of monosyllabic constituents, and result from inherent weight, in combination with consonant extrametricality and the rule of Closed Syllable Adjunction.

A potential problem to our analysis is in words such as *agenda*, with a penult that is a potential victim of Closed Syllable Adjunction. How to avoid a derivation leading to **ágenda*? Since syllable extrametricality is marked in the lexicon, following an essentially free distribution, an extrametrical syllable in words of the type *agenda* cannot be excluded. For words ending in suffixes like *-al*, *-ous*, syllable extrametricality is even forced, because it can be demonstrated that these suffixes are lexically extrametrical, cf. chapter 1 (7-8). Therefore, assuming lexically governed extrametricality, it seems as if CSA cannot be blocked in *agenda*:

```
(115)    . *     .                                (* .)
         v -     v         (LSA non-    CSA        v v    v
         agen<da>em        applicable)   =>        agen<da>em
```

In most analyses, such words are derived by constructing a monosyllabic constituent over the penult, and adjoining the stray final syllable as a weak node to this constituent by Stray Syllable Adjunction. This results in a binary foot over the final and penultimate syllable:

```
(116)    .  (*)    .                . (*    .)
         v   -     v                v  -    v
         a  gen  <da>em    =>       a gen  da
```

Crucially, the result of SSA cannot be distinguished from the result of the stress rule, since the stress value of the final syllable remains as it was. Furthermore, the Free Element Condition is respected, because no syllables are re-organized into binary constituents. In such cases, SSA can be reinterpreted as a reapplication of the stress rule to the domain including the extrametrical material. Let us assume that the light final syllable of *agenda* is indeed incorporated by Stray Syllable Adjunction into a binary constituent by the stage where Closed Syllable Adjunction applies. By the Free Element Condition, the binary constituent will then block CSA from applying to the penult:

```
(117)  .(*   .)          (* .)
        v -  v           v v   .
        agenda    =/=>   agenda
```

Therefore, we will assume Stray Syllable Adjunction to apply wherever it can, as long as it does not affect stress values, and respects the Free Element Condition. The constituency which automatically results from SSA guarantees that CSA does not produce words such as *ágenda.

After having discussed stress in final syllables, we will now relate the placement and retraction properties of suffixes to syllable weight. The generalization that can be derived from our analysis is that light suffixes trigger Q-sensitive stress placement, i.e. Stress Placement I chapter 1 (9), while heavy syllables trigger Sonorant retraction or Arab retraction, or have primary stress themselves. All suffixes with long vowels are heavy, while suffixes with short vowels and extrametrical consonants are light.

Apparently, no stressed short vowel suffixes occur. This clearly invites the generalization that *all consonants in suffixes are extrametrical*, as is even the case for dental consonant

clusters -n{t/s} in the suffixes *-ent*, *-ant*, *-ence*, *-ance*, and for the non-dental consonant /k/ in *-ic*.
Four suffix types arise from a two-by-two combination of the properties of syllable weight and extrametricality:

(118)	**extrametrical**	**non-extrametrical**
light	*-al*, *-ous*, *-an*, *-ent* etc.	*-ic*, *-id* etc.
heavy	*-oid*, *-ate*, *-ory* etc.	*-ese*, *-ade*, *-eer* etc.

Suffixes which are light and extrametrical can only be incorporated into a binary constituent by SSA if the Free Element Condition is respected:

```
(119)a.      *               b.  *
          .(*    .)             (* .)  .
          v -    v               v v   v
       fratern<al>em          minim<al>em
```

That is, these suffixes trigger the Weak retraction mode. In contrast, heavy extrametrical suffixes trigger the Strong mode, since they cannot be incorporated into a binary consituent by SSA without losing their inherent stress:

```
(120)a.  *                   b.           *
        (*   .)    *            (*  .)  *    *
         -   v     -             v v    -    -
        helminth<oid>em        salamandr<oid>em
```

Non-extrametrical light suffixes undergo Light Syllable Adjunction regardless of the weight of the preceding syllable:

```
(121)a.       *              b.    *
          .  (*   .)             .(* .)
          v   -   v              v v v
         authenti<c>em        specifi<c>em
```

Non-extrametrical heavy suffixes attract primary stress:

```
(122)a.          *           b.           *
         (* .)  *              (*  .)*   *
          v -   -               v v -    -
         cavalcade            rodomontade
```

The bisyllabic suffixes *-ity*, *-ion*, *-ify* always have the primary stress on the stem syllable directly preceding. This follows from their initial light syllable, and their extrametrical final syllable:

```
(123)a.     *                b.     *
         * (* .)  .             * (*  .) *
         -  - v   v             -  -  v  -
         identi<ty>em           identi<fy>em
```

The phonological representations of the six types of suffixes suffice to account for their retraction properties. The inherent weight of a suffix (which is subject to some opaqueness by consonant extrametricality) will yield its stress value, while its extrametricality yields its potential for incorporation into a binary constituent. Crucially, extrametricality is a constant property with respect to constituent construction rules as well as to prominence assignment.

6. **Rules of primary metrical analysis: conclusions**

This concludes our discussion of word stress patterns which result from the operation of rules of primary metrical analysis. Our most important findings with respect to English word stress are the following:
a. The distribution of stressed and stressless syllables can be largely accounted for by two iterative rules of primary metrical analysis, Light Syllable Adjunction and Closed Syllable Adjunction. The ordering between these rules, in combination with the Free Element Condition, is the key to the complex distribution of stressed and stressless closed syllables with short vowels, a traditional problem in analyses of English stress. Consequently, the system can be characterized as Q-sensitive throughout the domain of the stress rules.
b. Three types of lexical marking are needed to deal with the extensive lexical variability in primary word stress patterns: extrametricality of consonants and syllables, and lexical stresses. We have shown, however, that such lexical markings cannot fully replace stress rules, since this would leave unexplained the fact that the distribution of stressed and stressless syllables is free only within the limits of generalizations that are exceptionless, or nearly so.
The rest of this chapter will be devoted to the stress cycle (section 7), destressing by rules of metrical reanalysis (section 8), destressing by loss of prominence (section 9), destressing by weight adjustment (section 10), weight increases (section 11), word-internal rhythm (section 12) and conclusions (section 13).

7. **The stress cycle in English**

7.1 **Introduction**

In this section we will present an analysis of the phenomena which have been taken to support cyclic stress assignment in earlier analyses. This set of phenomena has been discussed in chapter 1 section 6, where various lexical relations between stress patterns of the base and the derived word were mentioned. Particularly, we find persistence of base stress (*manípulàte-manìpulátion*, *condénse-còndènsátion*), prominence (*infírm-infírmary*), and stresslessness (*stándardìze-stàndardizátion*), cf. chapter 1 (175-176).
The most interesting aspect of these phenomena is that blockades must be assumed in the derived word of stress rules that have been motivated for underived words. We will demonstrate that a generalizing account of such blockades requires two assumptions about the way in which cyclic stress rules operate.
The first assumption has to do with the way in which stress rules on the outer cycle are confronted with the *frozen* output of stress rules on the inner cycle. Kiparsky (1982) proposes that this confrontation is direct, stress rules on the outer cycle applying to an actual extension of the inner cycle, which contains all features specified on this inner cycle, cf. chapter 1, section 6.7. Hence, stress rules apply to the (partially) footed output of earlier cycles. Accordingly, they are directly blocked if their output is distinct from the Identity Rule of the inner cycle, as well as properly included in it. But even if cyclic rules apply in conformity to the Elsewhere Condition, there is a problem with respect to the Free Element Condition. That is, cyclic rules, as rules of primary metrical analysis, operate in violation of the Free Element Condition when they overrule inner cycle structure, i.e. elements that have already been specified for stress[33].

In order to avoid this undesirable consequence, we assume that the confrontation is less direct. First, we adopt the proposal by Halle & Vergnaud (1987) to erect a new stress plane for each cycle, where the stress rules apply to each plane as if it were an underived word. Second, we deviate from Halle & Vergnaud by assuming that the information on the stress planes is merged into one single representation, without a special rule to copy stresses from planes to other planes. The merging of stress planes is governed by the Elsewhere Condition. This excludes the merging of a stress plane *n* with a stress plane *n+1* if the latter contains stress information which is (a) distinct from and (b) properly included in the stress information recorded on the former. Consequently, only that part of the information of the outer cyclic plane will be copied that is not properly included in the stress information of the inner plane. In this way, there is no destruction of metrical structure, or violation of the FEC, but only a selection of competing metrical structures from different metrical planes.

Second, we will argue that stray syllables on inner cyclic planes are to be interpreted as 'unspecified' for stress, so that they cannot lead to distinctness (in the sense of the Elsewhere Condition) with structure as assigned on outer planes. We will show that Kiparsky's analysis produces incorrect results in exactly the cases covered by the observation below:

(124) Stress rules applying on the outer cycle can overrule constituency present on the inner cycle when incorporating a syllable that is unspecified for stress (i.e. a stray light syllable).

The invisibility of light constituentless syllables with respect to the merging of stress planes can be interpreted as strongly supporting our hypothesis that stress constituents are binary.

7.2 An analysis of Strict Cyclicity based on plane merging

Kiparsky (1982) proposes that the application of a cyclic stress rule is blocked if its output is distinct from and properly included in metrical structure on an inner cycle. However, rules which apply across morpheme boundaries can still destruct material in a way explicitly excluded by the Free Element Condition, chapter 0 (18). That is, any cyclic stress rule applying 'across' a morpheme boundary involves the *destruction of constituents*, i.e. those laid down by applications on inner cycles. In our notation, such FEC violations take the form of (125)[34]:

```
(125)a. *          *        b.  *            *      c.  *         *
       (* .)     .(* .)*       (*  .)     * (* .).     (* .)    .(* .)
        v v      v v v -        -  v      -  v v v      v v     v v v
       solid => solidify       mental => mentality      atom => atomic
```

Some answer is required as to why cyclic stress rules can overwrite the binary constituents laid down by cyclic stress rules on earlier cycles.

Our analysis is based on Halle & Vergnaud (1987), who propose to record the output of cyclic stress rules on separate cyclic planes, cf. chapter 1 section 6.8. However, we will not adopt Halle & Vergnaud's proposal to formalize the transfer of stresses from earlier planes to later planes by a special stress copy rule. Instead, we will assume that all cyclic planes are merged into one stress representation, and that this merging is subject to the condition that no stress information of outer (larger) cyclic planes be transferred to the merged stress representation that is distinct from the stress structure of the inner (smaller) cyclic plane as well as properly included in it. This solution does not violate the FEC, because the FEC keeps stress rules from overruling the output of earlier stress rules applying in the same domain of application, but not stress rules in different planes. Obviously, the FEC is not operative 'across' stress planes.

With Halle & Vergnaud (1987), we assume that each stress plane records the metrical structure that would result if it were an underived word. In the examples below, we will represent the output of the stress rules on inner planes above the segmental and morphological representation, and the output of the stress rules on outer planes below it.

Let us first discuss examples in which Kiparsky's and our analysis are essentially equal, cases of cyclic preservation of structure:

```
(126)a.      *                    b.       *
           *   *                        *   *
           -   -                        -   -
        [[ condens ] ation ]      [ [ infirm ] ary ]
           -   v     -   v              -   v    -
          (*   .)   (*   .)            (*   .)   *
                     *                  *

     c.      *                    d.         *
            (* .) *                       .(* .) *
             v v  -                       v v v  -
        [[ fraterniz ] ation ]      [[ manipulat ] ion ]
             v v  -     -  v              v v v  -     .
            (* .) *    (*  .)            .(* .)(*      .)
                        *                      *
```

As will be seen, Kiparsky's explanation of these cases transfers to our framework. In (126ab) a binary constituent on the outer plane is properly included in the embedded morpheme. Notice that this binary constituent itself is not distinct from any constituent on the embedded morpheme, as the inner plane is unspecified as to constituents. Here, the blockade is due to the distinctness of *stresses*: the constituent on the outer plane obscures the stress, as well as the *prominence*, on the medial syllable. In (126cd) binary constituents on the outer plane are properly included in embedded morphemes, but *identical* to those on the embedded morphemes, and hence non-distinct. Here, distinctness results from *prominence* contrasts. The prominence on the inner plane is obscured on the outer plane, violating the Elsewhere Condition. Consequently, the constituent that carries the primary stress on the inner plane survives. Let us now consider what portions of each plane are transferred to the merged output representation, which are fed to the non-cyclic level-2 stratum.

The output to the lexical level-2 consists of *the maximal portion of structure of the outer cyclic plane that is non-distinct to structure on the inner cyclic plane, in addition to the remaining structure of the inner plane*. In this case, the output to level-2 results from simply ignoring ('not applying') the conflicting part of the representation, and merging the planes:

```
(127)a.          *        b.           *      c.             *    d.
              *  *                 *   *              *      *           *
           *  *  (*  .)        .(* .)(* .)          (* .) * (* .)     *  *  *
           -  -  -   v          v v v  - v           v v  -  - v      -  -  -
           condensation       manipulation        fraternization    in fir mary
```

In (127abc), the relations between the prominences that originate in the inner and outer cycles arise by the Textual Prominence Preservation Condition of Selkirk (1984), cf. chapter 1 (132).

We will now turn to the 'overruling cases', where the output of stress rules applying on the outer cyclic plane is transferred into the merged representation, thereby rejecting part of the output of the stress rules applying on the inner cyclic plane. Three cases of inner cycle structure that is overruled are given below, repeated from (125) above:

```
(128)a.      *
            (* .)
             v v
        [ [ solid ] i <fy>em]
             v v    v   -
             .(*    .)  *
               *
```

```
b.           *
            (*  .)
             -  v
        [ [ mental ] i <ty>em]
             -  v    v   v
             * (*    .)  .
                *
```

```
c.          *
           (* .)
            v v
        [ [ atom ] i<c>em]
            v v    v
            .(*    .)
              *
```

Notice that the analysis is entirely analogous to Kiparsky (1982), since in each case an outer cyclic foot extending across a morpheme boundary transfers to the merged representation, i.e. a foot which is crucially not properly included in the stress information on the inner plane. The merged representations are given below:

```
(129)a.      *
           * *
           *(* .)*
           v v v -
          solidify
```

```
b.         *
        *  *
        * (* .).
        -  v v v
       mentality
```

```
c.       *
       * *
       *(* .)
       v v v
       atomic
```

However, the representations of (129) are unstable, and moreover are subject to a convention (that will be discussed in section 9.2), which flattens their prominence structure. Thereby it automatically removes an initial stress from a non-prominent light syllable in (129ac), given the close relation between syllable weight and stress in stray syllables. The final representations are the ones below:

```
(130)a.      *
           .(* .)*
           v v v -
          solidify
```

```
b.         *
        * (* .).
        -  v v v
       mentality
```

```
c.       *
       .(* .)
       v v v
       atomic
```

Let us now turn to the fate of stray syllables in cyclic derivations.

7.3 Stray syllables and Strict Cyclicity

As was discussed in chapter 1, Kiparsky (1982) restricted the overruling power of cyclic stress rules to applications across morpheme boundaries, or to cases where morphemes are unspecified as to stress features. These contexts together can be subsumed under the term 'derived context'. This theory is attractive, since it links the application of stress rules and the notion of 'derived context', which is independently motivated by a range of phenomena outside stress rules proper.

However, various classes of cases occur in which stress rules apply to a syllable string which is properly included in the embedded morphological domain, thereby violating the above-mentioned constraints.

In each of the cases that we will discuss, a syllable is involved that is extrametrical on the inner cycle. We will show that these cases form a problem in the theory of Kiparsky (1982) under the narrow assumptions made in that theory. In particular, Kiparsky assumes that no cyclic stress rule can apply if its output is both (a) properly included in the Identity Rule of the inner cycle and (b) distinct from that rule. However, the cyclic derivations that we will discuss point to a slightly weaker interpretation of cyclic blockades, since any constituent may be suppressed by a new constituent that only partially overlaps with it, as long as no lexical stress is suppressed, cf. (126a) above.

The problem then is how to account for the fact that only stresses and prominces (together '*asterisks*') are relevant to cyclic blockades, while constituency itself seems to be ignored. Our answer is that constituency simply cannot enter into a blocking relation with alternative constituency, as one of the following situations will always hold:

```
(131)a. (*   .)                b. (*   .)   .           existing constituent
         σ  σ ] σ   ...]          σ   σ    σ ] ... ]
            (*    .)                 (*     .)         overruling constituent
```

Either a binary constituent is erected across a morpheme boundary, as in (131a) (which cannot elicit distinctness, as no proper inclusion exists, exactly as in Kiparsky 1982). Or a binary constituent is built over two syllables the second of which does not match any footed syllable in the embedded morpheme, as in (131b). As we will see, stress rules will apply in this situation, overruling the constituent in the embedded morpheme. The reason why (131b) fails to undergo blocking must be the completely unspecified status of the stray syllable: unspecified as to constituency as well as to (stress by) weight and prominence.

Therefore we are forced to the conclusion that a cyclic stress rule may lead to a rebracketing if at least one member of the string to which it applies is unspecified as to bracketing, i.e. is unbracketed. With respect to distinctness, this seems to imply that if the application domain of some rule is only partially unspecified as to some feature, cyclic rules that fully specify this feature cannot be blocked, even if the partial specification is overruled in doing so. In other words, distinctivity is to be 'complete' in order to cause blocking[35].

Let us now turn to the derivations which lead us to this conclusion. The examples will first be presented in the foot-based format of Kiparsky's analysis, and later be analysed in our own framework.

Two types of cases require an overruling application of the stress rules involving proper inclusion within an Identity Rule. The first is *órigin-oríginal*, and additional examples in (132b). For ease of representation, we give only the relevant foot structures on the inner and outer cycles, respectively above and below the bracketed word:

```
(132)a.      ESR                    b. origin-original
              /\                       homonym-homonymous
        [ [  o ri gin ] <al>em ]       synonym-synonymous
                 \/                    medicin-medicinal
                 ESR                   gelatin-gelatinous
                                       pyramid-pyramidal  etc.
```

The relevant constituent properly included within an embedded morpheme is the *binary* output of the ESR, not the ternary constituent including the suffix syllable which arises after Stray Syllable Adjunction. This means that the ESR itself applies in contradiction to Kiparsky's claim that it respects metrical structure when applying within the Identity Rule. The conclusion is that the ESR is allowed to apply to a syllable string, even if properly included in an Identity Rule, if at least one syllable of the string (the extrametrical stem syllable) is unspecified for constituency.

Next to *órigin-oríginal*, the pair *órigin-oríginàte* makes this point as well. Formally, (133) is identical to (132), the final syllable being irrelevant to the operation of the bounded stress rule in a domain that is properly included in the inner cycle Identity Rule:

```
(133)a.      ESR                      b. origin-originate
             / \                         catholic-catholicize
        [ [  o ri gin ] ate ]            pyramid-pyramidoid
                \ /      |               gelatin-gelatinate
                SRR     ESR              politic-politicize etc.
```

To be sure, many words of this type follow Kiparsky's prediction that no inner cyclic structure can be erased in such cases:

```
(134) oxygenate     bestialize    naturalize  italianize
      skeletonize   hospitalize   popularize  disciplinary
      hydrogenate   americanize   circularize
```

This does not dismiss the problem implied by (132) and (133), however. Importantly, all of (134) can be accounted for by alternative means, as stress-neutral affixation, whereas an alternative explanation seems to be impossible for (132) and (133). And even if such an explanation would be possible, it would seriously undermine Kiparsky's explanation for the remaining cases, such as *solidity* and *solidify*, as nothing would prevent the application of the new explanation to these cases too. Therefore, we conclude that, even in Kiparsky's analysis, cyclic stress rules whose domain is properly included in an Identity Rule may lead to the destruction of constituents in that IR if only one stray syllable is involved.
Still, Kiparsky's conclusion that existing structure can only be destroyed by an application of a cyclic stress rule in a 'derived contect' holds for examples such as *párent-paréntal*, and *élephant-elephántìne*:

```
(135)a.      ESR                         b. parent-parental
              |                             moment-momentous
        [ [  pa ren t ] <al>em ]            incident-incidental
                 |                          column-columnar
                ESR                         etc.

(136)a.      ESR                         b. elephant-elephantine
             / \                            labyrinth-labyrinthine
        [ [ e le phant ] <ine>em ]          element-elementary
                  |        |                rudiment-rudimentary
                 ESR      LVS               sediment-sedimentary etc.
```

Here, the ESR erects a monosyllabic foot over the (formerly extrametrical) final rime in the embedded morpheme, which is unspecified for stress, so that no distinction can arise.
Let us now analyse these examples in our own framework, and see if there are any differences with Kiparsky's. The cases of *original* and *originate* are actually identical to the treatment they would receive in Kiparsky's analysis, as indicated in (132) and (133) above. Consider (137a,b):

```
(137)a.  *                    b.    *
        (* .) .                   (* .) .
         v v v                     v v v
      [[ origin ] al ]          [[ origin ] ate ]
         v v v     v               v v v     -
         .(* .)    .               .(* .)    *
           *                         *
```

What property distinguishes this case from cases where cyclic rules are blocked, e.g., (126a)? The answer is that the Identity Rule of the inner cycle contains a syllable which is completely unspecified as to syllable weight, constituency, and prominence. The stem-final syllable *-gin* is not bracketed, nor does it carry an asterisk. It is simply *indistinguishable* from a syllable in an underived word from the perspective of the stress rules. Being unspecified as to stress features, it can be specified for stress features without the intervention of the Elsewhere Condition, or Strict Cyclicity. Hence, it can be organized into a binary constituent as a stressless syllable. Stated differently, Light Syllable Adjunction applies in a 'feature-filling' fashion here.

Turning to cases with closed penults in the derived word, such as (138), we find that the same argument applies. The one non-essential difference resides in the fact that in our analysis the outer cyclic plane of such words will include a binary constituent whose head is the closed penult, cf. section 5 (116). This constituent will extend across a morpheme boundary in the cases discussed here, and therefore be comparable to the type *atomic* (128c) above:

```
(138)a.      *                     b.      *
           (*   .)                       (*   .) .
            -   v                         -   v  v
        [[ parent ] al ]            [[ incident ] al ]
            v   -   v                     -   v  -     v
          . (*      .)                   (*   .) (*     .)
             *                                   *
```

The heavy suffixes are somewhat more interesting. Here two potential cases of blocking arise, consider (139):

```
(139)a.      *                    b.      *
           (*   .)                      (* .)   .
            -   v                        v v    v
        [[ moment ] ary ]          [[ elephant ] ine ]
            -   v    v                   v v    -      -
           (*   .)   *                  (*  .)  *      *
            *                                   *
```

In (139a), the outputs of the inner and outer cycle are identical, which implies non-distinctness. And (139b) presents another example of a syllable unspecified on the inner cycle being specified on the outer cycle. On the inner cycle, this syllable is stressless because of being light, presumably by double (?) consonant extrametricality, cf. section 5 above. Just as the stray light syllable in (138) above is specified for stress by its being incorporated into a constituent, the stray syllable in (139b) is specified for stress by its weight, as no extrametricality of consonants is possible word-medially.

To conclude, our analysis is at least equivalent to Kiparsky's with respect to the light affixes of (132), and the heavy affixes of (133).

Esentially this analysis expresses that overruling applications of cyclic stress rules are permitted if the domain of application extends across a cyclic morpheme boundary, or contains an unspecified syllable which is in a right-peripheral position in the embedded morpheme. The assumption that unspecified features cannot cause blockades of cyclic structure-building rules, is due to Kiparsky (1982) (see also Kiparsky 1985). However the application of this assumption, so that stress rules leave parts of their domains unspecified, to be filled in on later cycles, is a direct result of our claim that stress constituency is exclusively binary[36].

7.4 Conclusion

Our analysis of the stress cycle in English shares certain assumptions with earlier analyses, such as the Elsewhere Condition (Kiparsky 1982), and multiplanar representation of stress cycles (Halle & Vergnaud 1987). However, our contribution to the issue of cyclicity is a (preliminary) answer to the problem that constituents can be constructed over syllable strings that are properly included in the internal cycle. The relevant generalization turned out to be that stray stressless syllables outside binary constituents are involved, i.e. syllables which are completely unspecified as to stress features. It is clear that the compatibility of such cases with strict cyclicity is a direct effect of our hypotheses that foot constituency is strictly binary and that syllable weight and stress are directly related, i.e. the compositional interpretation of stress.

8. **Destressing by reapplication of Syllable Adjunction**

8.1 **Introduction**

So far, we have (almost) exclusively paid attention to rules of 'primary metrical analysis', i.e. those (cyclic) rules which together provide the basic patterns of stress placement and retraction. These rules apply in a lexical stratum that is referred to as level-1 in Kiparsky (1982), as we have implicitly assumed. We have also shown that some rules which are often considered to be rules of metrical reanalysis (destressing rules), can in fact be eliminated (Pre-Stress Destressing), or reinterpreted as rules of primary metrical analysis (Sonorant Destressing, the Arab Rule) respecting the Free Element Condition. However, we have not yet paid any attention to a fourth 'destressing' rule, Post-Stress Destressing. In this section, we will argue that its effects can actually be derived by a reapplication of Light Syllable Adjunction at level-2, a stratum where rules of metrical reanalysis apply, i.e. rules that are not subject to the Free Element Condition.

According to Prince (1985), destressing rules should be viewed as stress rules applying in their feature-changing mode, unrestricted by the Free Element Condition. We assume that stress rules reapply in their feature-changing mode *at level-2*. The FEC only governs rules of primary metrical analysis, which apply at level-1 (Kiparsky 1982).

Prince (1985) shows that Post-Stress Destressing can be interpreted as a reapplication of the English Stress Rule (Hayes 1981). In our analysis, this rule more or less corresponds to Light Syllable Adjunction (89). It would apply as below:

```
(140)            *                  *
         . (* .)(* .)      (*  .). (* .)
         v  v v  v v        v  v v  v v
        Winnepesaukee  =>  Winnepesaukee
```

The formal implications of this type of derivation will be the subject of this section. As indicated by Prince, some constraints should govern the reapplication of stress rules as rules of destressing, in order to avoid complete erasure of the output of the former.

Examining such constraints, we will adduce additional evidence for our hypothesis that constituency-affecting rules are Syllable Adjunction rules. Rules of metrical reanalysis, applying at lexical level-2, profit from the adjunction format as they inherit the constraints motivated for phrasal Rhythmic Adjustment (Hayes 1984). These constraints may take the function of constraints proposed specifically for destressing, such as the Strong Foot Condition (Hayes 1981), as well as the Clash Resolution Hypothesis (Hammond 1984).

However, we will conclude that not all destressing effects can be due to the level-2 reapplication of Syllable Adjunction. Destressing by loss of *prominence* and by loss of *syllable weight*, will be discussed in sections 9 and 10, respectively.

A somewhat asymmetrical finding will be that Closed Syllable Adjunction, in contrast to Light Syllable Adjunction, does not reapply as a rule of metrical reanalysis at level-2.

This section is organized as follows. Before discussing the advantages of Syllable Adjunction in destressing operations we will examine in some detail the advantages of Prince's analysis of reapplying foot assignment over earlier accounts based on deletion-plus-adjunction of stress feet. This will be the subject of section 8.2. In section 8.3, we will take the step from foot assignment to Syllable Adjunction, and discuss the additional advantages of this format. Specifically, Syllable Adjunction, as a rule of node adjunction in the sense of Hayes (1984), but not foot assignment, is subject to constraints on metrical node adjunction. These constraints, independently motivated for phrasal adjunction, may replace conditions on destressing otherwise required. In section 8.4 we will show that the Maximality Principle (Hayes 1984) can replace the Clash Resolution Hypothesis (Hammond 1984), for at least the cases that are under discussion. In section 8.5 we will show that the Strong Domain Principle (Kager & Visch 1988) can replace the Strong Foot Condition (Hayes 1981). Section 8.6 will be devoted to an analysis of destressing in *-ory* and *-ary*, a phenomenon which apparently falls outside the scope of Light Syllable Adjunction. Finally in section 8.7 we will show that Closed Syllable Adjunction cannot reapply as a rule of metrical reanalysis.

8.2 Foot assignment versus deletion-plus-adjunction

Let us examine in detail what formal advantages are gained by expressing a destressing operation as a *foot assignment* rule (Prince 1985), instead of an operation of deleting and readjunction, as assumed in earlier work such as Hayes (1981), cf. chapter 1 section 5.5.
All Hayesian destressing rules, except Pre-Stress Destressing, cf. chapter 1 (155), share the property of *Left*-dominance. That is, the structural descriptions of these rules mention a monosyllabic foot immediately preceding. Analyses that formalize destressing as foot deletion readjoin the syllable whose foot has been deleted by a destressing rule back into the tree as a weak node, by Stray Syllable Adjunction. Selkirk (1980), Hayes (1981), Hammond (1984) and others thus advocate a *two-step model* of destressing operations:

```
(141)  (*) (*  .)    delete F    (*)          adjoin σ     (*  .  .)
        σ   σ  σ        =>        σ  σ  σ        =>         σ  σ  σ
```

Stray Syllable Adjunction applies in a structure-preserving way (Hayes 1981) in accordance with the dominance-parameter on foot construction. For English, this yields a *left-dominant* type of SSA, unless there is no foot to the left to adjoin a syllable to - as in Pre-Stress Destressing.
Obviously, this approach fails to make the generalization that left-dominant destressing rules - those which are triggered by a left-hand stress - always result in left-dominant adjunction feet.
We have shown in section 4.5 that right-dominant destressing (Pre-Stress Destressing) is superfluous. Therefore we can make the following strong generalization:

(142) Destressing is left-dominant:
  (a) it deletes a *right-hand* stress.
  (b) it results in a weak syllable being adjoined *leftward*.

The essential weakness of (142) is that the clauses (a) and (b) are formally unrelated. A priori, the situation could as well be reversed: left-hand stresses are deleted, and syllables are adjoined rightward, or vice versa. In short, (142) is not merely a coincidence, see (143):

(143) Left-dominant destressing implies leftward adjunction.

It is easy to see that formalizing destressing as foot assignment has the advantage of immediately explaining (142). The two steps taken in more conventional analyses, foot deletion and Stray Adjunction, are collapsed into one step, foot assignment. In (144a), foot assignment is represented in a conventional foot notation, in (144b) in our notation:

```
(144)a. (*)(*  .)   assign F  (*  .) .      b. . (*  .)      (*  .) .
         σ  σ  σ      =>       σ  σ  σ         σ  σ  σ   =>  σ  σ  σ
```

The side of the head in foot assignment is a parameter to be fixed for individual languages. This side is lefthand in English, so that both destressing and stress assignment must be left-dominant. In this way, we give real content to Hayes's notion of structure-preservingness of Stray Syllable Adjunction.

8.3 Syllable Adjunction versus foot assignment

Let us now take the step from foot assignment to Syllable Adjunction, and discuss its consequences. Let us first see how the functions of the foot assignment format translate to the Syllable Adjunction format.

The adjunction format of destressing mentions two terms, corresponding to the syllables which are organized into a binary constituent. As in foot assignment, the side of the head is parametrically defined. For English, the direction of adjunction of Light Syllable Adjunction (89) is leftward. The adjoined syllable will be weak by convention, yielding the actual destressing:

```
(145)   . (*  .)         (*  .) .
        σ  σ  σ    =>    σ  σ  σ
        X  Y             X  Y
```

Notice that subordination of the adjoined syllable as weak implies a reinforcement of the syllable providing the landing site, which will be stressed. Stress assignment and destressing are thus two sides of the same coin, viz. the imposition of a strength relation between syllables.

Notice that the output structure of (145) differs from the ternary output structure of Stray Syllable Adjunction (141), the one assumed in Hayes (1981) and Hammond (1984). However, according to McCarthy (1982) and Withgott (1982)[37], metrical surface structures such as those below are at least as adequate in accounting for a number of foot-sensitive rules as the ternary outputs assumed by Hayes and Hammond. That is, the major foot break may well be between the second and third syllable:

```
(146)        /\                  / \
            /  \                /   \
         __/____\______________/__ /_\__
           /\    /|\           /\  /  /\
      Winnepesaukee    Winnepesaukee
```

Interestingly, the arguments for (146) boil down to the indeterminateness of the third syllable. That is, the constituency of this syllable is at least unclear, whereas the constituency of the post-stress syllable is perfectly clear - it groups with the initial syllable. This matches our output structure of (144).

Let us now discuss the issue of Q-sensitivity. In chapter 1 section 5, we have discussed evidence for the claim that Post-Stress Destressing is at least restricted to open syllables

(Hayes 1981), and possibly even to light syllables (Prince 1985). No closed syllables should readjoin, cf. *Tìcònderóga* chapter 1 (63). We will interpret this Q-sensitivity of the destressing rule as indicating that Light Syllable Adjunction (89), but not Closed Syllable Adjunction (86b), is to reapply at level-2. We will come back to this issue in the sections 8.6 and 8.7 below.

First we will discuss the conditions on level-2 reapplication of Light Syllable Adjunction, required to prevent it from destroying the output of the level-1 rules of primary metrical analysis.

8.4 Syllable Adjunction and Maximality

We have now shown that it is at least possible to formalize Post-Stress Destressing as a level-2 reapplication of Light Syllable Adjunction. But it remains to be shown how a massive overgeneration of LSA at level-2 can be avoided in the absence of the Free Element Condition. Especially, derivations such as the one below need to be ruled out:

```
(147)                *                   *
        (* .)(* .)(*.)     .(* .) .(* .)
         v v  v v - v      v v v  v - v
        Apalachicola => Apalachicola
```

In order to rule out (147), previous analyses incorporated constraints on Post-Stress Destressing such as the requirement that a non-branching foot precede the focus, cf. Hayes (1981) chapter 1 (151).

The most generalizing constraint to rule out (147), however, is the one below, repeated from chapter 1 (164):

(148) **Clash Resolution Hypothesis** (Hammond 1984)
All destressing rules must apply so as to eliminate adjacent DTE's.

Destressing in (147) is blocked since it does not resolve a clash. Note that the CRH does not translate straightforwardly into our framework, as we have abolished monosyllabic feet over light syllables, and thereby have eliminated the possibility of referring to stresses over stray light syllables.

However, if our arguments for eliminating monosyllabic constituents are correct, an alternative approach must be possible. For English, such an approach is possible, as we will demonstrate in the next section. This alternative analysis has the additional advantage of being more restrictive, linking up as it does two otherwise unrelated observations: the fact that in the context of 'Post-Stress Destressing', the *lefthand* syllable survives as stressed, and the fact that Syllable Adjunction in English is strictly L-dominant.

Moreover, the constraint that is required to rule out (147) is actually independently motivated by phrasal rhythmic adjunction, the Maximality Principle of Hayes (1984).

Hammond (1984) interprets the presence of adjacent contextual feet in destressing rules as a defect of the traditional format of such rules. As he argues, this misses the generalization that it is the adjacent foot's head that is relevant, not the presence of the foot as such. The correct generalization, according to Hammond, restricts destressing rules to only apply under clash, cf. chapter 1, section 5.7.

Let us see what it would mean for a Syllable Adjunction rule such as LSA to apply under clash. It is easy to restate the condition of clash as the condition below, which is observationally correct:

(149) The lefthand syllable in the structural description of Light Syllable Adjunction is a free element (a stray syllable).

That is, Syllable Adjunction cannot create a constituent whose head was formerly the weak syllable of a binary constituent. Or stated otherwise, a grid element cannot be adjoined 'into' another constituent. Hence the application modes (150a,b) will be excluded, whereas the application modes (150c,d) will be allowed:

```
(150)a. (*   .)(*   .)        .  (*   .)  .      b. (*   .)  .          .  (*   .)
         v   v  v   v         v   v   v   v         v   v   v          v   v   v
         σ   σ  σ   σ  =/=>   σ   σ   σ   σ         σ   σ   σ   =/=>   σ   σ   σ

     c.  .  (*   .)          (*   .)  .         d.  .   .             (*   .)
         v   v   v            v   v   v             v   v              v   v
         σ   σ   σ      =>    σ   σ   σ             σ   σ       =>     σ   σ
```

Surely, (149) extends to rules of metrical analysis as it is a theorem of the Free Element Condition. Obviously, the FEC requires that *both* of the syllables that are joined into a foot by rules of primary metrical analysis are stray, excluding (150c). Rules of metrical reanalysis only require a stray status of the syllable that is to become the head of the newly formed foot. Rules of metrical analysis and rules of metrical reanalysis therefore differ only as to (150c), which is to be excluded in the former case, and to be excluded in the latter.

If (149) is a statement which holds for both types of rules, what is its status? In its present form it just states a completely ad-hoc condition on foot assignment, as it seems.

However we are now in a position to make use of the adjunction format of rules of metrical reanalysis. If metrical reanalysis is an instance of the general metrical adjunction schema of Hayes (1984), cf. section 3.4, (149) follows from the independently motivated Maximality Principle. We will clarify this idea below.

As a central structural constraint on the relation between the node that is adjoined and the node to which it is adjoined (the landing site), Hayes introduces the Maximality Principle[38]:

(151) **Maximality Principle**
Rules that manipulate tree structure must analyze maximal terms.

Hayes provides a technical definition of the notion *maximal term*, which we will not represent here. For our purposes, it suffices to remark that the Maximality Principle entails that *no element is adjoined leftward to an element that is the right branch of a constituent.* Hayes informally paraphrases this as the *Right Branch Constraint* as a way of stating the observation that strengthening cannot add a beat to a metrical node which corresponds to the righthand element in a constituent:

```
                                                                              *
(152)                              *                   *                      *
        *                          *                   *    *                 *
        * .  *         *           *                   * .  *          *      *
   [ [ [ overdone ] steak ] blues ]      =/=>     [ [ [ overdone ] steak ] blues ]
```

That is, Maximality can be partly paraphrased as 'no node Y can adjoin into a constituent properly including X'.This gives the desired result, as will be clear. Crucially, this result is obtained without reference to the notion of clash.

8.5 Syllable Adjunction and the Strong Domain Principle

A second type of constraint on metrical reanalysis is that it must leave prominent syllables unaffected. This constraint, discussed in chapter 1, section 5.5, is motivated by the ungrammaticality of derivations such as the ones below:

```
(153)a.         *                  *      b.
            *   *                  *            *              *
          .(* .)(* .)        (* .). (* .)     .(* .)*       (* .). *
          v v v  - v         v v v  - v       v v v -       v v v -
        manipulation =/=> *manipulation     Mamaroneck =/=> *Mamaroneck
```

In (153a) a prominent constituent in the embedded morpheme is preserved cyclically, cf. (126d). In (153b) prominence is due to the End Rule (and the extrametricality of the final syllable). Light Syllable Adjunction cannot reapply to either case, even though it would be capable of destroying existing constituents, and does not violate the Maximality Principle (151).

The most generalizing statement to rule out (153) is the Strong Foot Condition of Hayes (1981), repeated below from chapter 1 (150):

```
(154) Strong Foot Condition (Hayes 1981)
      No foot in strong metrical position may be deleted.
```

The Strong Foot Condition blocks Light Syllable Adjunction in (153ab), since by readjoining the syllable place-holder of the prominent foot, the foot itself is lost, together with its prominence.

Our central hypothesis that LSA is a Syllable Adjunction rule allows the elimination of the Strong Foot Condition, as we will demonstrate. The effect actually follows from the Strong Domain Principle, proposed by Kager & Visch (1988) as a condition on phrasal Rhythmic Adjustment. The Strong Domain Principle is given below:

```
(155) Strong Domain Principle (Kager & Visch 1988:42)
      No prosodic transformation may apply to the head of a strong
      domain. (The head of a constituent is the strong or only element
      of that constituent)
```

For motivation of the Strong Domain Principle, see Kager & Visch (1988), and Visch (forthcoming)[39]. Kager & Visch remark that the Strong Foot Condition can be interpreted as a special case of the Strong Domain Principle if destressing is formalized as adjunction, where the destressed syllable is the head of a foot. In the bracketed grids notation, 'strong' should be interpreted as 'prominent': aligned with an asterisk at a higher level. Together, this gives the (required) result that prominent stresses are immune to Light Syllable Adjunction.

8.6 Destressing of *-ory* and *-ary*.

There is one potential problem with an analysis subsuming Post-Stress Destressing under Light Syllable Adjunction (89). Hayes (1981) assumes a version of the destressing rule which applies to open syllables in branching feet, cf. chapter 1 (151). Referring to open syllables instead of light syllables, the rule is extended to *long vowels*.

This is motivated by the well-known cases of destressing of words ending in the suffixes *-ory* and *-ary*, whose vowels are analyzed as underlyingly long. The suffixes undergo destressing if they end up directly after the primary stress (156a). In words with primary stress falling further to the left, the suffix vowels surface as long, cf. (156b), and chapter 1 (50, 138)[40]:

```
(156)a. cúrsory        rosary         b. admónitòry    répertòry
        reféctory      directory         preliminary   sedentary
        maledíctory    elementary
```

The motivation for assuming underlying long vowels dates back to SPE, where the retraction behavior of the suffixes was analysed as dependent on the presence of a strong cluster, cf. chapter 1 section 3.2.1. In this way, the retraction type could be related to long vowel suffixes such as *-oid.*

The standard treatment of such words is (a) stress placement on the long suffix vowel, (b) Weak retraction, (c) Sonorant Destressing, and (d) Post-Stress Destressing. Two assumptions are crucial. The final [i] of the suffix is a glide /y/ underlyingly, where the suffix is monosyllabic and extrametrical, cf. chapter 1 section 3.1.2. This underlying /y/ is vocalized before Post-Stress Destressing applies, in order to make the long suffix vowel to be situated in an open syllable, as is required by destressing. Finally, Medial Laxing shortens the long suffix vowels if stressless, in order for Vowel Reduction to be applicable. In contrast to these standard assumptions, we will assume that *-ory* and *-ary* contain *short* vowels underlyingly. That is, their skeletal format is a (heavy) -VCC syllable, where the final C is a glide /y/. Moreover, the suffixes are extrametrical. Together, these assumptions guarantee that no binary constituent is constructed across the morpheme boundary. This also explains the retraction properties of the suffixes, which are typical of Closed Syllable Adjunction,

```
(157)a. *          b.   *          c. *           d   *        e       *
        *   *         * (*  .) *     (*  .)   *      . *    *      (* .) *  *
        -   -         -  v v   -      v v     -      v *    -       v v  -  -
      curs<ory>   admonit<ory>   repert<ory>   refect<ory>   maledict<ory>
```

The VCC suffixes are stressed by their inherent weight. At level-2, /y/ is vocalized, yielding (158):

```
(158)a. *          b.   *          c. *           d.  *        e.      *
        *  . .        * (*  .). .    (*  .) . .     . *  . .    (* .) * . .
        -  v v        -  v v v v      v v  v v      v -  v v     v v  - v v
      cursory       admonitory     repertory      refectory    maledictory
```

Now Light Syllable Adjunction reapplies, starting at the righthand word edge:

```
(159)a. *          b.   *          c. *           d.  *        e.      *
        * (* .)       * (*  .)(*.)   (*  .)(* .)    . * (* .)   (* .) *(* .)
        -  v v        -  v v v v      v v  v v      v -  v v     v v  - v v
      cursory       admonitory     repertory      refectory    maledictory
```

Light Syllable Adjunction, unconstrained by the Free Element Condition, but respecting Maximality, will reapply in (159ade), destroying its own output:

```
(160)a.  *          b.   *          c. *           d.  *        e.      *
        (*  .).        * (*  .)(*.)   (*  .)(* .)    .(*  .).    (* .)(* .).
         -  v v        -  v v v v      v v  v v      v -  v v     v v  - v v
       cursory       admonitory     repertory      refectory    maledictory
```

This is nearly the desired output, the only thing to be dealt with being the surface length of the suffix vowel in (160b,d).

Notice now that some of the relevant words in stressed *-ory*, *-ary* are morphologically related to words ending in -V*r*, with a (sometimes reduced) short vowel:

```
(161) monitor   - monitory
      commissar - commissary
```

Furthermore, no short vowels appear to occur in an open penult carrying subsidiary stress: not **téstim*[O]*ny*, but *téstim*[òw]*ny* with a long vowel. This gap in the distribution of vowel length requires an explanation.

For these two reasons, a rule lengthening short vowels in penults with a subsidiary stress is quite plausible. Presumably, the lenghtening rule is restricted to American English, as British English typically displays reduced vowels (and even vowel deletion) in positions where the American English variant displays a long vowel: *testim*[ə]*ny* etc.

Interestingly, SPE (p.200) proposes a minor rule tensing lax /o/ in open penults. This rule accounts for tenseness alternations in words such as *télesc*[ow]*pe*, *tèlesc*[O]*pic*, *telésc*[ə]*py*:

```
(162) o => [+tense] /  ___ C V [-seg]
```

This rule is ordered after Post-Stress Destressing, exactly as required in our analysis with respect to Light Syllable Adjunction.

We conclude that an analysis for *-ory*, *-ary* based on vowel lengthening is well supported.

8.7 Closed Syllable Adjunction and metrical reanalysis

Turning to Closed Syllable Adjunction, we find that its reapplication as a rule of metrical reanalysis at level-2 must be excluded. Crucially, CSA must be blocked in the contexts where Light Syllable Adjunction may reapply. Derivations such as (163) - these examples are repeated from chapter 1 (59, 63) - are ruled out:

```
(163)a.          *         b.          *        c.          *
          .(* .)(* .)          *(* .)(* .)             *  *  *
          v - v  - v           - - v  - v              -  -  -
          Monongahela          Ticonderoga          chimpanzee
  CSA
                 *                     *                    *
          (* .). (* .)         (* .). (* .)          (*  .) *
           v v v  - v           - v v  - v            -  v  -
         *Monongahela         *Ticonderoga         *chimpanzee
```

The failure of (163ab) to undergo Post-Stress Destressing led previous analyses such as Hayes (1981) to restrict the destressing rule to open syllables, cf. chapter 1 (151).

Notice especially that (163c) cannot be subject to CSA, as this would eliminate its lexical stress after all. The lexical stress was assumed in section 4.3 to block CSA in its primary metrical analysis mode, by the Elsewhere Condition. But presumably, the Elsewhere Condition does not extend to the non-cyclic level-2, where CSA would reapply.

Words with cyclic derivations support our conclusion that reanalysis is to be restricted to light syllables, see examples like ***condensation*** and ***instrumentality*** in chapter 1 (175a,177).

The conclusion is justified that Closed Syllable Adjunction cannot reapply in a metrical renalysis mode at level-2, and is restricted to level-1. We have no explanation for this assymmetry between the two Syllable Adjunction rules.

9. Destressing by loss of prominence

9.1 Introduction

Cyclic preservation of prominence is crucial in words like *manìpulátion*, to block level-2 destressing of the medial foot as in *Wìnnepesáukee*, cf. chapter 1, section 6.5.2. As has been illustrated in (127), we have formalized this observation by means of merging of stress planes under the Elsewhere Condition.

As discussed in chapter 1, section 6.1, a subordinated cyclic prominence may not surface when word-internal rhythmic adjustment eliminates it. In this section we will analyse this phenomenon in our framework. We will provide further evidence for our compositional theory of stress. Specifically, we predict that loss of prominence of a syllable outside a constituent automatically leads to re-evaluation of its stress value, by the wellformedness condition (88), based entirely on syllable weight.

This is the case, for example, when loss of prominence implies automatic loss of stress if the relevant syllable is light (164a). Heavy syllables are predicted to retain a stress by inherent weight (164b). Similarly, a syllable which is stressed by being in the head position of a binary constituent (164c) will retain its stress after the loss of prominence.

```
(164)a.  *                b.  *              c.   *
         *                    *        *         (* .)     (* .)
         v   =>   v           -   =>   -          σ σ  =>   σ σ
```

These three predictions will be shown to be correct.

What are the factors determining the loss of prominence? In traditional analyses, a once-prominent syllable can end up as non-prominent in two ways. The first is automatic loss of cyclic prominence by subordination to the word DTE. See the trees below, where in (165b) the initial foot is subordinated to the second, and can be deleted by destressing:

```
(165)a.   |        b.   / \
          F            Fw  Fs
         / \           |   / \
         a tom         a to mic
```

The second way is inversion of prominence relations among feet, both of which are subordinated to the word DTE. Kiparsky (1979) was the first to analyse this loss and shift of prominence by the Rhythm Rule, cf. chapter 1, section 6.5.2:

```
(166)a.                 b.    /\                    / \
                             w  \                  w   \
          / \               / \  \                / \   \
         Fw  Fs            Fw  Fs Fs             Fs  Fw  Fs
         |   |             |   | / \             |   |  / \
         explain           explanation   =>      explanation
```

Again the once-prominent medial foot may undergo further destressing.

We will show that both ways of losing prominence can be attributed to a single origin, viz. the convention that representations of word stress are 'minimal' in a certain sense.

9.2 Prominence flattening

Our analysis excludes initial Pre-Stress Destressing by right-dominant foot assignment, since Syllable Adjunction in English is strictly left-dominant. Actually, alleged cases of right-dominant destressing (*átom-a̱tómic*) can be reanalysed as instances where loss of prominence leads to the automatic loss of stress in light syllables, by the wellformedness condition (88).

The convention which we will assume to cause the loss of prominence on syllables with subordinated cyclic prominence is (167):

```
(167) Prominence Flattening
      Prominence structure is minimal.
```

This convention can be viewed as an instantiation of Stress Conflation of Halle & Vergnaud (1987), applied to the upper lines, eliminating all prominences except for the primary stress. Its effect is a flattening of cyclic structure. This will lead to automatic "Pre-Stress Destressing" in (168a,d,e) below:

```
(168)a.   *                    b.   *                c.    *
        * *        *               * *       *           *  *           *
        *(* .)   .(* .)            * *      * *          * (* .).    * (* .).
        v v v    v v v             - -      - -          -  v v v    -  v v v
        atomic   atomic         Chinese  Chinese       mentality  mentality

     d.       *                              e.      *
            * *        *        *                  * *              *
          . * *      . . *    (* .)*          (*.)*(* .).     (*.).(* .).
          v v -      v v -    v v -            v vv v v v      v vv v v v
        Japanese  Japanese  Japanese          periodicity     periodicity
```

As indicated, (168d) undergoes a rule to re-establish an initial stress after Prominence Flattening. In the following sections, we will identify this rule as word-internal Rhythmic Adjustment. Furthermore the pretonic vowels in words such as *expl<u>a</u>nation* and *retrogr<u>a</u>dation* will be shortened by a common rule of medial shortening, to be discussed in section 10.

Finally, a remark is in order as to the relation between Light Syllable Adjunction and Prominence Flattening. Flattening does not feed further destressing by Light Syllable Adjunction in *manipulation*, etc.:

```
(169)            *
             *   *                    *                         *
          .(* .)(* .)            .(* .)(* .)            (* .). (* .)
          v v v  - v             v v v  - v             v v v  - v
        manipulation   =>    manipulation    =/=>   manipulation
```

In order to account for this, we will impose an ordering between Light Syllable Adjunction and loss of prominence by Prominence Flattening. Maybe the ordering can be derived from a general principle according to which rules affecting lower regions in the prosodic hierarchy are applied before rules affecting higher prosodic regions. Proposals for principles formalizing bottom-up application can be found in Hammond (1984) and in Kager & Visch (1988).

This concludes our analysis of destressing by loss of prominence. The final section of this chapter will be devoted to the third source of destressing: weight adjustment.

10. Destressing by weight adjustment

10.1 Introduction

So far we have discussed two ways of destressing a cyclically stressed syllable. The first was by reapplication of a binary stress rule at level-2, subordinating a former head-of-a-foot as a stressless element in a new foot. The second was the elimination of prominence from a formerly prominent syllable. In this section we will discuss the third way of destressing: adjusting the weight of a syllable which is heavy by composition, which invokes automatic destressing by the wellformedness condition (88). The processes to be discussed in this section involve the alternation below:

```
(170)   *        .
        -   ~    v
```

Weight adjustment is either a phonological rule or the automatic result of an independent process. In the latter case, it may result from e.g. resyllabification of closing consonants into a following syllable. In the former case, weight adjustment may be instantiated as a rule of vowel shortening etc. This theory implies that the shortening of a lexically long vowel leads to the erasure of stress on that vowel.

Although the ordering of weight adjustments with respect to Prominence Flattening, word-internal Rhythmic Adjustment, and reapplication of Light Syllable Adjunction appears to be irrelevant in most cases, at least one weight adjustment process, Medial Shortening, must be ordered after Flattening. That is, the relevant vowels must be non-prominent at the application of shortening. For this reason, we will assume flattened input representations throughout this section. On the other hand, many of the output representations have to undergo Rhythmic Adjustment, to be described in section 12.4.

10.2 Destressing by resyllabification of single consonants

In many derivations given above, as those in (168), we have represented the syllabification of words with embedded morphemes as if they were underived. That is, we represented the medial syllable of the word *Japanese* as light, whereas the corresponding syllable in *Japan* is closed and *heavy*. This alternation is due to automatic resyllabification of the consonant before the following suffix vowel.

```
(171)     σ     σ              σ      σ
         / \   / \             |     / \
         m m   m m     =>      m     m m
         | |   \ /             |    /\ /
         V C    V              V   C  V
    Jap  a n    e   se    Jap  a   n  e   se
```

The effect is shown in its simplest form in words such as *epigrammatic*, where the relevant syllable is already non-prominent in the base word, (cf. *épigràm*):

```
(172)a.          *                *        b.         *              *
         (* .) *  (* .)   (* .)  .  (* .)       * *  (* .)      *  .  (* .)
         v v   -   v v    v v    v   v v        - -   v v       -  v   v v
         epigramm.atic    epigra.mmatic      programm.atic    progra.mmatic
```

In words such as *Japanese* and *periodicity* (cf. *periódic*), consonant resyllabification brings about destressing in combination with Prominence Flattening (167). Since resyllabification and the weight-stress relation (88) are both completely automatic, we can explain the absence of stressed pretonic medial syllables with single intervocalic consonants.

As a matter of fact, there are some indications that resyllabification is cyclic, feeding Light Syllable Adjunction on the outer cyclic stress plane, cf. footnote 36:

```
(173)a.  *            b.      *           c. díplomàt  -  diplómatìze
         (*    .)*        . (* .) *          democrat  -  democratize
         v   v -          v  v v  -
         diplomat       diploma.tize
```

These alternations constitute counter-examples to the claim that cyclic stress rules cannot overrule stresses on inner cycles. Resyllabification creates a derived context for the cyclic stress rules to apply in, while wiping out the stress-by-inherent-weight.

10.3 Destressing by resyllabification of /s/

The second example of destressing by weight adjustment is the *optional* resyllabification of /s/ in the initial position of consonant clusters. Again, the destressing effect can be obtained in an unadulterated fashion (174a), or in combination with prominence flattening (174b):

```
(174)a. catás.trophe    -  càta.stróphic     b. mánifèst    - mànife.státion
        molest          -  molestation
        miasma          -  miasmatic
        protest         -  protestation
        statistic(s)    -  statistician
```

The effect of /s/ resyllabification can be represented as below:

```
(175)a.          *                 *          b.      *               *
        (* .) * (*  .)     (* .). (*  .)       * *   (*  .)     * .  (*  .)
        v v  -  -  v        v v v  -  v        v -    v  v      v v   v  v
        manifes.tation => manife.station     catas.trophic => cata.strophic
```

As (174b), the output of (175b) will undergo Rhythmic Adjustment.
The optionality of /s/ resyllabification transpires from the fact that a number of similar words retain a cyclically stressed closed syllable:

```
(176)  attést  - àttès.tátion      elastic  - elasticity      infest    -
infestation
       detest   - detestation   domestic - domesticity
```

10.4 Destressing by medial shortening

The third type of destressing by weight adjustment is a vowel shortening rule applying to medial long vowels in non-prominent syllables outside a binary foot. The rule may apply in combination with flattening.

```
(177)a.        *              *           b. cívilìze    - cìvilizátion
        (* .)* (* .)  (* .). (* .)            retrográde - rètrogradátion
         v v -  - v    v v v  - .             expláin    - èxplanátion
        civilization  civilization            párasìte   - pàrasitólogy
```

Such a rule has been proposed earlier in the literature, in combination with (segmental) destressing, or as a stress-dependent rule, cf. chapter 1, section 6. Here we will assume Medial Shortening, a rule very similar to Hammond's (1984) rule of Medial Laxing, cf. chapter 1 (168):

```
(178) Medial Shortening
      .
      *     .
      σ     σ / σ ___ σ
      |\    |
      m m   m
      |/    |
      V     V
```

As formulated in (178), Medial Shortening will not affect the prominent or long vowels of *sensation*, *Arizona*, etc.
As a lexical *rule*, instead of an automatic convention, Medial Shortening has some exceptions. Especially the suffix *-ee* blocks shortening of the long stem vowel (*devote-devotee*, *detain-detainee etc.).*

10.5 Destressing by sonorant coalescence

Another type of destressing by deweighting is the process described by Liberman & Prince (1977:299) as a low level coalescence of a vowel and a tautosyllabic sonorant:

(179)"... a certain amount of unexpected reduction is found, but it appears to lie within a phonetically circumscribed domain: metrically weak nonlow vowels occasionally collapse with following tautosyllabic sonorants, even when they should bear a protecting stress. We find such examples as *commntary* (*commɛnt*), *consltation* (*consʌlt*), *transfrmation* (*transform*), and, optionally, *sentimntality* (*sentimɛntal*). Note that there are nonreduced instances of all these: as in *indɛntation*, *conformation*, *exʌltation*. Perfectly regular, though unstressed, is the second syllable of *confirmation*; as noted above, the vowel [r] of *confirm* is always stressless when metrically weak in medial position. In fact, all syllabic liquids and nasals (m n l r) are stressless when medially weak, and we can conclude that what is unusual about words like *transformation* is the coalescence of the vowel with the sonorant /r/; after that, the reduction of the resulting r-colored vowel (or syllabic r) is completely normal."

Mora theory (Hyman 1985, Hayes 1989) makes possible an account of this process as involving an occasional deletion of the second mora linked to a sonorant consonant, and subsequent linking of the segmental melody to the first mora. This is represented below:

(180) **Sonorant Coalescence** (exceptional)

```
          .
          *                  .
          σ      =>          σ
         /|\                /|
       / m m              / m
     /   | |            /   |\
    C    V C           C    V C
        [+son]             [+son]
```

Notice that this is exactly the deweighting operation performed by Closed Syllable Adjunction in the Sonorant Destressing mode. In (181) we give a derivation involving (180):

```
(181)          *                      *
       *    * (*   .)         *    . (*   .)
       -    -  -   v          -    v  -   v
     transformation   =>  transformation
```

10.6 Prefix destressing

Monosyllabic prefixes may destress if non-prominent and outside a binary constituent. Examples with frequently reducing prefixes are given below, partly repeated from chapter 1 (140):

```
(182) con+síder    ex+pect     pro+found    pre+tend
      con+tain     ab+surd     de+sire      pro+long
      ex+plain     ad+vance    re+venge     re+lax
```

This type of destressing, which is quite pervasive in initial positions, has often been collapsed with initial pretonic (Pre-Stress) destressing. In our framework, initial pretonic destressing of light syllables is an automatic effect of the weight-stress relation as formulated in (88). That is, no special rule is required to destress the initial syllable of *banána* etc. But prefixes require a special rule since many are heavy by syllable composition, containing an underlying long vowel (*re-*, *de-*) or a short vowel and consonant(s) (*con-*, *ex-*, etc.).

We will assume that a rule of deweighting is involved. This rule must be lexical, since it refers to morphological information and shows lexical variation. The lexical variation occurs both among prefixes and among words derived by identical prefixes. The prefix *trans-* never reduces, while lexical variation exists among words with vowel-initial prefixes such as *ab-*, *ad-*, *ob-* (Liberman & Prince 1977).

(183) **Prefix Deweighting**

```
[...]Prefix
  σ
  |⍀
  m m
```

The deletion of the second mora implies the reassociation with the remaining mora of the melody originally linked to the deleted mora. In long vowels no reassociation takes place since the vocalic melody was already linked to the first mora. The result will be a short vowel. In closed syllables, the consonantal melody will reassociate with the first mora:

```
(184)a.   σ     =>    σ          b.      σ     =>    σ
         /|\         /|                 /|\         /|
        / m m       / m                / m m       / m
       /  | /      /  |               /  | |      /  |\
      r   e       r   e              k   o n     k   o n
```

What about the location of Prefix Deweighting in the lexical component? It is attractive to assign the rule to level-1, where it would feed the Arab Stress Rule in cases such as (185ab):

```
(185)a.      re:+cogn+i:ze    b. récognìze    c. reconcile
        PD   re +cogn+i:ze       designate       demonstrate
        ASR  récognìze           devastate       promontory
```

However, strict cyclicity (i.e. the Elsewhere Condition) is probably a serious objection to this strategy, as deweighting applies in an underived context. For this reason we will assign the rule to level-2, where it accounts for the reducibility of cases such as (182).

11. Weight increases

Stressed short vowels in open syllables attract a consonant from the following stressless syllable, whereas stressless closed syllables lose their weight and reduce. The former option, consonant resyllabification, is well-attested (Hoard 1971, Stampe 1973, Kahn 1976, Donegan and Stampe 1978, Selkirk 1982, Borowsky 1986, Myers 1987), as well as motivated by allophonic variation (flapping versus aspiration) in pairs such as *átom* versus

atómic. The resyllabified consonant ends up as ambisyllabic (Kahn 1976), and may feed a variety of post-lexical rules, such as flapping (Borowsky 1986).
Recent research suggests that consonant ambisyllabicity is a cyclic rule which triggers vowel shortening in closed syllables (Myers 1987). Within the mora theory, the rule can be formulated on the foot domain as below:

```
(186) Consonant Resyllabification

      (*        .)      (*         .)
      σ         σ   =>  σ          σ
      |        /|       |\        /|
      m       / m       m m      / m
      |      /  |       |  \   /   |
      V    C    V       V    C     V
```

Its effect is a weight *increase* in the stressed syllable attracting the consonant. As indicated by Myers, the ambisyllabicity is undone as soon as the context of the resyllabification rule is no longer met. This may invite an interpretation of (186) as a wellformedness condition on the syllabification of intervocalic consonants.
This concludes our discussion of weight increases affecting stress.

12. Word rhythm and word-internal prominence relations

12.1 Introduction

English words exhibit a general tendency for the initial syllable to be rhythmically strong unless the primary stress follows immediately. That is, if more than one stressed syllable occurs before the primary stress, a rhythmic principle subordinates medial stresses to initial stresses, cf. chapter 1 (113, 179):

```
(187)a.          *       b.          *
          *      *             *     *
          *   *  *             *  *  *  .
         chimpanzee         condensation
```

Hayes (1984) analyses the initial rhythmic beat in both underived words (cf. 187a) and derived words (cf. 187b) by the same type of operation: Rhythmic Adjunction. In the following sub-sections we will investigate the properties of word-internal Rhythmic Adjustment, and its relation to destressing. Rhythmic Adjustment produces constituents on a level in the grid above the syllable level. As these constituents are strictly binary by their source, viz. adjunction, we strengthen our central claim that stress constituency is strictly binary.
We will first summarize and, where necessary, extend the data bearing on this issue. Then we we present an analysis which splits up word-internal Rhythmic Adjustment between two components: the lexical level-2 stratum, and the post-lexical stratum.

12.2 Observations about word-internal rhythm

In chapter 1 section 4.2, we have discussed prominence relations between subordinated stresses. The generalizations made there were that a strong tendency exists towards a 3-4-1 pattern, except when the initial stress is directly followed by a stress preceding a stressless syllable. Hence in *Ticonderoga*, cf. chapter 1 (113), both 3-4-1 and 4-3-1 are possible. We also discussed the fact that cyclically derived words of identical segmental composition are generally 4-3-1 only, cf. *sensationality* chapter 1 (178b). Still, the generalizations made there are not precise enough for our present purposes - analysing word-internal prominence - and will therefore be partly replaced by new ones in this section.

The following generalizations govern word-internal prominence relations, both in underived words and in cyclically derived words:

(188) a. Initial branching feet attract prominence.
b. Sequences of two stray syllables take initial prominence.
c. Initial light stray syllables reject prominence when followed by branching feet.
d. Initial heavy stray syllables take optional prominence when followed by branching feet.

Before accounting for these generalizations, we will support them with examples. The examples fall in two distinct categories: (a) underived words, in which Rhythmic Adjustment applies in its 'Beat Addition' mode, (b) words with embedded cyclic domains, in which Rhythmic Adjustment applies in its 'Rhythm Rule' mode. After comparing words from both categories with similar prosodic structures, it will become clear that hardly any differences exist between the Beat Addition and Rhythm Rule modes, which supports their unification by Hayes (1984) into Rhythmic Adjustment. Of course, these results abstract away from the existing differences between underived words and derived words in the distribution of stressed syllables as such.

As discussed in chapter 1, section 4.3.1, Kiparsky (1979) points out that underived words with two stressed syllables before primary stress exhibit a general initial rhythmic beat, except for words such as *Ticonderoga* and *Dodecanesian*, in which variation exists as to the strongest non-primary stress ('0' indicates absence of stress, i.e. stressless syllables).

```
(189)a.  3  4  1    b.  3 0 4  1  0   c. 3 0 4  0 1 0   d. 3 4  0 1 0
     chimpanzee      Halicarnassus     Apalachicola       Ticonderoga
                                                           4 3  0 1 0
```

However, this optionality does not hold if the initial syllable is light, in which case the initial syllable reduces, cf. chapter 1 (63c):

(190) **Mo**nòngahéla **a**mànuénsis **A**tàscadéro

Rejection of prominence by initial light syllables stands in contrast with the general 3-4-1 pattern that is found when the second stress does not head a branching foot, but is followed by a single heavy syllable:

(191) à**nàx**ágoras e**pen**cephalon o**don**tology
a**nal**gesia me**sen**cephalon ra**con**teur

Clearly the weight of the initial syllable is relevant only in words with initial single syllables followed by branching feet:

(192) **Beat Addition in underived words**

		3 4 1 σ σ σ	3 4 0 1 σ σ σ σ	3 0 4 1 σ σ σ σ	3 0 4 0 1 σ σ σ σ σ
weight of the initial syllable	Light	obligatory	excluded	obligatory	obligatory
	Heavy	obligatory	optional	obligatory	obligatory

Kiparsky (1979) claims the distribution of non-primary prominence to be slightly different in words with internal cyclic structure, cf. chapter 1 section 6.5.1. Here, words comparable to (underived) *Ticonderoga* are claimed to lack variation, and have 4-3-0-1 patterns. However, as indicated by Halle & Vergnaud (1987), many examples of the relevant kind do exhibit the same rhythmic variation as occurring in underived words:

(193)	àccèntuátion	iconoclastic	totalitarian
	anticipation	inferiority	transfiguration

Perhaps surprisingly, only few examples with initial heavies support Kiparsky's claim, occurring in Kenyon & Knott as they do with only a single stress contour 4-3-0-1. Some of these are in (194):

(194)	ègàlitárian	posteriority	superiority
	hypothecation	somnambulation	

Interestingly, the predominance of the 3-4-0-1 pattern in *inferiority* and other words of this type is explicitly denied in Kenyon & Knott, p.xxv:

(195) "Shifting or variable secondary accent often occurs in such words as *a,cade'mician*, *,anastig'matic*, *,impecca'bility*, *,impenetra'bility*, *,incompre'hensible*, *,incorpo'reity*, *in,feri'ority*, where in longer words the secondary accent precedes the primary. Here, in actual speech, such alternative accentuations as *a,cade'mician* or *,acade'mician*, *,impenetra'bility* or *im,penetra'bility*, *in,feri'ority* or *,inferi'ority* are very common, and do not represent more or less desirable pronunciations, but chiefly show the effect of varying sense stress, emphasis, speech rhythm, semantic distinctions, and other constantly varying factors of connected speech, so that in many such instances the question which accentuation is preferable is irrelevant."

A general restriction is found in the sources with respect to initial light syllables in cyclically derived words. These reject prominence, and their initial syllables reduce:

(196)	adáptable	-	adàptabílity	collective	-	collectivistic
	accountable	-	accountability	columniate	-	columniation
	amalgam	-	amalgamation	manipulate	-	manipulation
	amortize	-	amortization	domestic	-	domestication
	appendix	-	appendicitis	effectual	-	effectuality
	approximate	-	approximation	sophisticate	-	sophistication
	capitulate	-	capitulation			

Apparent counterexamples such as the words in (197) can all be related to embedded words whose medial syllable is *stressless*. That is, *academician* can be related to both *acádemy* and *àcadémic*, corresponding to two stress patterns in the derived word (cf. Fidelholtz 1967):

(197) a.	àcademícian	-	àcadémic	b.	acàdemícian	-	acádemy
	àristocrátic	-	áristocràt		arìstocrátic	-	arístocràt
	àrithmetícian	-	àrithmétic		arìthmetícian	-	aríthmetic
	cànalizátion	-	cánalìze		canàlizátion	-	canálìze

The second syllable in such words may be reduced.
Words whose initial foot branches (*artificiality*, *representation* etc.), all exhibit internal rhythm, are are marked with a secondary stress on the initial syllable in Kenyon & Knott.

Internal rhythm is also exceptionless in words such as *condensation*, comparable to underived *chimpanzee*, in which the initial syllable is heavy (187a-b).
Turning to words with initial light syllables, the weight of the medial syllable suddenly becomes relevant. Again, rhythm is exceptionless if the *medial* syllable is light (*Japanese* etc.). But among cyclically derived words with *light* initials and heavy medials, four types can be distinguished.
The first type, words such as *annexation* (*annex*), exhibits 3-4-1 only:

```
(198) annex       - annexation       connective   - connectivity
      assent      - assentation      immortal     - immortality
      attest      - attestation      inactive     - inactivity
      collect     - collectanea      Melanchton   - Melanchtonian
      collective  - collectivity
```

The second type, and the only source of differences between underived and derived words, consists of words of the type *acoustician* (*acoustic*), which optionally vary between the contours 3-4-1 and 0-3-1:

```
(199) acoustic     - acoustician      ellipsoid    - ellipsoidal
      appoint      - appointee        elliptic     - ellipticity
      department   - departmental     elongate     - elongation
      destructive  - destructivity    erectile     - erectility
      domestic     - domesticity      eruct(ate)   - eructation
      elastic      - elasticity       illustrate   - illustration
      electric     - electricity      receptive    - receptivity
      sequestrate  - sequestration
```

Some of (199) can have the 3-4-1 variant only if the initial syllable contains a long vowel, hence is heavy.
The third type, words such as *apartmental* (*apartment*), even completely lack a 3-4-1, having a reduced initial syllable, 0-3-1:

```
(200) apartment    - apartmental      selective    - selectivity
      divorce      - divorcee
```

The fourth type, words such as *adaptation* (*adapt*), have occasional medial reduced closed syllables, in contrast with the tendency that closed syllables keep cyclic stress:

```
(201) adapt      - adaptation     evangely     - evangelic
      affect     - affectation    present      - presentation
      molest     - molestation    lament       - lamentation
      deform     - deformation    catastrophe  - catastrophic
      commend    - commendation   adumbrate    - adumbration
      authentic  - authenticity   occult       - occultation
      inundate   - inundation
```

By their initial light syllables and their medial short vowels, the words of (201) match the Structural Description of the Arab Rule[41].
Let us summarize our observations about the word-internal Rhythm Rule:

(202) **The Rhythm Rule in cyclically derived words**

		3 4 1 σ σ σ	3 4 0 1 σ σ σ σ	3 0 4 1 σ σ σ σ	3 0 4 0 1 σ σ σ σ σ
weight of the initial syllable	Light	variation	excluded	obligatory	obligatory
	Heavy	obligatory	optional	obligatory	obligatory

The patterns of Beat Addition and the Rhythm Rule are identical except for two minor differences. Firstly, the variation exhibited by the RR in words with light initial and heavy medial syllables such as *annexation* (198), *acoustician* (199), *apartmental* (200), and *adaptation* (200), is absent in segmentally parallel underived words, which are always beat-initial. Secondly, the RR is slightly inhibited in words such as *iconoclastic* (193), whereas BA exhibits variation in segmentally similar words such as *Ticonderoga* (189d). Summarizing:

(203) **Beat Addition and the Rhythm Rule compared**

		3 4 1 σ σ σ	3 4 0 1 σ σ σ σ	3 0 4 1 σ σ σ σ	3 0 4 0 1 σ σ σ σ σ
weight of the initial syllable	Light	variation (BA: obligatory RR: variation)	excluded	obligatory	obligatory
	Heavy	obligatcry	optional (BA: free RR: inhibited	obligatory	obligatory

12.3 A comparison with phrasal rhythm

Comparing this pattern with the possibilities of the phrasal Rhythm Rule, a number of similarities and differences appear.

The first similarity is in the unrestricted rhythmic strengthening of initial binary feet, as occurs in the cases below (cf. Liberman & Prince 1977), chapter 1 section 3.1.1:

(204)a. Tennessée-Tènnessee áir b. achromátic-àchromatic lénse.

The second similarity is in the inhibition of rhythmic strengthening of a syllable followed by a binary foot. The inhibition is absolute in case of an initial light syllable (205a), and only relative in case of an initial heavy syllable (205b,c):

(205)a.	acídic *àcidic chémicals	b. Montána *Mòntana cówboy	c. Salvátion Sàlvation ármy

The differences between phrasal and word-internal rhythm are entirely in the strengthening of single syllables followed by single syllables. As opposed to word-internal rhythm, the phrasal Rhythm Rule is entirely excluded in words with a light initial syllable (206a) and subject to lexical variation in words with an initial heavy syllable (206b,c).

(206)a.	benígn *bènign túmor	b. uníque *ùnique stóry	c. bambóo bàmboo tábles

As will be clear, the disyllabic words of (206) and the trisyllabic words of (205) behave largely alike. This observation is due to Hammond (1984). The difference of pattern (206) with word-internal rhythmic patterns resides in the absolute blockade of shift to initial light syllables and the relative blockade of shift to initial heavy syllables.

These differences are at the root of analyses such as Kiparsky (1979), cf. chapter 1 section 6.5.2, and Hammond (1984), cf. chapter 1 section 5.7, which 'sandwich' Pre-Stress Destressing in between word-internal and phrasal applications of the Rhythm Rule. However, it will be clear that the reluctance of words such as *Monongahela* and *manipulation* to undergo initial strengthening poses a problem to this type of analysis, since these cases seem to require an application of initial destressing before word-internal rhythm.

12.4 An analysis

12.4.1 Introduction

Our analysis is based on the idea that word-internal rhythmic patterns arise partly by post-lexical applications of Rhythmic Adjustment. Only a restricted number of word-internal applications will take place at the lexical level-2. A typical diagnostic of post-lexical rules is that they are sensitive to *strings of words* instead of being restricted to single words. Typically, they apply across word-boundaries. Furthermore, they exhibit *optionality* instead of lexical variability.

We will show that applications of word-internal Rhythmic Adjunction which affect branching constituents display post-lexical diagnostics, and are generally subjected to the same conditions as phrasal applications. However, word-internal applications between single syllables outside constituents must be lexical level-2, as lexical rules are unaffected by material outside the word, and are not optional, but instead display lexical variation between items. Our conclusion will then be that two differences exist between lexical and post-lexical modes of application of Rhythmic Adjustment. Firstly, post-lexical applications involve the association of actual pitch accents, a circumstance imposing the condition that the landing site be stressed, or rhythmically strong. Secondly, the lexical context of application is captured by the condition that all elements in the Structural Description are adjacent.

12.4.2 Lexical word-internal applications

Let us first discuss the arguments for assigning applications of Rhythmic Adjustment between single syllables to the lexical level-2 stratum. The class that provides evidence for this are words in which the primary stress is preceded by two single syllables outside binary feet. Among these words, the ones with initial heavy syllables are obligatorily subject to word-internal Rhythmic Adjustment. The words with initial light syllables display lexical variation with respect to rhythm only when the second syllable is heavy, and the word is cyclically derived, cf. (199). Let us consider the representations of some derived words after Prominence Flattening (167):

```
(207)a.      *      b.      *      c.       *        d.       *
           . . *          * . *           .  *(*  .)       *  * (* .).
           v v -          - v -           v  - -  v        -  -  v v v
          Japanese       Sudanese        annexation       abnormality
```

The possibilities of vowel reduction in *Japanese* are completely reversed as compared to its base word *Japan*. Whereas the base word has a reduced, stressless initial syllable and a stressed second syllable, the derived word has a non-reduced, stressed initial syllable and a stressless second syllable. This reversal has been analyzed in metrical theory as involving a rhythmic shift between feet, followed by a destressing of non-prominent feet and vowel reduction (as in Kiparsky 1979), cf. chapter 1, section 6.5.2.

An argument for the lexical nature of the word-internal rhythmic process applying in the words of (207) is its obligatory nature. Although lexical variation may exist among words of the type (207c) this variation should not be confused with optionality. First, words occur for which no 3-4-1 contour exists, cf. *apartmental* (200) and second, words occur which only show a 3-4-1 contour, cf. *annexation* (198). Lexical variation and exceptionality go hand in hand for lexical rules.

Since the reducibility of the initial light syllable in *Japanese* remains unaffected by the presence of (final) stress in preceding words in a phrasal context (_*réal J[ə]panése_), no post-lexical properties can be advanced to counterbalance the lexical properties at all.

In our theory without monosyllabic feet, the option of prominence reversal between feet is excluded. Nevertheless, we can employ level-2 Rhythmic Adjustment as a mechanism of strengthening initial syllables.

Now we have to specify the additional condition of Rhythmic Adjustment in the lexical stratum to capture the context of application discussed above.

(208) **Rhythmic Adjustment** (lexical version)
In the configuration ... X Y DTE ..., adjoin Y to X,
where X, Y, and DTE are in adjacent grid columns.

This rule is identical to the post-lexical version (80), with the only difference that it requires the two grid elements to be adjoined, and the following primary stress, to be in adjacent grid columns. This will restrict it to the proper type of word, i.e. (207). It applies as below:

```
(209)a.                       b.                         *
           *             *              *         (*  .) *
       . . *        (* .)*        *  * (* .).      *  * (* .).
      Japanese  =>  Japanese      abnormality  =>  abnormality
```

In (209a), Rhythmic Adjustment applies to line 0 grid elements. It can apply at this level in the grid, since the rule does not mention any level of application. Hence the result of Rhythmic Adjustment cannot be distinguished from the result of Light Syllable Adjunction here.

In (209b), the rule applies one level higher as compared with (209a). This level of application is forced because an illformed grid would result from the application to line 0 elements. More specifically, the output of line 0 application would violate the wellformedness condition (88) saying that heavy syllables bear stress. And since Rhythmic Adjustment does not mention a syllable weight class in its structural description, as opposed to Closed Syllable Adjunction, it lacks the ability to adjust a heavy syllable's weight while adjoining. Therefore, Rhythmic Adjustment applies at line 1, and does not affect the stress on the medial syllable.

Now let us turn to words with initial light and medial heavy syllables, those of (198-201). We will not represent words such as *acoustician*, cf. (199), since their output structure vacillates between that of the types (198), cf. 3-4-1, and (200), cf. 0-3-1. The output of RA to these words is (210):

```
(210)a.      *      b.             c.
       (* .) *               *             *
        * * (*  .)     . *  (*  .)   (* .)(*  .)
        v -  v  v      v -   v  v     v -  -  v
        annexation     apartmental    adaptation
```

The actual input structure (207c) surfaces in *apartmental* (200), whereas (210c) appears to be the correct output structure of *adaptation* (201). We have shown earlier that (210c) violates the basic correspondence between stress and syllable weight, and should therefore not be allowed. Nevertheless, cases occur of closed, cyclically stressed syllables being reduced in a derived word. We hypothesize that the involvement of the Arab Stress Rule at level-2, where it should not apply, is due to the unstable input structure (207c). For Rhythmic Adjustment to apply to a line 1 element Y, some landing site X must be present at the same grid level. However, since the initial syllable is light and stressless, no required line 1 element occurs to the left. This leaves three options. First, a blockade of adjustment such as in *apartmental* in (210b). Second, an application violating the stress-weight relation. This is what seems to have happened to *adaptation* in (210c). Third, *annexation* (210a) may be seen as a reaction to this violation by raising the level on which the prominence relation between X and Y comes to be represented. Stress by weight can thus be maintained by a non-minimal grid structure.

We will now turn to post-lexical word-internal applications of Rhythmic Adjustment.

12.4.3 **Post-lexical word-internal applications**

Let us now discuss the arguments for assigning word-internal rhythm of branching feet to the post-lexical phonology. Words such as *Ticonderoga* optionally display the rhythmic patterns 3-4-0-1 and 4-3-0-1 in isolated words, as we saw before. But the internal 3-4-0-1 pattern is suppressed if a rhythmic beat is located closely enough in an adjacent word:

```
(211)a.                      b.               *
                   *             *            *
       *           *             *    *       *
       *------*----*             *    * *     *
       *    * *  * * *           *    * *  *  * *
      Fort Ticonderoga        ??Fort Ticonderoga
```

This important observation, which is due to Bolinger (1981), is given by Hayes (1984) in support of his theory of *Eurhythmicity*. The word-internal application of Rhythmic Adjustment is inhibited in (211) since no eurhythmic goal is achieved: no improvement is made with respect to the ideal that rhythmic beats occur at disyllabic distances, the so-called 'Disyllabic Rule'.

The phenomenon displayed in (211) clearly shows the post-lexical nature of the word-internal rhythmic realization in words such as *Ticonderoga*. In the first place, it is optional in the isolated word. In the second place, it is affected by prominences on adjacent words.

Both word-internal and phrasal strengthening of initial binary feet are rhythmically highly likely if not obligatory in domain-initial position. This is shown by the initial beats in *àpalachicóla*, *rèconciliátion*, and *àchromatic léns* for domains involving double binary feet, and for domains with a binary foot followed by a single stressed syllable in *ròdomontáde*, *rèpresentátion*, and *Tènnessee áir*. This strong tendency is attributed by Hayes (1984) to the Quadrisyllabic Rule, the tendency for grid marks to be spaced close to four syllables apart.

A second characteristic of phrasal rhythmic adjustment is found in word-internal patterns such as *Monòngahéla*, cf. (190), and *manìpulátion*, cf. (196). Here the absolute rejection of prominence from a light (reduced) initial syllable matches a similar blockade of phrasal rhythm in *acìdic chémicals*, cf. (205a), and *benìgn túmor*, cf. (206a).

A third property of phrasal rhythm is its lexically governed inhibition when strengthening single heavy initial syllables. Here we cannot appeal to vowel reduction to account for blockades such as **Mòntana cówboy* and **ùnique stóry*, for the simple reason that these initial syllables are not reduced. Evidently, such rhythmic blockades are related to the status of the initial syllables as stray, outside binary constituents. This must be so because no inhibitions occur in initial binary feet[42].

Kaisse (1987) draws the conclusion that words are marked individually for their potential of undergoing rhythm, thus allowing for post-lexical rules with lexical exceptions, which is an undesirous situation from a theoretical point of view. Moreover, this solution leaves unexplained Hammond's observation that variability is restricted to words containing non-reduced upbeat syllables.

Hammond (1984) proposed to express the distinction in terms of stress: *Montana* and *unique* contain initial stressless syllables, but they do not reduce since the (late) vowel reduction rule is sensitive to syllable weight. This captures the fact that inhibitions to the Rhythm Rule only occur if a clash is present in the word undergoing the rule, as destressing strictly depends on clash. Application of the Rhythm Rule in *bamboo* and *salvation* can then be attributed to these words being exceptions to destressing, instead of rhythm. Hammond thus drops the strict correspondence between stress and vowel reduction, while adhering to the correspondence between stress and rhythm. However, this analysis runs into the problem that exceptions to initial destressing are expected to occur among initial *light* syllables as well, predicting the existence of light-initial words undergoing phrasal rhythm. As far as we know, however, such cases do not occur.

Hammond's account of phrasal rhythm is not available in our theory, since stress and syllable weight are directly linked up. Instead, we will assume that the blockades are related to principles of phrasal rhythmic strength in the grid. The obvious generalization is that phrasal prominence can be shifted to syllables which have (a) stress by prominence (primary stress) or (b) stress by binary constituency (heads of feet). Now consider (212) as a theory of phrasal grid strength.

(212) **Grid Construction** (Hayes 1984:35)

a. As a place marker, assign every syllable on the lowest level of the grid.
b. Assign a mark at level two to the strongest syllable of every phonological word.
c. Assign sufficient additional marks so that the strongest syllable of every constituent labeled S has a higher column than the strongest syllable of its weak sister.

Notice that (212), which is designed for mapping *arboreal* prominence into grids in a *trees-and-grids* framework, does not mention foot-level stress as a sufficient condition for rhythmic prominence. This is a significant fact, to which we will shortly return. The mapping of stress into rhythmic beats specifies exactly the two kinds of stress mentioned above (primary stress in b., constituent stress in c.). That is, these types of stress find an automatic expression in the grid as rhythmic pulses. We will incorporate this distinction into bracketed grids by an interposition of a beat-level in between the level of 'foot-stress' (i.e. line 1) and the level of 'prominence-stress' (i.e. line 2):

```
(213)a.    b.          c.          d.        e.          f.
      *          *           *         *          *                   *   PROM
      *     *    *           *         *          *             *     *   BEAT
      *    (* .)(*.)      * (* .)   .(* .).    .(* .)*      .(* .)(* .)  FOOT
    tree    Alabama    Montana    America   manipulate  manipulation
```

The rhythmic strength specified by (212) is a necessary condition for landing sites of phrasal rhythm. Furthermore, we will assume (212) to apply as early as level-2, being subject to the minimal condition (214):

(214) Only syllables with a foot-level stress can have a rhythmic beat.

Hence syllables which are stressed by syllable weight can but need not be associated with a rhythmic beat. Nonprominent heavy initial syllables are essentially free to have a rhythmic pulse or not, which is expressed in their exhibiting lexical variation in this respect. It is only natural to find lexical variation where general principles such as (212) do not strictly determine the situation[43]:

```
(215)a.     *     b.     *       c.  *
            *         *  *           *
         * (* .)      * (*  .)     .(* .)
        Montana     Salvation     acidic
```

However, light syllables are denied any right to rhythmic strength since they lack the necessary property of stress. This result improves on the analysis by Hammond (1984), which predicts lexical variation even among initial light syllables.

Now we will apply this account to word-internal post-lexical rhythm. A direct effect of (212) and (214) is the fact that initial light syllables in words as *Monongahela* cannot be strengthened by post-lexical Rhythmic Adjustment (80), since they do not have a foot-level stress. In the post-lexical phonology, having a rhythmic beat, or being *accentable*, is arguably a necessary condition for rhythmic strengthening.

```
(216)           *
           *    *
         .(* .)(* .)
        Monongahela
```

When considering rhythmic strengthening in words such as *Ticonderoga*, we must both represent the 4-3-0-1 and 3-4-0-1 patterns and account for the relation between them. Here, the initial syllable is inherently stressed by its weight, so that it optionally has a rhythmic beat by (212-214), and it may be strengthened, cf. (217):

```
(217)          *                 *
        * *    *        (* .)    *
        *(* .)(* .)      *(* .)(* .)
      Ticonderoga => Ticonderoga
```

In order to account for the 4-3-0-1 perception of the input pattern, we will assume, with Selkirk (1984), that in a sequence of two stresses the one followed by a stressless syllable is perceived as more prominent.

Finally, consider the words in (218) below, with initial binary feet:

```
(218)a.          *                   *    b.        *              *
        *    *   *        (*     .)  *          *   *   *     (*    .) *
       (* .)(* .)(* .)    (* .)(* .)(* .)      (* .)*   *     (* .)*   *
       Apalachicola  =>  Apalachicola       rodomontade => rodomontade
```

In both cases a beat level element is adjoined leftward to another beat level element. Rhythmic Adjustment actually causes a flattening at beat level here.

12.5 Conclusion

This concludes our analysis of word rhythm and word-internal prominence relations. The most important result is that word-internal applications of Rhythmic Adjustment can take place both lexically and post-lexically, and that the stratum of application explains most of the differences in lexical and post-lexical contexts.

We have found that some types of word-internal Rhythmic Adjustment have the properties of phrasal, post-lexical Rhythmic Adjustment: sensitivity to the rhythmic strength of the landing site, eurhythmic conditions, optionality, and the rhythmic inhibition by stresses in words that are adjacent in the phrase. This complex of properties is absent in other word-internal applications, where the primary stress is preceded by two syllables. Here, obligatoriness, lexical variation, and the feeding relation to vowel reduction all point to a lexical status of such word-internal Rhythmic Adjustment.

13. Conclusion

The analysis of English word stress that has been proposed in this chapter is embedded in a compositional theory of stress. This theory views syllable weight and constituency as two (fairly independent) aspects of stress in the following ways. First, it restricts constituency to binary size, as a result of the assumption that all stress constituency results from one type of operation: metrical adjunction, which has Syllable Adjunction as an important instantiation. Second, it formalizes the relation between syllable weight and stress by a wellformedness condition. This governs the stress values of stray syllables outside constituents, and it imposes deweighting on closed syllables that are stressless adjuncts in binary constituents. As we have shown, these assumptions, together with general conditions, such as the Free Element Condition, the Strong Domain Principle, the Maximality Principle, and the Elsewhere Condition, account for much of the complexities of the English word stress system. A summary of the major rules and principles of the stress phonology of English is below:

(219) **Lexical phonology**

Level-1	Inherent stress by syllable weight (88)
	Light Syllable Adjunction (89)
	Closed Syllable Adjunction (86b)
	End Rule (Final) (10)
Level-2	Inherent stress by syllable weight (88)
	Light Syllable Adjunction (89)
	Prominence Flattening (167)
	Medial Shortening (178)
	Sonorant Coalescence (180)
	Prefix Deweighting (183)
	Consonant Resyllabification (186)
	Grid Construction (212-214)
	Rhythmic Adjustment (208)

Post-lexical phonology

	Vowel Reduction
	Rhythmic Adjustment (80)

Let us now return to the two central problems that were signalled at the end of chapter 1, and see how our analysis has dealt with them.

First, a problem with respect to the interaction between syllable weight and binary counting rules existed. On the one hand, heavy syllables are best interpreted as basically stressed, but on the other hand at least some closed syllables can be *destressed* prior to prominence assignment. Since rules applying before primary stress assignment are, in the terms of Prince (1985), rules of primary metrical analysis, the question arose what licenses destruction of stress constituents prior to primary stress assignment. Furthermore, we needed an explanation for the fact that such constituent destruction shows contextual sensitivity for stresses, as is exemplified by the Sonorant Destressing context.

A solution to these problems came from the assumption that constituency is strictly binary. Therefore, the Free Element Condition will not allow rules of primary metrical analysis to apply to syllables inside a binary constituent, but it will allow these rules to apply to stray syllables.

We assumed that the rules of primary metrical analysis scan through the word in two passes: after the first pass of Light Syllable Adjunction, a second pass of Closed Syllable Adjunction occurs. Crucially, the latter rule deviates from the former by directly referring to the weight of the syllables that it adjoins. This allows it to destress heavy syllables of a certain type, and also deweight them. But the Free Element Condition keeps this rule from destroying binary constituents, which produces the complicated Sonorant retraction pattern that earlier analyses could only stipulate as contextual restrictions on Sonorant Destressing.

The second problem involved similarities between stress and destressing as to Q-sensitivity and binarity, which earlier analyses were unable to deal with. Our proposal eliminates at least three rules which in earlier analyses could only be stated as rules of metrical reanalysis. We showed that Pre-Stress Destressing is actually superfluous, and that Sonorant Destressing and the Arab Rule are actually rules of primary metrical analyses, feeding primary stress assignment. The latter conclusion is of much importance, as it eliminates rules destroying constituency from the rules of primary metrical analysis, or the rules feeding primary stress assignment. A fourth destressing rule, Post-Stress Destressing, involves metrical reanalysis, but we showed that it can be formalized as a level-2 reapplication of Light Syllable Adjunction.

In the next chapters, we will analyse the Dutch word stress system with the help of these assumptions. As we will see, the Dutch system provides additional support for our theory of word stress.

Footnotes to chapter 2:

1 In order to be generalizable to the Arab Rule, chapter 1 (156), (6) is in need of an additional condition on the weight of the landing site syllable - which must be light - when the adjoined syllable is closed by an obstruent.

2 Travis (1983) and Piggott & Singh (1984) propose a similar (but non-moraic) analysis - they incorporate sonorants in the syllable nucleus.

3 In the latter case, a more accurate representation would be:

```
(i)  σ
     |
     m
   / |
 Co  C
   [+son]
```

4 But non-lexical items can have such a form ("a", "the", etc.).

5 Cases such as *infírmary* (*infírm*) and *etérnize* (*etérne*) will be held out of the examples, since these may well involve 'stress-neutral' affixation, so that they are no clear cases of Weak retraction.

6 The examples marked "BE" are British English examples taken from Jones (1977).

7 An intrusive stop may be involved in *asymptote* and *palimpsest*, which would turn these words into regular cases of Sonorant retraction.

8 The examples marked "AE" are American English examples taken from Kenyon & Knott (1944).
9 Most of the above words have a distinctly *learned* character, making them suspect pieces of evidence in favor of Weak retraction. This observation is due to Bruce Hayes (personal communication).
10 *confiscate*, *illustrate*, *obfuscate* are vacillating verbs.
11 Notice that the resyllabification rule must be cyclic, since stress is preserved on the medial syllables of *attestation*, *elasticity*, etc.
12 Strong retraction across long vowels is very difficult to demonstrate in underived words, since alternations are quite rare.
13 Exceptions are *émendàte* (*eménd*) and *ádvertìse* (*advért*).
14 The lexically governed nature of the alternations in (30) is clear from nonalternating pairs such as below:

(ii) des[í:]rous (des[í:]re) betrayal (betray)

15 Rare exceptions of stress-neutral stress placement are *házard-házardous* and *chívalry-chívalrous*). As shown, the cases of (16) are not per se cases of closed syllables being skipped.
16 This suggests a relation with another well-known shortening rule, Trisyllabic Laxing, cf. SPE, Kiparsky (1982). We will not go into this, however.
17 Potentially, a non-initial heavy syllable may suffice as well; however, this presupposes quantity-sensitivity of stress retraction leftward of the focus of Sonorant Destressing. In the literature where such Q-sensitivity is assumed (Selkirk 1984 etc.) this extra possibility has never been worked out, probably because relevant cases are so rare.
18 *admínistràte*, a weak retracting verb with an obstruent instead of a sonorant in the relevant syllable, may be related to *mínister* in the same way as *órchestràte* is related to *órchestra*. Alternatively, if /s/ is part of the following onset, it simply involves Weak retraction.
19 The sole case of long retraction *pátriarchàte* may be related to *pátriàrch* by stress-neutral suffixation.
20 *Elephantiasis* (with an optionally reduced pretonic syllable) may well be related to *elephant*. Fidelholtz (1967) cites *elecampane* with an unreduced pretonic syllable, as in Jones (1977) for British English.
21 The vowel quality of the /I/ in *indignation* does not clearly present itself as reduced, since /I/ may well function as a reduction vowel itself. Notice furthermore that *diagnosis* parallels *diagnose* (12a) in being a (rare) positive exception to the Arab Rule.
22 The final three words of (45b) may well be cyclically related to *ápophthègm*, *díaphràgm*, and *páradìgm*; still they are of some relevance since the obstruent /g/ closing the VObs syllable only surfaces in the derived form.
23 In section 4, it will be argued that these destressing rules actually adjust syllable weight.
24 Travis (1983) has proposed a similar scale for syllable strength.
25 This condition can be traced back to older stages of English, and even to early Germanic. See for a recent analysis Dresher & Lahiri (1986).
26 Van der Hulst (1984) elaborates this idea of 'main stress first'.
27 We are aware that dominance inversions may lead to foot types explicitly excluded in the asymmetric foot inventory of Hayes (1985, 1987), as is the case with the quantity-insensitive Iamb in Maranungku. It appears however that this foot type should be allowed universally anyway, as it is essential in Winnebago, because of its 'antepeninitial' stress.
28 According to Voegelin (1935), as cited in Prince (1983), all stresses are equally strong.
29 The allophonic contrast between the aspirated [t^h] of *veto* versus the flapped [D] of *motto* is mostly interpreted as one involving the presence versus absence of stress on the following vowel (see for instance Selkirk 1980, who relates these allophonic variants to foot structure).
30 A related function is to provide landing sites for the rules of secondary prominence and for the phrasal Rhythm Rule in phrases such as *bàmboo tábles* (*bàmbóo*). We will come back to these in some detail in later sections.
31 For the moment, final syllables (*gymnast-tempest*) are left out of consideration, as these interact with consonant extrametricality, to which we will come back in section 5 below.
32 Such words with initial light syllables are quite rare, a fact observed by Oehrle (1972), cf. chapter 1, section 3.1.2.
33 This has been noticed earlier in Steriade (1988).
34 The pretonic syllables of (125) have been represented without the prominence that they inherit from the stress cycle. We will discuss their way of losing this prominence in section 9.
35 We do not wish to speculate on potential consequences of this conclusion to other cyclic rules than stress rules.

36 Some evidence exists that only prominence, not stress as such, is to be counted for the purposes of the Elsewhere Condition. Stress rules on the outer cycle can be fed by phonological rules which cause weight adjustments, and consequently destressing, under our assumptions.
Some interesting cases of cyclic stress rules being fed by deweighting rules are below. In (ia), vowel shortening, triggered by suffix, cf. section 2.1.4, is fed by deweighting, in (ib) resyllabification, taking away the closing consonant of the final stem syllable:

```
(iii)a. cóntemplàte - contémplative     b. démocràt   - demócratìze
        compensate  - compensatory         diplomat   - diplomatize
        alternate   - alternative          telegraph  - telegraphy
                                           maniac     - maniacal
```

These examples seem to imply that stress is automatically lost by weight decreases, without the Elsewhere Condition blocking this destressing.
37 See for a similar view Prince (1983:88).
38 The Maximality Principle rules out ungrammatical rhythmic adjustments in phrases, for which we refer to Hayes (1984) and Kager & Visch (1988).
39 In phrases, specific prominences are immune to rhythmic shifts in a way strongly reminiscent of the blockades discussed above in relation to metrical reanalysis in words. The Strong Domain Principle is motivated by blockades of the Rhythm Rule in cases such as (iab) below, to be contrasted with the cases of (icd):

```
(iv)a. *one thìrteen Jáy Street   b. *Tòm Paine Street Blúes
    c.  two bàmboo tábles         d.  Tòm Paine Road Blúes
```

Kager & Visch (1988) show that these contrasts are due to differences in metrical constituency and tree labeling. The SDP is supported by phrasal rhythmic adjustments in English and Dutch.
40 As mentioned earlier this stress contrast is restricted to AE.
41 The observation that the Arab Rule may be involved in (201) is attributed by Ross (1972:256) to Kiparsky, who (1979:429) refers to unpublished work by Fidelholtz.
42 Hammond observes that heavy initial syllables in words which fail to undergo rhythm (*unique*, *grotesque*, *forlorn*, *baboon*, *overt*, *urbane* and *supreme*) nevertheless reduce somewhat more easily than heavy syllables in words which can undergo rhythm (*bamboo*, *abstract*, *Maltese*, and *Chinese*), which is confirmed by the reduced variants of *forlorn* and *baboon* in Kenyon & Knott. This situation clearly points to some relation between reducibility and behavior with respect to the phrasal Rhythm Rule. Notice that Kenyon & Knott give *overt* as non-reducible, and with the addition *'o,vert 'act*, hence as undergoing rhythm.
43 Interestingly, many of the words with initial heavies that can undergo rhythm have internal cyclic structure (*Chinese*, *Maltese*, *unkind*, *transparant*, *salvation*, *simplistic*, etc.). This observation can be traced back to Liberman & Prince (1977), who notice that rhythm is quite possible within words composed of two lexical items (*good-looking lifeguard*), and is restated in Kiparsky (1979) and Kaisse (1987). As a general trend, lexical transparency increases the possibilities of words undergoing the Rhythm Rule.

Chapter 3
Syllable structure and weight restrictions in Dutch

1. Introduction to the chapters on Dutch

In this chapter we will turn to the second stress system to be closely analysed in this study, the word stress system of Dutch. Our interest in Dutch primarily involves the following aspects. First, Dutch has an interesting syllable weight distinction: open syllables with long (non-diphthongal) vowels are light, and closed syllables and syllables with diphthongs are heavy. Although this distinction is universally rare (McCarthy 1979, Hyman 1985), it can be well-motivated, as we will show. In three subsequent chapters, this distinction will be discussed from three different angles: syllable structure in this chapter, primary stress placement in chapter 4, and secondary stress and vowel reduction in chapter 5. Closed and diphthongal syllables will be shown to behave as systematically heavier than open non-diphthongal syllables, which fits in well with our hypothesis that stress is an automatic effect of syllable weight. We will argue, with Lahiri and Koreman (1987), that this 'odd' weight distinction can be effectuated by the fact that Dutch has no short vowels in open syllables at level-1, where stress assignment takes place. This will be shown in this chapter. Therefore, Dutch lacks the 'usual' mora count distinction (as in English) between light monomoraic syllables and heavy bimoraic syllables, and another, non-moraic, distinction can take over. In chapter 4, after having demonstrated the relevance of this weight distinction to primary stress, we will formalize it in terms of 'melodic complexity'. This non-moraic notion of syllable weight refers to the number of feature matrices (or root nodes) that are linked to a syllable. Since long non-diphthongal vowels have only one feature matrix, and closed syllables and diphthongs (minimally) two, the latter are heavier. In chapter 5, we will extend the relevance of this weight distinction to secondary stress and vowel reduction.

The second interesting aspect of Dutch, to be discussed in chapter 5, is its optional vowel reduction, and its different reduction hierarchies according to stress, position, and vowel quality. Interestingly, a reduction hierarchy exists among stressless syllables in different positions in the word, which can be made up from reduction orders among identical vowels. Crucially, syllables in adjunct positions (those aligned with an adjoined line 0 element in a constituent) reduce systematically better than syllables in stray positions (those aligned with a line 0 element outside a constituent). The distinction between adjunct and stray stressless positions is a distinguishing property of our theory, particularly the Strict Binarity Hypothesis. Therefore, we take reduction orders referring to adjunct and stray positions as independent evidence for our theory.

The third interesting property of Dutch is the behavior of lexical schwa with respect to syllabification and stress. Schwa behaves as if absent at level-1, where primary syllabification and stress assignment reside. As shown by Kager & Zonneveld (1986), consonant clusters before schwa are part of the preceding syllable at level-1. This appears from various restrictions on consonant distribution, and from the fact that pre-schwa consonants add to the weight of the preceding syllable, which is obligatorily stressed if penultimate. Furthermore, schwa cannot be stressed itself. In spite of its invisibility at level-1, schwa cannot be a product of some late epenthesis rule, since its distribution is largely unpredictable. Our analysis of syllabification, to be presented in this chapter, will account for this complex of observations by one single assumption, that schwa is weightless at level-1, and syllabified by default rules only at level-2.

The exposition of the following chapters is as follows. In this chapter, we will analyse syllable structure of underived words and words derived with level-1 suffixes - essentially 'stress-sensitive' suffixes. These words have a much more restricted syllable structure than those derived at level-2, and are also the domain of the stress assignment rules to be discussed in chapter 4. We will discuss three aspects of Dutch syllable structure. First, the 'bimoraic minimum', or the absence of short vowels in open syllables. We will formalize this well-known observation by means of an obligatory level-1 rule of Core Syllable Formation, which is fairly similar to weight-by-position (Hayes 1989), but ordered before Onset Formation. Second, *maximum* weight constraints holding at level-1, which will be related to combinatory restrictions on consonant clusters outside the bimoraic core syllable. Third, the behavior of schwa with respect to syllabification. As mentioned above, schwa behaves as if absent at level-1, and we will formalize this observation by rendering schwa moraically weightless at level-1, and having it syllabified only by level-2 default syllabification.

In chapter 4, we will turn to primary stress assignment in Dutch. After having introduced the basic data and generalizations, we will propose an analysis within the compositional framework of stress, as introduced in chapter 0, and applied to English in chapter 2. The weight distinction between (light) non-diphthongal open syllables and (heavy) closed and diphthongal syllables will be formalized in terms of melodic complexity, as mentioned above. A level-1 Syllable Adjunction rule will be proposed similar to English Light Syllable Adjunction. Although this set of level-1 stress rules is relatively simple, it accounts for the basic distributional generalizations governing the location of primary stress, which will be independently motivated by 'mispronunciation' data and new words, such as trade names. We will conclude this chapter by a detailed discussion of stress patterns deviating from the 'minor' generalizations but still falling within the 'major' generalizations. To account for the relative markedness of such patterns, we will propose two devices: lexical stresses and lexically governed late extrametricality. Crucially, such devices are weak enough not to annihilate the major generalizations of Dutch stress. In this sense, they substantiate the partly 'free' nature of Dutch stress.

Chapter 5 will address secondary stress and vowel reduction. These phenomena will provide independent evidence for the rules that were used in the analysis of primary stress in chapter 4. First we will show that secondary stress essentially recapitulates the binary, Q-sensitive nature of the rules motivated for primary stress, and that an extension of these rules to the remaining parts of the domain directly yields much of the distribution of secondary stresses. However, four types of level-2 adjustments are required to arrive at the surface secondary stress pattern: (a) a deweighting rule much like English Sonorant Coalescence, (b) a level-2 reapplication of Syllable Adjunction, (c) a so-called 'Dutch Arab Rule', and (d) a level-2 word-internal application of Rhythmic Adjustment. Then we will turn to vowel reduction hierarchies among stressless (reducible) syllables. We will show that level-2 reapplication of Syllable Adjunction, independently motivated for the distribution of secondary stresses, yields the distinction between stray and adjunct positions that vowel reduction refers to. More precisely, among two identical vowels, the one in an adjunct position reduces before the one in a stray position. This provides independent evidence for the Strict Binarity Hypothesis.

1.1 **Syllable structure in Dutch: an introduction**

Syllable structure in Dutch has been studied intensively in recent years (Trommelen 1983, Booij 1984, Van der Hulst 1984, 1985, Kager & Zonneveld 1986, Van der Hulst & Van Lit 1987). Syllable structure is quite important for the analysis of word stress, because of the central notion of *syllable weight*. This notion may be understood in two ways: as a notion relevant *internally* to the theory of syllable structure, and as a notion relevant *externally* to the theory of word stress. In this chapter only the former aspect of weight will be discussed, leaving the second aspect to chapter 4. The view of Dutch syllable structure to be assumed throughout the stress analysis can be summarized as follows.

Cumulative results of work in progress describe the Dutch syllable as a (minimally and maximally) *bimoraic* entity, the first part of which is vocalic and the second part of which is chosen fairly freely.

Arguments for the claim that syllables are *minimally* bimoraic are found in the limited distribution of short vowels: (a) the absence of short vowels in open syllables and (b) the strong co-occurrence restrictions between short vowels and following consonants. This can be explained under the assumption that level-1 syllabification creates bimoraic constituents at an early level, thus requiring short vowels to be in closed syllables.

Our syllabification analysis, cast in a moraic framework (Hyman 1985, Hayes 1989), will have the bimoraic core syllable as its central notion. The Dutch syllable is a basically bimoraic constituent:

```
(1)      σ
        / \
       m   m
       |   |
       V  {V}
          {C}
```

The construction of this constituent has priority over syllabification of pre-nuclear (*onset*), and post-nuclear (*coda* or *appendix*) consonants. Furthermore, important distributional generalizations refer to the core syllable.

Our moraic analysis of syllable weight can be fully motivated only when we will discuss word stress and external syllable weight, in chapter 4. There we will claim the bimoraic core syllable to be the constituent governing the basic syllable weight distinction in Dutch.

Arguments for a *maximally* bimoraic syllable involve the near absence of *non-final* syllables containing more than two nuclear positions. The restrictions on non-final tri-positional syllables have been a topic of discussion during recent years. A number of authors reject restrictions on the third position in the syllable template, either implicitly (Booij 1981) or explicitly (Booij 1984, Van der Hulst 1984). Others (Trommelen 1983, Kager & Zonneveld 1986) impose restrictions, however. We will now review these positions, and conclude that tripositional non-final syllables cannot be completely excluded. However, we will show that most of the maximality phenomena analysed earlier as involving a *hierarchical* maximality constraint on syllable structure in fact follow from an essentially *linear* filter on consonant sequences outside the domain of the bimoraic core syllable. This filter restates a (traditional) observation which is nearly exceptionless, hence motivated independently of the somewhat less exceptionless maximum weight generalization. Again, the filter crucially refers to the bimoraic core syllable.

A major topic in analyses of Dutch syllabification, and a topic quite relevant to external syllable weight in stress assignment is the moraic status of final syllables containing schwa, *schwallables*, so to speak. Quite interestingly, schwa's distribution is unlike that of short vowels, as it behaves much like a long vowel when viewed from the word end (as observed by Trommelen 1983), and much like the word end when viewed from the preceding material (as observed by Kager & Zonneveld 1986). However, no analysis deals with schwa's ambiguous behavior by means of one single property, which is what we intend to do.

We will derive schwa's distribution from one property: moraic *weightlessness* at level-1. This property prevents schwa from being syllabified into a bimoraic core syllable, providing the key to its behavior as a non-short vowel. It will be shown that schwa's special distributional properties can all be traced back to this assumption. Schwallables arise only at level-2, after a default rule has assigned mora-status to them.

This analysis slightly weakens the maximally bimoraic generalization because crucially consonants must be adjoined as coda's to non-final syllables. The potential overgeneration of non-final *super-heavy* syllables will be trimmed however, by the linear filter on consonant sequences outside the bimoraic core syllable mentioned earlier.

We will illustrate how rules of level-1 syllabification obey the Free Element Condition, and how rules of level-2 syllabification do not. This assumption is instrumental in explaining the interaction in Dutch between the bimoraic minimality condition of level-1 syllabification on the one hand and the surface syllabification of intervocalic consonant clusters on the other.

This chapter is organized as follows. We will discuss the Dutch segment inventory, especially segmental specifications of vowels, in section 2. A bimoraic status of long vowels and diphthongs will be argued for, as well as a monomoraic status of short vowels. Section 3 will address issues of domain and level in syllabification. A distinction will be made between early *level-1* and late *level-2* syllabification. The former is restricted to *underived* lexical items, and words derived with level-1 affixes. We will review and analyze different aspects of syllable structure in four consecutive sections. Section 4 is devoted to the important bimoraic minimum, and a proposal will be made for constructing bimoraic core syllables. Section 5 discusses maximum weight restrictions, partly reinterpreting evidence in favor of bimoraic maximality in terms of a linear filter, operative during level-1 syllabification. In section 6 the distribution of schwa is discussed. An analysis is proposed based on schwa's weightlessness. Finally, section 7 contains a summary of the analysis.

2. The segment inventory

2.1 Introduction: consonants and vowels

As necessary ingredients to a discussion of syllable weight, the Dutch segment inventory will be given. The consonant inventory is relatively simple:

(2)	Voiceless	Voiced
a. Stops	/p/ /t/ /k/	/b/ /d/
b. Fricatives	/f/ /s/ /χ/	/v/ /z/ /ɣ/
c. Nasals		/m/ /n/ /ŋ/
d. Liquids		/l/ /r/
e. Glides	/h/	/j/ /w/

Obstruents and nasals have three places of articulation: labial, dental, and velar. Notice the absence of voiced velar stop /g/[1].

Most descriptions distinguish four classes of vowels, for distributional reasons to be discussed in section 2.2 and later:

```
(3)a. Long, or tense vowels /a/, /e/, /o/, /ø/, /i/, /y/, /u/
   b. Short, or lax vowels /ɑ/, /ɛ/, /I/, /O/, /oe/
   c. Schwa /ə/
   d. Diphthongs /ɑu/, /ɛi/, /ʌy/
```

A first important observation is that the set of long vowels exceeds the set of short vowels in number by seven to five. Therefore, an attempt to construe the former as lengthened or tensed variants of the latter seems problematic (De Groot 1931:238). Also only a few *productive* alternations exist between pairs of vowels belonging to different sets. At a very low level, long and short vowels alternate with each other in a post-lexical shortening process closely related to vowel reduction: /a/-/ɑ/ (*banáan*, [banan]-[bɑnan]), /e/-/I/ (*telefóon*, [teləfon]-[tIləfon]), /o/-/O/ (*molestéer*, [molɛster]-[mOləster]), /i/-/I/ (*minúut*, [minyt]-[mInyt]). Furthermore, the phonological length contrast between the sets of vowels only partly corresponds to *phonetic duration*. As reported in Nooteboom (1972), phonologically short vowels are phonetically short as well, but among the phonologically long vowels a distinction exists as to phonetic duration. Mid and low vowels /a/, /e/, /o/, /ø/, are always phonetically long while high vowels /i/, /y/, /u/ are phonetically short, except when they directly precede /r/. Moulton (1962) refers to the latter class as 'half-long' vowels. Finally, diphthongs are phonetically long, and schwa is phonetically short.
We will first discuss segmental specifications of vowels (vowel quality) in section 2.2, and then turn to moraic specifications (vowel quantity) in section 2.3.

2.2 Vowel quality

Descriptions differ as to the number of vowel *heights* that are required, and as to the specification of the vowels for height. Most descriptions assume three distinctive vowel heights - high, mid, and low (Cohen e.a. 1959, Trommelen & Zonneveld 1979, Van der Hulst 1984). The height of long vowels is agreed upon: /i/, /y/, /u/ are classified as high vowels, /e/, /o/, and /ø/ as mid vowels, and /a/ as a low vowel. However, the height of short vowels is less clear. One problem involves the relative heights of /I/ and /ɛ/. On the one hand, /I/ is distinct from /ɛ/ by height, as both are non-round front vowels. Therefore, those who assume three vowel heights often classify /I/ as high, /ɛ/, /O/, and /oe/ as mid, and /ɑ/ as low; see (4), drawn from Trommelen & Zonneveld (1979):

(4)a. *Long vowels*

[-back]		[+back]		
[-round]	[+round]	[-round]	[+round]	
i	y		u	+high, -low
e	ø		o	-high, -low
		a		-high, +low

b. *Short vowels*

[-back]		[+back]		
[-round]	[+round]	[-round]	[+round]	
I				+high, -low
ɛ	oe		O	-high, -low
		ɑ		-high, +low

But on the other hand, /I/ is a mid vowel phonetically: it is not as high as /i/. Moreover, /ɛ/ is considerably lower than its length counterpart /e/. This is not expressed in the above vowel system. Finally, next to (correctly) predicted length alternations between /o/ and /O/,

and /a/ and /ɑ/, it predicts such alternations between /i/ and /I/, and /e/ and /ɛ/. But as remarked above, long /e/ alternates with short /I/ instead of /ɛ/, by vowel shortening.
There is a choice of two options in accounting for these observations. The first is lowering /I/, /ɛ/ by one degree in lexical specification, the second is to lower short (and shortened) vowels post-lexically, or in the phonetic component. We will return to this problem in chapter 6, in the context of our analysis of vowel reduction.
Phonetically, diphthongs are characterized by a rapid movement from a relatively low to a relatively high position. This is captured by the complexity in the notation: /ɛi/, /ʌy/, /ɑu/. Lexical specification of diphthongs will involve two feature matrices to account for the height contour, and probably a shared matrix to express backness harmony. In all thr diphthongs the first part is [-high], the second part [+high][2]:

```
(5) [-high] [+high]    [-high] [+high]   [-high] [+high]   [-high] [+high]
        \   /              \   /             \   /             \   /
      [αback]            [-back]           [-back]           [+back]
                           /ɛi/              /ʌy/              /ɑu/
```

The vowel /ʌ/, occurring in the diphthong /ʌy/, may be added to (4) as the low counterpart of /oe/. Rounding distinguishes the front rounded diphthong /ʌy/ from the front unrounded diphthong /ɛi/.
Schwa's segmental make up is often described as 'mid and unrounded'. It can be called neither back nor front. Phonetically it is close to /oe/, deviating from this rounded mid front vowel by its being unrounded (and perhaps by being slightly more low and back). Since schwa's quality can best be described as phonetically centralized, it will be assumed to be phonologically *unspecified.*

2.3 Moraic vowel quantity

The reasons for distinguishing *short* and *long* vowels have not been made clear so far. Systematic durational differences were indicated between short vowels on the one hand, and non-high 'long' vowels and diphthongs on the other, but no *phonological* arguments were given. Such arguments do exist, however.
Distributionally long vowels and diphthongs pattern like combinations of a short vowel plus a consonant. For instance, the cluster [mp] cannot be preceded by long [e], the diphthong [ɛi], or the sequence [ɛl], whereas it can be preceded by the short vowel [ɛ] (Moulton 1962):

```
(6)a. [e] *teempo b. [ɛi] *teimpo     c. [ɛr] *telmpo     d. [ɛ] tempo
```

Moreover, long vowels, diphthongs, and short vowels plus consonants, but not 'unchecked' short vowels, can occur in open syllables):

```
(7)a. [e] thee     b. [ɛi] tij        c. [ɛl] tel         d. [ɛ] *[tɛ]
```

This strongly points to a *bimoraic equivalence* of [e], [ɛi], and [ɛl]. The data of (6) and (7) will be of crucial importance in the sections 4 and 5 below, as arguments for various kinds of weight restrictions.
An important linear ancestor of the bimoraic analysis of long vowels and diphthongs is introduced in Smith (1973), and elaborated in Zonneveld (1978) and Zonneveld & Trommelen (1980). Long vowels and diphthongs are represented as sequences of two short ones:

```
(8)a. short vowels        b. long vowels           c. diphthongs
       [-cons]                [-cons]i [-cons]i        [-cons]i [-cons]j
```

Bimoraic representation clearly captures the distributional similarities between long vowels and diphthongs. Moreover, it allows the elimination of the feature 'tense', which had been used in SPE-like analyses of the Dutch vocalic system. The constraint against long vowels and diphthongs before specific consonant clusters takes the general form of (9) in the Zonneveld & Trommelen analysis[3]:

```
(9)  * [-cons] [-cons] C C Y
```

The phonetic interpretation of bimoraic vowels involves a 'contraction' or 'degemination', "where the same rule may be employed to specify, for instance, degree of centralization, of specific height, and of length of these vowels under various environmental conditions"[4]. We will assume this approach to Dutch vowels to be essentially correct.

We will follow Hayes (1989) in lexically representing vowel quantity by pre-associated mora's. That is, short vowels are lexically monomoraic (10a), whereas long vowels (10b) and diphthongs (10b) are bimoraic:

```
(10)a.  m     b.  m m     c. m m
        |         \ /        | |
        V          V         ViVj
```

Further evidence for (10) will be presented in the following sections on syllable structure. More precisely, many distributional generalizations will turn out to be directly related to moraic length.

There is one further issue that needs to be discussed here: the high vowels /u/ and /y/ do not have length counterparts, cf. (4). This will have relevance to some of the weight contrasts to be discussed in this chapter. Slightly running ahead of the discussion in section 5 below, in which maximum weight restrictions on syllables are discussed, many examples of 'excessive weight' in *non-final* syllables involve the high 'long' vowels /u/, /y/, and /i/. This is pointed out in Trommelen (1987):

```
(11)a toen.dra    poes.ta     b mues.li     c piz.za
      toer.nooi   koes.koes     luk.sor       hyp.nose
      loem.pia    spoet.nik                   pier.lala
```

Trommelen suggests that all of (11) contain 'short high vowels', a class of short vowels developing next to long high vowels, indistinguishable from the latter by segmental feature specification. In the vowel system below, this class would occupy the space where /I/ has been traditionally located (indicated by the arrow in 12):

```
(12)   short               long

     I <-------->    i  y  u     high
     ε   oe  O/α     e  ø  o/a   mid/low
```

This proposal has advantages in view of several observations to be made below. First, it explains why words of the type (11) so often contain a high vowel /i/, /u/, /y/. Second, it explains why words which violate a main restriction on consonant clusters after long vowels and diphthongs (saying that such clusters have a *dental* in second position) typically involve /i/,/u/,/y/: *smiespel, loempia, bruusk.* However, the proposal of short high vowels has some disadvantages as well. First, it makes claims concerning the phonological length of high vowels essentially vacuous. Second, it cannot explain the co-occurrence of the high short /I/ and /i/ in the vowel inventory (12), casting doubts on the presence of short /i/, which is clearly the vowel which would benefit most by the proposal. For these reasons, we do not unconditionally accept Trommelen's proposal, although we agree that the short vowel-like behavior of /i/,/u/,/y/ is ideally to be related to their height and the absence of short counterparts of some of them.

There are strong distributional arguments for distinguishing schwa as a vowel class on its own, involving syllable weight and stress. The most important argument for distinguishing schwa from all other vowels is its being *unstressable*. Distributionally, this implies that it cannot be the single vowel of a lexical word. Furthermore, schwa is distinguished from all other vowels *segmentally*, being the only vowel which is unspecified for height, backness, and rounding. For this reason, many attempts have been made to eliminate schwa as a phoneme of Dutch, by deriving it from vowel reduction in unstressed syllables, epenthesis, etc. The debate has not come to a conclusion but the position that at least some schwa's are underlying seems hard to reject. The most stubborn schwa's are those in positions where neither vowel reduction nor epenthesis are successful explanations - typically in morpheme-peripheral positions (word-final or affix-initial/final). We can only briefly touch upon the underlying form of schwa since the implications for Dutch phonology are immense. See for discussion Cohen e.a. (1959), Moulton (1962), Brink (1970), De Schutter (1978), Booij (1985a), Ter Mors (1986), Van der Hulst & Van Lit (1987).

Schwa is in a different category than short vowels because of the applicability of arguments based on quantity. As shown by Trommelen (1983), schwa behaves unlike short vowels for various distributional reasons, at least in final syllables. Judging by the criteria to distinguish long and short vowels given in (6), schwa is certainly not short since it (a) cannot precede /mp/ (*[adəmp]), (b) can appear word-finally ([mikə], *Mieke*). In section 6 we will demonstrate that a specification of schwa as a (non-short) *weightless* vowel captures its distributional properties in a more generalizing fashion.

3. Issues of domain and level in syllabification

3.1 The domain of syllabification

In Trommelen (1983), the following position is expressed with respect to the domain of syllabification:

(13) "The simplest view appears to be that the domain of the syllable template is the underived lexical item. This is not to say, however, that *all* syllabification takes place within this domain. If derived structure is obtained simply by combining morphemes, the grammar of Dutch might logically possess independent templates for derived syllabification. But a much more simple solution appears to be the opposite: the grammar of Dutch should not be burdened with the task of specifying the possibilities of derived syllabification, but this whole area may be relegated to the realm of universal laws."

Trommelen notices that traditional observations on Dutch syllabification (a) hardly distinguish restrictions holding in underived words and those holding in derived words, and (b) are based almost completely on monosyllabic and disyllabic words with schwa-ful final syllables. Hence one type of syllable has been left out of the picture: syllables in non-final positions in underived words (or what we call *level-1* items here). These are far more restricted than final syllables (which may contain appendix consonants), and non-final syllables of (*level-2*) derived words (which are final in the base word, and followed by a level-2 suffix).

Examples of distributional freedom in final syllables (14a) and level-2 derived words (14b) are given below. These contain syllables of a composition hardly if ever attested in non-final syllables of underived words and words derived at level-1.

```
(14)a. prompt  gierst   b. prompt+st     [prOmp(t)st]
       vreemd  markt       vreemd+eling  [vrem.də.lIŋ]
       herfst  schurft     herfst+ig     [hɛrf.stəχ]
       melaats kwarts      melaats+heid  [me.lats.hɛit]
```

The examples in (14a) contain the *dental obstruent* (sequence) typical of word-final positions. Those in (14b) illustrates that level-2 suffixes can be freely added to such words, giving rise to complex word-internal syllables[5].

The notion of 'underived' word being the domain of syllabification needs some refinement, since words derived with level-1 affixes typically stay within the syllabification conditions as observed for underived words. That is, the addition of a level-1 suffix to an underived word typically does not lead to 'overheavy' word-internal syllables. Partly, this is an effect of the characteristic vowel-initial nature of level-1 affixes[6]:

```
(15)a. kwart - kwart+aal [kwɑr.tal]   toon  - ton+aal    [to.nal]
       harp  - harp+ist  [hɑr.pIst]   fluit - fluit+ist  [flʌy.tIst]
       kalm  - kalm+eer  [kɑl.mer]    graad - grad+eer   [χra.der]
```

Interestingly, words derived with a level-1 suffix behave as underived words for purposes of stress as well. We will take the position that not one, but two domains are required for syllabification, one of level-1, and one of all words, including those derived at level-2. In the following section, we will clarify this.

3.2 The level of syllabification

An issue closely related to the domain of syllabification is that of the *level* of syllabification, or the phonological stage at which syllable structure is constructed. This issue can be potentially resolved by means of rules referring to syllable structure. As will be seen, both stress assignment and much of segment distribution show sensitivity to syllable structure, which orders syllabification rules at level-1, at least as deep as the level where stress rules and segment distribution are located[7]. Importantly, segment distribution and stress assignment can be shown to require only *part* of the complete syllabification present at the surface after the application of level-2 (re)syllabification.

The concept of initial syllable structure has consequences for the issue of domains, especially since stress assignment and segment distribution, being heavily dependent on syllable weight, are restricted to a lexical morphological level ordered before compounding and recursive affixation. The relation between domain and level of syllabification is obvious, and requires characterization in terms of the theory of Lexical Phonology. A way of doing this is by assigning part of syllabification to *level-1*:

```
(16)        Level-1 Syllabification I   Level-1 affixes
    Lexicon -----------------------------------------------------------
            Level-2 Syllabification II  Level-2 affixes, compounds
```

The model of (16) will make (a) underived words and (b) words derived by level-1 suffixes the domain of early syllabification. The distinction between level-1 and level-2 syllabification is central in the analysis to be presented in the following sections.

4. The bimoraic minimum

4.1 The evidence

The evidence that Dutch syllables are minimally bimoraic is based on the traditional observation (De Groot 1931:237, Van Wijk 1939:39, 109, Cohen e.a. 1959, Moulton 1962, Trommelen 1983, Van der Hulst 1984, 1985) that short vowels are absent from (a) word-final and (b) prevocalic positions. Two alternative ways of stating this observation are that short vowels are restricted to preconsonantal positions, or that '*close contact*' exists between a short vowel and a following consonant.

The generalization is that short vowels *cannot occur in open syllables*, so that syllables minimally contain a short vowel plus consonant, or a long vowel or diphthong. These observations have been at the root of analyses of syllabification (Trommelen 1983, Van der Hulst 1984, 1985, Kager & Zonneveld 1986). Let us review the evidence in some more detail.

First, short vowels (17a) cannot occur word-finally, whereas long vowels (17b) and diphthongs (17c) can[8]:

(17)a.	*[tɑksI]	b.	taxi	[tɑksi]	c.	bui	[bʌy]
	*[satɛ]		sate	[sate]		galei	[χalɛi]
	*[jydO]		judo	[jydo]		Kenau	[kenɑu]
	*[mikɑ]		mika	[mika]			
	*[snoe]		sneu	[snØ]			
			opoe	[opu]			
			menu	[mǝny]			

Second, the complementary observation that short vowels (18a) cannot occur in hiatus (in prevocalic position), while long vowels (18b) and diphthongs can (18c), is illustrated below[9]:

(18)a.	*[hI.at]	b.	hiaat	[hi.at]	c.	vijand	[vɛi.ɑnt]
	*[krɛ.ol]		creool	[kre.ol]			
	*[mɑ.ori]		Maori	[ma.ori]			
	*[vI.ɑnt]						

Note that /a/ is the only long vowel that actually occurs prevocalically at the surface. Other vowels are separated from the following vowel by a homorganic intervocalic glide /j/ or /w/, inserted by the automatic rule of Homorganic Glide Insertion (Zonneveld 1978)[10]. The glide insertion rule is probably post-cyclic, as it applies between words as well.

Close contact between a short vowel and the following consonant is clear from the following observations. Firstly, short vowels are not *free*, but *checked*: the following consonant is felt as being on or even before the syllable boundary. Secondly, the co-occurrence restrictions between short vowels and following consonants confirm this close relation. In particular, glides /j/ /w/ (19a) or /h/ (19b) cannot follow short vowels (Cohen e.a. 1959:84):

(19) a.	[draj]	draai	*[drɑj]	b.	[abrahɑm]	Abraham	*[abrɑham]
	[maja]	Maya	*[mɑja]		[sahɛl]	Sahel	*[sɑhɛl]
	[doj]	dooi	*[dOj]		[johɑn]	Johan	*[jOhɑn]
	[trojə]	Troje	*[trOjə]		[kohezi]	cohesie	*[kOhezi]
	[snew]	sneeuw	*[snɛw]		[teherɑn]	Teheran	*[tɛherɑn]
	[niw]	nieuw	*[nIw]		[bɛtlehɛm]	Bethlehem	*[bɛtlɛhɛm]

This can be interpreted as a general restriction against semi-vowels as second morae. Another well-known observation excludes voiced fricatives after short vowels (Cohen e.a. 1959:90), four exceptions being *mazzel, puzzel, razzia, gravel*:

(20) a.	[fazə]	fase	*[fɑzə]	b.	[lava]	lava	*[lɑva]
	[ozOn]	ozon	*[OzOn]		[lovər]	lover	*[lOvər]
	[ezɑu]	Ezau	*[ɛzɑu]		[eva]	Eva	*[ɛva]
	[kizəl]	kiezel	*[kIzəl]		[ivo]	Ivo	*[Ivo]
	[rØzəl]	reuzel	*[roezəl]		[Øvəl]	euvel	*[oevəl]
	[fuzəl]	foezel			[uvər]	oever	
	[ɛizəl]	ijzel			[ɛivər]	ijver	
	[dʌyzəl]	duizel			[ʌyvər]	uiver	
	[pɑuzə]	pauze					

All this points to the conclusion that a short vowel-consonant sequence forms a *constituent* at the stage of early lexical syllabification, where the distribution of segments is controlled[11].

Arguments for syllabification based on segmental distribution do not imply that this syllabification is found at the surface as well. Clearly, surface syllable structure may be adapted due to factors such as stress, an example being consonant resyllabification in English. Dutch surface syllabification seems to be different from level-1 syllabification too.

Although short vowels and consonants are a unit of segment distribution, they are not tautosyllabic at the surface. Instead, single intervocalic consonants are (claimed to be) *ambisyllabic* (Booij 1981, Van der Hulst 1985) on the basis of intuitive syllabification, and crucially, *voiced* intervocalic obstruents, escaping the automatic syllable-final devoicing rule of Dutch[12]:

(21)	midden	knudde	modder	Eddy	adder	
	knibbel	Wubbo	hobbel	kwebbel	Abba	sabbath

Essentially the safest position seems to be that intervocalic consonants are tautosyllabic with the preceding short vowels at the stage of level-1 syllabification, and ambisyllabic - possibly heterosyllabic - by surface syllabification, or at level-2. Although we will later favor surface *ambisyllabicity*, this issue is in no way central to our claims.

4.2 Earlier accounts

The evidence reviewed above strongly supports a distributional relation between a short vowel and its following consonants at a deeper level of syllabification. Any other solution has to mention the conjunction *word-finally and pre-vocalically*, suggesting that a generalization is missed. We will review ways in which the bimoraic minimum has been formalized in earlier analyses. As we will see, all existing analyses have problems as to an adequate formalization. In section 4.3, we will propose a new, and as we claim more adequate, formalization.

In a segmental framework, Zonneveld & Trommelen (1980) formulate the constraint against word-final short vowels as (22), referring to short vowels as a sequence of one vowel:

```
(22) * [+cons] [-cons] #
```

Obviously, this solution is not available for ruling out short vowels in hiatus, since then another [-cons] takes the place of the word boundary, causing ambiguity with legal tautosyllabic double [-cons] sequences. The segmental framework simply cannot represent the relevant *syllable*-based constraint.

Trommelen (1983), the first truly metrical analysis of syllabification, formalizes bimoraic minimality by two obligatory segmental positions in the *rime* template, viz. 1. [-cons], filled by a vowel, and syllabified in the *peak*, and 2. [+son], filled by a vowel (syllabified in the peak), or a sonorant consonant, syllabified in the *coda*. These obligatory nodes are adjoined first, and only then are optional *onsets* constructed. Thus the syllabification of single intervocalic consonants is as below:

```
(23)a. Rime   Onset   b. Rime   Onset   c.  Rime          d.    Rime     Onset
        |       |          |       |         / \                 / \        |
       Peak     |         Peak     |     Peak Coda           Peak Coda      |
       / \      |         / \      |       |    |              |    |       |
      b a a     m  i      o o     t o    k O    m   a          O    -       t o
      (bami)              (auto)         (komma)                (Otto)
```

In *Otto* (24d), the medial obstruent cannot fill the obligatory [+son] so that this node can only be structurally present. Therefore short vowels are structurally in *closed* syllables, even if the coda is phonologically empty. Yet it is unclear how the rime-configuration of (23d) is excluded in *word-final* and *pre-vocalic* position, where short vowels do not occur. The possibility of empty syllable positions thus leads to the loss of an explanation for the distribution of short and long vowels.

Van der Hulst (1984) argues that in order to explain this distribution, it must be assumed that syllables are obligatorily *branching* (bimoraic). To fulfil this requirement, short (monomoraic) vowels occur necessarily in closed syllables. Then the distribution follows: short vowels cannot occur word-finally and prevocalically because in these positions there is no consonant to fill the second mora. The execution of this idea has implications for intervocalic consonants following short vowels. Notice that the surface syllabification of such consonants (as in *komma*, *Otto*) is not *tautosyllabic* with the preceding syllable, as VC.V (*[kOm.a]). His way to capture both lexical and surface syllabification is to assume that consonants following short vowels are *ambisyllabic*[13]:

```
(24)  σ   σ
     / \ / \
     V C C V
     | \ / |
     O  t  o     (Otto)
```

Van der Hulst (1985) presents arguments for the claim that ambisyllabic consonants are represented as in (24), hence as *long* segments linked to two skeletal slots. Ambisyllabic consonants behave as long segments by displaying *inalterability* (Hayes 1986): the property of not undergoing rules which automatically apply to short segments. The formal means of capturing this in Hayes (1986) is the Linking Constraint:

```
(26) Linking Constraint
     Association lines in structural descriptions are interpreted as
     exhaustive.
```

By (26), rules referring to some segment as being associated to a timing slot can only affect short segments. In order to affect a long segment, both association lines must be present in the structural description, hence explicit reference to a geminate must occur.
Ambisyllabic consonants are crucially inalterable with respect to the process of *syllable-final devoicing of obstruents*. Since intervocalic obstruents after short vowels can be voiced at the surface, it must be assumed that devoicing does not apply to ambisyllabic consonants, which is explained under the assumption that ambisyllabic consonants are *long*. Examples of voiced intervocalic obstruents after short vowels are *Abba* ([ɑba], *Eddy* ([ɛdi]) (21). This argument is not conclusive, however, since by itself, the fact that devoicing does not apply to intervocalic consonants after short vowels only proves that such consonants are not tautosyllabic with the preceding vowel at the *surface*, or at least at level-2, where devoicing applies (cf. Booij 1985b).
Van der Hulst goes on to argue that if a consonantal length contrast is assumed, Dutch does *not* display it at the surface, nor do arguments for an *underlying* consonant length contrast exist. The conclusion must then be that ambisyllabic consonants acquire their length in the course of the derivation. The analysis is as follows. No underlying long segments are present, except for long vowels, which are linked to two skeletal slots. After Onset Formation, vowels are organized into syllable nuclei by Nucleus Formation, yielding bimoraic nuclei for long vowels (as auto, cf. 27a) and monomoraic nuclei for short vowels (as *Otto*, cf. 27b):

```
(27)a.                N  O  N       b.              N O  N
                      / \ | / \                     | | / \
  x x x x x           x x x x x          x x x x    x x x x
  \ / | \ /           \ / | \ /          | | \ /    | | \ /
   o  t  o             o  t  o           O t  o     O t  o
```

Bimoraic minimality takes the form of a *nucleus expansion* rule inserting a skeletal slot after a monomoraic syllable. By (leftward) spreading of consonantal features, the long consonant arises: the righthand consonant becomes *ambisyllabic*. Short vowels in open syllables basically *borrow* a consonant to fulfil the bimoraic minimum requirement:

```
(28)    N O  N          N  O  N          N  O  N
        | | / \         / \ | / \        / \ | / \
        x x x x   =>    x x x x x   =>   x x x x x
        | | \ /         |   | \ /        | \ / \ /
        O t  o          O   t  o         O  t   o
```

By representing intervocalic consonants as bipositional, a complication arises with respect to segment distribution which goes unnoticed by Van der Hulst. Exactly the interpretation of association lines as being exhaustive will preclude reference to the nucleus as the domain of distributional restrictions. To see this, observe that the filter ruling out a voiced fricative as the second member of the nucleus, cf. (20), cannot have the form of (29a), but needs to have to have the form of (29b):

```
(29)a.  *N                        b.  *N
        / \                           / \
       x   x                         x   x    x
       |   |                         |    \  /
       V [-son  ]                    V  [-son  ]
         [+cont ]                       [+cont ]
         [+voice]                       [+voice]
```

However, (29b) is obviously incorrect, as it fails to exclude word-final voiced fricatives after short vowels, which are not followed by vowels. Clearly, this conclusion implies a severe problem for the idea of representing intervocalic consonants after short vowels as long segments at level-1, the level at which segment distribution is determined.

This point is strengthened by distributional evidence from other languages, as shown in Itô (1986). In many languages, sonorants, but not obstruents, can appear in the nucleus. However, such languages do allow intervocalic *geminate* obstruents in the nucleus, which are obviously not affected by the restriction just mentioned. This yields strong evidence that the Linking Constraint is valid at the level of syllable-sensitive lexical filters on segment distribution. In turn, this would imply that Van der Hulst's analysis of ambisyllabic consonants as long consonants cannot be correct, since it precludes a uniform formulation of filters such as (29). Clearly, at some stage in the derivation, a short vowel + consonant sequence must form a constituent on its own. The analysis that we will present in 4.3 will have exactly this property.

Van der Hulst observes a curious gap in the distribution of ambisyllabic consonants which will be of some importance in the analysis that we will propose in section 4.3 (we will discuss the observation here, instead of in section 4.1, as it does not constitute direct evidence in favor of the bimoraic minimum). Dutch has complex onsets consisting of a string of obstruent-liquid (Trommelen 1983). Van der Hulst observes that these strings cannot follow a (stressed) short vowel[14]:

```
(30)a. [zebra]   zebra   b. *[zɛbra]     c. * O  N   O   N
       [makro]   macro      *[mɑkro]           | / \ / \ / \
       [lepra]   lepra      *[lɛpra]           x x x x x x x
       [kobra]   cobra      *[kObra]           | | \ / | \ /
       [dyplo]   duplo      *[doeplo]          z ɛ  b  r  a
```

Van der Hulst & Van Lit (1987) elaborate upon Van der Hulst's (1985) suggestion that ambisyllabic consonants are *long* consonants, linked to two timing slots. Crucially, they include consonant length into the lexical representation, hence do not derive consonantal length by spreading to an expanded nucleus. Thus surface vowel length contrasts can be attributed to underlying consonant length contrasts as vowels before short consonants are simply lengthened after nuclear expansion by the rightward spreading of vocalic melodies. Hence vowel length is *underspecified* in open syllables.

Vowel length contrasts before single intervocalic consonants now arise by lexical moraic consonant length when the preceding vowel is short, as in *lemma* (31b). In *schema* (31a), the preceding vowel is lengthened because it ends up in an open syllable: the following consonant is not lexically marked for length, and associates with the mora following it:

```
(31)a.                     σ      σ         b.                     σ     σ
                          / \    / \                              / \   / \
          m   m          m   m  m   m           m m m m          m   m  m  m
          |   |         / / \ /  / \ /          | \ / |         /|    \ / \ /
        s χ e m a  =>  s χ  e   m   a          l ɛ m a    =>  l ɛ     m   a
```

Vowel length must still be lexically marked in *closed* syllables, because no lengthening can apply there. The lexical representations of the words *ra*, *ram*, and *raam* must then be as in (32):

```
(32)a.  m        b.  m         c.  m   m
        |             |            \ /
      r a         r a  m       r  a   m
     [ra]          [rɑm]        [ram]
```

Derivations include vowel lengthening in (32a) and the creation of morae over post-vocalic consonants in (32b,c)[15].

Clearly this analysis has the major drawback that it requires *both* vowel length and consonant length to be lexically marked. Moreover, it assumes that vowel length can be lexically marked in closed syllables only, thus circularly presupposing a syllable-sensitive restriction in order to set up a syllable-determining distinction. Moreover a serious problem arises as to the melodic content of lengthened vowels. As we learned in section 2, no one-to-one relation between short and long vowels can be stated for Dutch. First, the set of short vowels is (surprisingly) smaller than the set of long vowels. This would imply that at least some long vowels (*two* to be exact) cannot be related to short vowels by lengthening. Second, the remaining five long vowels (whichever are analysed as such) deviate from their short length counterparts not only by moraic length, but melodically as well, cf. (4).

Following the proposal of Hayes (1989) for geminate consonants, Van der Hulst & Van Lit (forthcoming) point out that *all* underlying vowel length can be eliminated if consonants can be lexically prespecified as morae. A lexical mora closes the preceding syllable and blocks a lengthening of its vowel. No rule of weight-by-position needs to be assumed because its effects are already immanent in lexical representation. Derivations run from maximally underspecified lexical representations in (33), with only consonantal morae (capital *M*) prespecified:

```
(33)    a.        b.      M    c.         d.   M      e.
                          |                    |
Lexical    r a       r a  m       r a  m      o t o       o t o
repres.   [ra]      [rɑm]       [ram]       [Oto]       [oto]

             σ         σ           σ  σ      σ   σ       σ   σ
             |         | \         |  |      |\  |       |   |
             m         m  M        m  m      m M m       m   m
Form        /|        /|  |       /|  |      | |/|       |  /|
morae      r a       r a  m       r a  m      o t o       o t o
          [ra]      [rɑm]       [ram]       [Oto]       [oto]

             σ         σ           σ   σ     σ   σ       σ    σ
             |\        | \         |\  |     |\  |\      |\   |\
             m m       m  M        m m m     m M m m     m m  m m
Lengthen    /|/       /|  |       /|/  |     | |/|/      |/  /|/
vowels     r a       r a  m       r a   m     o t o       o  t o
          [ra]      [rɑm]       [ram]       [Oto]       [oto]
```

Vowel lengthening is expressed as mora doubling in *open syllables*. Notice that in order for this proposal to work, syllables such as *raam* in (33c) must be analysed as open, hence bisyllabic. Van der Hulst and Van Lit present independent evidence for the bisyllabic representation of these *super-heavy* syllables based on stress assignment, which will be discussed in chapter 4. But denial of syllable-status to prespecified morae is entirely stipulatory, showing that an essential problem remains unresolved: the distribution of open/closed syllables.

4.3 A proposal for bimoraic minimality at level-1

We will formalize the VX-minimum constraint by assuming that Dutch has a rule of weight-by-position deep in its lexical phonology, as well as a filter ruling out monomoraic syllables. We will assume a vowel length distinction instead of a consonant length distinction. Moreover, vowels will be syllabified before consonants are adjoined[16]:

```
(34)a.  σ     b.   σ       c.  σ
        |         / \         / \
        m         m m         m m
        |         \ /         | |
        V          V          V V
```

At level-1, the obligatory nuclear bimoraic constituent [VX] is constructed. We will assume a rule similar to Weight by Position (Hayes 1989) to be responsible for this, its special property being its application *prior* to onset formation. To distinguish it from the former, we will refer to it as Core Syllable Formation:

```
(35) Core Syllable Formation

      σ             σ
      |            / \
      m     =>    m   m
      |           |   |
      V  C        V   C
```

Core Syllable Formation applies at level-1 and creates closed syllables by linking a consonant to a preceding short vowel:

```
(36)a. σ      σ    σ              σ       σ       σ
       |     / \   |             / \     / \     / \
       m     m m   m             m m     m m     m m
       |     \ /   |             | |     \ /     | |
       α l m  a  n α k    =>     α l  m   a   n  α k        (almanak)

    b.   σ    σ    σ               σ     σ   σ
        / \   |   / \             / \   / \ / \
        m m   m   m m             m m   m m m m
        \ /   |   \ /             \ /   | | \ /
       d i   l ɛ m  a     =>     d i   l ɛ m  a            (dilemma)
```

The following filter checks the output of level-1 syllabification[17]:

```
(37) Bimoraic Constraint (level-1)
     Syllables dominate at least two morae.
```

Ungrammaticality arises whenever the Bimoraic Constraint is not met. It is satisfied in a trivial way by syllables containing long vowels and by diphthongs. Syllables containing short vowels which are bimoraic by Core Syllable Formation are legal as well but monomoraic syllables containing short vowels are ruled out:

```
(38)                                σ     σ   σ
                                   / \   / \  |
        m m   m    m               m m   m m  m
        \ /   |    |               \ /   | |  |
       d i   l ɛ m α      =>     *d i   l ɛ m  a           (*dilemm[α])
```

This avoids all of the problems (noted above) related to ambisyllabicity based on long consonants and to underlying consonant length distinctions instead of vowel length distinctions. Segment distribution can safely be formulated referring to the core syllable, and no vowel lengthening will be needed.

Yet the interaction between onset formation and Core Syllable Formation deserves some special attention, since the presence of the [VC]-minimum constraint in combination with the (universal) *Maximal Onset Principle* (see Clements and Keyser 1983) clearly imposes *contrary* forces to the initial syllabification of intervocalic consonants after short vowels.

Most languages lack the [VX]-minimum constraint. Here universal syllable theory assumes the first mora (including the *onset*) to be created before the second mora, as (a) single intervocalic consonants are tautosyllabic with following vowels and (b) intervocalic consonant clusters are split up in a way that maximizes the onset. Together, these observations are known as the Maximal Onset Principle.

But Dutch level-1 syllabification is ambiguous in this respect. On the one hand, single consonants after short vowels are distributional units with the preceding syllable. But on the other hand the non-occurrence of complex onsets after short vowels (*[zεbra], cf. 30) may be interpreted as onset formation bleeding Core Syllable Formation, since the resulting syllable structure would be ruled out equally as in final short vowels:

```
(39)    σ       σ            σ        σ             σ       σ
        |      / \           |       / \            |      / \
        m      m m           m       m m            m      m m
        |      \ /          / |     / / \ /         / |    / /\ /
      z ε   b r  a    =>  z ε   b r   a     =>  *z ε   b r  a
```

But exactly this possibility is ruled out. Note that if onset formation is to apply before Core Syllable Formation, *ambisyllabicity* at level-1 is forced for at least single intervocalic consonants in order to satisfy the [VX]-constraint (Van der Hulst 1985). Ambisyllabicity of consonants at level-1 has negative effects that have been discussed above, in relation to the Linking Constraint. Compare (40) to (24) above.

```
(40)     σ    σ    σ           σ       σ    σ            σ       σ    σ
        / \   |   / \         / \      |   / \          / \     / \  / \
        m m   m   m m         m  m     m   m  m         m  m    m m  m  m
        \ /   |   \ /        / \ /    / |  / \ /       / \ /   / | \ / \ /
      d  i   l ε m  a   =>  d  i     l ε  m   a   =>  d  i     l  ε  m   a
```

Clearly Van der Hulst's problem was how to allow for ambisyllabicity in single consonants, but to block it in complex onsets. This problem will be quite hard to solve. Because we have good reasons to rule out doubly linked consonantal feature matrices at level-1 anyway (cf. section 4.2) that solution is untenable.

We therefore choose the reverse order, and apply Core Syllable Formation first. Onset Formation can then be formulated as below[18]:

(41) **Onset Formation**

```
      σ            σ
      |\           |\
      m m          m m
      |           / |
  Co  V    =>   Co  V
```

Complex onsets occur, which consist of an obstruent and either a liquid or a glide, excluding /tl/, /dl/, and /sC/ (see for further restrictions on onsets Trommelen 1983).
This rule is subject to the universal constraints of Sonority Sequencing (42a), and the Maximal Onset Principle (42b).

```
(42)a. Segments can be ranked along a sonority scale in such a way that
       higher-ranking segments stand closer to the center of the syllable
       and lower-ranking segments closer to the edges.
       (Clements 1987)
    b. Given two possible parsings, choose the one where onsets are
       maximized, such that no illformed syllables arise.
       (Van der Hulst 1984)
```

We assume the Free Element Condition to govern level-1 syllabification, so that consonants that are part of the preceding core syllable cannot at the same time be syllabified as onsets by (41) (cf. Steriade 1982, Prince 1985). This is crucial, since it rules out ambisyllabicity at level-1, and therefore prevents outputs such as that of (40), so that distributional filters on core syllables are not complicated by the Linking Constraint[19].
The problem with *[zɛbra] now returns in a slightly different form. The first consonant in a cluster following a short vowel syllabifies into a core syllable by (35). And the second consonant will be syllabified as a single onset in a following syllable, see (43a):

```
(43)a.                              σ      σ               σ     σ
                                   / \    / \             / \   / \
          m      m m               m m    m m             m m   m m
          |      \ /               | |    \ /            /| |  /\ /
        z ɛ  b r  a      =>      z ɛ b  r  a      =>   *z ɛ b r  a

    b.
                                    σ         σ            σ         σ
                                   / \       / \          / \       / \
        m m     m m                m m       m m          m m       m m
        \ /     \ /                \ /       \ /          /\ /     //\ /
       z  e  b r  a      =>      z  e  b  r  a     =>   z  e  b r  a
```

The problem is how to exclude configuration (43a). The idea is of course to restrict the distribution of specific consonant clusters to the onset position of core syllables. Notice that allowing some consonant clusters in the onset position of a syllable - the statement that complex onsets of the form obstruent plus liquid occur - surely does not imply that the relevant consonant clusters must occupy that position. A priori, Dutch could have allowed for words such as [zɛb.ra] in addition to words such as [ze.bra]. Therefore, a separate statement is required to guarantee a position in the syllable onset for those consonant clusters which can be complex onsets.
Rephrased, the problem is to guarantee that *all and only* the consonant strings described above syllabify as complex onsets. The *only*-provision will be satisfied by positive restrictions on Onset Formation (41), but the *all*-provision needs a separate statement. A Complex Onset Condition (41) excludes any sequence of obstruent-liquid that is (partly) outside the core syllable, i.e. does not form a complex onset.

(44) **Complex Onset Condition** (level-1)

```
     *C       C            outside the core syllable
   [-son] [+son  ]
          [+cont ]
```

The Complex Onset Condition rules out forms like *[zɛb.ra], which could arise when an obstruent (followed by a liquid) would syllabify to close the preceding syllable by Core Syllable Formation. Note that the rule of Onset Formation must reapply after level-1 syllabification to single intervocalic consonants following short vowels, in order to establish their surface ambisyllabic position. As in constituent construction in stress rules, the late level-2 applications of Onset Formation may reorganize the relationship established by earlier rules.

```
(45)     σ       σ     σ                 σ     σ     σ
        / \     / \   / \               / \   / \   / \
        m m     m m   m m              m   m  m m   m   m
        \ /     | |   \ /             / \ /  /| \  / \ /
      d  i  l   ɛ m    a     =>      d  i  l  ɛ   m    a
```

The bimoraic core syllable is the domain of several filters of segment distribution. The most important of these are those excluding glides (19a), /h/ (19b), and voiced fricatives (20) as the second mora in [VX].

```
(46)a.   *σ               b.  *σ            c.    *σ
         / \                  / \                 / \
         m m                  m m                m   m
         | |                  | |                |   |
         V G                  V h                V ┌-son   ┐
                                                   │+cont  │
                                                   └+voice ┘
```

Notice that we do not defend the position that *all* segment distribution rules apply at the early level of level-1 syllabification. Crucially, a number of constraints govern level-2 syllabification, particularly the Sonority Sequencing Principle (42a).

This concludes the first part of our analysis of Dutch syllabification.

Dutch syllable structure is more complex than suggested by the data that were presented so far. In particular syllables containing more than two morae exist, the so-called *superheavy* syllables. We will discuss the maximum restrictions of syllable weight in the next section 5., and only after this section continue our analysis.

5. Maximum weight restrictions

5.1 The evidence

Various types of evidence indicate a maximum weight restriction on Dutch syllable structure. Partly the evidence involves the distinction between final and non-final syllables, where the latter type is more restricted. And partly the evidence involves the distinction between consonants that may close a (non-final) ternary syllable, in relation with the consonant that follows it.

Several sorts of maximum weight restrictions are to be distinguished: an almost exceptionless constraint against tripositional rimes followed by non-dental consonants (Moulton 1962), a somewhat more restrictive, less exceptionless constraint against sonorants in third position (Trommelen 1983), and finally, the most restrictive, but also least exceptionless constraint which rules out all tripositional non-final syllables (Kager & Zonneveld 1986).

The basic constraint to which all others can be related has already been touched upon in (6), but will be made explicit here: a bimoraic minimum syllable cannot be followed by the velar nasal [ŋ], nor by any consonant cluster whose second element is non-dental (Moulton

1962:303, Cohen e.a. 1959:93, Bakker 1971). We illustrate this with tautosyllabic sequences[20]:

(47) a. zee+m	b. vree+md	c. *vree+mp	[vremp]	d. *vree+ng	[vreŋ]
staa+r	staa+rt	*staa+rk	[stark]	*staa+ng	[staŋ]
baa+r	Baa+rn	*baa+rm	[barm]	*baa+ng	[baŋ]
war+m	Gar+mt	*gar+mp	[χarmp]	*gaa+ng	[χaŋ]

The interesting aspect of (47a-c) is that no general constraint against non-dental consonants in clusters exists. Thus, the clusters /mp/, /rk/, /rm/, freely occur after short vowels:

(48) ram+p [rɑmp] ster+k [stɛrk] war+m [wɑrm]

Clearly non-dental consonants which are adjacent to the bimoraic nucleus escape the effects of the filter, whatever its nature may be.
One attractive way of interpreting the contrast between (47ab) and (47c) is to assume that the syllable is maximally ternary, as (47a), but that it can be followed in word-final position by an *extrametrical* appendix consisting of a dental obstruent (cluster):

(49)	mark+t	Garm+t	nert+s	herf+st	burch+t	promp+t	ern+st
	naak+t	aam+t	kaat+s	gier+st	maag+d	vreem+d	koor+ts

This further limits down the object of inquiry, as we can now establish the maximum weight of the core syllable to three positions. Any bimoraic syllable can be followed by a consonant chosen freely, within the limits set by the sonority hierarchy.
Trommelen (1983) shows that non-final tripositional syllables rarely contain a sonorant in third position:

(50) a. [lem]	leem	b. *[tem.po]	c. [tɛm.po]	tempo
[man]	maan	*[man.darɛin]	[mɑn.darɛin]	mandarijn
[kol]	kool	*[sol.dat]	[sOl.dat]	soldaat
[lɛim]	lijm	*[tɛim.pan]	[tIm.pan]	timpaan
[fɑun]	faun	*[fɑun.tɛin]	[fOn.tɛin]	fontijn
[tɛrm]	term	*[tɛrm.po]	[tɛm.po]	tempo
[kɑrn]	karn	*[mɑrn.darɛin]	[mɑn.darɛin]	mandarijn

Although this claim establishes a fairly accurate criterion of non-final syllable weight, some exceptions exist, among which the following words:

(51) a. toen.dra	pier.la.la	aar.de	Schijn.del	b. loem.pia
toer.nooi	Mier.lo	vaan.del	Goir.le	Eel.ko
boer.noes	pien.ter	daal.der	hein.de	
jun.ta		gaar.ne	voor.de	
Woen.sel		Maar.ten	Deel.der	
boer.de		aar.zel	Toon.der	
Woer.den				

Notice that hardly any cases involve tripositional syllables followed by non-dentals (51b), which is in line with the observation made above in relation to (47). Essentially, the latter observation is more accurate (has fewer exceptions) than the former observation that non-final ternary syllables (either closed by a sonorant or not) are ruled out. Still, Trommelen's observation is at least a strong tendency.

While excluding sonorants from non-final ternary syllables, Trommelen attributes a fully regular status to ternary syllables with an *obstruent* instead of a sonorant in the third position:

```
(52)a. Aus.tralië     vreug.de     Xerk.ses        part.ner    b. Oet.ker
       Pleis.toceen   bauk.siet    Terp.sichore                   ast.ma
       pries.ter      Kreid.ler    plant.soen                     Sans.kriet
       kloos.ter      piz.za       domp.teur
       woes.tijn      hyp.nose     symp.toom
       bus.te         luuk.se      plank.ton
       mues.li        Spoet.nik    tinc.tuur
       bis.tro                     sculp.tuur
       balus.trade                 palimp.sest
                                   Antarc.tica
```

Trommelen thus claims that non-final syllables can be tripositional only *if the third segment is an obstruent*. Kager & Zonneveld (1986) take the more radical position that non-final syllables are never tripositional. Clearly, this requires a reanalysis of cases of allegedly tripositional syllables as bipositional. Arguments will be reviewed below.

5.2 Maximality restrictions in earlier analyses

Restrictions on non-final tri-positional syllables have been a topic of discussion during recent years. A number of authors reject restrictions on the third position in the syllable template, either implicitly (Booij 1981) or explicitly (Booij 1984, Van der Hulst 1984). Others (Trommelen 1983, Kager & Zonneveld 1986) impose restrictions, however. We will now review these points of view.

Recall from the previous section the claim by Trommelen (1983) that only obstruents, and no sonorants can occur as third moras in non-final syllables. This is captured in her template by an *optional* obstruent node following the obligatory vocalic and sonorant nodes discussed in section 4.2. We will now present this rime template fully:

```
(53)           Rime
              /    \
          Peak    Coda
          /          \
    [-cons] [+son] ([-son])
```

As illustrations of maximal expansions in which the obstruent node is segmentally occupied, consider (54):

```
(54)a          Rime                    b            Rime
              /   \                                /   \
           Peak    Coda                        Peak    Coda
           /  \       \                        /       /   \
    [-cons] [+son]  [-son]              [-cons] [+son] [-son]
       V       V       C                    V      C      C
  kl   o       o       s    tər       ks    ɛ      r      k   sɛs
   b   ɑ       u       k    sit             o      -      k   troj
```

This rules out non-final rimes consisting of either a long vowel plus a sonorant consonant (*[*tempo*]), or a short vowel plus a two sonorant consonant sequence (*[*tɛrmpo*]). Note that a very complex syllable structure is assumed with empty positions (23d,54b) to match the obligatory [+son] node.

One sonorant consonant may be adjoined to a rime by Chomsky-adjunction, word-finally. This leaves *kerk* and *kerm* with different rime structures:

```
(55)a.                                      b.          Rime
                                                         /\
                Rime                                 Rime \
               /    \                                / \    \
           Peak     Coda                        Peak  Coda  \
            /       /    \                       /       \    \
     [-cons] [+son]   [-son]              [-cons] [+son]   [+son]
        V       C        C                   V       C        C
    k   ε       r        k              k    ε       r        m
```

In addition to a sonorant consonant, an appendix of a dental consonant can be adjoined word-finally (cf. 49):

```
(56) Appendix
        |
     [-son]
     [+cor]
```

This dental appendix covers the extra possiblities in final syllables, a number of examples of which were presented earlier in (49).

Booij (1984), rejecting Trommelen's restriction of all language-specific syllabification to monomorphemic words, expresses the alleged absence of sonorants from the third position in the rime in a linear fashion, as a morpheme structure condition:

$$(57)\quad *[\ \ldots\ V\ [+son]\ \underset{[+son]}{C}\ C_1\ V\ \ldots\ ]_{Morpheme}$$

Since (57) does not extend to derived words as *maan.den* (*maand+en*), no additional constraint need to be put on the rime template itself, which can be simplified accordingly. The rime consists of a nucleus of a long vowel or a short vowel plus a sonorant, and an optional coda filled by a consonant:

```
(58)a.  Rime                b. raa+m       wal+m
         / \                   raa+k       har+k
        /   \
   [+son]    \
    /  \      \
   1   (2)    (3)
   V    V      C
   V   Son     C
```

Word-finally, an appendix *-s*, *-t*, *-ts*, or *-st* may be added[21].

Van der Hulst (1984) proposes mora representations with even less internal structure than those of Booij (1984):

```
(59)        σ                      σ                      σ
          / | \                  / | \                  / | \
         m  m  m                m  m  m                m  m  m
       / |  |  |              / |  |  |              / |  |  |
      r  a  a  m             w  α  l  m             k  α  s  t
      r  a  a  k             h  α  r  k             l  α  k  s
```

Van der Hulst takes three morae to be the maximum number for non-final syllables. He claims this theory to account for the same distributional generalizations as Trommelen's, omitting complex constituent structure, empty positions, and structurally different positions for sonorants and obstruents. But he does not discuss Trommelen's evidence for differences in rime structure between sonorants and obstruents, as based on word-internal

maximum syllable weight. Yet his representations seem to imply that such distinctions cannot exist, which leaves only two options for a condition on the maximum weight of non-final syllables: maximally one nucleus, or no distinction at all.
The former, more restrictive, position is defended by Kager & Zonneveld (1986), who claim that the distribution of non-final ternary syllables is restricted to word-final and pre-schwa position, and they propose a bimoraic maximality constraint - [VX] - on core syllables[22]. In underived words this claim is supported to a large extent although some exceptions remain. In particular, examples of the type used by Trommelen (1983) to illustrate obstruents in the third position of syllables (52), will have to be considered. For many of these words alternative analyses are suggested so that the generalization of maximal bipositionality can be upheld in its basic form. For instance, morphological complexity is suggested for the words in (60a), intrusive stops for (60b), and vowel lengthening for (60c):

(60) a	oor.log	<u>ex</u>.treem	b	plan<u>k</u>.ton	c pi:s.tool
	oor.deel	<u>obs</u>.truent		ran<u>t</u>.soen	bi:s.tro
	arg.waan			sym<u>p</u>.toom	pi:s.tache

A handful of others (*Sans.kriet* etc.) resist reanalysis, but in view of such a highly restricted analysis of the core rime, some may be expected to exist. The most important source of violations of the [VX]-constraint is excessive weight before schwa, however. Actually final-syllable schwa is the main topic of Kager & Zonneveld, who show that excessive weight is very much dependent upon final-syllable schwa, as in *aar.de* ([ar.də]). These words will be discussed in section 6 on schwa.
Bimoraic maximality forces Kager & Zonneveld into a *double* appendix for final syllables. The free consonant following the [VX]-rime translates as $Appendix_1$, the additional dental consonant cluster as $Appendix_2$. The appendices are represented below:

(61) $\ldots[\mathrm{VX}]_{\mathrm{Rime}}$ $\quad \underset{[+\mathrm{cons}]}{\mathrm{App}_1} \quad \underset{\begin{bmatrix}+\mathrm{cor}\\-\mathrm{son}\end{bmatrix}_2}{\mathrm{App}_2}$

Note that a sequence of Appendices violates the Peripherality Condition (Hayes 1981), which restricts extrametricality to single constituents at the margins of domains. This is a clear theoretical drawback.
With Kager & Zonneveld, Van der Hulst & Van Lit (1987) interpret the VX-constraint *maximally* to non-final syllables. They do not follow Kager & Zonneveld in the $Appendix_1$ for consonants in the third position. Instead they assume that such consonants are in monomoraic syllables on their own (as McCarthy 1979 proposes for superheavy syllables in Cairene Arabic), an option that is said to be restricted to word-final positions:

```
(62)    σ     σ            σ     σ
       / \    |           / \    |
      m   m   m          m   m   m
     / \ /    |         / |  |   |
    r   a     m        r  ɑ  m   p
```

The main motivation for this step is that it allows a simplification of the stress rule (to be discussed). But no distributional evidence based on syllabification is presented, which seems to be required.

5.3 A proposal for constraining excessive weight

As we have shown, the prohibition against tripositional syllables followed by non-dental consonants has considerable generality. This motivates its relevance to the grammar independently of less exceptionless constraints proposed before, such as the constraint against tripositional syllables as such (cf. Kager & Zonneveld 1986), or the constraint against sonorants in third position (cf. Trommelen 1983).

We will formulate the former as a basically linear constraint at level-1 on consonant strings outside the bimoraic core syllable:

(63) **The Extrasyllabicity Constraint** (level-1)

```
* C1 C2    outside the bimoraic core syllable
      |
   [-cor]
```

In words: the second consonant in an extra-nuclear sequence is a dental. By its reference to consonants outside the bimoraic core, (63) provides evidence for the latter as a constituent during level-1 syllabification.

In this respect, (63) differs from constraint (9) in Zonneveld & Trommelen (1980), which also fails to capture cases like *[xɑrmp] (47) and *[tɛrm.po] (50). Moreover, (63) extends to the appendix position, whose dental character no longer needs to be stipulated as such. Finally, as will be shown in section 6, (63) extends to post-schwa consonant sequences, thus ruling out *[adəmp]. Therefore, (63) is considerably more general than earlier comparable versions of linear constraints, such as (9) of Zonneveld & Trommelen (1980).

In order to appreciate the powerful filtering effect of (63), see the level-1 syllabifications of (66), where we have underlined the core syllable as created by Core Syllable Formation:

```
(64)a.    σ                  c.     σ                    c.    σ
         / \                       / \                        / \
         m m                       m m                        m m
        /| |                      / | |                      /| |
       w ɑ r  m                  χ  ɑ r  m t                w ɑ r  m p

       [lem]      leem           [bemt]       beemd          *[bemp]
       [kɛr.kər]  kerker         [ksɛrk.sɛs]  Xerxes         *[kserk.sɛs]
       [star]     staar          [start]      staart         *[stark]
       [wɑrm]     warm           [χɑrmt]      Garmt          *[χɑrmp]
       [bar]      baar           [barn]       Baarn          *[barm]
```

Notice that (63) extends to *appendix* consonants (49), hence renders the specification [+cor] redundant. In the face of examples such as *Baarn*, cf. (64b), it may even be possible to drop the requirement [-son] from the consonant appendix, leaving the contents of the appendix completely to (63) and word-final sonority restrictions[23].

Notice too that the examples (51,52) violating either Trommelen's or Kager & Zonneveld's constraint against tripositional syllables typically remain within the limits of (63). A handful of counterexamples remains:

```
(65)a. bruusk  smies.pel    b. zwierf      c. loem.pia    d. twaalf
       Weesp   Keijs.per       stierf         Oet.ker        Eel.ko
               gots.pe         verwierf       Lies.beth      zeug.ma
               Trots.ky        bedierf                       ast.ma
               ob.scuur        wierp                         Sans.kriet
                                                             Alk.maar
                                                             Rönt.gen
                                                             Husq.varna
```

Interestingly, many of these exceptional cases contain /i/, a fact noted by Trommelen (1987), who argues that an underlying short high vowel may be involved, see also (11).
The set of possible consonant sequences can be further narrowed down by independently required linear filters or lexical rules, imposing harmony of place features between nasals and obstruents, voicing harmony between obstruents, and by several other filters. See Trommelen (1983) and Van der Hulst (1984) for a discussion of these.
Does all this mean that restrictions as to maximal syllable weight must be reinterpreted as essentially *linear* restrictions on consonant strings in core syllabification? This would eliminate appendices, if the maximum string of final consonants is determined by (63) in combination with the sonority-governed concatenation of possible consonant pairs:

```
(66)a. her+fst      b. koo+rts
       gie+rst
```

However, this would leave unexplained that the full range of consonantal strings that is possible word-finally (*herfst*, *markt*) is never attested in non-final syllables. Clearly, final syllables exhibit some additional possibilities as compared to non-final ones, so that we will maintain an appendix. However, we claim that we do not have to specify the features of consonants filling this appendix, because they follow from (63) and the Sonority Sequencing Principle (42a).
Now what is the status of the fairly strong tendency to avoid non-final tripositional syllables? Kaye & Lowenstamm (1982) suggest that syllables (non-final core syllables) are universally limited to the bipositional [VX]-maximum. If this is correct, it is no longer necessary to restate the constraint in the grammar of specific languages. Dutch includes a small number of violations of the [VX]-maximum constraint in non-final syllables at level-1, and allows for some relaxation of the constraint word-finally, where (a) one free consonant and (b) one or two dental consonants can be appended. We assume both options to be universally available, though marked.
As Trommelen (1983) has pointed out, non-final tripositionality arises at level-2 whenever a base word containing both (a) and (b) combines with a level-2 suffix, see (14b). However, this kind of tripositionality is completely productive and automatic, and the [VX]-constraint can safely be assumed not to affect it. Presumably then, the [VX]-constraint is restricted in Dutch to governing level-1 syllabification.
If we adopt this position, i.e. that (63) is sufficient as the language-specific constraint against excessive weight, leaving the burden of the [VX]-maximum constraint to universal principles, this does not relieve us from stating precisely how the latter works out in Dutch. The input for the *level-1* syllabification of heavy syllables is shown in (67):

```
(67)a.   σ          b.   σ          c.  σ           d.   σ         σ
        / \             / \            / \              / \       / \
        m m             m m            m m              m m       m m
       /\ /            /| |           /| |             /| |      /\ /
      l  e  m         r ɑ m p        h ɛ r f s t      b ɑ u k   s  i  t
      leem            ramp           herfst           bauxiet
```

We assume that Coda Formation applies to these forms, as a universally available, though marked option. The rule Chomsky-adjoins a consonant to the core syllable, embedding the latter into a superordinate constituent:

```
(68) Coda Formation
                            σ
                           / \
        σ                 σ   |
       / \               / \  |
       m m               m m  |
            C  =>             C
```

Crucially, Coda Formation (68) is bled by Onset Formation (41) in case of a consonant (cluster) following the core syllable ([o.to], *auto*).

```
(69)                                                σ
                                                   / \
       σ      σ          σ      σ               σ   |     σ
      / \    / \        / \    / \             / \  |    / \
      m m    m m        m m    m m             m m  |    m m
      \ /    \ /        \ /   /\ /             \ /  | / \ /
       o  t   o    =>    o  t  o      =/=>      o  t     o
```

We will assume this blocking to be due to the Free Element Condition: no segment that has already been syllabified can be made part of another syllable by rules of primary (level-1) syllabification, cf. Steriade (1982). In section 6 on schwa we will show that Coda Formation crucially re-applies at level-2.

Let us now turn to the generalization, discussed in section 5.1 above, that the velar nasal occurs exclusively after short vowels, i.e. not in the adjoined mora position defined by (68), nor in onset position defined by (41).

In order to restrict the velar nasal /η/ to a position inside the core syllable - i.e. after short vowels - we will assume that underlyingly it is a cluster /ηχ/, a position taken earlier by Robinson (1972), as an improvement over Leys (1970). See for discussion Trommelen (1983) (who does not share this view of /η/, however). The cluster status of the velar nasal formally equates it to a non-dental nasal-plus-obstruent cluster such as /mp/, whose distribution it shares:

```
(70)a.   σ               b.                           c.   σ          d.
        / \                                               / \
       σ   |                  σ     σ                    σ   |             σ
      / \  |                 / \   / \                  / \  |            / \
      m m  |                 m m   m m                  m m  |            m m
     /| |  |                /| |  /\ /                 /\ /  |          / /| |
     t α η χ  tang          t α η χ  o  tango       *t  a  η  χ        η χ α t
     l α m p  lamp          l O m p  o  Lampo       *l  a  m  p        m p α l
```

We exclude *[taη] in (70c) by the same constraint that excludes *[lamp], in a way to be discussed in section 5.3. We exclude *[ηαl] in (70d) by sonority sequencing (42a), analogously to *[mpαl].

Since the velar nasal surfaces as cluster [ηχ] only before full vowels, we need a rule such as the one below to delete the velar obstruent:

(71) $\chi \Rightarrow \emptyset$ / η ___ $]_{\sigma}$

The context of this rule will receive support from our analysis of schwa in section 6.4.

Finally, the consonantal appendix is adjoined, whose dental content is guaranteed by the language-specific filter (63), as pointed out before[24].

```
(72) Appendix Formation
                                σ
                               / \
     σ                        σ   \
    / \                      / \   \
          Co       =>                Co  /    ___ ]
```

We show the level-1 application of Coda Formation (68) and Appendix Formation in (72), running from the output of Core Syllable Formation (35) and Onset Formation (41):

```
(73)a.      σ          b.    σ          c.   σ            d.    σ          σ
           / \              / \             / \                / \        / \
           m m              m m             m m                m m        m m
          /\ /             /| |            /| |               /| |       /\ /
         l  e  m          r α m p         h ε r f st         b α u k   s  i   t

Coda                σ               σ              σ               σ          σ
Formation          / \             / \            / \             / \        / \
                  σ   |           σ   |          σ   |           σ   |      σ   |
                 / \  |          / \  |         / \  |          / \  |     / \  |
                 m m  |          m m  |         m m  |          m m  |     m m  |
                /\ /  |         /| |  |        /| |  |         /| |  |    /\ /  |
               l  e   m        r α m  p       h ε r  f st     b α u  k   s  i   t

Appendix                                           σ
Formation                                         / \ \ \
                                                 σ   | | |
                                                / \  | | |
                                                m m  | | |
             ---             ---               /| |  | | |          ---
                                              h ε r  f s t
```

All of the above rules apply in conformity to the (universal) principle of Sonority Sequencing (42a). This sufficiently constrains consonant sequences in the face of those that are actually attested.

6. The distribution of schwa

Since schwa is never stressed and since it is phonetically short, it may be expected to be monomoraic or even *weightless*. Yet schwa does not behave as short by all criteria for quantity given above. We will review various aspects of schwa below, as well as analyses designed to capture these aspects.

6.1 Schwa as a non-short vowel

Trommelen (1983) demonstrates that schwa distributionally deviates from short vowels. Since schwa resembles long vowels in many ways, Trommelen argues that schwa is a bimoraic vowel.

As we saw earlier in (17, =74a), short vowels do not occur word-finally. In contrast, schwa can appear word-finally (74b) like long vowels (74c):

```
(74)a. *[mikα]      b. [mikə]    Mieke    c. [mika]   mica
       *[hIndI]        [hIndə]   hinde       [hIndi]  Hindi
```

Secondly, schwa obeys a restriction which is typical of long vowels. It cannot occur before a tautosyllabic sequence of consonant and non-dental consonant (75b), unlike short vowels (75a), but like long vowels (75c):

```
(75)a. [dɑmp]   damp     b. *[adəmp]     c. *[damp]
       [dɑŋk]   dank        *[adəŋk]        *[daŋk]
       [wɑlm]   walm        *[awəlm]        *[walm]
```

Final consonant clusters after schwa are extremely limited, and consist only of a dental sonorant followed by a dental obstruent:

```
(76) avond    honderd  bongerd  wereld  tangens
     duizend  buizerd  mosterd  sedert  mieters
     ochtend  wingerd  lommerd  yoghurt telkens
     arend    tabberd  basterd          Napels
```

Thirdly, allomorphs of two suffixes pattern in a way which groups schwa with long vowels. The diminutive suffix occurs in two allomorphs: /-tjə/ and /-ətjə/. The latter attaches to final syllables containing a short vowel plus a single sonorant consonant. Again schwa does not behave as a short vowel, but as a long vowel, because both final-syllable schwa and final-syllable long vowels select the allomorph /-tjə/:

```
(77)a. zwaan+tje    b. tekən+tjə    c. man+ətjə
```

However, schwa differs in a very important respect from all other vowels: it cannot be stressed, whereas all other vowels can be stressed (this property will be dealt with in detail in chapter 4). The bimoraic representation of schwa proposed by Trommelen structurally expresses the similarity to long vowels, while the difference with other vowels is captured by its empty first position, see (78b), where 'V' is schwa:

```
(78)a.    [+voc]      b.  [+voc]     c.   [+voc]
           / \              / \              |
          Vi  Vi           -   V             V
          Vi  Vj
```

The empty first position in schwa captures its inability to be stressed, since Dutch has falling diphthongs, stress being realized on the initial part.

Trommelen's three important observations clearly prove that schwa cannot be a short vowel in underlying representation, but at the same time fail to show that schwa must be a bimoraic vowel at that level. More precise, all distributional similarities between schwa and long vowels might as well be due to a property of short vowels instead of a property of the complementary set of schwa and long vowels. This claim will be motivated in section 6.4 below, where we will show that it is the close connection between a short vowel and the following consonant what sets short vowels apart from long vowels and schwa. But we will first discuss some earlier accounts of schwa's distribution in 6.2.

6.2 Schwa as a weightless vowel

Schwa's unstressability leads Van der Hulst (1984) to stipulate that all final syllables containing schwa, whether closed or not, are monomoraic, hence *obligatorily non-branching*. A moraic theory would express this as in (79):

```
(79)a.  σ        σ        σ          b.     σ         σ
       / \      / \       |                / \        |
      m   m    m   m      m               m   m       m
      |   |   / |  |     /| \            /|   |     / | \ \
      V   C  C  V  V    C V  C          C V   C    C  V  C  C
      |   |  |   \/     | |  |          | |   |    |  |  |  |
      o   k  t   o      b ə  r          h o   n    d  ə  r  d
```

Consonants following schwa are not separate mora's, but are adjoined to the mora linked to schwa. Thus they do not contribute to moraic weight, this in contrast to consonants after full vowels. We will see later how its monomoraic representation makes schwa *too light* to be stressed.

Schwa can appear word-finally since it escapes the branching requirement on full vowels. Notice that this is essentially a circular argument, since it must be *stipulated* that only full vowels are subject to bimoraic minimality. Trommelen's observation that schwa can be followed by the same number and type of consonants as long vowels (75) is clearly problematic for the moraic representation too. To see this, notice that there is no parallel way of representing post-nuclear consonants between schwa and long vowels. The restriction should therefore be expressed at the skeletal level, by reference to the linear distance of consonants from the first skeletal vocalic position. But this fails too since at the skeletal level schwa is indistinguishable from short vowels, as it is associated to only one skeletal position[25].

Van der Hulst & Van Lit (1987) aim at capturing the unstressability, or *weightlessness* of schwa by denying its existence at an underlying level. Schwallables, final syllables containing schwa, arise by epenthesis of schwa in consonant clusters that are otherwise illegal syllable-final clusters. The idea as such is not new, as similar proposals have been made in De Schutter (1978), Booij (1985a), Hoeksema (1985), and Ter Mors (1986). Its elaboration however, presents a lot of difficulties to all who engage in it.

Indeed, schwallables are predictable by epenthesis in consonant clusters of rising sonority. A minor epenthesis rule (80) inserts schwa directly after a consonant in degenerate syllables, as shown in (81):

```
(80)     m                  m
         |      =>         / \
     [+cons]        [+cons] ə

(81)a.    σ    σ σ          σ    σ σ
          |    | |          |    | |
          m    m m          m    m m
         /|   /| |         /|   /| |
        l a  w i n   =>   l a  w i n ə
```

In consonant clusters of rising sonority this rule is intended to yield a maximally positive effect as to the sonority sequencing generalization (42a). However, it is not completely clear why it should not produce **papavr*[ə], as a legal syllable-initial sequence would result. The problem is that if (80) is restricted to application in between a consonant and a sonorant consonant, it can no longer account for final schwa's, so that the idea that schwallables arise by epenthesis has to be given up.

Moreover, in at least two contexts insertion *cannot* be predicted, hence needs to be marked by brute force: word-finally after single consonants (81,82a), and in or after homorganic dental clusters whose sonority does not rise (83a):

(82) a.	[duanə]	douane	b.	[banan]	banaan
	[mɑskOtə]	mascotte		[mɑrmOt]	marmot
	[kamIlə]	kamille		[pypIl]	pupil
	[lawinə]	lawine		[stramin]	stramien
	[sonatə]	sonate		[parat]	paraat

(83)	a. [hɑnəs]	hannes	b. [hɑns]	Hans	c. [hɑnzə]	Hanze
	[ɛrəs]	Erres	[vɛrs]	vers	[travɛrsə]	traverse
	[bɑkəs]	bakkes	[lɑks]	laks	[profilɑksə]	profylaxe
	[ɛləs]	Ellis	[ɛls]	Els	[ɛlzə]	Else
	[χɛrət]	Gerrit	[χɛrt]	Gert	[ofɛrtə]	offerte
	[tɪkət]	ticket	[delɪkt]	delict	[sɛktə]	sekte
	[χoelət]	Gullit	[boelt]	bult	[koeltə]	culte

Actually, Van der Hulst & Van Lit only discuss final schwa. In (82a), a rule-feature on the relevant words would suffice, as only one consonant is available for (80). But proper application in (83) is less evident from the formulation of the rule, since here a lexical feature does not suffice, but the *position* of insertion must be indicated as well, cf. (83a) versus (83c). This problem cannot be solved without giving up the basic idea behind the analysis: epenthesizing schwa where it can be predicted. It may be argued that not all schwa's are epenthetic, and that deriving schwa from full vowels by vowel reduction is an additional strategy deserving attention. But since Van der Hulst & Van Lit neither mention nor follow this strategy, and since we do not see how it can be maintained under whatever modification, we will consider schwa epenthesis as an insufficient improvement on the appendix analysis proposed by Kager & Zonneveld. Further consequences of their analysis for stress assignment will be discussed later.

6.3 Schwa as an appendix-vowel

Kager & Zonneveld (1986) claim final syllable schwa to be in a special '*Schwappendix*', on the basis of distributional evidence discussed below. This evidence shows that schwallables behave as *word-boundaries* with respect to segment distibution. Many distributional statements require a disjunction of the type as in (84):

(84) ___ {#, ə}

Kager & Zonneveld's basic idea is to simplify the context of (84) by direct reference to syllable structure. Consonants before schwa are part of the *preceding* syllable in early syllabification, where distributional filters apply. The assumption that -əC_0 is in an appendix (*Schwappendix*) will suffice to guarantee this effect.

First, Schwappendix occurs after sequences such as [VX]+*st*, while tripositional syllables VVC/VCC hardly occur before full vowels (as was demonstrated in previous sections).

(85)	a. kloost+er	lijst+er	b. worst+el	hamst+er
	heest+er	luist+er	holst+er	venst+er

This seems to indicate that Schwappendix may follow consonants which (in line with bimoraic maximality) can only be in an appendix themselves. As a matter of fact, this observation only *gradually* distinguishes schwa and full vowels, since as we saw earlier tripositional syllables are not completely excluded before full vowels (cf. 51, 52, 60, 64). In this sense, the bimoraic maximum weight generalization may be a spurious one for Dutch, even though it may be a universal tendency (cf. Kaye & Lowenstamm 1982).

Second, filters governing the distribution of consonants exclude in the right-hand context the disjunction of word end, a consonant, and schwa. The relevant strings are /h/, diphthong plus /r/, and the cluster /ŋχ/:

(86)	a. *[brah]	b. *[brahs]	c. *[brahəl]	d. [abrahɑm]	Abraham
	*[ɑur]	*[ɑurs]	*[ɑurəl]	[ɑurora]	aurora
	*[ɑŋχ]	*[ɑŋχs]	*[ɑŋχəl]	[ɑŋχora]	angora

These filters are completely exceptionless in the case of (86a,c), while (86b) is confronted with a small number of exceptions in the case of the sequence [ɑur] (*centaur* [sɛntɑur], *Dessaur* [dɛsɑur], and *Joure* [jɑurə]).
Third, the mirror-image context of (86) holds for the velar nasal /ŋ/:

```
(87)a. [wɑŋ] wang   b. [bɑŋk] bank   c. [ɑŋəl] angel     d. *[aŋora]
```

Again, this filter is exceptionless, and a fair number of cases such as (87c) occur:

```
(88) angel    bengel   stengel   tangens   Linge
     engel    hengel   wrongel   Ganges
```

Fourth, consonant clusters preceding schwa decrease *in sonority*, as if these clusters were word-final. Clusters of increasing sonority occur before full vowels:

```
(89)a. *[katr]    b. *[ka.trəl]   c.   [ka.trOl]    katrol
       *[dypl]       *[dy.plə]         [dy.plo]     duplo
       *[ɑtl]        *[ɑt.ləs]         [ɑt.lɑs]     atlas
       *[ɛtn]        *[ɛt.nəl]         [ɛt.na]      Etna
```

Still, a small number of words (most of which are of Greek origin), as well as the productive level-1 suffix *-isme*, are exceptional:

```
(90) [drɑχ.mə]   drachme    [ariɑt.nə] Ariadne    [boet.lər]  butler
     [rIt.mə]    ritme      [dɑf.nə]   Dafne      [frɑn.jə]   franje
     [kybIs.mə]  kubisme    [pɑrt.nər] partner    [tɑr.wə]    tarwe
     [Orχɑs.mə]  orgasme    [Ort.nər]  ordner     [rapɑl.jə]  rapalje
```

Kager & Zonneveld capture the distributional similarity between word end and schwa by assigning schwa (and consonants optionally following it) to the second appendix position outside the bimoraic nucleus, the Appendix_2 or *Schwappendix*:

(91) $[\text{VX}]_{\text{Nuc}}\quad [\left\{\begin{matrix}\text{C}\\ \text{st}\end{matrix}\right\}]_{\text{Appendix}}\quad (\text{ə}\text{C}_0)_{\text{Schwappendix}}$

Distributional observations on consonant clusters preceding schwa can be interpreted as syllable-based, or rime-based, if it is assumed that the Appendix_1 is part of the preceding syllable or rime, while Schwappendix adjoins under the prosodic word:

```
(92)      M                  M                  M                    M
         / \                /\                 / \                  / \
        σ   \              σ  \               σ   \                σ   \
       / \   \             |   \             / \   \              / \   \
      O   R   \            R    \           O   R   \            O   R   \
      |  / \   \           |     \          |  / \   \           |   |    \
      | N App1 App2        N    App2        | N App1 App2        |   N    App2
      | / \ /\  / \       / \   / \         | / \  |  / \        |  / \   / \
      h e : st  ə r       ɛ ŋ   ə l         h a :  m  ə r        w  ɑ k   ə r
      heester             engel             hamer                wakker
```

The problem with respect to the Peripherality Condition, noted earlier, remains. It could be suggested that both appendices are peripheral in a domain of their own, Appendix_1 adjoining under the final syllable of the word, and Schwappendix under the word itself.

But clearly, these domains of syllabification lack independent motivation, neither do they coincide with morphological domains.
By (91), Kager & Zonneveld claim that no post-nuclear clusters can precede Schwappendix, except for /st/. Indeed, obstruent clusters are virtually absent before schwa (i.e. next to *secte* [sɛktə], words such as [sektə] hardly occur). On the other hand the existence of pre-schwa *sonorant-obstruent* clusters as in *pienter*, *vaandel*, *heinde*, *Maarten*, *aarde*, *boerde*, and *voorde* (51) remains unexplained under (91). The same goes for *sonorant* clusters as they occur in *deerne*, *taveerne*, *Spaarne*, *Voorne*, *Haarlem*, *Oerle*, *Goirle*, etc.
Additional evidence for the Schwappendix analysis (91) is presented in De Haas (1986), who presents an analysis of schwa epenthesis within the appendix framework. Clusters of a liquid and a non-dental consonant are subject to schwa epenthesis in two contexts: at the end of a syllable and before schwa. Crucially, no epenthesis takes place in heterosyllabic clusters preceding full vowels. The data (partly taken from Berendsen & Zonneveld 1984) are in (93), where $ indicates a schwa epenthesized:

(93)	a.	[hɑr$p]	harp	b.	[kɑr$.pər]	karper	c.	[hɑr.pun]	harpoen	*[hɑr$.pun]
		[zɑl$f]	zalf		[ɑl$.fən]	Alphen		[ɑl.fa]	alfa	*[ɑl$.fa]
		[kɛr$k]	kerk		[kɛr$.kər]	kerker		[kɑr.kɑs]	karkas	*[kɑr$.kɑs]
		[wɑr$m]	warm		[mɑr$.mər]	marmer		[mɑr.mOt]	marmot	*[mɑr$.mOt]
		[bɑl$k]	balk		[stɑl$.kər]	Stalker		[bɑl.kɑn]	Balkan	*[bɑl$.kɑn]
		[hɛl$m]	helm		[hɛl$.mər]	Helmer		[hɛl.ma]	Helma	*[hɛl$.ma]
		[bOr$χ]	borg		[Or$.gəl]	orgel		[mɑr.χa]	Marga	*[mɑr$.χa]
		[dOl$k]	dolk		[bOl$.kə]	Bolke		[pOl.ka]	polka	*[pOl$.ka]

Although epenthesis is nearly obligatory in (93a), and only optional in (93b), it is completely excluded in (93c). Again, a pre-schwa consonant cluster behaves as if it were word-final.
Let us summarize our review of the literature. First, Trommelen (1983) takes schwa to be a bimoraic vowel (78) by its distributional similarity to long full vowels, but misses the possibility that short vowels form a natural class, instead of schwa and long vowels. Second, Van der Hulst (1984), stipulating a monomoraic nature of schwallables, meets various problems in capturing Trommelen's distributional observations. Third, a schwa epenthesis analysis (Van der Hulst & Van Lit 1987) fails for the fact that schwa's distribution is essentially unpredictable. Third, the Schwappendix analysis by Kager & Zonneveld runs into the problem of non-peripherality.

6.4 A moraic analysis of schwallables

We will present a new analysis of schwallables that accounts for most of the observations discussed above. The two central ideas are as follows. First, schwa is *weightless* in lexical representation, which will keep it outside Core Syllable Formation at level-1. Second, schwa is syllabified as a vowel *at level-2*, when rules of default syllabification reapply to form schwallables, adjoining the onset and coda. We will discuss schwa's distribution in final syllables, but by this we do not exclude that non-final syllable schwa shares properties with final syllable schwa. As far as we see, there are hardly any objections to apply our analysis to non-final syllables. Perhaps the only property that distinguishes non-final schwa from final syllable schwa is that it can be preceded by complex onsets: [frəχɑt] *fregat*, [brəvɛt] *brevet*, etc., cf. property f. below.

The observations below must be incorporated into an adequate analysis of schwallables:
a. Schwa cannot be stressed.
b. Schwa can appear in open syllables (cf. 74).
c. Schwa cannot be followed by a consonant cluster of which the second member is a non-dental (cf. 75).
d. Schwa cannot be preceded by /h/, a diphthong plus /r/, or /ηχ/ (cf. 86).
e. Schwa can be preceded by /η/ (cf. 87).
f. Schwa cannot be preceded by consonant clusters of rising sonority (more accurately, by *complex onsets*) (cf. 89).

Most of the above observations suggest that schwa cannot function as the vocalic nucleus of a full vowel syllable. In fact, (b) and (c) can be interpreted as reflecting schwa's position *outside* the bimoraic syllable core. And (d), (e), (f) suggest a defect in schwa's ability to combine with preceding consonants (or clusters) since these are distributionally *heterosyllabic*. We will attempt to derive both properties (schwa's being outside a bimoraic core syllable and its failure in binding onsets) from the minimal assumption that schwa is weightless, or mora-less (cf. 94c)[26]:

```
(94)a.  m m       b.  m        c.
         \ /           |
          V            V           ə
```

A direct consequence of representing schwa as weightless is that it will not participate in Core Syllable Formation (35). Actually it will remain as it is until a level-2 rule syllabifies it as a syllabic nucleus by default, because of its vocalic content. Schwallables thus simply arise too late to affect level-1 syllabification. We will show that this view is quite compatible with the above observations on the distribution of schwa. We will leave observation (a) on schwa's unstressability to the next chapter, and will discuss (b-f) in this order.

To start, schwa's position outside the core syllable explains (b) and (c) above, or its presence in open syllables (74b) and its absence before consonant clusters whose second member is non-dental (75b). And a second positive effect is that post-nuclear pre-schwa consonants will be adjoined to the preceding syllable by Coda Formation, which will give us the explanation for (d) - (f). Finally, schwa's weightlessness gives us the cornerstone of the explanation of its instressability which will be presented later.

We must make the assumption that segments can be left unsyllabified at level-1, to be syllabified only at level-2. We assume that Stray Erasure is not operative at the end of each stratum (as has been proposed in Steriade 1982).

Observe that schwa's weightlessness prohibits its taking part as a syllable core at level-1, hence its inability to bind either an onset or a coda:

```
(95)    σ
       / \
      σ   |
     / \  |
    m m   |
     \ /  |
      a   r d ə
```

We will come back to the surface syllabification of words such as (95) shortly. The pre-schwa consonants will be syllabified as onsets during level-2 syllabification, fully respecting the Sonority Sequencing Principle (42a), as will be illustrated in (105) below.

To illustrate our account of (b) and (c), see (96):

```
(96)a.        σ              b.       σ
             / \                     / \
            σ   |                   σ   |
           / \  |                  / \  |
           m m  |                  m m  |
         / \ /  |                  \ /  |
         m  i   k  ∂               a    d  ∂  m p
         Mieke                     *ademp
```

Note that (96a) is legal, as schwa simply does not match the Structural Description of Core Syllable Formation. Furthermore, (96b) is excluded by our filter (63), since the word-final cluster contains a non-dental consonant in second position, the entire cluster being outside the core syllable. In sum, schwa's being outside the bimoraic syllable accounts for Trommelen's observations of schwa being unlike short vowels, without having to invoke a bimoraic structure for schwa.

Let us now consider the distributional effects of schwa on the preceding consonant cluster. In discussing the evidence for the claim that schwa occupies a separate Appendix2, we noted that consonant clusters before schwa behave as if word-final, as is reflected in the observations (d)-(f) above. With Kager & Zonneveld (1986), we take these observations to reflect that post-nuclear pre-schwa consonants are part of the preceding syllable, at some level of syllabification. The situation resembles the ambisyllabicity of consonants between stressed and stressless syllables in English, with the crucial difference that Dutch shows distributional non-allophonic constraints on the pre-schwa consonant cluster, whereas in English it is mostly allophonic variation which motivates consonant ambisyllabicity in such clusters.

Actually, the explanation for (d) is in our hands already. Since post-nuclear pre-schwa consonants are adjoined to the preceding syllable by Coda Formation at level-1, two of Kager & Zonneveld's filters in (46) can be reformulated with the syllable σ as their domain:

```
(97)a.      σ                b.       σ
           / \                       / \
          σ   |                     σ   |
         / \  |                    / \  |
         m m  |                    m m  |
         | |  |                   /\ /  |
         ε I  r  ∂  l            j  o   h  ∂  n
        *[εir∂l]                *[joh∂n]
```

The relevant filters are stated below, where (98a) excludes diphthongs followed by /r/ within the syllable, and (98b) is a positive filter to exclude /h/ in any other positions than the onset:

```
(98)a.   *  σ            b.  σ
           / \              / \
          /   \             m m
         /_____\           /
          ViVj r          h
```

The effects of two remaining filters in (86-87), that allow [ŋ], but not [ŋχ] before schwa, are already accounted for by the rule deleting /χ/ in syllable-final position, as formulated in (71). Schwa's syllabification properties will leave the cluster /ŋχ/ after short vowels syllabified as below, matching the context of the deletion (71):

```
(99)      σ
         / \
        σ   |              σ
       / \  |             / \
       m m  |             m m
       | |  |             | |
       ε η χ  ∂  l   =>   ε η -  ∂  l
```

Let us now discuss the observation that complex onsets before schwa are absent. Since Onset Formation (41) refers to syllable structure erected by Core Syllable Formation, it is blocked before schwa. This explains the gap in the distribution of complex onsets before schwa, since the (independently motivated) Complex Onset Condition (41) rules out (100a):

```
(100)a.       σ              b.
             / \
            σ   |                  σ        σ
           / \  |                 / \      / \
           m m  |                 m m      m   m
          /\ /  |                /\ /     // \ /
         w  a   t r ∂            z  e     b r  a
```

But what about Kager & Zonneveld's claim that consonant clusters before schwa display falling sonority? Actually, this claim is falsified by the words below, which contain clusters such as /tm/, /nj/, /mn/, /tl/ etc. The words of (101a) contain obstruent-plus-sonorant clusters, those of (101b) sonorant-sonorant clusters[27]:

(101) a.	[drαχm∂]	drachme	[boetl∂r]	butler	b.	[frαnj∂]	franje
	[rItm∂]	ritme	[krajsl∂r]	Chrysler		[rapαlj∂]	rapalje
	[Orχαsm∂]	orgasme	[Ortn∂r]	ordner		[tαrw∂]	tarwe
	[dαfn∂]	Dafne	[pαrtn∂r]	partner		[kOrnulj∂]	kornoelje
	[ariαtn∂]	Ariadne				[flOtilj∂]	flottielje
						[hImn∂]	hymne
						[deml∂r]	Daimler

Interestingly, exceptional pre-schwa clusters of rising sonority involve sequences which cannot function as *complex onsets*. The consonant strings /sl/ and /tl/ cannot be complex onsets for instance, as is evident from the syllabifications [Os.lo] (*Oslo*) and [αt.las] (*atlas*).

The existence of words such as (101) is predicted by our analysis, since their pre-schwa consonant clusters are not subject to the Complex Onset Condition (44). Furthermore, their clusters respect the Extrasyllabicity Constraint (63)[28]:

```
(102)a.                   b.      σ            c.           σ
                                 / \                       / \
             σ                  σ   |             σ      σ   |
            / \                / \  |            / \    / \  |
            m m                m m  |            m m    m m  |
          //| |               /| |  |           /| |   /\ /  |
         d r α χ  m ∂        p α r t  n ∂ r    k O r n  u  l j ∂
```

Counterexamples to our analysis would be words with a pre-schwa complex onset, since these would violate the Complex Onset Condition (41). A small number of such words exist, but they form a very specific class: all have French *loan-vowels* [oe:], [α:], [ε:], [O:], [i:], [y:], [u:], preceding the complex onset cluster (103).

(103) [ma.noe:.vrə]	manoeuvre	[tεri:.blə]	(enfant) terrible
[α~.sα:~.blə]	ensemble	[du:.blə]	doubles
[bi.nO:.klə]	binocle	[tε~.brə]	timbre
[sε:.vrə]	Sèvres	[li:.brə]	libre
[ko.mεs.ti:.blə]	comestibles	[oe:.vrə]	oeuvre

This group is sufficiently deviant because of their foreign vowels to be exempted from our analysis[29].

Of course we must guarantee that in *surface* syllabification schwa forms a syllabic nucleus. Schwa's surface syllabification straightforwardly follows from several default syllabification principles operative at level-2.

First, schwa, being a vowel, is associated with a mora and a syllable by default:

```
(104)           m
                |
     V    =>    V
```

Second, all syllabification rules discussed above will reapply at level-2, in a structure-chanching mode, exempted from the Free Element Condition: Core Syllable Formation (35), Onset Formation (41), Coda Formation (68), Appendix Formation (72). These rules apply to the output of level-1 syllabification as illustrated in the derivations below:

```
(105)a.      σ           b.   σ              c.   σ              d.   σ
            / \              / \                 / \                 / \
           σ   |            σ   |               σ   |               σ   |
          / \  |           / \  |              / \  |              / \  |
          m m  |   m       m m  |   m          m m  |   m          m m  |  m
         /\ /  |   |       \ /  |   |          \ /  |   |         /| |  |  |
Core    m  i   k   ə        a   d   ə   m       a   r d ə         h O n d  ə r d
Syllable
Formation    σ                σ                   σ              d.   σ
            / \              / \                 / \                 / \
           σ   |   σ        σ   |   σ           σ   |   σ           σ   |  σ
          / \  |   |       / \  |   |          / \  |   |          / \  |  |
          m m  |   m       m m  |   m          m m  |   m          m m  |  m
         /\ /  |   |       \ /  |   |          \ /  |   |         /| |  |  |
        m  i   k   ə        a   d   ə   m       a   r d ə         h O n d  ə r d
Onset
Formation    σ                σ                   σ                   σ
            / \              / \                 / \                 / \
           σ   |   σ        σ   |   σ           σ   |   σ           σ   |  σ
          / \  |   |       / \  |   |          / \  |   |          / \  |  |
          m m  |   m       m m  |   m          m m  |   m          m m  |  m
         /\ /  |  /|       \ /  |  /|          \ /  |  /|         /| |  | /|
        m  i   k   ə        a   d   ə   m       a   r d ə         h O n d  ə r d
Coda
Formation    σ                σ       σ           σ                   σ   σ
            / \              / \     / \         / \                 / \ / \
           σ   |   σ        σ   |   σ   |       σ   |   σ           σ   |  σ |
          / \  |   |       / \  |   |   |      / \  |   |          / \  |  | |
          m m  |   m       m m  |   m   |      m m  |   m          m m  |  m |
         /\ /  |  /|       \ /  |  /|   |      \ /  |  /|         /| |  | /| |
        m  i   k   ə        a   d   ə   m       a   r d ə         h O n d  ə r d
Appendix
Formation                                                             σ   σ
                                                                     / \ / \\
                                                                    σ   |  σ | |
                                                                   / \  |  | | |
             ---              ---                 ---              m m  |  m | |
                                                                  /| |  | /| | |
                                                                  h O n d  ə r d
```

Notice how consonants that are left unsyllabified at level-1 are saved at level-2 from the fate of stray deletion.

7. A summary of the analysis

A distinction has been made between *level-1* and *level-2* syllabification, where the Free Element Condition governs the former only. In both phases, the rules below apply:

```
(106)a. Core Syllable Formation (35)
     b. Onset Formation (41)
     c. Coda Formation (68)
     d. Appendix Formation (72)
```

Reapplication of syllabification rules is independently motivated by the surface syllabification of intervocalic consonants after short vowels. Our syllabification analysis, cast in a moraic framework (Hayes 1989), has the bimoraic core syllable as its central notion. The construction of this constituent has priority over syllabification of pre-nuclear (*onset*), and post-nuclear (*coda* or *appendix*) consonants. Furthermore, important distributional generalizations were shown to refer to the core syllable.

Tripositional non-final syllables were shown to be marginal, although a subset turned out to be almost excluded, the one captured by the linear level-1 filter, which crucially refers to the core bimoraic syllable. This analysis slightly weakens the maximally bimoraic generalization as consonants are adjoined as coda's to non-final syllables, but this is well-motivated in terms of actually occurring words.

Schwa's distribution has been shown to be crucially unlike short vowels, as it behaves much like a long vowel when viewed from the word end (as observed by Trommelen 1983), and much like the word end when viewed from the preceding material (as observed by Kager & Zonneveld 1986). However, no existing analysis deals with schwa's schizophrenic behavior by means of one single property, which is what we have done by means of schwa's level-1 weightlessness. This property keeps schwa from syllabifying into a core syllable, providing the key to its behavior as a non-short vowel.

Finally, we will give a derivation through the level-1 and level-2 phase of syllabification below, of the (partly nonsense) words *lama*, *lamma*, *lame*, *lamme*:

```
(107)a.       m m   m m    b.  m     m m    c.  m m        d.   m
              \ /   \ /        |     \ /        \ /             |
Lexical     l  a  m  a       l ɑ m    a       l  a   m  ə      l ɑ m ə
Represent.

               σ     σ         σ    σ          σ               σ
              / \   / \       / \  / \        / \             / \
Core          m m   m m       m m  m m        m m             m m
Syllable      \ /   \ /       | |  \ /        \ /             | |
Formation   l  a  m  a       l ɑ m    a       l  a   m  ə      l ɑ m ə

               σ     σ         σ    σ          σ               σ
              / \   / \       / \  / \        / \             / \
              m m   m m       m m  m m        m m             m m
Onset        /\ /  /\ /      /| |  \ /       /\ /            /| |
Formation   l  a  m  a       l ɑ m    a       l  a   m  ə      l ɑ m ə

                                                 σ
                                                / \
                                               σ   |
                                              / \  |
                                              m m  |
Coda                                         /\ /  |
Formation      ---            ---            l  a  m  ə         ---
```

At level-2, the derivations are completed as below:

```
(108)                                               σ
                                                   / \
                                                  σ   |            σ
                                                 / \  |           / \
Default                                          m m  |  m        m m m
Mora                                            /\ /  |  |       /| | |
Supply          ---          ---             l   a    m  ə     l α m ə

                                                    σ
                                                   / \
                                                  σ   |  σ       σ   σ
                                                 / \  |  |      / \  |
Core                                             m m  |  m      m m  m
Syllable                                        /\ /  |  |     /| |  |
Formation       ---           ---            l   a    m  ə    l α m  ə

                                                    σ
                                                   / \
                                  σ   σ           σ   | σ       σ   σ
                                 / \ / \         / \  | |      / \  |
                                 m m m m         m m  | m      m m m
Onset                           /| |/\ /        /\ /  |/|     /| |/|
Formation       ---            l α m  a      l   a    m ə    l α m ə

Coda Formation  ---              ---              ---           ---
```

This completes our discussion of primary syllabification. We have shown that representing schwa as weightless accounts for its syllabification properties: its behavior as a word boundary, and its unability to form a core syllable.

In chapter 4, we will discuss the relevance of this analysis to stress assignment in Dutch. Closed and diphthongal syllables will be shown to behave as systematically heavier than open non-diphthongal syllables. We will argue, with Lahiri and Koreman (1987), that this 'odd' distinction is caused by the fact that Dutch has no monomoraic syllables at level-1 (where stress assignment takes place), which has been argued in this chapter. Dutch lacks the 'usual' mora count distinction between light monomoraic and heavy bimoraic syllables, and another, non-moraic, distinction can take over. We will formalize it in terms of 'melodic complexity'. This non-moraic notion of syllable weight refers to the number of feature matrices (or root nodes) that are linked to a core syllable. Since long non-diphthongal vowels have only one feature matrix, and closed syllables and diphthongs (minimally) two, the latter are heavier. In chapter 5, we will extend the relevance of this weight distinction to secondary stress and vowel reduction.

We will also use our analysis of schwa that was proposed in this chapter to explain schwa's behavior with respect to stress. Crucially, schwa cannot be stressed, which follows from its weightlessness at level-1, where stress is assigned. Also, schwa attracts stress onto the preceding syllable if at least one consonant precedes schwa. Obviously, pre-schwa consonants add to the weight of the preceding syllable, which follows from the analysis proposed here.

Footnotes to chapter 3:

1 A phonetic voicing contrast among velar fricatives is disputed in much of the literature (cf. Van den Broecke & Van Heuven 1979), but phonologically it is safely motivated by contrasts between verbs like *lachte* /lαχ+tə/ and *vlagde* /vlαγ+də/, whose preterite allomorphs /tə/ or /də/ match the voice value of the final stem consonant.
2 There has been some debate as to the segmental contents of the second part of diphthongs. We follow Trommelen & Zonneveld (1979) here.
3 In section 5.3 we will show that (9) as a first attempt is on the right track, but can be stated more adequately by referring to the bimoraic syllable.
4 Zonneveld & Trommelen (1980) offer (i) as the general scheme:

```
(i) [-cons]i [-cons]i  =>  [-cons]i
                            with centralization p in env. x
                                 height q in env. y
                                 length in env. z
                            and so on.
```

5 Booij (1984) rejects Trommelen's position for the reason that level-2 suffixes *themselves* typically conform to the syllable structure constraints holding in underived words. This syllabification conspiracy can be understood only if it is assumed that all syllabification takes place at level-2, the level where all morphological operations have applied. If special weight restrictions for underived words exist at all, they are to be expressed by redundancy rules for the segmental composition of morphemes, not in the syllabification rules themselves. Clearly, Booij's position implies that syllabification applies at a relatively shallow level in the derivation, which is incompatible with segmental distribution and stress assignment referring to it, as will be shown in the remainder of this chapter.
6 Exceptions are *waard+eer* [war.der], *marx+ist* [mαrk.sIst].
7 According to Van Beurden (1987) and Backhuys (1987), this occurs deep in the lexicon.
8 Exceptional are some interjectives (*hè* [hε], *bah* [bα], *goh* [χO], *joh* [jO], *huh* [hoe] etc) and some loans (*schwa* [çwα], *cachet* [kαçε], *bidet* [bidε] etc.), cf. Cohen e.a. (1959), Zonneveld & Trommelen (1980).
9 This observation has been made explicitly in Van der Hulst (1985).
10 Autosegmentally, the rule can be viewed as a *contour formation* rule spreading the melodic content of the first vowel to the timing slot of the second - Wim de Haas, personal communication.
11 An additional argument that short vowels are constituents with following intervocalic consonants is based on stress assignment, where a sequence of short vowel plus single consonant cannot be skipped, as is the case with closed syllables. This will be discussed in some detail in chapter 5.
12 The bimoraic minimality of the Dutch syllable has not always been agreed upon, especially for the reason that opinions differ as to the surface syllabification of single intervocalic consonants after short vowels in words of the type (21), and others with different consonants. Some (Booij 1981, 1984) ascribe potential ambisyllabicity to a late rule of resyllabification in the spirit of Kahn (1976). In his view there is no minimum restriction on the size of the syllable.
13 Van der Hulst basically follows Borowsky, Itô, & Mester (1984) here.
14 Some rare counterexamples are *Accra*, *Biafra*. Notice that words such as *Oslo* [Os.lo], *moslim* [mOs.lIm], *atlas* [αt.lαs] do not count as counterexamples, since no complex onsets such as [sl], [tl] occur in Dutch.
15 The latter morae are motivated primarily by stress assignment, to be discussed in chapter 5.
16 With Zonneveld & Trommelen (1980) we assume that the sonority relation between the morae decreases, yielding falling diphthongs.
17 For those who would argue that (37), in combination with (35), yields a redundant specification of the bimoraic minimum constraint, the Bimoraic Constraint (37) may be interpreted as an independently required addition to (35) to the effect that (35) applies *obligatorily*. That is, each short vowel *must* be closed by a consonant.
18 In section 6.4 we will show that (41) crucially applies at level-1, and reapplies at level-2.
19 Languages in which the nucleus may either be branching or non-branching (i.e. the universally most common type) display a mirror-image effect with respect to Dutch (ia). That is, intervocalic consonants once syllabified into the onset, cannot be syllabified as a mora by Weight by Position into the preceding syllable, cf. (iib):

```
(ii)a.                         σ     σ                    σ     σ
                 Core          / \    |                   / \    |
     m      m    Syll.        m   m   m       Onset      m   m   m
     |      |    Form         |   |   |       Form.      |   |/  |
     V   C  V     =>          V   C   V        =/=>      V   C   V

  b.                           σ      σ                    σ     σ
                               |      |      Weight        / \    |
     m      m    Onset         m      m      by           m   m   m
     |      |    Form.         |    / |      Pos.         |   |/  |
     V   C  V     =>           V   C  V        =/=>       V   C   V
```

The blocking effect may be attributed to the Linking Constraint, rather than to the Free Element Condition, under the interpretation that material to be adjoined is represented in Structural Descriptions of Onset Formation and Weight by Position unlinked to syllable structure.
This would fit in badly, however, with our later attempts to account for surface ambisyllabicity of Dutch intervocalic consonants following short vowels by Onset Formation.

20 Some well-known exceptions are *twaalf, zwierf, wierp.*

21 The second position in the [+son] node (nucleus) is optional - recall from section 4.2 that Booij rejects the bimoraic minimality of the Dutch syllable, preferring a linear morpheme structure condition much like (22) to rule out word-final short vowels.

22 Recently, English has been claimed to follow a similar maximum bipositional weight restriction (Myers 1987).

23 Zonneveld (1983) observes that consonant clusters tend to contain at least one obstruent.

24 We assume that Appendix Formation applies at level-1, as well as at level-2, this being the simplest assumption about syllabification. As we will see in section 6 on schwa, re-application at level-2 is crucial.

25 This observation is better expressed in a metrical framework, which Van der Hulst (1984) elaborates on next to his moraic proposal. Assuming that metrical schwallables have non-branching nuclei, any post-nuclear consonant will end up in a position structurally similar to the post-nuclear consonants after long vowels:

```
(iii)a.   / \      b.   |       c.    / \
          N  C          N             N  C
         / \ |         / \            |  |
        r a a m       r α m       a d ə  m
```

Now **raamp* and **ademp* are excluded similarly as non-coda consonants can only be *dental* appendix consonants.

26 A similar idea is pursued in Van der Hulst & Van Lit (forthcoming).

27 Many of the words in (101a) are words of Greek origin.

28 If the /u/ in (102c) is underlyingly long the Extrasyllabicity Constraint (63) will not rule out the example if it is assumed that /j/ is [+cor], cf. Clements (1976).

29 Two remaining exceptions are *tumbler* and *scrambler.*

Chapter 4
Primary stress in Dutch underived words

1. Introduction

This chapter addresses the characteristics of primary word stress in underived words and in words derived with level-1 affixes. We will propose an account within the theory of stress that has been proposed in chapter 0, and as has been applied to English in chapter 2. Essentially, Dutch differs from English in aspects of *syllable weight* (long vowels in open syllables are light), and extrametricality (syllable extrametricality does not affect Syllable Adjunction, but only the End Rule). Considerable attention will be paid to lexical variability in stress positions, and a proposal will be made to capture the relative markedness of stress patterns, and vacillation paradigms within and across lexical items. This chapter 4 will provide the starting point for our analysis of secondary stress, destressing, and vowel reduction to be developed in chapter 5.

Dutch word stress has been analysed in recent years as rule-based, even in the face of pervasive exceptionality. Arguments for this derivational view are based on the restricted position of primary stress with respect to the word end and the obvious sensitivity to syllable structure.

Nevertheless, the derivational view has come under attack from proponents of the view that Dutch word stress is basically *free*, or unpredictable, be it governed by dominant patterns. This claim, made explicitly in Van Marle (1980), is on first sight hard to refute.

We believe that the controversy is somewhat misleading in the sense that Dutch takes an *intermediary* position between fixed and free systems, just as English does, by showing a considerable freedom in lexically marking of stress-relevant properties (such as lexical stresses and extrametricality), paired to a rule system to interprete these markings. As we see it, the crucial issue must then be to characterize the nature and the scope of lexically supplied stress. We will show that basically two lexical marking devices suffice: lexical stresses, whose effects resemble heavy syllables, and a lexical marking with respect to the End Rule. Importantly, these devices can be allowed to have an across-the-board distribution without leading to a completely free distribution of primary stress.

Syllable *weight* is fairly complex. In the previous analyses, different weight distinctions have been proposed, ranging from vowel quantity or vowel quality (schwa-full, short-long, lax-tense), weight by mora number (monomoraic-bimoraic, and bimoraic-trimoraic), syllable closing (open-closed). Our contribution to the discussion will involve a review of the factors affecting syllable weight, which will not turn out to be mora-counting - syllable structure being basically bimoraic - but rather *melodic* complexity.

This chapter is organized as follows.

Section 2 will present the basic data of primary stress placement and the most important generalizations to be drawn from them. We will make a distinction between major and minor generalizations. Within the limits of the minor generalizations, we will distinguish dominant patterns from recessive patterns. The three major generalizations affect Q-sensitivity and window conditions.

Section 3 is devoted to a survey of earlier analyses. From the earliest descriptions of Dutch word stress (Gaarenstroom 1897), some issues have been pervasive in the literature. Among these are the question if word stress is *fixed* or *free*, if descriptions should treat on a par *native* and *non-native*, and *derived* and *non-derived* vocabulary, and if one or more (*initial/final*) basic stress patterns occur.

Section 4 will contain a basic analysis, in the adjunction framework as developed in chapter 2. Starting out from theoretical assumptions put forward in a recent description by Kager, Visch and Zonneveld (1987), and our moraic analysis of syllable structure of chapter 3, we will present an analysis which accounts for the basic patterns as discussed in section 2. The most important features of this analysis, and at the same time its deviations from earlier work, are the following.

First, we will show that closed syllables and diphthongs can be heavier than open long vowel syllables. This may strike the cognescenti as odd in the sense that universally, closed syllables appear to be heavy in a stress system only if long vowel syllables are heavy too (McCarthy 1979, Hyman 1985). In line with unpublished work by Lahiri & Koreman, we will assume that Dutch can have this 'odd' weight distinction because it lacks the basic mora count distinction between light monomoraic and heavy bimoraic syllables, all syllables being minimally bimoraic (which has been shown in chapter 3). We will formalize the syllable weight distinction in terms of the segmental association of morae, instead of syllable-internal branching. Weight is proportional to the difference in segmental contents between both morae. Therefore, a bimoraic syllable containing a long vowel - where both morae are linked to the same feature matrix - is light with respect to a bimoraic syllable with a diphthong, or a bimoraic closed short vowel syllable - where each mora is linked to its own feature matrix.

Furthermore, our analysis presented in chapter 3 of schwa as being weightless at level-1 will explain the fact that schwa cannot have primary stress, since it is simply not a potential stress-bearer at level-1 where stress is assigned. Furthermore, this analysis explains that primary stress falls directly before schwallables in case a consonant precedes schwa, since consonants preceding schwa are part of the preceding syllable at level-1, which will therefore gain in syllable weight.

Second, the analysis will involve the automatic weight-stress relation argued for in chapter 2, and a left-dominant Syllable Adjunction rule. In contrast to earlier analyses where prominence assignment is directly sensitive to the branching of the final constituent, we will propose an End Rule (final), supplemented by a rule of extrametricality of minimal core syllables.

This analysis provides the basis for the analysis of secondary stress, destressing and vowel reduction of chapter 5. There we will show that the basic pattern of secondary stress results from the same L-dominant, Q-sensitive, iterative Syllable Adjunction rule as primary stress.

Finally, in section 5 we will extend the basic analysis by proposing a restricted set of lexical markings (lexical stresses, lexically governed 'late' extrametricality) to account for various deviations from dominant patterns within the limits of the major generalizations. Starting with some points of discussion as formulated in Van Marle (1980), we will re-examine certain basic claims regarding the position of primary stress on the basis of several types of evidence, including stress shifts, vacillating pairs, newly formed words, and 'mispronunciations'.

2. Primary stress: the basic patterns

2.1 Introduction

In this section we will discuss the location of primary stress in Dutch underived words and words derived by level-1 suffixes. This will provide the basis for a review of the earlier analysis in section 3, and for our own analysis to be presented in sections 4-5. We will present the patterns of primary stress as if no stress retraction were involved. Although we will argue in chapter 4 that the location of primary stress actually can result from weak stress retraction, we will abstract from that idea in this section for two reasons. First, the difference between primary stress assigned by placement and retraction is quite unclear for Dutch, at least much less clear than in English. English yields clear criteria for secondary stress on the final syllable, in particular in the form of irreducibility. However, final syllables in Dutch are quite reluctant to reduce, even if stressless. Therefore there is no a priori way to tell if the primary stress is followed by a final secondary stress, which is the main diagnostic for primary stress retraction. Second, most earlier accounts of Dutch stress describe the location of primary stress stress without reference to the stress value of the final syllable. Because we intend to discuss the literature in close relation to the presentation of the data, we will maintain the traditional terminology in presenting patterns of primary stress. Nevertheless, it should be kept in mind that retraction will reappear as a major explanatory mechanism in some of the recent analyses.

Although it is clear that primary stress cannot be predicted as in, e.g. French or Latin, the Dutch system does not completely conform to the opposite situation, free stress either, as is the case in, e.g., Russian. To illustrate the middle position of Dutch in between fixed and free, the following observations are often made.

First, primary stress does not function fully distinctively as it does in true free stress systems, even if a limited number of word pairs such as (the ever mentioned) *cánon* versus *kanón* may be mentioned.

Second, there is an opposition between full vowels and schwa as regards stressability: only full vowels can bear primary stress.

Third, a distinction should be made between level-1 and level-2 affixes. The former are stress-sensitive, behaving as if they formed part of underived words, but the stress properties of the latter are morphologically governed. In particular, level-2 affixes can be stress-neutral, stress-bearing, or stress-attracting. Relations between the stress properties of the level-2 affixes and their lexical category were brought to light in Schultink (1980).

Fourth, after accepting the distinction between level-1 and level-2 with respect to primary stress, and restricting our attention to the former, tendencies can be discovered correlating a syllable's position within the word or its internal composition on the one hand, and its potential stressability on the other. Although primary stress in underived words is often initial, it is seldom more than three syllables from the right word edge, nearly always penultimate if the final syllable contains a schwa, very often on the final syllable if it is 'super-heavy', etc. We will first discuss the domain of these and other generalizations.

2.2 The domain of the generalizations

The generalizations on primary stress to be presented in section 2.3 are based on underived words, as well as on words derived by level-1 affixes. It can be shown that these follow essentially the same stress placement patterns as underived words. Here, we will show that primary stress in words derived at level-2 is morphologically governed.

Stress in compounds is typically on the initial member, as shown below:

(1)	wáter+fiets	glóei+lamp	húis+deur	hóofd+stad
	lég+batterij	klím+rek	stróop+wafel	telefóon+boek

Exceptions exist, but no one doubts that compound stress is essentially morphologically governed (see Langeweg 1988, Visch forthcoming).
Many *stress-neutral* (mostly nominal) suffixes occur, which are outside the domain of primary stress assignment, since primary stress is located on the same stem syllable that is stressed in the word in isolation:

(2)	*-heid*$_N$	corréct	-	corréct+heid
	-er$_N$	Edám	-	Edám+er
	-dom$_N$	hértog	-	hértog+dom
	-achtig$_A$	woestíjn	-	woestíjn+achtig
	-loos$_A$	karákter	-	karákter+loos

Another set of *stress-bearing* affixes carries primary stress regardless of the position of primary stress in the base.

(3)	*-ín*$_N$	vórst	-	vorst+ín
	-és$_N$	vóogd	-	voogd+és
	-eríj$_N$	drogíst	-	drogist+eríj

These suffixes can be recognized as level-2 by the fact that a non-final syllable results in the derived word which exceeds the bimoraic maximum, or [VX]-constraint, which is fairly well respected at level-1.
The final set of (adjectival) *stress-attracting* affixes influences the location of the primary stress in the base word.

(4)	*-baar*$_A$	áan+toon	-	aan+tóon+baar			
	-(e)lijk$_A$	bíj+woord	-	bij+wóord+elijk	víjand	-	vijánd+elijk
	-ig$_A$	nóod+lot	-	nood+lót+ig	víjand	-	vijánd+ig
	-zaam$_A$	méde+deel	-	mede+déel+zaam	árbeid	-	arbéid+zaam
	-end$_A$	ín+span	-	in+spán+end			

These suffixes clearly do not relocate primary stress by the same rules that assign primary stress in underived words. First, two of these affixes have a phonological shape (superheavy syllables) that normally takes the primary stress itself (*-baar* and *-zaam*). Second, stress is not attracted in some morphologically (some claim phonologically) determined contexts - see in particular Schultink (1980):

(5) a.	be+klém+toon	-	be+klém+toon+baar	(*be+klem+tóon+baar)
b.	terúg+betaal	-	terúg+betaal+baar	(*terug+betáal+baar)

Third, adjunction of these affixes results in non-final excessive weight on stem syllables, as well as in violations of several level-1 filters on segment combination. For at least these reasons, we will exclude stress-attracting suffixes from our generalizations on primary stress.
Level-2 prefixes come in two types: (a) stressless (verbal) prefixes, and (b) stressed prefixes. We will illustrate each type below:

(6) a.	*ver-*	óordeel	- ver+óordeel$_V$	b.	*wan-*	órde	- wán+orde
	be-	vóordeel	- be+vóordeel$_V$		*oer-*	knál	- óer+knal
	ont-	persóonlijk	- ont+persóonlijk$_V$				
	onder-	schát	- onder+schát$_V$				

Verbal prefixes are stress-neutral, as will be clear from (6a). From examples such as *bevóordeel* etc, it is clear that they adjoin 'outside' compounds, a clear indication of their level-2 nature. The prefixes in (6b) are typically analyzed as members of compounds, since they follow the same stress pattern, and behave morphologically alike.
The generalizations on primary stress of section 2.3 will include words derived by level-1 suffixes. These will be shown to follow essentially the same stress placement patterns as underived words.

2.3 The patterns of primary stress

We will discuss primary stress patterns in different subsections each of which deals with a phonological word shape that must be distinguished by its specific stress properties. We will distinguish the *major* and *minor* generalizations about primary stress. The major ones, which have almost no exceptions, are the ones below:

(7) a. Primary stress is within a three-syllable window at the righthand word edge.
b. Primary stress is directly before a schwallable - if the schwa is preceded by a consonant.
c. Primary stress cannot be on the antepenult if the penult is closed and contains a full vowel, or if the penult contains a diphthong.

Exceptions to these generalizations fall into very narrow classes, which will be treated in a separate section 2.3.3. These exceptions can partly be reanalysed morphologically, but partly they fall outside the scope of our analysis.
The minor generalizations, remaining within the major ones of (7), are given below:

(8) a. Words with final superheavy syllables have final primary stress.
b. Words with final diphthongs have final stress.
c. Words with final closed short vowel syllables have antepenultimate primary stress.
d. Words with open final syllables have penultimate primary stress.

As will be seen, these generalizations allow for various exceptions, the nature of which will be discussed in some detail.
We have omitted from (7) the basic generalization that each lexical word has a primary stress, i.e. the (universal) generalization which is true for English as well. Moreover, we have omitted the generalization that a syllable with schwa cannot have primary stress - as discussed in chapter 3, section 6.
Together these two generalizations account for the majority of underived words in Dutch, for the following reasons. First, because most underived words are monosyllabic, the location of primary stress is trivial in this category. Second, disyllabic words with schwallables are quite frequent. Such words will have stress on their initial (or penultimate) syllable, by the restriction against stressed schwallables. We will give a number of words where stress placement is trivial for these reasons:

(9) a. fíets vréemd dág hónd b. zéker hónderd wáter

According to our analysis of chapter 3, the words in (9b) are basically monosyllabic at level-1. Therefore, words have to contain at least two full vowel syllables to be interesting in our survey below.

2.3.1 The major generalizations

2.3.1.1 The three-syllable window restriction

The restriction that primary stress falls within a three-syllable window at the righthand word edge is a very powerful one. Essentially this will yield three locations of the primary stress: the final syllable, penult, or antepenult. The window restriction has not always been recognized as such, because rare quadrosyllabic or longer words are required to test its validity. That is, initial primary stress in disyllabic and trisyllabic words can also be described as simply 'initial', instead of penultimate and antepenultimate. Obviously, Dutch has Germanic *initial* stress from a diachronic point of view, and this has led many analysts to posit this initial stress view as basic for present day Dutch too. But by taking a look at new words (such as trade names) of relevant length, it becomes clear that initial stress is no longer the (only) operative factor:

(10) Caliméro citronélla Aristóna

Most of (10) are (brand) names of recent origin.
Another way of checking this is by examining adaptations into Dutch of words from other languages:

(11) Serajéwo (Sárajevo) Kopenhágen (Kóbenhavn)

Let us now turn to the two other major generalizations.

2.3.1.2 The schwallable restriction

Another major generalization is that primary stress is directly before a final syllable with schwa - a schwallable - if the schwa is preceded by a consonant. Of course, words must contain minimally three syllables - two of which having a full vowel - to be relevant here. We illustrate it with a small selection out of the enormous number of words which follow it. The examples are grouped according to the segments preceding schwa: a long vowel and single consonant in (12a), a short vowel and consonant cluster in (12b), and a short vowel and single consonant in (12c):

(12) a.	kalíber	syllábe	b.	helikópter	karákter	c.	kolónne	estafétte
	furóre	tentákel		rotónde	Mathílde		idÿlle	melísse
	extáse	mirákel		minister	dragónder		mascótte	komkómmer
	saláde	machíne		apóstel	Egÿpte		finésse	pantóffel
	formúle	zigéuner		lavéndel	kadáster		mesjókke	etáppe

Level-1 suffixes such as the ones below conform to this restriction:

(13) a.	-ide	fluor+ide	-ibel	flex+ibel	b.	-isme	activ+isme
	-ade	claxon+ade	-abel	respect+abel			
	-ine	alp+ine	-ode	elektr+ode	c.	-esse	accuraat+esse
	-ose	psych+ose	etc.			-ette	oper+ette

Schwa's preceded by vowels do not always attract stress onto the penult. If /i/ directly precedes schwa, primary stress is typically antepenultimate:

(14) a.	agráriër	vegetáriër	b.	índië	Brazílië	c.	Bétuwe
	mágiër	parlementáriër		ázië	Líbië		Véluwe
	térriër	sáuriër					

The words in (14b) contain the geographical level-1 suffix *-ië*. The words of (14c) are relevant examples, according to Kager & Zonneveld (1986), as their pre-schwa glide [w] can be assumed to result from a level-2 application of Homorganic Glide Insertion, cf. chapter 3 section 4.1. It is important to point out here that the generalization does not restrict words without a pre-schwa consonant to antepenultimate stress. That is, cases such as *Alexandríë* occur, where the penult has stress. The generalization can be found as early as Gaarenstroom (1897).
The force of the schwallable restriction is clear from rightward stress shifts to match the pattern, both in mispronunciations and in imported words:

```
(15)a. katalógus   (katálogus)  b. Kekkónen    (Kékkonen)
       notúlen     (nótulen)       Kopenhágen (Kóbenhavn)
       normalíter (normáliter)
```

The schwallable restriction basically reduces the three-syllable window into a two-syllable window.

2.3.1.3 **The closed penult restriction**

Finally, primary stress cannot be 'across' a closed penult with a full vowel, or a penult with a diphthong. Of course, it takes words of at least three syllables for this generalization to be even observed. Just like the schwallable restriction, the closed penult restriction reduces the three-syllable window to a two-syllable window. Moreover, it shows that Dutch word stress is Q-sensitive.
Below are some words in which, as we will claim in subsequent sections, stress cannot be placed at a maximal distance from the word end because of the heavy penult, i.e. a closed syllable (16a) or a diphthong (16b):

```
(16)a. eléktron     Madagáskar  appéndix  b. Poséidon
       rododéndron  Agamémnon   Gibráltar    thesáurus
```

Its force is evident from stress shifts in foreign words adapted into Dutch (most examples are from Van Marle 1980):

```
(17) badmínton  (bádminton)  Helsínki  (Hélsinki)  Dubróvnik (Dúbrovnik)
     penálty    (pénalty)    Arkánsas  (árkansas)  Edmónton  (édmonton)
```

Interestingly, short vowels followed by one intervocalic consonant count as closed with respect to this generalization. This is predicted by each analysis of syllable structure which claims that short vowels occur always in closed syllables, even if followed by one intervocalic consonant. The data which bear on this prediction are words which should have stress on the antepenult because of the form of their final syllable, but do not:

```
(18) Armagéddon  Mohámmed  Makássar
```

The - unfortunately - rare words of this type confirm the prediction.
This concludes our discussion of the major generalizations about Dutch word stress. All data to be presented in the following subsections fall within their limits. After Van der Hulst and Langeweg (1984), we will group a sequence of a short vowel and a single intervocalic consonant with closed syllables.

2.3.2 The minor generalizations

2.3.2.1 Superheavy finals

Two well-known generalizations about the location of primary stress are stated below - both go back to at least Gaarenstroom (1897):

(19) a. Closed final syllables with long vowels have primary stress.
b. Final syllables closed by at least two consonants have primary stress.

These generalizations are illustrated below with a small selection from the enormous set of words which obey it:

(20)						
a.	tonéel	taríef	paradíjs	b.	biljárt	perkamént
	papíer	alkóof	astronáut		funést	sonoránt
	piráat	grafíek	bibliothéek		concért	labyrínt
	kostúum	profíel	ambassadéur		effékt	manuscrípt
	figúur	pistóol	anakolóet		prodúkt	emeráld
	bankróet	allóoi	gladióol		amórf	paradóx
	paráaf	kapóen	abrikóos		smarágd	triómf
	lawáai	mangáan	carambóle		contrást	dirékt
	proléet	pinéut	lokomotíef		fazánt	apocalýps
	azúur	azíjn	pelikáan		augúrk	basilísk

Together these types of final syllables have become known as *super-heavy* syllables (after Visch & Kager 1984), syllables which contain a closing consonant in addition to a bimoraic nucleus:

(21) a. C_0VVC b. C_0VCC

We will maintain the term *superheavy* throughout this chapter, while the skeletal abbreviation VXC will be used for shorthand purposes.
Interestingly, the generalization is followed by all level-1 suffixes that have the shape of superheavy syllables[1]:

(22)							
a.	-aal	orient+áal	-ief	educat+íef	b.	-esk	cabaret+ésk
	-iek	symbol+íek				-ist	monarch+íst
	-eel	sentiment+éel				-ent	stud+ént
	-eus	harmoni+éus				-ant	interess+ánt

Although the generalization that superheavy finals have primary stress is powerful, it certainly has exceptions, which can be seen as analogues of English primary stress retraction. Interestingly, retraction from VXC obeys maximality, cf. chapter 1 (18c), as we will make clear.
First, in disyllabic words stress can only be retracted to the initial syllable:

(23)								
a.	árbeid	síeraad	kíbboets	b.	thórax	índex	ásfalt	Rúdolf
	líchaam	kálief	ándries		clímax	álfons	bállast	ádolf
	áltaar	kóekoek	króepoek		Márnix	bíceps	árnold	kóbalt
	mámmoet	hásjiesj	vámpier		lárynx	kóbold	ávond	nápalm
	émir	fákir	áblaut		fálanx	Róeland	hérberg	Víncent
	bástaard	mínstreel	árthur		Gérard	éiland	éland	ásbest

As a general trend, VCC-syllables allow for non-final stress somewhat easier than VVC-syllables, but no superheavy syllable types occur which consistently decline main stress.

Among VCC-rimes, those ending in -/s/ (especially those in -/ks/) show most reluctance to take primary stress.
In trisyllabic words, however, stress is typically retracted to the initial syllable if the penult is open or contains (underlined) schwa:

(24) a. ádelaar	hóspitaal	Válentijn	b. ásterisk	ólifant	úniform
túreluur	ólivier	Bóudewijn	páranimf	lánterfant	
pierewiet	Béatrijs	májesteit	crúcifix	kátapult	
mársepein	páragraaf	ádelheid	Bíotex	léukoplast	
kíerewiet	Móndriaan		Béatrix	múltiplex	
élzevier	Bástiaan		Cónimex	Dúralex	
wíelewaal	ádriaan		Móulinex	ódorex	

But stress is retracted to a closed penult if it has a full vowel[2]:

(25) a. Demjánjuk	b. appéndix
Odysseus	Scalectrix

This generalization can be illustrated better for words ending in closed VC-syllables, however, as will be shown in section 2.3.2.3.
In quadrosyllabic or longer words, primary stress is retracted to the antepenult if the penult is open, otherwise to the closed penult[3]:

(26) a. Sebástiaan	Bonálkolax	b. Parodóntax
Kartófilex	Santánolix	
Abénolax		

We wind up the discussion of final superheavy syllables with concluding:

(27) a. Superheavy syllables in final syllables are generally stressed.
b. If not, stress is on the antepenult if (a) an antepenult exists and (b) the penult is open or contains a schwa.
c. If not, stress is on the penult.

2.3.2.2 Final diphthongs

The three diphthongs - and especially /ɛi/ - take primary stress fairly regularly in final position:

(28) a. /ɛi/			b. /ɑu/		c. /ʌy/
geléi	kopij	cichorei	rabáuw	kersouw	fautéuil
karwei	kandij	soldij	miauw	kabeljauw	
galei	partij	harpij	karbouw		
kassei	karwij	lakei	landauw		
livrei	karwei	akelei	juffrouw		
pastei	akelei	vallei	mevrouw		
schalmei	lamprei	selderij			

If primary stress is non-final, it is on a maximal distance to the left, as we have seen earlier for superheavy syllables.

(29) a. Móskou	Kenau	juffrouw	Ezau	b. sélderij	Krakatau
Nassau	Krakau	Moldau		Lorelei	Timotei
Warschau	rouwdouw	Donau		watjekouw	

This pattern can be exemplified much better with the numerically more important category of words ending in closed short vowel syllables, that will be discussed below.

2.3.2.3 Final closed short vowel syllables

Turning to final -VC syllables, we find that the dominant stress pattern is no longer final, as in superheavy syllables and diphthongs. Instead a pattern arises that can best be typified as *maximally binary retraction*[4]:

```
(30) Primary stress in -VC final words (dominant pattern)
     a. Primary stress is on the antepenult if (i) an antepenult exists
        and (ii) the penult is open (no diphthong) or contains schwa.
     b. Otherwise, primary stress is on the penult.
```

The pattern will first be illustrated by words in *-on*, as this syllable type fairly consistently follows it, as well as occurs in a large amount of words. Disyllabic words are given in (31a), longer words with closed penults or diphthongs in (31b), and longer words with penults that are open or contain schwa in (31c):

```
(31)a. ámbon   micron    b. eléktron       c. épsilon    accórdeon5
       claxon  moeflon      Melanchton        ganglion    acrostichon
       Mammon  moesson      Poseidon          lexicon     epitheton
       molton  natron       badminton         Lissabon    Napoleon
       mormon  neuron       Agamemnon         pantheon    symposion
       Orlon   Dralon       rododendron       pentagon    Abutilon
       bizon   neon         philodendron      bariton     asyndeton
       demon   neutron      Armageddon        stadion     Evoluon
       dragon  nylon        Erechtheion       marathon    centurion
       foton   ozon                           Oberon      Iraklion
       Ikon    proton                         Babylon     Pygmalion
       canon   python                         Libanon     idioticon
```

Words deviating from the pattern (30) above are of two types. First, a considerable number of -VC final words have final primary stress. Second, a far smaller number of words have primary stress on an open penult with a long vowel, preceded by one or more syllables. We illustrate the types in (32a) and (32b), again for *-on*:

```
(32)a. balkón   pardon  pion       bombardon    b. Aáron
       ballon   perron  salon      champignon      Ajalon
       bonbon   ponton  spion      bataljon        Philemon
       carbon   tampon  wagon      bastion         oxymoron
       cordon   baron   bidon      lampion         oxytonon
       jargon   dragon  Ceylon     pantalon        protozoön
       kanton   gazon   aceton     accordeon       Toetanchamon
       karton   japon   magnetron  kameleon        spermatozoön
       Marjon   kanon   musketon   Evoluon
```

The choice between the three stress patterns (30), (32a), and (32b) is largely governed by subregularities depending on the nature of the final -VC syllable.

We will first present examples which follow the dominant pattern (30). These are sorted into disyllabic words (33), trisyllabic or longer words with closed or diphthongal penults (34), and trisyllabic or longer words with open non-diphthongal penults (35)[6].

(33)	bívak	sinas	Balkan	sambal	bios	Opec	David
	kajak	Thomas	kaftan	sisal	chaos	sorbet	Judith
	Kodak	paljas	sultan	Nepal	epos	Sowjet	kievit
	Spartak	Whiskas	divan	bisschop	ethos	Vendet	zenit
	Bagdad	poespas	Johan	Jacob	kokos	debet	moslim
	sabbat	goelasj	rotan	lombok	logos	Alfred	pelgrim
	Fiat	Mirjam	Satan	amok	pathos	Tibet	denim
	Noach	bisam	Wodan	Nimrod	heros	Amev	Kremlin
	atlas	sesam	Tarzan	robot	eros	Andes	pinguin
	harnas	mustang	Kalkar	boycot	Argos	herpes	Karin
	canvas	pisang	Kaspar	foxtrot	slalom	Suez	Strepsil
	Jonas	wajang	nectar	hertog	Sodom	Agnes	Persil
	Judas	katjang	Oscar	moloch	diftong	Astrid	ketchup
	Lucas	koning	radar	kosmos	kampong	Ingrid	eunuch
	pias	haring	sonar	topos	Bibeb	Norit	consul

We have distinguished trisyllabic and longer words as to their penult: the words in (34a) have open full vowel penults, those of (34b) penults with schwa.

(34) a.	Báobab	Kanaan	Samuel	Jeruzalem	Uriel	b.	óelewap
	almanak	Lilian	Michael	Methusalem	Ezecheel		Kitekat
	anorak	ramadan	Viditel	clitoris	Nathanael		rammenas
	Cineac	charlatan	Ismael	syfilis	astrakan		sassefras
	zodiak	Jonathan	alfabet	ansjovis	alcohol		boemerang
	Pontiac	rataplan	Esopet	Immanuel	chocomel		gamelan
	Teleac	Alcazar	Nazareth	metropolis	Daniel		Senegal
	Izaak	Zanzibar	Exocet	Efraim	Abraham		bruidegom
	Goliath	jaguar	Unicef	Joachim	labrador		kardemom
	habitat	samovar	Brocacef	Jellinek	Rafael		ulevel
	Trinidad	Baltazar	Hercules	handicap	Genesareth		limerick
	Arafat	Potifar	Damocles	Benjamin	Kajafas		zwezerik
	Ararat	carnaval	Heracles	mocassin	senior		Genesis
	Galahad	Portugal	litotes	Habakuk	decibel		nemesis
	Hanomag	festival	rabies	Lilliput	Elizabeth		interim
	ananas	Hannibal	Sokrates	karamel	Veritas		krakeling
	pancreas	Belial	Sofokles	corduroy	monitor		Zeppelin
	alias	Paraguay	caries	Xenocrates	Israel		kakkerlak
	charitas	Uruguay	species	Parmenides	Sebastopol		Pasternak
	Ilias	samoerai	Marrakesj	Galapagos	Unitas		muzelman
	ischias	tomahawk	ibidem	proficiat	junior		talisman
	Tobias	Behemoth	requiem	humanitas	Gabriel		interval
	Adidas	Molotov	Bethlehem	Leonidas	Pheidippides		rinoceros
	Alcatraz	Stroganov	specimen	Pythagoras			Demosthenes
	Barnabas	albatros	caravan	Tiberias			Diogenes
	Caracas	calvados	lucifer	afrodisiac			Aristoteles
	Elias	merinos	Gulliver	Carvancevitam			epenthesis
	Honduras	Absalom	Jupiter	Ashurbanipal			metathesis
	Phidias	equator	archipel	Euripides			Beelzebub

Again, stress cannot be on the antepenult if the penult is closed:

(35)	Hermándad	Gibraltar	Makassar	Wladiwostok	opodeldoc
	Palembang	Dubrovnik	detective	Madagaskar	
	Hamilcar	Laertes	Mohammed	Kalimantan	

Final stress in -VC final words (pattern 32b) is common for specific VC-syllables, some of which are /ɛt/, /ɛl/, /Ol/, etc.:

(36)	trompét	congres	kolos	paskwil	abdis	kalebas	tiran
	minaret	reliëf	galop	nitril	hagedis	paperas	maniak
	violet	Marrakesj	marmot	april	Madrid	rammenas	Teleac
	bordes	model	apostrof	tonsil	Jamin	kalebas	patat
	succes	karamel	ocelot	mandril	ampul	kristal	diagram
	cipres	katrol	envelop	bacil	kompas	carnaval	Cineac
	adres	parasol	artisjok	narcis	terras	Japan	
	expres	cholesterol	kolom	amaril	matras	charlatan	
	proces	barok	papil	krokodil	moeras	roman	

Turning to the cases of primary stress on open penults in longer words, we find that many of the final -VC syllables have a quality that closely approximates schwa. See for instance the cases below, where orthographic *-is*, *-es*, *-us*, *-um*, is realized as schwa, or nearly so:

(37)	a. saláris	b. Mercédes	c. Jacobus	d. vademécum
	notaris	Herodes	papýrus	ultimatum
	dromedaris	Celebes	Martinus	decorum
	Brandaris	Archimedes	Neptunus	futurum
	ansjovis	diabetes	Jodocus	curiosum
	clematis	Dolores	Uranus	desideratum

Since Dutch does not easily reduce vowels in final syllables, the final syllables of (37) may be assumed to contain underlying schwa's.

Next to these quasi-VC syllables, morphologically triggered penultimate stress on open penults occurs. For instance, level-1 suffixes such as *-or*, *-um*, *-itis*, trigger penultimate stress[7]:

(38)	a. senátor	radiator	b. athéneum	c. bronchítis
	spectator	perforator	museum	hepatitis
	curator	elevator	lyceum	
	equator	indicator	jubileum	
	revisor	alligator	curiosum	
	dictator	gladiator	mausoleum	

The suffixed status of the words in (38) is indicated by their irregular plurals. Words ending in *-or* (38a) have plurals whose suffix vowel is both long and stressed: *-óren* ([orən]), cf. *senát+or - senat+óren*. Words in (38b) have irregular plurals *-a*, replacing *-um*: *athené+um - athené+a*.

Yet many words in *-um* and *-us* have antepenultimate stress, see (39).

(39)	anónymus	emeritus	arsenicum	linoleum
	catalogus	politicus	basilicum	petroleum
	magnificus	Herodotus	compositum	Kapernaum

But it is exactly this class to which words belong which are often cited as mispronunciations: *catalógus* etc. If final *-um*, *-us* are reanalysed as schwa, these mispronunciations are actually instances of the schwallable restriction. See (40), partly involving different final reducible -VC syllables:

(40)	catalógus	metropólis	notúlen
	petroléum	exódus	merítes
	linoléum	normalíter	

This would explain as well why words in *-ium* often undergo similar stress shifts: if the final syllable is taken as schwallable in such cases, their pattern matches (14) above:

(41)	aquarium	decennium	gymnasium	aluminium
	compendium	delirium	harmonium	honorarium
	criterium	geranium	uranium	laboratorium

Among the remaining words with penultimate stress on an open syllable preceding a -VC syllable, most are biblical and classical names of an extremely limited occurrence:

(42)a.	Abísag	Matthias	Jochanan	b.	Adinádab	Leviathan
	Manoach	mecenas	Naäman		Amminadab	Aschkenazim
	Behemoth	Elifaz	Astoreth		Melchizedek	Nebukadnezar
	Rehoboth	Elias	honorem		Mefisobeth	Zacharias
	schibbolet	Augias	valorem		Amenhotep	Ananias
	Astoreth	Abiram	terrorem		Mendelejev	Menelaos
	Jochebed	Ahikam	favorem		Abimelech	Balesteros
	Andreas	Jehoram	privatim		Elimelech	Dionysos
	messias	Semarang	Jojachin		Aldebaran	Ahasveros
	Aeneas	Welirang	sanyasin		catamaran	Torremolinos

In addition to the 'static' data that have been presented so far, there is evidence for the dominant pattern in the form of newly formed words and stress shifts.
Newly formed words (as brand names) tend to follow the dominant pattern (30):

(43)a.	Kódak	Prólog	b.	Unésco	c.	Hánomag	Carvancévitam
	Fíat	ópec		Roparco		ádidas	órganon
	Whiskas	áegon		Alberto		Kíttekat	Viditel
	ámev					Brócacef	Unicef

Stress shifts of the types discussed in earlier sections are often from the patterns (32ab) towards the dominant pattern (30). This can be shown with examples such as those below, where the words (44a) have a source with penultimate stress, those of (44b) have a source with final stress and shift to the antepenult, and the disyllabic ones of (44c) have a source with final stress and shift to the penult[8]:

(44)a.	Cáracas	(Carácas)	b.	Evóluon	(Evoluón)	c.	páljas	(páljas)
	óblomov	(Oblómov)		accórdeon	(accordeón)		nárcis	(narcís)
	Kásparov	(Kaspárov)		kaméleon	(kameleón)		Márcel	(Marcél)
	Tsjérnobil	(Tsjernóbil)		kólofon	(kolofón)		párfum	(párfum)
	áaron	(Aáron)		cárnaval	(carnavál)		Sóedan	(Soedán)
	Bólivar	(Bolívar)		Téleac	(Teleác)		díftong	(diftóng)
	Phílemon	(Philémon)		Cíneac	(Cineác)		lÿsol	(lysól)
	Célebes	(Celébes)		éxocet	(Exocét)		pías	(piás)
	élias	(Elías)		Stímorol	(Stimoról)			
	áugias	(augías)		káramel	(karamél)			
	Hónduras	(Hondúras)		chárlatan	(charlatán)			
	Crístobal	(Cristóbal)						

The vacillation type involved is only poorly typified by 'final' versus 'initial' stress, as in quadrosyllabic words stress vacillation occurs predominantly between the final syllable and the antepenult: *accordeon*, cf. (44b), not between the final and initial syllables[9].
The proper generalization appears to be that finally stressed words may alternate with a form stressed on the antepenult, and if there is no antepenult, with a form stressed on the penult. Roughly, shifts from the penult to the antepenult are favored by heavy final syllables, and disfavored by heavy penults.
Stress shifts and *mispronunciations* towards the penult that go against the basic pattern (30) that we claim to exist are the ones below[10]:

(45) a.	Herácles	Diarbákir	b.	kolófon	Ortahísar
	Karadéniz	Eskiséhir		adíos	Welírang

The forms in (45a) end in syllables whose pronunciation is close to schwa, and behave as light in many other words of the Dutch vocabulary.

2.3.2.4 Final open syllables

The situation among final VV-syllables is quite different from final VC-syllables. First, much more variation exists among final -VV syllables than among final -VC syllables. Penultimate stress is predominant, but a fair number of words have antepenultimate and final stress.

(46) **Primary stress in -VV final words** (dominant pattern)
a. Primary stress is on the penult if this does not contain schwa.
b. Otherwise, primary stress is on the antepenult.

The main difference with final closed syllables therefore resides in the fact that penultimate stress is pervasive, whereas in words with closed final syllables it is fairly restricted, being concentrated in words with some specific final syllables.
We will illustrate penultimate stress below with a sample from the large amount of words which obey it, viz. disyllabic words in (47a), longer words with closed or diphthongal penults in (47b), and longer words with open penults in (47c), and words with schwa in their penults (47d). For the latter type, antepenultimate stress is the basic pattern, since schwa is incapable of bearing (penultimate) stress:

(47) a.	sámba	sáldo	b.	Jolánda	c.	akéla	januari	d.	cámera
	rumba	rondo		agenda		angina	februari		opera
	mica	judo		Bernardo		Anita	harakiri		algebra
	pinda	tango		veranda		arena	monopolie		cinema
	jaffa	echo		embargo		aroma	evangelie		cholera
	noga	kano		excursie		aurora	peterselie		kiekeboe
	spécie	taptoe		Timboektoe		bazoeka	bolero		
	studie	opoe		commando		bodega	dynamo		
	koffie	goeroe		Walhalla		Diana	avocado		
	olie	bamboe		Marokko		diploma	diabolo		
	premie	rimboe		diafragma		hyena	eldorado		
	merrie	Zoeloe		anaconda		Jakoba	Palestina		
	toffee	accu		Esmeralda		Jehova	okapi		
	taugee	Gevu		Esperanto		pijama	koala		
	Jahveh	Pripu		Papiamento		Josina	kolonie		
	Bombay	Tabu		andijvie		panorama	bikini		
	Atjeh	Ecu		Aleida		Manusama	macaroni		

Most newly formed vowel-final words conform to this pattern:

(48) a.	ákzo	Brinta	Pripu	b.	Rowénta	c.	Chicíta	Sabena	Weleda
	Amro	Volvo	Hema		Alberto		Cosatu	Firato	Casema
	Cito	Gevu	Hero		Roparco		Ordina	Campina	Calimero

Antepenultimate stress in -VV final words is somewhat less widespread. A selection is in (49):

(49)	pagina	Amerika	dominee	Ninive	kangoeroe	domino	kolibrie
	tombola	Canada	mobile	apocope	kakatoe	farao	Sinaï
	platina	primula	Penelope	hupsakee	kariboe	radio	indigo
	begonia	begonia	aloë	maraboe	Eskimo	studio	alibi
	hospita	hernia	benzoë	Manitoe	libido	mikado	

Almost all words ending in *-ia*, *-io* follow this pattern, and a number of words with /i/ in their open penult (*pagina*). However, the latter group probably does not reflect the dominant pattern, as witnessed by various 'mispronunciations' of words out of class (49) with penultimate stress[11]:

(50)	pagína	alíbi	rocóco	pergóla	Niagára
	deposíto	indígo	diabólo	monopóly	mascára

Notice also the fact that new words (trade names etc.) with /i/ in their penult do not follow the antepenultimate stress pattern (49), but the penultimate pattern (46), cf. *Campina* etc. (48c).

Final stress in vowel-final words is the least frequent type. There are three vowels which fairly easily take primary stress in final position: /e/ (51a), /y/ (51b), /ö/ (51c). Some other cases of stressed final -VV are in (51d):

(51) a.	corvée	sateh	b. menú	c. Matthiéu	d. Bredá	etui
	dictee	souper	recu	milieu	dada	biskwie
	elpee	taugeh	revue	adieu	chocola	bougie
	essay	chimpansee	ambigu	Stafleu	hoera	kopie
	moskee	comité	avenue	Hazeu	poeha	Natalie
	pygmee	orchidee	paraplu		bistro	Rosalie
	trochee	diarree	residu		bravo	relikwie
	trofee	scarabee	continu		kado	sacristie
	café	prostitué	individu		bureau	compromis
	hachee	varieté			rococo	taboe
	idee	onomatopee			niveau	ragout
	puree	portemonnee			hobo	Baloe

However, such words easily undergo stress shifts to non-final examples, as demonstrated by Van Marle (1980) and others: *bístro* etc[12]. Final stress on /y/ is far less productive, as is evident from comparing the loans in (51b) to the new words (*pripu* etc) of (48). Final /ö/ is so rare that there is little to be said about its stress behavior in newly formed words.

Most of the finally stressed words in *-ie* have been shown to be derived by well-established criteria in Trommelen (1985):

(52)	chemíe	anemie	hierarchie	poezie	difterie	leukemie	therapie
	fobie	autopsie	ironie	prosodie	energie	litanie	travestie
	magie	blasfemie	lethargie	rapsodie	fantasie	parodie	allegorie
	orgie	calorie	leukemie	symfonie	farmacie	reünie	categorie
	regie	elegie	melodie	amnestie	industrie	sympathie	epidemie
	amfibie	harmonie	nostalgie	anarchie	jaloezie	theorie	epilepsie

Trommelen's arguments for the claim that words like (52) are derived by a stress-bearing suffix *-ie* are the following. First, *-ie* is very likely to be a suffix in the (less frequent) derivations of (53):

(53)	tiran+íe	chirurg+ie	pyromaan+ie	filantroop+ie
	pastoor+ie	dynast+ie	liturg+ie	strateeg+ie
	telefoon+ie	rebel+ie	monarch+ie	anatoom+ie

Second, -ie governs morphological gender and the choice of the article - *de* - as governed by the Righthand Head Rule (Williams 1981, Trommelen & Zonneveld 1986). Third, words in front vowels usually take *-s* plurals, regardless of word length or position of stress, whereas the words in (52) deviate by taking *-en* plurals. Fourth, the position of primary stress is unusual for underived vowel-final words, but comparable to the morphologically governed final stress of *-in*, *-es*, etc., cf. (3). Fifth, as shown in Booij (1977), words ending in stressed *-ie* never take the adjectival suffix *-ief*, but often *-isch*, while for words ending in unstressed *-ie* the situation is reverse: these never take *-isch*, but prefer *-ief* instead. Trommelen shows this affix selection to be governed by suffix, not by position of primary stress. In addition to Trommelen's arguments, a compelling semantic one can be given: all of the words in (52) and (53) are abstract nouns.
Stress shifts from the final to the penultimate syllable in vowel-final words do occur. Some well-known '*mispronunciations*' are in (54)[13]:

```
(54) demokrátie   amfíbie   irónie   categórie  rocóco         moussáka
     hegemónie    Bogóta    melódie  epidémie   encyclopédie   Timbóektoe
```

To be fair, a number of stress shifts are in the opposite direction, as in (55a), or from the final syllable to the antepenult (55b):

```
(55)a. bódega    (bodéga)    b. káketoe   (kaketóe)
       Gránada   (Granáda)      káriboe   (karibóe)
       pápoea    (papóea)       kólibrie  (kolibríe)
```

As a conclusion, we (as earlier Van Marle 1980) have found that vowel-final words tend to be stressed on the penultimate syllable, and that cases of final and antepenultimate stress tend to be 'corrected' towards the basic penultimate stress pattern.

2.3.3 Exceptions

Let us now consider the (limited amount of) cases which fall outside the major generalizations (7abc). As we will see, a number of these cases is exceptional with respect to more than one major generalization.
As to the three-syllable window, three groups of exceptions occur: many geographical names (56), grammatical terms in *-ief* (57d), and words in *-meter* (58).

```
(56) Schéveningen   Amerongen   Hoevelaken   Havezate
     Hindeloopen    Kemenade    Everdingen
```

Most of (56) are compounds historically.
Turning to words in *-ief*, we will present a (more or less) complete list to show the strict initial stress[14]:

```
(57)a. dátief  b. lócatief   c. súbjunctief   d. ínfinitief  índicatief
       pássief    génitief      ádjectief        áccusatief  nóminatief
                  áblatief      súbstantief      ínchoatief  cómparatief
                  cáusatief     cónjunctief
```

The initial stress in grammatical terms in *-ief* has been characterized by Gaarenstroom (1897) as "contrastive", which seems accurate. Since all end in the same affix, the words are distinguished by primary stress on their first syllable - the syllable that would carry secondary stress if the words were finally stressed. Notice that (57c) violates the closed penult restriction (7c) as well.

```
(58)a. míllimeter  héctometer   b. díameter
       céntimeter  kílometer       thérmometer
       décimeter
```

Apart from the fact that these forms can be analysed as words in *-ief* in (57), they are probably compounds of whose final member is *meter*.
Second, violations of the schwallable restriction occur that are not yet subsumed under (56) and (58):

```
(59) Níjmegen    Wínschoten   ármoede
     Cóevorden   Búnschoten
```

These forms, most geographical names, are historically compounds (as for instance *Nijmegen* < *Nim+wegen*). Synchronically, they may be interpreted as such.
Third, an extremely limited number of words displays antepenultimate stress 'across a closed penult'. Apart from the cases (57c) and some of the cases in (59), the following examples occur:

```
(60)a. chímpansee  b. bíatlon    c. Afgánistan   d. Hélsinki
       ístanbul       tríatlon      Pákistan        bádminton
       Cónstantijn    péntatlon     Kázachstan
```

All of (60a) end in syllables (/e/, /ul/, /ɛin/) normally taking final stress, and actually they alternate with finally stressed forms. In this sense, they resemble English Sonorant retraction. We have no explanation for their stress pattern.
We will assume (60bc) to be semi-compounds with *-atlon*, *-stan*, as their righthand member, respectively. Finally, (60d) are imported into Dutch with antepenultimate stress across a closed penult. However, such forms typically undergo stress shifts to the penult, as shown in (17)[15].

2.4 Conclusions

From the discussion of primary stress in Dutch underived words we can draw the following conclusions.
First, stress patterns exhibit a considerable amount of variation within the limits of three major generalizations: (a) primary stress is located in a three-syllable window at the word end, (b) primary stress is directly before a schwallable (if a consonant precedes schwa), (c) primary stress cannot be on the antepenult 'across' a closed or diphthongal penult. Second, variation within the limits of these solid restrictions follows patterns of preference, which can be summarized as: (a) primary stress tends to be on a final superheavy syllable or a final diphthong, (b) primary stress in VC-final words tends to be maximally to the left, within the strict limits of the three-syllable window and the closed penult restriction, (c) primary stress in VV-final words tends to be on the penult. Third, the basic patterns can be validated by various stress shifts and mispronunciations.
In the following section, we will illustrate how previous analyses of Dutch word stress have viewed the basic generalizations.

3. Accounts of Dutch word stress

3.1 Introduction

The history of descriptions of Dutch word stress is characterized by a number of recurrent issues, the most important of which have already been mentioned in section 1. Traditional descriptions in the pre-generative period make a strict distinction between stress in the native versus non-native vocabulary, corresponding with a native (Germanic) 'initial' pattern and a non-native 'final' pattern. These descriptions often have a prescriptive, normative purpose.

Only in the generative period did linguists start to study stress patterns of originally non-native words, obviously influenced in this respect by SPE. It was found that many 'non-native' words obeyed to stress patterns that could not be ascribed to their origin languages. Moreover, various stress shifts, 'mispronunciations', newly formed words, and other kinds of substantial evidence pointed out that a strict distinction between native and non-native words could not be upheld.

Shortly after SPE, close copies of Chomsky & Halle's stress rules were proposed for Dutch, often characterized by naive transpositions of both the cluster conditions and retraction modes. A real testing of the generative formal apparatus combined with an increased awareness of the specific demands of Dutch syllable structure occurred only after the introduction of metrical phononogy.

Still, some later theoreticians, such as Van Marle (1980), maintain the view that a more than residual basic initial pattern is still at work in modern Dutch, arguing for a two-pattern approach.

3.2 Traditional descriptions

In early traditional descriptions of Dutch word stress (as for example Gaarenstroom 1897, Zwaardemaker & Eykman 1928), two claims are dominant.

The first is to consider Dutch a truly Germanic language and proclaim a basically *initial* stress pattern. Also, traditional descriptions mostly consider stress in derived and underived words as basically similar.

As shown above, initial stress is pervasive in both compounds and words derived with stress-neutral suffixes, cf. section 2.2. In this view, all words stressed non-initially are believed to represent a non-native stress pattern imported from Latin, Greek, French, or some other foreign language. This idea was related to the strongly normative goals of most early descriptions.

The first (very early) study of Dutch word stress, Gaarenstroom (1897), cannot be ignored in our survey. It contains many detailed observations which re-occur time and again in later analyses. Primary word stress is believed to be basically *initial*, be it semantically or morphologically governed in derived words. Gaarenstroom discusses polysyllabic underived words, i.e. foreign words, in a separate chapter. His most important conclusions can be summarized (and partly paraphrased) as follows. We indicate the corresponding generalization from section 2 behind each of the generalizations:

(61) Primary stress is on:
- a. final closed syllables with long vowels (19a).
- b. final syllables with diphthongs (28).
- c. final syllables with /e/ (51a)[16].
- d. final syllables ending in two or more consonants (19b).
- e. penults in words ending in *-or* (38a).
- f. penults in words ending in *-a*, *-o* (47), *-um*, *-us* (38b), if there is no penult with *-i-*.
- g. antepenults in words ending in *-a*, *-o* (49), *-um*, *-us* (39), (41), if there is a penult with *-i-*.
- h. penults followed by a consonant and schwa in the final syllable (12).
- i. antepenults in words ending in *-ië* (14).

Gaarenstroom's generalizations have been at the basis of many following descriptions, especially Blancquaert (1969) and Neyt & Zonneveld (1982).

3.3 Generative analyses in the SPE-tradition

In the seventies, several analyses of Dutch word stress in a linear SPE-framework were published. These analyses share with SPE the elimination of the bias against 'non-native' words, that had been pervasive in the traditional literture. As a result, interest awoke in a much wider array of words, as well as in 'mispronunciations' and new words (such as trade names) as relevant data.

Basically, these analyses transpose Chomsky & Halle's analysis to Dutch without giving much attention to special properties of the latter system. Stress rules are proposed which closely resemble the Main Stress Rule, chapter 1 (24), including SPE-like cluster definitions, chapter 1 (19). The basic form of the stress rule in all analyses is (62), where W_1 and W_2 indicate weak clusters:

(62) $V \Rightarrow [1\text{stress}] \;/\; X \_\_\_ C_o\ (W_1)\ (W_2)\ ]$

From (62), it is clear that all analyses share the three-syllable window restriction (7a). We will now review some instantiations of (62) in a nutshell, and refer to Kager, Visch, & Zonneveld (1987) and Trommelen & Zonneveld (forthcoming) for further discussion.

Evers & Huybregts (1975) were the first to present a SPE-like analysis for Dutch. They fill in both weak clusters with a *lax* vowel followed by maximally one consonant. In this respect, they deviate from SPE only in the word-final cluster definition, thereby capturing the generalization that final VCC tends to be stressed in Dutch, see *biljárt* (20b). They also capture the closed penult restriction (7c), by the maximum of one consonant in W_1, and by the fact that diphthongs qualify as tense. In order to reach the antepenult in words such as *tómbola* (49) or *álmanak* (34a), Evers & Huybregts assume underlying lax vowels in the penult, whose surface tenseness is due to a rule applying in open syllables. Underlying lax vowels are also assumed in any vowel-final word with non-final stress. This is reminiscent of the SPE (and standard) analysis of vowel-final words which go by Stress placement 1 in English, cf. chapter 1 (9). However, this tensing rule differs in one main aspect from the one of SPE's: it erases underlying tenseness distinctions not only pre-vocalically and word-finally, but in all open syllables. Therefore, the underlying lax quality of these vowels is used purely *diacritically*. Moreover, this analysis loses the generalization that vowel-final words tend to have penultimate stress (46). This regularity becomes a purely accidental state of affairs, since it requires an arbitrary combination of laxness of the final vowel and tenseness of the penultimate vowel in words such as *dynámo*, cf. (47c)[17].

Van den Berg (1974) replaces the SPE-like cluster definitions by more accurate syllable-based ones, and also removes the underlying (purely diacritic) tense/lax distinction. Closed syllables are regarded as strong, which correctly captures the closed penult restriction (7c), but also strongly overgenerates final stress in VC-final words, cf. (36). Nevertheless, Van den Berg is the first to observe that final VC takes stress more easily than final VV. Stressed final VV requires special marking as strong, as /e/, /ö/, and diphthongs, cf. (28,51). The first weak cluster in (62) is restricted to high vowels /i/, /y/, /u/ (as in *página*, *pápoea*, *prímula*, cf. 49), and schwa (as in *cámera*, cf. 47d). Van den Berg relates their skippability to their phonetic shortness.

Booij (1977) resembles Van den Berg (1974) in many respects, but is the first to notice that vowel-final words tend to have antepenultimate stress. Booij gives mispronunciations such as *pagína* (<*página*), cf. (50) and *democrátie* (<*democratíe*), cf. (54), to support this claim. That is, Booij takes issue here with Van den Berg's claim that *high* penultimate vowels are weak, and restricts W_1 to schwa. Booij introduces various minor rules to deal with stress on word-final vowels, for antepenultimate stress, etc, which we will not discuss.

Kooij (1978) is the first to draw attention to the fact that superheavy syllables (VVC, VCC, cf. 8a) tend to have final stress, by which he argues against Van den Berg (1974) and Booij (1977), who do not distinguish these syllables from VC as to strength. Kooij rejects any differences in cluster strength between VV and VC, not only in final position W_2, but also in penultimate position W_1. Instead he notes a general tendency towards penultimate stress in words that do not end in superheavy syllables. As we have pointed out in section 2.3.2.3, this is at least inaccurate for VC-final words, although it is regular for those ending in *-is*, *-um*, *-us*, *-or*, etc., cf. (37-40).

Van Zonneveld (1980, 1983) mainly recapitulates Van den Berg (1974), but shares with Kooij (1978) the viewpoint that final VC is basically weak. Accordingly, Van Zonneveld's improvement over Van den Berg (1974) is a refinement of the final weak cluster W2 in (62), from which position he excludes all VC-syllables except those which regularly have final stress, such as -et, -el, -es, -ot (36).

3.4 **Van Marle (1980)**

Van Marle deviates in two important respects from the SPE-type analyses discussed earlier in this section. First, he advocates a '*two-pattern-approach*' of Dutch word stress. Next to the 'stress-final' pattern which is evident in all SPE-inspired Main Stress Rules, he claims a 'stress-initial' pattern to exist as well. This does not imply a rule-based analysis, however, but rather a '*stress template*' analysis much like Selkirk (1980), cf. chapter 1 section 3.4.2. Each word is assumed to be stored in the lexicon with its stress template. The stress templates themselves, as morpheme structure conditions, are defined independently. Essentially, Dutch is analyzed as a *free stress* language, with various positional or segmental factors accounting for the position of primary stress.

Apart from an initial stress template, which is quite general but does not seem to have any specific conditioning factors, three final stress templates are proposed. Final stress is favored by final /e/ (51a), and by final closed syllables with tense vowels or diphthongs (20a). The penultimate stress template is favored by final schwa (12) or /a/ (47). The antepenultimate stress template is favored by an /i/ in the penult, followed by *a*, *o*, *um*, *us* (39), or schwa (14a) in the final syllable, and by words ending in the sequence *-esis* (*Génesis*, 34b).

In words consisting of a limited number of syllables, ambiguities arise as to their exact stress pattern. For instance, the position of primary stress in words in *-ks* such as *clímax* (23b), *crúcifix* (24b), can be classified as both initial or 'final' (penultimate or antepenultimate).
In order to dissolve the ambiguities, Van Marle suggests constraints on the notion 'preferred stress pattern': " (i) The 'preferred stress patterns' associated with the 'stress-final' patterns [...] should be operative irrespective of the number of syllables of the word. (ii) Bi- and trisyllabic words which are stressed word-initially can only be associated with penultimate and antepenultimate stress, respectively, if they conform to one of the 'preferred stress patterns' which specify these stress contours."
By these criteria, *clímax* and *crúcifix* are classified as stress-initial, since the location of primary stress cannot be uniformly described by a final pattern (penultimate, antepenultimate) irrespective of the number of syllables, and they do not conform to some 'preferred stress pattern' for penultimate or antepenultimate stress.
Notice that these criteria protect the initial pattern against competing final stress patterns by (i) imposing strict syllable count on the final stress patterns, and (ii) imposing strict segmental conditions on final stress patterns. Clearly these criteria positively affect the proportion of words classified as 'stress-initial'. Moreover, as we have shown in section 2, the position of primary stress in *climax* and *crucifix* can be generalizingly described as 'maximally to the left within the limits of the major generalizations', without strict syllable count.
Van Marle investigates the relevance of various patterns by substantive evidence from stress shifts. The conditioning factors for various shifts seem to be as follows. First, shifts to the *final* syllable are frequent among words ending in a superheavy syllable (*samovár*, *Stockhólm*), or /e/ (*satéh*), cf. section 2. Second, shifts to the *penultimate* syllable occur in "words ending in a vowel [cf. (50)], and in words the final syllable of which contains a schwa [cf. (15)] or an unstressed [oe] which may be followed by a consonant [cf. (40)]."
In order to demonstrate the initial stress pattern in Dutch stress, Van Marle mentions examples such as (44) of section 2. Many of these stress shifts must first be ruled out as shifts to the penult and antepenult, respectively. In order to do this, a special set of conditioning factors (related on the criteria mentioned above).
First, in trisyllabic words the conditioning factors for shifts to the initial syllable are: (a) a final VC syllable with a lax vowel and often a sonorant consonant, cf. (44), (b) a penult that (also in the original word-final stress contour) contains schwa or a vowel that is (normally) strongly reduced, cf. (15), (c) final *i* or *u*, cf. (55b).
Second, in disyllabic words the conditioning factors are (a) a final VC syllable with a lax vowel and a sonorant consonant, cf. (44c), (b) final *-ks*, cf. (23b), (c) final *i*, *o*, or *a*, see our comments for (51).
These factors fail to set apart exclusively the stress-initial pattern from the stress-final pattern. To see this, notice that the conditioning factors for trisyllabic and disyllabic words are nearly identical, and might as well have been formulated in the way argued for in section 2: stress shifts maximally leftward.
Finally, describing these shifts only in terms of the initial pattern misses the generalization that nearly the same conditioning factors are relevant in antepenultimate stress in longer words. As to final VC (such as words ending in *-on*), Van Marle fails to explain that stress is both 'stress-initial' (independent of syllable number, in *drágon*, *hórizon*), and 'stress-final' (within a three-syllable window from the right-hand word edge, in *acróstichon*, *rododéndron*, *accordeón*). Exactly the same goes for words in *-ks*, as in the triplet *clímax*, *crúcifix*, and *Abénolax* from section 2.3.2.1.

Van Marle's evidence for an initial stress pattern is therefore highly obscured (a) by remaining ambiguities between the antepenultimate stress pattern and the 'stress-initial' pattern, and (b) the inability to express in a generalizing fashion the stress pattern of words ending in a lax vowel plus a consonant. The remaining evidence for a 'stress-initial' pattern is found in words stressed on the fourth or fifth syllable from the end (56-58). These words form very restricted classes, however, both by their segmental make-up and by their semantic homogeneity, for which reason they can hardly figure as evidence for a synchronic stress-initial stress pattern. But most importantly, no shifts to the initial syllable seem to occur in such longer words.

Van Marle's second conclusion that Dutch word stress is essentially *free* is more substantial and harder to reject. Without being accused of playing word games, one may assume a gradual transition from free stress systems with favored patterns, to fixed stress systems with lexical stresses. Here, an analysis based on a *stress rule* and *lexical exception features* may be equipped better to explain the facts than an analysis which, more or less redundantly, has to lexically specify the stress pattern of each word. We will return to this in our analysis of Dutch word stress.

3.5 Metrical analyses

After the breakthrough of metrical analyses of English stress in the late seventies (cf. Liberman & Prince 1977, Selkirk 1980, Hayes 1981), the early eighties produced a variety of metrical and semi-metrical analyses of Dutch word stress. Because linear analyses had already shown the superiority of syllables over clusters, many of these analyses were essentially linear ones in a metrical disguise. Until 1984, the Main Stress Rule was translated into a Main Stress Foot à la Selkirk (1980), cf. chapter 1 (88), almost without exception, while theoretical notions such as extrametricality and labeling based on branching remained out of the picture. With respect to the Main Stress Foot the discussion focused on the role of syllable weight and the mechanisms of making syllable weight available to foot construction. Some analyses elaborated upon the idea of a '*syllable weight scale*', paired to a so-called '*mismatch condition*' for selecting the DTE. Although interesting as attempts, such analyses suffered from great heterogeneity of factors to be accounted for in the major foot construction rule. Gradually, analyses began to develop into the direction of a metrical standard theory (Hayes 1981), incorporating maximally binary feet, syllable extrametricality, and the LCPR for word tree labeling, cf. chapter 0, section 2.4.3. Syllable weight became formalized in terms of syllable-internal geometry, without reference to a separate scale. As a result, distinctions that had formerly been made gradually had to be expressed binarily, and recent discussion primarily addresses the issue as to how binary distinctions can be made optimally.

3.5.1 Neyt & Zonneveld (1982)

After two attempts at metrical analysis by Schultink (1979) and Booij (1981), Neyt & Zonneveld (1982) propose the first foot-based analysis for Dutch. But as it is always the final foot that is assigned primary stress, the differences with linear primary stress rule are more of principle than of practice. Formally, the binary application of the foot construction rule is iterative, to express the alternating character of secondary stress. Actually, this is the major result of Neyt & Zonneveld (1982), which will be discussed in more detail in chapter 5 on secondary stress.

The foot inventory, which resembles the one of Selkirk (1980), is below:

```
(63)a.  F    b. F        c.    F
        |      / \            / \
        σ     σs σw          s   \
                            / \   \
                           σs σw  σw
```

The distribution of these feet over strings of segments is as follows:

```
(64) Foot construction
     a. If the final syllable contains a long vowel followed by one or
        more consonants, or a diphthong, then the final foot is
        monosyllabic;
     b. If the final syllable contains a long vowel which is not
        followed by a consonant, or a short vowel, and if the
        penultimate syllable contains an -i-, then a trisyllabic foot
        is constructed over the final three syllables;
     c. Those syllables which have not yet been grouped into feet by a.
        or b. are grouped into bisyllabic feet from right to left.
```

The specific cases (64a) for final stress and (64b) for antepenultimate stress are explicitly ordered before the general *default case* (64c) for penultimate stress. Clearly, penultimate stress is considered basic for Dutch. Final primary stress is restricted to syllables of the type VVC, cf. (20b), a subset of the set of superheavy syllables, and those containing a diphthong, cf. (28). Antepenultimate stress is restricted to words that do not qualify for final stress by (64a), and whose penult contains /i/, as in various cases from (34, 39, 41, 49). Generally, these generalizations resemble those by Van Marle (1980) for the final stress pattern.

The derivations are completed by building a right-branching word tree, labeled uniformly weak-strong. Metrical trees like those below result:

```
(65)a.                 b.     M               c.
                             / \                     M
         M                  /   Fs                  / \
        / \                /   / \                 /   \
       Fw Fs              Fw  s   \               Fw   Fs
       |  |               |  / \   \              |   / \
       σ  σ               σ σs σw  σw             σ  σs  σw
      vi ool            har mo ni  ka            pi  a   no
```

In chapter 5, we will return to Neyt & Zonneveld's analysis of secondary stress.

3.5.2 Van der Hulst & Moortgat (1981)

This analysis takes the weight distinction between *full vowels and schwa* as its empirical basis. The restriction of stress to full vowels is the basis for an analysis of Dutch as unbounded, Q-determined: the stressed syllable of a foot must contain a full vowel[18]:

```
(66)a.  F              b.  / \
      s  \                Fw  Fs
     / \  \               |  / \
    s  w ..w             pa ra de
    V  ə   ə              V  V  ə
```

The analysis works well to capture the major generalization that primary stress directly precedes schwa, cf. (7b). However, it has serious drawbacks in the case of final full vowel syllables. The analysis constructs monosyllabic feet over any full vowel syllable that is not followed by syllables with schwa. Therefore, in order to avoid final primary stress on every final full vowel syllable, the word tree labeling has to be adapted:

```
(67)a.    /\            b.     /\
         /  s                 /  s
        /  / \               /  / \
       Fw Fs  Fw            Fw  Fs Fw   F
       |  |   |             |   |  |    |
       pi a   no            har mo ni <ka>em
```

Of course, the theory provides formal ways of reaching the penultimate foot (67a) by means of the LCPR, cf. chapter 0, (31), or antepenultimate foot (67b) by additional foot extrametricality. But this apparatus will generate, with the same ease, non-occurring forms such as **hárm*[ə]*nika*:

```
(68)a.     /\
          /  \
        Fs    Fw  F
        / \   |   |
       har mə ni <ka>em
```

The loss of binarity - or the three-syllable window generalization (7a) - is a grave disadvantage of adopting unbounded feet for Dutch. More seriously, there is no way to capture syllable weight distinctions other than the one between full vowels and schwa.

3.5.3 Stress scale analyses

In the early eighties, a number of analyses appeared whose primary goal was to refine the syllable weight distinctions in a scalar fashion, and design a weighing mechanism to make this scale accessible to the stress rule. This mechanism itself is a (somewhat unorthodox) extension of the standard metrical claim that stress is *relational*, a weighing mechanism whose basic form is (69):

(69) F
/ \ *Mismatch Condition*: $\sigma_s > \sigma_w$
σ_s σ_w (i.e. σ_s is not lower on the weight scale than σ_w)

That is, in a metrical foot, the weak syllable may not be lower on the weight scale than the strong syllable. Within a window at the word end, the heaviest, or otherwise the leftmost, of two syllables takes primary stress.

The refined scale by Dijkstra (1982) is an extension of the proposals by Van Zonneveld (1980, 1983) that have been discussed above. Dijkstra takes long vowels to be bipositional:

```
(70)  ə   |  V  |  V Son  |  V Obs  |  VV  |  VV C
          |     |         |  V C2   |      |
```

The relatively high position of VObs on the scale captures the fact that stressed final VC is often of this type: /ɛt/, /Ot/, etc., cf. (36). The domain of the weighing principle (69) is the final three syllables of a word, which are only fully considered if the penult contains a high vowel or schwa. Some examples conforming to (69) and (70) are below:

```
(71) di-a-rrée  át-las     ma-trás    kom-plót
     VV V  VV   VObs VObs   V  VObs   VSon VObs

     ás-best    kom-pléks  ká-no    de-káan
     VObs VC2   VSon VC2   VV VV    VV  VVC
```

Hence, the weakness of the final syllable - W_2 in (62) - is relativized with respect to the preceding syllable(s).

Dijkstra assumes VV to be heavier than (almost) any other syllable type. In case another VV precedes, this correctly predicts penultimate stress (*káno*), but if a closed syllable precedes, final stress is predicted as the 'unmarked' case: **pindá*, which is obviously incorrect in the face of the minor generalizations of section 2.3.2.4.
The most interesting part of Dijkstra's paper is the deduction of the stress scale from syllable-internal geometry. Metrical rime structure is assumed, with an obligatory nucleus (containing vowels) and an optional coda (containing a sonorant position and a obstruent position, possibly phonologically empty). The rimes of the scale are represented as below:

```
(72)a. R    b.  R      c.  R       d.  R        e.  R     f.  R
       |       / \        / \         / \           |        / \
       N      N  Co      N  Co       N   Co         N       N   Co
       |      |  / \     |  / \      |   / \       / \     / \  / \
       V      V Son -    V  - Obs    V Son Obs     V V     V V  (C)
```

Two principles produce the scale. First, the more branching constituents dominating filled positions, the stronger the rime. This set apart V (no branching constituents) from VSon, VObs, VV, VVC.
Second, the longer the linear distance between vowel and coda consonant, the stronger the rime. This sets apart VSon and VObs. In later analyses, the deduction of weight contrasts from syllable-internal geometry became a central issue. In this respect, Dijkstra's paper is an important one.
As compared to Dijkstra's scale (70), Van Nes (1982) contains a small but significant improvement: final VV is ordered lower on the scale than (most) VC rimes, so that incorrect results such as **pindá* are ruled out. Apart from this, Van Nes takes a Selkirkian foot template as the domain of the weighing principle, and extends the scale to eleven (!) points.
The central improvement of Kager & Visch (1983), Visch & Kager (1984) over the weight-scale analyses discussed above is a principled weight distinction between closed and open syllables. More specifically, they argue that *VC is heavier than VV*, on the basis of three types of evidence, to be discussed below.
The stress scale is reduced to five positions:

```
(73)   1. V    2. VV    3. VC    4. VCC    5. VVC
```

The weight scale is derived by three hierarchically ordered principles: First, branching rimes are heavier than non-branching rimes. This sets apart V and VV from VC, VCC, VVC. Second, branching nuclei are heavier than non-branching nuclei. This sets apart V (schwa) from VV, and VC/VCC from VVC. Third, branching coda's are heavier than non-branching coda's. This sets apart VC from VCC. See (74):

```
(74)   1.  R     2.  R      3. R       4.  R         5.   R
           |         |        / \         / \            / \
           N         N        N Co        N  Co          N  Co
           |        / \       | |         | / \         / \ |
           V        V V       V C         V C C         V V C
```

Closed rimes (including VC) are consequently heavier than open rimes.
Three types of evidence are presented for this. First, final VC tends to be stressed more easily than final VV. This is no new observation (cf. Van den Berg 1974 and Booij 1977), but this is the first metrical analysis in which it is expressed. However, in the form that Kager & Visch give to this tendency, the *incorrect* claim is made that final VC is stressed consequently in VV-VC words but stressless in VC-VC words.

The many exceptions to the basic patterns are dealt with by two devices. First, consonant extrametricality decreases the weight of final VC in VV-VC words such as *bívak* (33), for which stress scale (73) incorrectly predicts final stress. Second, a feature [+F] is attached to final rimes that should be stressed, but are not by (73). In particular, a feature [+F], similar to that proposed by Liberman & Prince (1977), cf. chapter 1 section 4.3.1, is required for final VV, *satéh*, cf. (51), and final VC preceded by another VC rime, *portrét*, cf. (36).

The second argument for marking VC as heavier than VV is that a VC in the penult cannot be skipped, in contrast to VV in the penult. Actually, this is the closed penult restriction (7c). Kager & Visch capture it by the Weight Criterion, which rates the construction of the disyllabic foot of (75a) higher than the ternary foot of (75b)[19]:

```
(75)a.     M         b.       M
          / \                 |
         /   \                F
        /     \              / \
       Fw     Fs            s   \
       |     / \           / \   \
       σ    σs σw         σs  σw σw
       VC   VC VV         VC  VC VV
       Ber nar do         Ber nar do
```

The distribution of weight over strong and weak syllable positions is more optimal in (75a), where a *VV* syllable is weak with respect to a VC syllable, than in (75b), where a *VC* syllable is weak with respect to another VC syllable.

The third argument for ranking VC higher on the weight scale than VV is that words ending in VC tend to have antepenultimate primary stress, if an antepenult exists and the penult is open, cf. (30a). This observation is new in the literature. Kager & Visch select *álmanak* over **almának* as below:

```
(76)a.   M        b.
         |               M
         F              / \
        / \            /   \
       s   \          Fw    Fs
      / \   \         |    / \
     σs σw  σw        σ   σs  σw
     VC VV  VC        VC  VV  VC
     al ma  nak       al  ma  nak
```

The s-w structure over VC-VV in (76a) is evaluated higher than the VV-VC foot of (76b), since the former structure places the heavier syllable in the strong position, while the latter does not. Exceptions which go like (76b), cf. *senátor* (38), are handled by consonant extrametricality rules.

Two objections can be raised against this analysis. First, it is unclear how to distinguish superheavy closed syllables VCC and VCC - which tend to have final stress - from other closed syllables VC - which tend to be skipped. Kager & Visch extend the Weight Criterion (69) to weighing not only syllables, but *entire feet* against each other. In this way, 'superheavy' VCC and VVC win out against each type of foot, including branching ones, whereas VC do not (except if marked by [+F]). Weighing of feet against rimes implies that feet are assigned a completely ad hoc position on the rime weight scale (73).

The second objection against the analysis is that interactions between various principles - applying in their unmarked modes - are so complex that predictions can hardly be checked properly. On the other hand, the analysis incorporates exception marking devices powerful enough to annihilate the subtle complexities of the core analysis with great ease.

3.5.4 **Van der Hulst (1984), Van der Hulst & Langeweg (1984)**

The metrical analysis proposed in Van der Hulst (1984) improves upon the weight-scale analyses by replacing ternary feet by maximally binary feet and the LCPR for word tree labeling. A weighing mechanism is maintained as in (69). Van der Hulst assumes the weight scale (73) of Kager & Visch. However, he does not derive it from syllable-internal branching, because as he argues such an account presupposes an over-articulated syllable-internal structure - see for his alternative moraic analysis chapter 3. Instead, three distinctions are used.

First, syllables are ranked according to the number of morae that they contain. This sets apart superheavy trimoraic syllables from others, and bimoraic ones from monomoraic schwallables. Second, closed syllables are heavier than open syllables, setting apart VC from VV. Third, syllables with long vowels count as heavier than syllables with short vowels. This sets apart VVC from VCC. Together, these criteria produce the scale (73):

```
(77)                      /     |       \
       mora number       one   two     three
       closure            |    / \       |
       quantity           |   |   |     / \
                          ə   VV  VC  VCC VVC
                          1   2   3    4   5
```

The analytic machinery is stated below:

```
(78)a. Assign feet from right to left that are
         - binary
         - Q-sensitive [in the sense of (69)]
         - labeled SW

    b. Assign a word tree that is
         - right branching
         - labeled by the LCPR

    c. LCPR
         In the configuration [AB] B is Strong iff
         1. it branches, or
         2. it dominates a superheavy syllable, or
         3. it dominates a marked syllable ([+F])
```

The major empirical difference between this analysis and the one by Kager & Visch is in the treatment of final VC. Whereas Kager & Visch incorrectly predict that disyllabic words with the skeleton VV-VC have final stress in the regular case, Van der Hulst assigns initial stress by the LCPR 1. This is shown in (79a). Exceptional final stress is obtained by [+F], viz. provision 3. of the LCPR, in cases such as (79de). Finally, in (79f), a superheavy syllable is stressed by provision 2. of the LCPR:

```
(79)a. /\         b.         c.     /\      d.   /\       e.  /\       f.  /\
      /  \                 |        /  \        /  \         /  \          /  \
     Fs   Fw               F       Fs    Fw    Fw   Fs      Fw    Fs      Fw  Fs
     |    |               / \     / \    |     |    |       |     |       |   |
     VV   VC            VC  VC   VC VV   VC    VV   VC      VV    VV      VV VVC
     ka  jak           har nas   al ma  nak    ta  bak     tro  fee       to neel
                                                   [+F]         [+F]
```

By referring directly to superheavy syllables VCC, VVC in the LCPR, the problems which forced Kager & Visch to include feet in the weight scale, have been solved. Finally, words such as *tómbola*, cf. (49), must be stored in the lexicon with an *extrametrical* syllable.
There is one more aspect of this analysis that is crucial: it introduces *stress retraction* to derive non-final stress in words such as *kajak* (79a) and *almanak* (79c). Hence, foot construction is crucially *iterative* in such cases, since a non-final foot is the one to receive primary stress. This idea finds a solid place in the literature following Van der Hulst (1984).
This analysis is better integrated in Hayesian metrical theory than its ancestors, as will be clear from (78). The only remaining non-standard device is the Mismatch Condition (69) combined with the weight scale (73)[20].

3.5.5 **Kager (1985)**

This paper eliminates both the Mismatch Condition and the weight scale, elaborating on the LCPR analysis by Van der Hulst. The idea is that Q-sensitivity should be simply equated with the closed-open distinction in Dutch, allowing a standard Hayesian foot type. A way to make the distinction between open and closed syllables is to assume that rimes consist of a nucleus and a coda, and to attribute the weight effects to branchingness of the rime, as in Visch & Kager (1984).

```
(80)     Light          |            Heavy
                        |
         R    R         |   R        R       R
         |    |         |  / \      / \     / \
         N    N         |  N C     N   C    N  C
         |   / \        |  | |    / \  |    | / \
         ə   V V        |  V C    V V  C    V C C
```

The analysis is identical to Van der Hulst's (78), except for a small but significant improvement, cf. chapter 0 (41):

```
(81) Q-sensitivity
     The rime of a recessive (weak) node cannot branch.
```

Consequently, *each closed syllable is the head of a foot*. The effect of eliminating feet with closed syllables in weak positions can only be tested in comparison to former VC-VC feet. It can be shown that the new analysis accounts for all correct results of the former, and at the same time avoids its most important drawback. Consider (106):

```
(82)a.          b.          c.           d.    /\          e.           f.
      /\          /\          /\              /  s           /\           /\
     /  \        /  \        /  \            / /  \         /  \         /  \
    Fs  Fw      Fs  Fw      Fs    Fw       Fw Fs   Fw      F    \       Fs  Fs
    |   |       |   |       / \   |        |  |    |      / \    \      |   |   \
    VV  VC      VC  VC     VC VV  VC       VV VC   VC    VC VV   VV     VC  VC   VV
    ka  jak     har nas    al ma  nak      e lek tron    tom bo <la>    em bar <go>
```

A different analysis arises for *hárnas* (82b), *eléktron* (82d), which gives the correct result as well as does Van der Hulst's analysis (79b). The new analysis, eliminating the weight scale and Matching Criterion, is to be preferred over Van der Hulst (1984) as it is more in line with Hayes' parametric word stress theory of 1981.
There is also an empirical improvement. Van der Hulst and Kager assume syllable extrametricality in order to account for antepenultimate stress in words such as *tómbola*, cf. (82e). Since extrametricality is unpredictable, cf. (47c) versus (49), it may be assumed

to be freely distributed among lexical entries. But if this is accepted, words with a skeleton VC-VC-VX (such as *embárgo*) should occur whose final syllable is marked extrametrical. The Van der Hulst analysis has no way of blocking antepenultimate stress in such words, which never occurs (**émbargo*), by the closed penult restriction (7c). Obviously, the problem is caused by the possibility of constructing a VC-VC foot over the antepenult and penult. In contrast, Kager's analysis avoids this possibility by obligatorily assigning a monosyllabic foot to the heavy closed penult, as shown in (82f).

3.5.6 **Kager & Zonneveld (1986)**

Departing from Kager's analysis of word stress, this article proposes an explanation for the observation that primary stress is on the penult if the final syllable contains schwa - the schwallable restriction (7b). We have seen how previous analyses which attempted to capture this observation, such as Van der Hulst & Moortgat (1981), were not satisfactory in this respect. Kager (1985) does not perform much better, predicting antepenultimate stress across a light penult if the final schwallable is extrametrical:

```
(83)     /\
        F  \
       / \  \
      VV VV  ə
      pa ra <də>em
```

Kager & Zonneveld show that the schwallable restriction, including its mysteriously looking condition on a preceding consonant, is directly explained by their appendix analysis of schwallables, cf. chapter 3, section 6.4. The clue is in the consonant cluster preceding schwa, which at the point of primary syllabification is final in the penult rime, contributing to its weight. Four possibilities exist, and all are assigned the correct analysis by simply applying the stress rule of Kager (1985):

```
(84)a.   σ              b. σ              c.  σ                d.      σ
         |                 |                 / \                      / \
         R  App2           R  App2          R  App1 App2             R  App2 App2
        / \  |            / \  |           / \  |    |              / \  |    |
        V V  ə            V C  ə           V V  C    ə              V C  C    ə
   Belg i i  ə      pant  O f  əl     law  i i  n    ə        min  I s  t    ər
```

Crucially, the syllable preceding the Schwappendix gains weight from the pre-schwa consonant syllabified to the left in (84bcd). This syllable cannot be skipped by the stress rule since it is closed, hence heavy. It follows that primary stress is on the syllable directly before schwa. No possibility exists of the pre-schwa syllable being extrametrical, since it is non-peripheral by the following Appendix$_2$ segments. This explains why next to words such as *tómbol*[a], no words such as **tómbol* [ə] occur.
The most interesting case is (84a), where there is no consonant between the vowel and schwa, so that the penult is *open*, cf. (14) in section 2. Precisely in these cases antepenultimate stress may occur. This is a direct consequence of Kager's word stress analysis, since open syllables can occupy the weak position in a foot.

3.5.7 **Kager, Visch & Zonneveld (1987)**

Although a paper largely devoted to reviewing recent literature on Dutch stress, Kager, Visch and Zonneveld (1987) contributes to the discussion in a number of points, especially to the treatment of exceptions. It is noticed that exceptions to antepenultimate stress in X-VV-VC words tend to end in a specific set of rimes: *-um*, *-us*, *-or*, *-is*, etc., cf. (37). Many of these can be analyzed as containing schwa (*saláris, Jodócus, vademecum*), and therefore be simply accounted for as in Kager & Zonneveld (1986). A morphological analysis is suggested for nouns ending in *-um, -us, -or*, which alternate with plural forms *-a, -i, -oren*, cf. (38).

Furthermore, a number of arguments for the distinction between open and closed syllables are added to the existing ones. It is noted that closed rimes which normally bear final main stress, by being superheavy or [+F], remain regular VC rimes if exceptional to final stress: they have antepenultimate stress if the penult is open. Examples are in (85):

```
(85)a. superheavy    b.  [+F]
       ólifant           álfabet
       léukoplast        ésopet
       hóspitaal         dóminee
       kátapult          áloë
```

Furthermore, VCC rimes which avoid final stress, such as -V*ks*, behave as regular VC rimes: *crúcifix, appéndix*, cf. (24b, 25b). Classes of rimes for which [+F] is highly unpredictable, such as *-on*, conform to the same stress paradigm: *márathon, acróstichon, eléktron, balkón*, cf. (31, 32).

Finally, words ending in VV-VV with penultimate or final stress patterns tend to shift stress to the penult: *página-pagína*, cf. (50), and *demokratíe-demokrátie*, cf. (54). In contrast, words ending in VV-VC with penultimate or final stress shift stress to the antepenult: *Carácas-Cáracas*, cf. (44a), and *carnavál-cárnaval*, cf. (44b).

All these types of evidence suggest that the removal of irregular stress features, viz. [+F] and extrametricality, leads to the unmarked patterns as predicted by the stress analyses of Van der Hulst (1984) and Kager (1985):

```
(86)a.      /\       b.      /\          c.               d. /\
           /  \             /  \                 /\          /  \
         Fw    Fs         Fs    Fw             F   \        Fw   Fs
         / \    |         / \    |            / \   \       |    / \
       VC  VV   VC      VC  VV   VC         VV  VV   VV     VV  VV  VV
       car na  val      car na  val         pa  gi  <na>em  pa  gi  na
               [+F]
```

Also, a new argument for the LCPR is presented. An alternative analysis doing without the LCPR would have difficulties in capturing the generalization that words ending in VX-VV-VC tend to have antepenultimate stress, while words ending in VX-VV-VV tend to have penultimate stress. Suppose that a VC syllable were marked extrametrical by rule, to account for the above stress patterns. Then words such as *álma<nak>* and *elék<tron>* would be assigned their non-final stress on the proper syllable. However, such an analysis would lose the generalization that VC avoids being footed as a weak syllable both word-finally and word-internally, which is a serious objection[21].

3.5.8 **Langeweg (1988)**

Langeweg (1988) deviates from Van der Hulst (1984) and Van der Hulst & Langeweg (1984) in two aspects. First, the stress-attracting behavior of superheavy syllables is analysed as an effect of their forming branching feet. Second, lexically marked (underlying) weight is suggested as a way of accounting for lexical exceptions.

Langeweg (1988) suggests an explanation for the tendency for superheavy syllables to have stress. Somewhat in the spirit of McCarthy (1979), who analyses Arabic superheavy syllables as containing degenerate syllables, Dutch superheavy syllables are considered to constitute branching feet, consisting of a (nuclear) syllable and a coda constituent. The branching foot will be labeled strong by the LCPR (78c), which can then be simplified by elimination of the provision on superheavy syllables[22]:

```
(87)         F
            / \
          σ    \
         / \    \
        O   N  Coda
        |  / \  / \
        Co V X C (App)
```

Langeweg refers to the *coda* as a *syllabic constituent*, an adjunct to the syllable under the node *foot*. But it remains unclear whether the foot is an effect of coda adjunction during syllabification, or if the standard footing rule is to be held responsible. If the former option is chosen, it must be assumed that syllabification rules actually construct supra-syllabic nodes, i.e. feet. In that case, the analysis boils down to the stipulation that superheavy syllables are 'actually' branching feet. The explanatory value of such a stipulation is fairly minimal.

If the latter option is chosen, foot construction must be complicated in an ad-hoc way to apply to 'coda', in addition to 'regular' syllables. As an additional complication, it must be stipulated that a coda obligatorily forms a foot with the preceding syllable. If this were left unsaid, the coda may be ignored by footing (for instance because it is extrametrical), leading to non-occurring stress outputs such as **admíraal*:

```
(88)       /\
          /  \
        Fw    Fs
        |    / \
        σ  σs σw   Coda
       ad mi raa   <l>em
```

Actually, two notions are confused: degenerate syllables (i.e McCarthy's suggestion for Arabic) and the syllabic constituent *coda*.

Second, Langeweg handles exceptions to the analysis by means of abstract lexical skeletons. That is, in order to derive final stress on syllables that are not superheavy, the skeletons of these syllables are 'extended' with an abstract consonantal position, cf. (89ab). In the reverse case, where a superheavy syllable fails to carry final stress, its skeleton is reduced in underlying form, cf. (89c)[23]:

```
(89)a.  /\          b.  /\          c.  /\
       /  \            /  \            /  \
      Fw   Fs         Fw   Fs         Fs  Fw
      |   / \         |   / \         |   |
      VV  VC  C       VV  VV  C       VV  VC
      ra  ket         i   dee         la  riks
```

This solution is certainly not inferior to the one using [+F] and consonant extrametricality, such as Kager & Visch (1983). Also, it runs into the same objection of arbitrariness and unconstrainedness. Marking skeletal abstract positions (minus/plus one position or many?) is equivalent to giving up any empirical content of the analysis. For instance, if closed syllables (VC) can lose their closing consonant in underlying forms, the closed penult restriction (7c) and schwallable restriction (7b) can no longer be captured:

```
(90)a.    /\            b.
         /  \                  /\
        Fs   Fw              Fs  \
       / \   |              / \   \
      VC  V  VV            VV  V   V
      em bar go            pa ra de
```

It may be argued that underlying skeletal strings (a) should conform to the bimoraic minimality of Dutch syllables, and (b) can deviate from the surface skeleton only in peripheral positions. However, Langeweg does not restrict her analysis in such a way, as will be clear from her analysis of *página*:

```
(91)      /\
         /  \
        Fs   Fw
       / \   |
      VV  V VV
      pa gi na
```

Clearly, exception marking devices are to be chosen so as to respect the major generalizations.

3.5.9 **Van der Hulst & Van Lit (1987)**

Van der Hulst & Van Lit (1987) attack superheavy syllables by employing degenerate syllables. Their analysis of syllabification - see again our review in chapter 3 - assigns morae to word-final consonants that cannot be incorporated into the (maximally bipositional) syllable. These morae are projected as *degenerate syllables*:

```
(92)a.     σ   σ σ     b.   σ     σ   σ
           |   | |          |\    |\  |
           m   m m          m m   m m m
          /|  /| |         /| |  /| | |
         t o n e l        b I l j α r t
```

The foot construction rule (essentially the one proposed by Kager 1985, Kager, Visch & Zonneveld 1987) yields (93):

```
(93)a.     F   F       b.   F     F
           |   |\           |     | \
           σ   σ σ          σ     σ   σ
           |   | |          |\    |\  |
           m   m m          m m   m m m
          /|  /| |         /| |  /| | |
         t o n e l        b I l j α r t
```

Superheavy syllables are analysed as branching feet, be it in a somewhat different way than in Langeweg (1988), i.e. by means of degenerate syllables instead of coda's. The difference is in favor of the current analysis, since the foot construction rule need not be complicated (i.e. need not apply to coda's in addition to syllables). Nevertheless, by giving up the syllabic constituency for superheavy syllables, the analysis incorrectly predicts that both parts can go their own way, as shown in (88) above.

As discussed in chapter 3, section 4.2, Van der Hulst & Van Lit assume an underlying monomoraic status of long vowels in open syllables, and a way of lengthening these to conform to the surface filter against monomoraic syllables. Since VV is underlying V, the weight distinction between open and closed syllables can be recast into a distinction between monomoraic and bimoraic syllables:

```
(94)  Light    |    Heavy
               |
        σ      |      σ
        |      |     / \
        m      |    m   m
        |      |    |   |
        V      |    V   C
```

They claim that this analysis solves a problem with respect to the earlier weight distinction of Kager (1985), cf. (80). The situation that closed short vowel syllables are heavier than open long vowel syllables is universally odd. It conflicts with the generalization that systems having a length contrast between vowels never treat VC syllables as heavier than VV syllables (McCarthy 1979, Hyman 1985). But obviously, Dutch does have a length contrast between vowels, thereby violating the generalization[24].

Van der Hulst & Van Lit claim their analysis to solve this problem with respect to syllable weight: since VV is actually V, it makes sense that it is lighter than VC. Crucially, vowel length can only be contrastive, or lexically marked, in closed syllables. Since vowel length is predictable in open syllables, all open syllables contain monomoraic vowels in lexical representation[25]. The two major disadvantages of this analysis have already been mentioned in chapter 3, section 4.2. Because the issue is important enough we will restate the most important drawback. This analysis underspecifies vowel length in open syllables, circularly presupposing a syllable-sensitive restriction in order to set up a syllable-determining distinction. An additional problem is the claim that superheavy syllables are actually disyllabic. This makes a proper definition of 'closed' syllable with respect to vowel length distinctions impossible, because 'closed' VVC syllables are split up into an 'open' VV syllable and a degenerate C syllable. Furthermore, since it assumes long vowels in open syllables to stem from short vowels, it is confronted with the task of accounting for the obvious asymmetries between the sets of short and long vowels qua number and feature composition.

3.5.10 **Lahiri & Koreman (1987, 1988)**

This section reviews some recent analyses which rationalize the weight distinction between open and closed syllables without returning to a lengthening analysis as advocated in Van der Hulst & Van Lit (1987).

Lahiri & Koreman (presentation at Nijmegen 1987) propose to relate the weight of VC-syllables in comparison to VV-syllables to the obligatory closure of syllables with short vowels. Mora count never effectuates the opposition between short and long vowels in open syllables, as these never contain short vowels. In this situation, the moraic distinction can be replaced by a distinction of open versus closed, favoring VC-syllables over VV-syllables. The vowel length distinction takes effect in closed syllables only, where VVC and VC can contrast in moraic weight.

The generalization is that vowel length contrasts are effectuated only in syllables where a mora contrast can result. This explanation is very attractive, since it relates the generalization that short vowels are in closed syllables to the puzzling weight difference between VC and VV. So where Van der Hulst & Van Lit deny the vowel length contrast for all but closed syllables, Lahiri & Koreman accept a vowel length contrast in all positions, but limit its weight effects to those syllables where a mora contrast can result.

Lahiri & Koreman (1988) have suggested that the weight distinction of VC versus VV syllables is to be represented separately from the quantity distinction between long and short vowels. Consequently, the skeletal tier can be used to represent long vowels as bipositional, whereas the moraic tier can be used to represent long vowels as mono-moraic.

```
(95)  σ         σ      σ
      |\        |      |\
      m m       m      m m
      | |     // \    /| |
      V C C V V C V C
      | | | \ / | | |
      a l m  a  n a k
```

The generalization that short vowels must be in closed syllables can be accounted for by requiring syllables to dominate at least two skeletal positions, or timing slots.
Unfortunately, this proposal fails to capture the generalization that quantity, or vowel length, leads to weight distinctions in (final) closed syllables. Since vowel length is never represented moraically, but only in the skeleton, VVC syllables and VC syllables are expected to be of equal weight, which obviously misses the distinction. Furthermore, by having syllables indirectly dominating the skeletal tier through the moraic tier, it becomes problematic to guarantee that syllables dominate at least two positions, denying the prevocalic consonants. In 'traditional' mora theory, this follows directly from the statement that syllables are bimoraic, where the prevocalic consonants are invisible by sharing the first mora with the first part of the vowel.

3.6 **Conclusions**

After reviewing the literature on Dutch word stress, it is clear that a number of essential problems remain. Let us summarize them.
First, although the LCPR plays an important role in the analyses after Van der Hulst (1984) and Kager (1985), its theoretical status has been questioned by Prince (1983) and others, as it presupposes word trees to be of a richer structure (binary branching in uniform direction) than can be motivated. Moreover, extrametricality and the End Rule are much simpler mechanisms to capture the same patterns. Can such an analysis be given for Dutch as well?
Second, syllable weight has not been formalized in a satisfactory way. A geometrical account runs into the problem of over-articulated syllable-internal structure (Van der Hulst 1984). A moraic analysis capturing the distinction by mora count only is incapable of distinguishing VV and VC. Moreover, the problem related to VC being heavier than VV has only been solved *informally*, by Lahiri & Koreman (1987). It remains to be seen if their ideas can really be implemented, and also, if syllable closure is to be taken as the central notion in such an analysis.
Third, no analyses of exceptions has been developed which have the property of respecting the *major* generalizations (7), and also capturing the basic stress patterns that we have called *minor* generalizations (8). The devices suggested so far, consonant or syllable extrametricality, [+F], lexically specified skeletons, underlying length contrasts, all have the negative aspect of bringing the major generalizations in danger.
In the next sections, we will try to solve these problems.

4. An analysis of the basic stress patterns

4.1 Introduction

Our analysis will be in the footsteps of Kager (1985), Kager & Zonneveld (1986) and Kager, Visch & Zonneveld (1987), but with various refinements. We will show that the adjunction framework as presented in chapter 2 for English fits Dutch very well too, and also allows for improvements over earlier accounts.

The three building blocks whose exact form is to be established are (a) a mechanism for obtaining quantity information, (b) an adjunction rule, and (c) a prominence rule. Most of our attention will be towards the first type of device.

Recall from section 2.3 that underived words and words derived with level-1 suffixes behave alike with respect to the location of primary stress. Therefore, we will assume that stress is assigned at level-1.

Our analysis in a nutshell is given below:

(96) a. QS (where V_iV_i is light, and V_iV_j, VC, and VXC are heavy).
b. Optionally, mark V_iV_i with a lexical stress.
c. Syllable Adjunction (L-dominant, Right-to-Left).
d. Optionally, mark a right-peripheral syllable extrametrical.
e. End Rule (Final).

In the remainder of section 4, we will mainly provide motivatation for (96acde), and not go into lexical stresses (this issue will be left to section 5). Moreover we will not deeply discuss lexical variability right-peripheral syllable extrametricality (again, this issue is dealt with in section 5). Hence, in section 4.2 through 4.4, we will present an analysis of the core of the Dutch stress system, without discussing the lexical variability (or its 'free' aspects) in location of primary stress.

4.2 A basic analysis

In this section we set out to give an analysis of the 'unmarked' stress patterns in Dutch, leaving aside aspects of syllable weight such as the schwa-full distinction and the treatment of superheavy syllables. These aspects will be formalized in section 4.3.

Let us therefore (for the moment) assume the basic weight distinction to be as claimed in Kager (1985), and Kager, Visch & Zonneveld (1987). That is, open syllables are light, and closed and diphthongal syllables are heavy. First, as in English, we assume that heavy syllables are stressed by default, and that light syllables are stressless by default. A weight interpretation principle such as the one in (97) will guarantee this:

(97) **Inherent stress by syllable weight** (QS)
A heavy (closed, diphthongal) syllable is aligned with a line 1 grid element.

By minimality of stress representations (see again chapter 2), the basic stress values of syllables will be as in the selection of cases below:

```
(98)  .  .     *   .    . .  .    *   *  .    .  .  .  .     .  .   *  .
      v  v     -   v    v v  v    -   -  v    v  v  v  v     v  v   -  v
      ki lo   Brin ta   a ke la   em bar go   pa no ra ma   pro pa gan da

      *   *    *  .   *    .  *   *     .  .   *   *     . .  .   *
      -   -    -  v   -    v  -   -     v  v   -   -     v v  v   -
      at las   al ma nak   e lek tron   ro do den dron   E li za beth
```

Second, a L-dominant Syllable Adjunction rule is assumed, scanning the word right-to-left:

```
(99) Syllable Adjunction
     Adjoin a syllable place-holder leftward.
     Direction: right-to-left.
```

Syllable Adjunction produces (100):

```
(100) (*  .)   (*    .)   . (*   .)   *  (*    .)   (*   .)(*   .)   (*   .)(*    .)
       v  v     -    v    v  v   v    -   -    v     v   v  v   v     v   v  -    v
      ki lo    Brin ta    a ke  la   em bar  go     pa  no ra  ma    pro pa gan  da

      *   *    (*    .) *   .  *     *       (*   .) *    *      .  (*   .) *
      -   -     -    v  -   v  -     -        v   v  -    -      v   v   v  -
      at las    al  ma nak  e lek  tron      ro  do den dron     E  li  za beth
```

Third, primary stress is assigned. In order to derive the LCPR-effect of the Kager, Visch & Zonneveld analysis, the End Rule will be preceded by a rule marking the rightmost syllable as extrametrical. This rule will, for the moment, be formulated as ignoring the distinction between final -VX and final -VXC, i.e. superheavy syllables:

```
(101) Syllable Extrametricality
      Mark a syllable extrametrical at the word end.
```

The End Rule can be stated accordingly:

```
(102) End Rule
      Put a line 2 element on top of the rightmost line 1 element.
```

Together, the rules (101) and (102) yield (103):

```
(103)  *       *           *          *                 *                *
      (*  .)  (*    .)   . (*  .)    *  (*    .)    (*   .)(*    .)   (*   .)(*    .)
       v  v    -    v    v  v  v     -   -    v      v   v  v   v      v   v  -    v
      ki<lo> Brin<ta>    a ke<la>   em bar<go>      pa  no ra<ma>     pro pa gan<da>

      *        *              *                 *              *
      *   *   (*    .) *   .  *     *        (*   .) *    *      .  (*   .) *
      -   -    -    v  -   v  -     -         v   v  -    -      v   v   v  -
      at<las>  al  ma<nak> e lek<tron>       ro  do den<dron>    E  li  za<beth>
```

Note that by marking syllables extrametrical, their line 0 place-holders as well as any higher-level grid elements become inaccessible to the End Rule. Actually, this is the same convention as was assumed in chapter 2, in order to guarantee that the English End Rule ignores an extrametrical syllable. The difference between English and Dutch is basically that the latter system imposes syllable extrametricality only *after* constituents have been formed by Syllable Adjunction, while the former system employs syllable extrametricality to govern both Syllable Adjunction and the End Rule[26].

Notice also that Syllable Adjunction is formalized as an iterative rule. This assumption is never crucial for primary stress assignment, since by the absence of monosyllabic feet and by Syllable Extrametricality (101), the End Rule will never ignore a final branching constituent, and assign stress to the head of the next branching constituent preceding it. There is evidence from secondary stress, however, for an iterative application mode of

Syllable Adjunction (particularly the Q-sensitivity of secondary stress provides such evidence). This issue will be discussed in section 6 below.

Our analysis leaves word-final heavy syllables solitary if preceded by an adjoinable light syllable. This is why heavy syllables either carry primary stress or keep a comfortable binary distance from it. As shown in section 2.3.2.3, heavy syllables in final positions typically retract stress across the maximal distance of two syllables. An example is final -*et*, which keeps a maximal distance from primary stress if not stressed itself (*Tíbet*, *álfabet*, *Elízabeth*).

```
(104)a. *            b.  *              c.     *
        *  *             (*    .) *          . (*   .) *
        v  -             -   v  -            v  v   v  -
       Ti <bet>em        al fa <bet>em       E li za <beth>em
```

A final point to be noted here is that the End Rule, as in English, will default to the lowest grid line 0 if there is no available landing site on line 1:

```
(105)                                        *
      .  *           .   *                   *    *
      v  -  (101)    v   -      (102)    v    -
     ka jak   =>    ka <jak>em    =>    ka <jak>em
```

4.3 **Syllable weight distinctions**

4.3.1 **Introduction**

We will show that our analysis of syllable structure of chapter 3 will provide direct ways of representing syllable weight distinctions with respect to stress assignment. Let us begin with restating the three weight oppositions that seem to be present in Dutch:

(106) a. Syllables with full vowels versus syllables with schwa.
   b. Closed syllables and diphthongs versus long vowels in open syllables.
   c. Superheavy syllables (VXC) versus bimoraic core syllables (VX).

4.3.2 **Full vowels versus schwa**

We will first discuss schwallables. As motivated in chapter 3, most of the distributional properties of schwa are captured by the assumption that schwa is *underlyingly weightless*. This assumption is also the key to schwa's stress-rejecting behavior. As will be clear, this property directly follows from the assumptions below in (107). Assumption (107a) states that line 0 place-holders in the grid can only be positioned over syllables, which necessarily contain morae, by Core Syllable Formation, cf. chapter 3 (35). Assumption (107b) is motivated to explain the domain in which generalizations on stress placement hold:

(107) a. Stress-bearing elements are syllables (projected from morae).
   b. Stress is assigned at level-1.

Since schwallables arise only at level-2, they cannot receive stress at level-1. As we will show, the major generalization that primary stress is located directly before schwallables, section 2.3 (7b), also follows from schwa's weightlessness at level-1. Our analysis essentially follows Kager & Zonneveld (1986) here.

According to our analysis of chapter 3, no consonant preceding schwa can be syllabified as an onset of a schwallable at level-1, simply because schwallables arise only at level-2.

Therefore, intervocalic consonants are syllabified as coda's with the preceding syllable, whereas remaining consonants in clusters remain unsyllabified at level-1. Then, if one or more consonants precede schwa, the preceding syllable will be closed. But if no consonants precede schwa, the pre-schwa syllable will be open, cf. (108):

```
(108)a.       σ          b.       σ          c.                d.
             / \                 / \
       σ    σ    |         σ    σ  |           σ     σ              σ    σ
      / \  / \   |        / \  / \ |          / \   / \            / \  / \
      m m  m m   |        m m  m m |          m m   m m            m m  m m
     /\ /  /\ /  |        \ /  /| | |        /| |  /| |           /\ /  /\ /
    p a r  a    d ∂       a p O s t ∂ l     p α n t O f ∂ l       m a  χ i  ∂ r
```

Let us now assume that the weight distinction (106b) is the basic one (it will be formalized in due course). Then the syllable weight of pre-schwa syllables is proportional to their closure. Furthermore, by assuming an automatic interpretation of syllable weight as stress the words of (108) come out as in (109):

```
(109)a.   . *        . *           *  *          . .
          v -    b.  v -      c.   -  -      d.  v v
        parade     apostel     pantoffel      magier
```

After Syllable Adjunction, (110) results:

```
(110)a.   . *    b.   . *      c.   *  *      d.  (* .)
          v -         v -           -  -           v v
        parade      apostel      pantoffel       magier
```

Crucially, Syllable Extrametricality (101) is blocked in all of (110), as the rightmost syllable is non-peripheral. The unsyllabified schwa and the consonants following it form a sequence of segments lying in between the rightmost syllable and the end of the domain, effectively rendering the rightmost syllable inaccessible to Syllable Extrametricality.
As a result the End Rule promotes the rightmost stress in each of (110), correctly selecting the pre-schwa penultimate syllable when a consonant precedes schwa (111abc), and the antepenult when no consonant precedes, as in (111d).

```
(111)a.     *    b.     *      c.      *      d.   *
          . *         . *           *  *          (* .)
          v -         v -           -  -           v v
        parade      apostel      pantoffel       magier
```

So we have derived the major generalization that primary stress precedes schwa when schwa is preceded by a consonant (7c) from the independently motivated syllabification properties of schwa, as analysed in chapter 3. Schwa's moraic weightlessness at level-1 is the key to our analysis both for syllabification and stress assignment. Schwa's weightlessness leaves pre-schwa consonants to close the preceding syllable, making it heavy. A second effect of weightlessness, schwa itself and consonant(s) following it will remain unsyllabified during level-1 syllabification, but still be visible to the Syllable Extrametricality rule. The two effects of weight of a preceding syllable (if closed) and non-peripherality of a preceding syllable force the primary stress to move to the syllable preceding schwa, if it is followed by at least one consonant.
After schwa is syllabified at level-2, it is incorporated into metrical structure under the conditions discussed in chapter 2, section 8; the Maximality Principle blocks Syllable Adjunction in (112d), but allows Syllable Adjunction in (112abc):

```
(112)a.     *       b.     *          c.       *        d.  *
          .(* .)         .(*   .)         * (*   .)         (* .).
          v - v          v -  v           -   -  v           v v v
         parade         apostel        pantoffel           magier
```

This concludes our discussion of schwa's stress properties.

4.3.3 **Closed syllables/diphthongs versus long vowels in open syllables**

The second weight distinction is the one between closed syllables and diphthongs, and (on the other hand) long vowels in open syllables.

According to Kager (1985) and Kager, Visch & Zonneveld (1987), this is the basic weight distinction which governs the assignment of bounded feet. We will accept this assumption, in view of the considerable support it receives from stress patterns, as discussed in section 2.3. However, it has been rightly remarked by Visch & Kager (1984), Van der Hulst (1984) and Lahiri & Koreman (1988) that this weight distinction is problematic in view of the well-established universal generalization that languages that treat closed syllables as heavy always treat long vowel syllables as heavy as well (McCarthy 1979, Hyman 1985). In order to resolve this paradox, we will make use of insights present in the original Lahiri & Koreman proposal, discussed in section 3.5.10. Recall that they suggest that the open-closed distinction may become functional in a stress system that lacks the basic mora-count distinction between monomoraic and bimoraic syllables. Our analysis of syllable weight supports exactly bimoraic minimality of syllables, the factor that Lahiri & Koreman assume to factor out mora counting in favor of a distinction between open and closed syllables. Let us investigate how this idea may be implemented in our analysis of syllable structure of chapter 3.

At first sight, our moraic analysis, which is much flatter than a rime-based analysis that assumes the nucleus node, seems incapable of making a structural distinction between open and closed syllables. That is, both long vowel syllables and closed short vowel syllables are branching, as they dominate exactly two moraic positions:

```
(113)a. σ     b. σ
       / \      / \
       m m      m m
       \ /      | |
        V       V C
```

Essentially, consonants as second morae add more weight to the syllable than do the second mora of long vowels. However, a *geometrical* branching distinction between open and closed syllables is inessential, and also inadequate, since there is evidence that it is not syllable closing that attributes to syllable weight, but rather *melodic complexity* of the syllable. Let us informally define melodic complexity as equal to the number of root nodes - in the sense of Clements (1985), Sagey (1986) - associated to the post-nuclear part of the syllable.

This leaves syllable type (113a) light, since both its morae are linked to the same root node. But syllable type (113b) is heavy, since one root node is associated to the post-nuclear mora of the syllable, in addition to the one associated to the first mora. Let us see what evidence can be obtained from Dutch to support this melodic complexity hypothesis over the competing hypothesis that syllable closure is at stake[27].

The crucial difference between the melodic complexity hypothesis and the syllable closure hypothesis is that the former predicts that *diphthongs* are heavy, and therefore in a syllable weight class together with closed syllables, instead of long vowels. Diphthongs are not closed, but share with closed syllables the property of being melodically complex: their second part is different from the first one.

In (114a), an open syllable with a long vowel is represented, in (114b) a diphthong, in (114c) a closed short vowel syllable. Finally, (114d-f) represent the three possible types of superheavy syllable, all of which consist of a bimoraic core syllable and an adjoined consonant:

```
(114)    Light      |     Heavy
    a.              | b.          c.          d.   *      e.     *      f.   *
                    |  .                           σ             σ           σ
          .         |      *          *           / \           / \         / \
          σ         |      σ          σ          σ   |         σ   |       σ   |
         / \        |     / \        / \        / \  |        / \  |      / \  |
         m m        |     m  m       m  m       m m  |        m  m |      m  m |
         \ /        |     |  |       |  |       \ /  |        |  | |      |  | |
          V         |     Vi Vj      V  C        V   C        Vi Vj C     V  C C
```

See for examples, repeated from section 2, (31, 20)

```
(115)a. *              b.    *           c.   *
       (*   .)   *         .  *    *          .  *      *
        v   v    -         v  -    -          v  -      -
       ho  ri  <zon>em    Po sei <don>em      e lek  <tron>em

    d.     *           e.    *           f.       *
         .  *              .  *                 .  *
         v  -              v  -                 v  -
        pi raat            a zijn              fa zant
```

This eliminates the need to represent the distinction between light and heavy syllables by referring to branching nuclei versus branching rimes, as is assumed by Kager (1985) and Kager, Visch & Zonneveld (1987). The present proposal improves these analyses by explaining the inherent weight of diphthongs. In effect, we have removed the weight distinction from syllable geometry to the melodic tier. Recall that this distinction is made possible by the absence of a mora-count distinction in Dutch, i.e. Lahiri & Koreman's idea. Lahiri & Koreman's generalization can be rephrased as: "in the case that weight distinctions resulting from quantity are neutralized by constant core syllable size, melodic complexity may become distinctive".

4.3.4 Superheavy syllables versus bimoraic syllables

Let us now discuss the third alleged weight distinction in Dutch, the one between 'superheavy' ternary syllables and bimoraic core syllables. We claim that this is not an actual weight distinction, but basically an effect of a lexical redundancy rule exempting superheavy syllables from Syllable Extrametricality (101).

Importantly, the generalization that final superheavy syllables bear primary stress is subject to lexical variation, cf. section 2.3.2.1. For this reason, we have referred to the generalization that superheavy syllables bear primary stress as a *minor*, not a major generalization. In contrast, the generalization that the primary stress is directly before schwa if schwa is preceded by a consonant (7b) is a major one, since it hardly meets exceptions. Moreover, some newly formed words that end in superheavy syllables, cf. (24-26) have non-final primary stress, which is an indication of the fact that "stress on final superheavy syllables" is at least not among the core generalizations of Dutch.

Essentially, we reject a syllable weight distinction as the one below:

```
(116) Light          |      Heavy
                     |
                     |        σ
                     |       / \
        σ            |      σ   |
       / \           |     / \  |
       m m           |     m m  |
```

Notice that no mechanism of foot formation or primary stress assignment ever simultaneously refers to syllable closing *and* mora weight. Since a three-way distinction between VV/VC/VXC is never required it need not be derived from one representation. Let us now see how we can incorporate the strong tendency for superheavy syllables to have primary stress. In the literature after Van der Hulst (1984) and Kager (1985), it has been accepted almost generally that superheavy syllables require a Liberman & Prince-like statement in the LCPR, cf. chapter 1 (120), and the analogue for Dutch in this chapter (78c).

The one alternative for such lexical marking is to claim that superheavy syllables are actually branching in a way that feeds the LCPR. This type of analysis has been proposed, for example, in Langeweg (1988), and in Van der Hulst & Van Lit (1987), who analyse superheavy syllables as basically disyllabic, in line with McCarthy (1979). But as has been pointed in chapter 3, a disyllabic analysis of superheavy syllables has two serious drawbacks. First, it is not independently motivated by syllabification but exclusively serves to give the LCPR effect. Second, it predicts that superheavy syllables will carry main stress with precisely as few exceptions as the schwallable generalization (7b), i.e. none, which is incorrect. This parallellism between degenerate consonant syllables and schwallables, to eliminate a separate statement about superheavies in the LCPR, is simply misconstrued[28]. In our view, there is no other option than to stick to some amendment of the primary stress rule. In our framework this would entail some marking as to Syllable Extrametricality, presumably in the form of a redundancy rule:

(117) **Superheavy Syllable Provision**
Superheavy syllables are generally non-extrametrical.

We will assume that the minor generalization that final diphthongs have primary stress (8b), is expressed in a similar way, as is also the case with the minor generalizations about final stress in *-et*, *-el*, etc., cf. (36).

4.4 Conclusions: differences between English and Dutch

Our basic analysis of Dutch word stress, as presented in the preceding sections, invites some comparison with the one we proposed for English in chapter 2. Essentially, the mechanisms of Q-sensitivity, Syllable Adjunction, and the End Rule, were found to be identical for English and Dutch. The major differences are the following.

First, English has a weight distinction based on mora count, where light syllables are monomoraic, and heavy syllables are bimoraic. In contrast, Dutch was shown to have a less conventional weight distinction between, on the one hand, melodically simplex long vowels in open syllables, and on the other hand melodically complex closed syllables and diphthongs. The crucial factor which makes the latter weight distinction possible is that Dutch has no syllable weight contrast based on mora count.

Second, English is a less conventional Q-sensitive language than Dutch, by having a Syllable Adjunction rule which affects closed (i.e. heavy) syllables. The fact that Dutch lacks such a rule is the explanation for the major generalization that primary stress cannot be on the antepenult if the penult is closed and has a full vowel, or if the penult contains a diphthong (7c).

Third, English has lexically marked extrametricality of consonants and syllables, whereas Dutch lacks such lexical markings. In contrast, Dutch has lexical exceptions to Syllable Extrametricality, as will be shown in the following sections.

Fourth, English lacks lexical stresses on light syllables, while we will show in section 5 that Dutch employs exactly this device as a quite restricted way of lexically marking stress patterns.

In the following section, we will discuss lexical variability in stress patterns in Dutch, and with mechanisms to deal with it. As previewed in the preceding lines above, Dutch will be argued to have two types of lexical marking: lexical exceptionality to Syllable Extrametricality and lexical stresses on (light) open syllables with long vowels. In other words, this implies that Dutch ends up in the fixed/free dichotomy of stress systems as partly free, partly fixed. In a sense, the 'initial and final stress patterns' of Van Marle (1980) will be reinterpreted as variability of primary assignment to the final or prefinal stressable syllable in the word.

5. Lexical variability

5.1 Introduction

As was discussed in section 2, Dutch exhibits a considerable amount of lexically governed stress placement. In a sense, Dutch is halfway on the continuum from 'fixed stress languages' to 'free stress languages', by having lexical variability within the strict limits of the three major generalizations of section 2.3, (7a-c). These are: (a) a three-syllable window at the word end, (b) the schwallable restriction, and (c) the closed penult restriction. The major issue that will be discussed in this section is how to set up exception markings that will not interfere with the major generalizations, but that will only affect the minor generalizations. In particular the analysis should present ways to derive lexically 'marked' patterns while (a) remaining within the three major generalizations, and (b) expressing the relative 'markedness' of the patterns deviating from those indicated by the minor generalizations. To this end, we will first discuss the margins of variability for various skeletal types of words in section 5.2. Having done this, we will show that both criterions just mentioned are best met by means of two lexical devices: lexical stresses and a feature blocking Syllable Extrametricality. In section 5.3 we will discuss several alternatives for these features, in particular [+F] and lexically governed late syllable extrametricality, and show that our proposal provides a better account of the relative markedness of various patterns deviating from the basic patterns.

5.2 The limitations of variability and two types of exception marking

From the above discussion of the basic stress patterns in underived words, it became clear that stress is not completely predictable; it was shown that a certain amount of 'free stress' occurs within the 'fixed' limits of the three major generalizations.

As was shown in section 2.3, the dominant stress patterns of words that end in heavy syllables differ from those of words ending in light ones. Particularly, words ending in superheavy syllables and diphthongs follow pattern (27), words ending in closed syllables pattern (30), and words ending in long vowels pattern (46).

Here we will show, on the basis of vacillating stress patterns, and some mispronunciations signaled in the literature, that the sub-cases of the patterns are not unrelated, but vary across two dimensions. At the same time, an adequate choice of exception marking

mechanisms should be made, one that does not obliviate the generalizations of (7), and correctly expresses the relative 'markedness' of specific matches between stress patterns and segmental skeletons.
To clarify this, reconsider the vacillating pairs below - repeated from (44) - where stress is either final or at a maximally binary distance to the left:

```
(118)a. Marcél    => Márcel
     b. carnavál => cárnaval
     c. Evoluón   => Evóluon
```

In each of these pairs, the first member is the 'marked' one, while the second member is the 'unmarked' one. This appears from the direction of the shifts, which is from the first form to the second. In terms of our analysis, the pairs involved in the shifts can be represented as below:

```
(119)a.      *     b.           *     c.            *
         *   *        (*    .)  *        *   (*   .) *
         -   -         -    v   -        v    v   v  -
       Mar cel        car  na val        E   vo  lu  on

(120)a.  *         b.  *               c.       *
         *    *       (*    .)   *          .  (*   .)  *
         -    -        -    v    -          v   v   v   -
       Mar <cel>em    car  na <val>em       E   vo  lu  <on>em
```

The vacillating forms share foot structure but differ in the location of prominence. Obviously what has been 'regularized' here is undergoing the rule (101) for assigning (late) extrametricality to the final syllable. We will argue later against an alternative analysis based on loss of the [+F] feature for these cases. Here, we will propose an exception marking feature [-E], which is to be interpreted as marking the word carrying it immune to the late extrametricality rule (101). Furthermore, we will assume that all words with final primary stress carry [-E]. The feature can be lexically present on the word, or can be marked by a redundancy rule for superheavy syllables that we have introduced earlier as (117). Here we will reformulate it accordingly:

(121) **Superheavy Syllable Provision**
Superheavy syllables are generally [-E].

Of course, there are more endings that require treatment by a redundancy rule, among which the following final VC types, cf. (36):

(122) /Ol/, /Ot/, /ɛl/, /ɛt/, /ɑl/, etc.

Let us consider another type of regularization that appears from stress shifts from the penult to the antepenult in pairs like *Cáracas-Carácas*, cf. (44a). Here, we submit, the exceptionality that is lost is a lexical stress on an open penult. The first member of the pair carries the lexical stress, which blocks Syllable Adjunction (99) at level-1, by the Elsewhere Condition:

```
(123)                                               *
        .  *  *             .  *    *            .  *    *
        v  v  -    (101)    v  v    -     (102)  v  v    -
       Ca ra cas    =>     Ca ra <cas>em   =>   Ca ra <cas>em
```

The second member of the pair has lost the exceptional marking, and will undergo Syllable Adjunction to end up with antepenultimate stress. Hence both members of (123) differ minimally in their lexical representations. We will assign lexical stress by a redundancy rule to the final syllable in stems that are followed by the suffix *-or*:

(124) **Pre-stressing in *-or***

```
      Ø => * /   ___ ] or
                  |
                  σ
```

This accounts for the sub-generalization that words in -or have primary stress on their penult.
Lexical stresses will be assumed to be freely distributed in the lexicon, attached to stress-bearers, i.e. morae. Since schwa does not have a mora it can never be lexically stressed, by definition. Furthermore, a lexical stress associated with a monomoraic short vowel is ineffective as short vowels are always syllabified into closed syllables by Coda Formation, cf. chapter 3 (68). Therefore, a closed syllable can in fact carry a lexical stress, but this would have no effect since such a syllable will be automatically stressed by QS (97) anyway.
The assumption of lexical stresses has the effect of splitting up light syllables into two types: unmarked, lexically unstressed syllables (125a), and marked, lexically stressed syllables (125b):

```
(125)a.  .     b. *
         v        v
```

Crucially, a converse marking of heavy syllables as being 'lexically unstressed' has no interpretation. Heavy syllables are inherently stressed by the automatic Q-sensitivity convention (97), which is not a rule but universally valid for Q-sensitive systems, by definition. In Dutch, 'heavy' is interpreted in the way suggested in section 4.3.3, i.e. as melodic complexity[29].
Since light syllables can be lexically stressed, but heavy syllables can never be 'lexically unstressed', the closed penult generalization (7c) is now a solid effect of our analysis.
Let us now explore the effects of our assumption that lexical stress can be present on light syllables with a truly free distribution. Consider a shifting pair as the one below, repeated from (50):

```
(126) página   => pagína     diábolo  => diabólo    Niágara => Niagára
      máscara  => mascára    depósito => deposíto   índigo  => indígo
```

Loss of a lexical stress on the final syllable provides a simple way of explaining the shift. Antepenultimate stress is explained by a blockade of Syllable Adjunction of the final stressed syllable:

```
(127)                                                          *
       .  .  *         (*  .) *         (*  .)   *          (*  .)   *
       v  v  v          v  v  v          v  v    v           v  v    v
      pa gi na   =>    pa gi na    =>   pa gi <na>em   =>   pa gi <na>em
```

Loss of the final stress will regularize such forms, with the effect of penultimate stress, by the standard rules. In contrast to the cases in (119-120), this type of shift affects constituent structure[30].

A redundancy rule will assign lexical stress to the antepenult of words ending in *-ia*, *-io* etc., cf. (49)

```
(128) Ø => * /   ___
                  |
                  V  Co V  V Co]
                        |
                     [+high]
```

Note that a final lexical stress as such does not trigger final primary stress. A word with a final lexical stress will simply undergo Syllable Extrametricality (101) in the unmarked case. It takes an additional [-E] marking to yield final primary stress in vowel-final words:

```
(129)                        *
          .  *             .  *
          v  v             v  v
        tro fee   =>   tro fee
          [-E]
```

In such cases both Syllable Adjunction and Syllable Extrametricality are blocked. The doubly marked status of final stress in vowel-final words reflects the highly marked status of this pattern in the vocabulary, as compared to antepenultimate stress in vowel-final words, see again our discussion in section 2.
We can now interpret stress shifts from the final syllable to the penult in the words below - repeated from (54) - as a loss of lexical stress:

```
(130) rococó    => rocóco       moussaká => moussáka
      epidemíe => epidémie    hegemoníe => hegemónie
```

The members of such pairs can be represented as below:

```
(131)a.        *      b.    *
        (*  .) *          . (*    .)
         v  v  v          v  v    v
        ro co co         ro co <co>em
          [-E]              [-E]
```

In these cases, we cannot be sure if [-E] is lost in addition to lexical stress in the second member of the pair (131b), as its persistence would yield the same output. However, cases occur where only [-E] is lost, and the lexical stress is preserved, as we will point out now.
Since both types of exception marking must combine to yield final stress in vowel-final words, and since each of the markings can be considered to have a free distribution, it is predicted that the features can be lost one by one. This is exactly what explains stress shifts of the type below, partly from Van Marle (1980), cf. (55b):

```
(132) Panamá   => Pánama    jamborée => jámboree   karibóe  => káriboe
      rococó   => rócoco    kaketóe  => káketoe    kolibríe => kólibrie
      Natalíe  => Nátalie   Rosalíe  => Rósalie    Odyssée  => Ódyssee
```

What we find here is that [-E] is lost, but the lexical stress has been *preserved*:

```
(133)a.        *     b.  *
        (*  .) *        (*  .)  *
         v  v  v         v  v   v
        ro co co        ro co <co>em
         [-E]
```

In section 2 it was shown that words in /e/ are generally stressed on the final syllable, cf. (51a). This sub-generalization can be captured by two redundancy rules, one for assigning lexical stress to final /e/, and one for assigning [-E] to words ending in /e/. Quite interestingly, final /e/ behaves like a true VC syllable not only in final position but in other positions as well. The examples below are repeated from (49), (42).

```
(134)a. dóminee    b. Andréas  Celebes    diabetes
        Nínivee       mecenas  Archimedes Mendelejev
        apócope       Aeneas   Mercedes   Nebukadnezar
```

In (134a), /e/ is lexically stressed without [-E], in (134b) /e/ blocks Syllable Adjunction in a way comparable to (123) above. Possibly then, /e/ is lexically stressed in all positions by a redundancy rule.

Let us now test our exception marking devices by the criteria that were formulated earlier in this section: (a) keeping within the limits of the major generalizations (7), and (b) capturing the markedness of various deviations from the basic stress patterns - or the minor generalizations (8).

First, all major generalizations are respected. The three-syllable window restriction (7a) cannot be broken by lexical stresses, since this device does not mark primary stress. Therefore, a potential example as **pánorama* can never arise:

```
(135)                                                                *
       *  .  .  .           *  .  (*  .)        (*  .) (*  .)       (*  .) (*   .)
       v  v  v  v           v  v   v  v         v  v   v  v         v  v   v    v
      pa no ra ma    =>    pa no  ra ma   =>   pa no  ra ma   =>   pa no  ra <ma>em
```

Clearly, [-E] cannot cause pre-antepenultimate stress, since its effect on primary stress is opposite, towards the word end.

The schwallable restriction (7b) is also strictly respected by our exception marking. Since the weight of the pre-schwallable syllable cannot be negatively affected by lexical stress, cases where a consonant precedes schwa are left intact. However, lexical stress can bring stress to the penult if no consonant precedes schwa. Actually, this is exactly what is required in cases such as *Alexandríë*, *Farizéeër*, cf. section 2.3.1.2.

```
(136)          *
       (*  .)  *
        v  v   v
       Fa ri zee ər
```

Again, [-E] cannot affect the schwallable restriction as its effects are opposite. Finally, the closed penult restriction (7c) is preserved because no heavy syllable can be lexically 'non-stressed'. If the initial syllable of words such as *agénda* were lexically stressed, this would never affect primary stress:

```
(137)     *
       * (*     .)
       v  -     v
       a gen <da>em
```

The same goes for [-E]. Therefore we have shown that our lexical marking will not affect the major generalizations.

Let us now turn to the relative markedness of patterns deviating from the minor generalizations. Actually we have come a long way towards this goal already by showing that the basic analysis presented in section 4.2 accounts for all and only the basic stress patterns. Moreover, we have shown in this section that all deviating patterns can be considered as 'marked' by one or both exception features. It remains to be seen how the relative markedness of 'marked' patterns is accounted for in this analysis. Actually, it is predicted that words carrying both features are more 'marked' than words carrying only one feature. We will set out to show that our analysis makes the right predictions in this respect in the following section. We will do this partly by comparing alternative analyses in this respect.

5.3 **Alternative analyses**

It is quite hard if not impossible, to express the major generalizations without making use of a binary left-dominant Q-sensitive foot type, and a right-dominant prominence assignment mechanism. If this is assumed, the choice between different exception features is to be made. Here we will show lexical stresses and [-E] to score much better in this respect than other features, particularly lexical syllable extrametricality and [+F]. Our argument will be based on words with open penults with the skeletal form VX-VV-VX, since these exhibit the largest lexical variation: they can have final, penultimate, and antepenultimate stress.
In fact, it is quite a trivial matter to show the need of minimally two features. Consider the possibilities of words with the skeletal sequence X-VV-VV[31]:

```
(138)a. pijáma    b. álibi   c. paraplú
        rocóco       rócoco     rococó
```

Quite naively, the first step might be to select one feature, a lexical primary stress, to deal with the variation:

```
(139)a.  .  *  .   b.  *  .  .    c.  .  .  *
        ro co co      ro co co       ro co co
```

But this analysis would violate the three-syllable window restriction (7a) simply by lexical stress on the pre-antepenult. Clearly, the Dutch system is bounded, with a rule constructing binary constituents leftward.
Obviously, in the absence of relevant segmental differences, one feature is insufficient to account for a ternary distinction as the one above. A puzzle is therefore presented to the naive analyst as to the choice of a set of features.
We expect exception features to express the relative 'markedness' of a stress pattern with respect to the skeleton it is associated with. From our discussion in section 5.2, it became clear that minimal differences exist between words such as *carnavál* and *cárnaval*, cf. (119b), (120b), and that vacillation patterns and shifts express this difference.
Applying the same line of reasoning to the three stress forms of (139), we are led to the conclusion that form a. is the least marked, on the basis of both frequency and 'mispronunciations'. And obviously, form c. is the most marked by the same criteria. The question now arises how to reflect the intermediate position of form b. in between a. and c. One possibility is that one feature is involved in the contrast between a. and b., and another in the contrast between a. and c., where marking by the latter feature induces relatively more markedness than marking by the former. Alternatively, the highest markedness of form c. may reflect its being marked twice, whereas form b. is only marked once. Crucially, if b. and c. were to share one exception feature, the loss of the other feature on c. would lead to 'halfway' mispronunciation towards form b. On the other hand, if b. and c. are marked each by different exception features, relations of vacillation and

mispronuciation between the two will not occur, since loss of one exception feature will not result in adaption of the other.

Crucial data occur, pointing to the correctness of 'double markings' on form c., i.e. the type (132). Stress shifts to the antepenult in words with final stress point to the conclusion that in this shift only one exception marking feature, viz. [-E], is lost. This feature also directly captures the relation between VC-final word pairs such as *carnavál-cárnaval* (44b). Any further regularization from antepenultimate stress to penultimate stress in X-VV-VV words reflects the loss of the second exception feature (lexical stress).

Let us inventarize our results below:

(140)

		Lexical stresses	
		unmarked	**marked**
[-E]	**unmarked**	rocóco	róococo
	marked	rocóco	rococó

This analysis captures the relative markedness of final stress in VV-final and VC-final words, since *rococó* can only arise by double marking, whereas for *carnavál* marking by [-E] suffices[32].

Let us now compare the exceptions analysis of Kager, Visch & Zonneveld (1987) in this respect. In this analysis, two features are assumed: syllable extrametricality to set apart (141b) and (141a,c), and [+F] to set apart (141a) and (141c):

```
(141)a.      *        b. *               c.          *
        . (*   .)       (*   .)            (*    .) *
       ro co co        ro co <co>em        ro co co
                                                [+F]
```

It will now be clear that this feature combination is not adequate. In order to see this, notice that (141a) and (141c) do not form a natural class under this feature combination. Since both features serve to block a binary foot over the last two syllables, they can only differ in their effects on prominence to make the distinction between the marked forms b. and c. Let us inventarize this situation below:

(142)

		Syllable extrametricality	
		unmarked	**marked**
[+F]	**unmarked**	rocóco	rócoco
	marked	rococó	??

From (142), a second difficulty for this combination of exception features becomes evident. There is no formal interpretation for doubly marked forms, since extrametricality and [+F] specify incompatible prominence markings; assuming that combination of stress features is free, a special interpretation convention would be needed, complicating the analysis. Finally, notice that (142) does not express the fact that final stress in VV-final words is less frequent than final stress in VC-final words. Assuming a free distribution of exception features, it is expected on the basis of (142) that final stress in both types of words is equally (in)frequent.

We conclude that our analysis of exception features is an improvement over at least that by Kager, Visch & Zonneveld (1987).

6. Conclusions

Our analysis of Dutch word stress is an improvement over earlier ones in the following respects.

First, it accounts for the distributional properties of schwa - both its syllabification behavior and stress properties - by a single assumption: that schwa is weightless (hence unsyllabified) at level-1.

Second, it is based on the End Rule and (late) syllable extrametricality instead of the LCPR. Our account is more in line with recent insights to the effect that prominence structure is essentially 'flat', and does not involve binarily branching trees.

Third, it formalizes the syllable weight in a non-geometrical way within the assumption that Dutch syllables are minimally bimoraic - the latter assumption was argued for in chapter 3.

Fourth, it provides an analysis of exceptions which respects the major generalizations about stress, and at the same time captures the relative markedness between the patterns of stress falling within these margins.

Vacillations, stress shifts and 'mispronunciations' led Van Marle (1980) to assume two basic stress patterns for Dutch: an initial pattern and a final pattern. In our view, two stress patterns indeed exist, but these are not distinguished by their reference to the left or the right word edge, but by their ignorance of the final syllable for prominence assignment or not, i.e. in the presence versus absence of the feature [-E].

Finally, let us discuss some consequences of our analysis for secondary stress. Distinctions of stress after the primary stress were required to account for the 'weak retraction' pattern occurring in words ending in a heavy syllable (115abc). The motivation for the stress distinction between final syllables was purely distributional, directed towards a maximally generalizing account of the position of primary stress. But no reflexes of stress (such as reducibility) were even considered. Nevertheless, we will go into this matter in the following chapter. It will be shown that secondary stresses following the primary stress are hard to demonstrate by means of reducibility, since vowel reduction hardly if ever occurs in the final syllable. However, secondary stresses preceding primary stress can be demonstrated by means of reducibility. Let us see what secondary stresses preceding the primary stress are predicted from our analysis of section 4.

The rule of Syllable Adjunction (99) that was motivated by the position of primary stress is iterative, as was tacitly assumed in sections 4 and 5. Although it never happens that primary stress is on a constituent that is not the last in the word (the End Rule ensures this) it may well be the case that primary stress is on a non-peripheral constituent. This always happens if the final syllable is constituentless and extrametrical, cf. (115). From this it will be made up that Syllable Adjunction has access to syllables that are non-peripheral, i.e. that it applies from right-to-left through the word, in an iterative fashion. This predicts that secondary stresses will have the same bounded character as the position of primary stress. Actually, this is the case in Dutch, much the same as in English.

Moreover, it was crucially the case - and in fact a direct result of our theory - that syllable weight is relevant throughout the stress domain. Neglecting for the moment the issue of destressing, this predicts that a heavy syllable preceding the primary stress will be stressed by QS. This prediction will be shown to be largely correct, by the fact that heavy syllables (either closed or diphthongal) generally resist reduction. The exceptions will be argued to result from a level-2 rule of Closed Syllable Adjunction, much like the one demonstrated for English, but crucially differing in its stratal specifications.

Footnotes to chapter 4:

1 The suffix *-isch* attracts stress onto the syllable immediately preceding it, even though its phonological shape is -VVC: [is].

(i) harmón+isch satán+isch motór+isch

Backhuys, Trommelen & Zonneveld (1988) assign *-isch* the underlying form -/iəs/, formally equating it to -*ië* (14b).

2 In section 2.3.6, we will discuss some rare counterexamples, such as *ístanbul, Constantijn.*

3 Most of these words are (partly fictitious) trade marks cited in Van Marle (1980).

4 This pattern is supported by the extensive data sections given in Van der Hulst & Langeweg (1984) and Don & Zonneveld (1988).

5 *Accordeon* and *Evoluon* also occur with final stress.

6 We have left out words in *-um, -us, -or,* and *-is.* These will be treated separately.

7 Actually, some cases of final *-um* in (37) may be suffixes too.

8 Cases such as (44b) are frequent. Some more are: *feuilleton, ammoniak, artisjok, rammenas, aceton, Marrakesj, Rataplan, archipel, Marion, ramadan.*

9 The only exceptions being grammatical terms such as *índicatief,* cf. section 2.3.3).

10 Cited in Van Lessen Kloeke (1975), Booij (1977), Kooij (1978), Van Marle (1980).

11 Most are drawn from Van Marle (1980).

12 Final stress in /e/-final words is productive as far as words imported with non-final stress may shift stress to the final syllable, as in *sateh, taugeh, toffee, sake.*

13 Again, mostly drawn from Booij (1977) and Van Marle (1980).

14 The suffix *-erie* in *ínfanterie* resembles *-ief* as to stress.

15 Van Marle (1980) cites mispronunciations such as *flámingo, Wísconsin.* We cannot offer an explanation for these pronunciations, and their status is obscure to say the least, since no other structurally identical words occur in the Dutch vocabulary. Perhaps *flámingo* is stressed by analogy to derived words containing -*ing*, such as *Vlaming* - as suggested by S. Nooteboom, personal communication. Trommelen & Zonneveld (forthcoming) extend this analysis, on independent grounds, to words such as *Hélsinki,* cf. (60d).

16 Actually, Gaarenstroom states (61abc) in orthographic terms, as a sequence of two vowels. In Dutch orthography, such sequences denote (a) long vowels in closed syllables, (b) diphthongs, or (c) final /e/. We have chosen to paraphrase the generalization in phonological terms.

17 Van Lessen Kloeke (1975) omits the one consonant maximum from the definition of a word-final weak cluster. Empirically, this amounts to claiming that words ending in -VCC have non-final stress, which is correct for syllables containing schwa, but not for those containing full vowels, such as *biljárt* (20b).

18 The motivation for this analysis is mainly found in derived words in which one or more suffixes with schwa follow the stem. Such suffixes are typically level-2 and stress-neutral, cf. section 2.

19 The weighing mechanism refers to nodes in the foot inventory of Neyt & Zonneveld (1982), cf. (63).

20 In order to eliminate these, Van der Hulst (1984) discusses an alternative analysis much resembling the Van der Hulst & Moortgat (1981) analysis. This analysis involves a fairly arbitrary upper limit of *four morae* on stress feet, and incorrectly accepts VC on weak positions. See for further discussion Kager, Trommelen & Visch (1985).

21 Don & Zonneveld (1988) give large numbers of words supporting the Kager, Visch & Zonneveld analysis. Also, they discuss and classify various exceptions to this analysis, and suggest ways to capture these. Particularly, they discuss words in suffixes such as *-um, -us, -is,* and *-or,* whose stress properties have been reviewed in section 2.3.2.3. For the former three, they suggest (underlying) schwa, to derive stress on the penult by the schwallable generalization (7b). For *-or,* an ending that cannot be argued to have a schwa, they suggest an idiosyncratic status as a Schwappendix.

22 This suggestion originates in Van der Hulst (1984) and Van der Hulst & Langeweg (1984).

23 See Giegerich (1985) for a similar analysis of German stress.

24 This has been pointed out as early as Visch & Kager (1984:201).

25 As in Van der Hulst (1985), consonant length, not vowel length, is lexically marked in syllables with surface short vowels.

26 Later we will propose that Syllable Extrametricality (101) may be blocked by lexical marking.

27 As discussed in section 2, syllables closed by obstruents are heavy almost without exception, whereas those closed by sonorants allow for limited weight exceptions -/Vr/. Actually, this looks as a *negative sonority effect,* since the higher sonority of sonorants would make them better candidates for adding weight to the syllable they close. However, we find the reverse situation.

28 Also, it is completely unclear how Sonority Sequencing, cf. chapter 3 (42a), can be invoked to rule out words such as *[fazαtn], if the final consonant is heterosyllabic to the preceding one.

29 Notice that lexically unstressed and stressed VV syllables are the equivalents of underlyingly short and long vowels in analyses such as Evers & Huybregts (1975). See section 3.3 for our objections against the latter type of analysis.

30 Our use of lexical feet to derive antepenultimate stress in *página* etc. matches a proposal by Trommelen & Zonneveld (forthcoming).

31 In the remainder of this section, we will use the example *rococo*, which is the only Dutch word vacillating between all three stress types, although the penult stress pronunciation is sub-standard.

32 Of course, the fact that both *may* be lost *together*, as in the examples (130), does not contradict our conclusion about independency.

Chapter 5
Secondary stress and vowel reduction in Dutch

1. Introduction

In the preceding chapters we have discussed the phenomenon of syllable structure and that of primary stress assignment in Dutch. This leaves to be discussed the closely related issues of secondary stress and vowel reduction. They will be the topic of the final chapter of this study, chapter 5. We will propose an analysis of these phenomena in the compositional theory of stress motivated in the chapters 0, 2, and 4.

Recall that our major claim is that stress is compositionally determined by syllable weight, binary constituency, and prominence. Accordingly, destressing can be caused by deweighting, syllable adjunction, or loss of prominence. In this chapter, we will illustrate which options are selected in Dutch for adapting the secondary stress pattern resulting from the level-1 lexical stress rules into the surface secondary stress pattern, motivated by vowel reduction to schwa, by rhythmic patterning, and by accentability.

A central issue in the literature on Dutch secondary stress is whether secondary stress is merely a low-level by-product of the lexical primary stress, or whether an iterative stress rule lays down the stresses from which both primary and secondary stress are selected. We will support the latter view and account for the distribution of secondary stresses largely by the stress rules motivated in chapter 4. Q-sensitivity and Syllable Adjunction, going from right to left through the word, together lay down the pattern of stresses. One of these is selected as primary stress, as we have demonstrated in chapter 4. The remaining non-primary stresses that are predicted by these rules will be shown to be directly relevant to the distribution of secondary stress. We will show that the pattern of secondary stress is essentially Q-sensitive and binary, precisely in the same way as are the rules that account for primary stress.

Departing from the predicted secondary stress pattern, four adaptations are required to arrive at the actual surface secondary stress pattern. A first adaptation concerns destressing of light syllables that are heads of binary constituents directly following stray syllables, much like the *Winnepesaukee* case in English. A level-2 rule of Syllable Adjunction will account for these. Second, some types of closed syllable (such as /ɛr/) can be stressless regardless of their position in the word. These syllables will undergo level-2 *deweighting*. Third, closed syllables may be reduced after a short vowel and one intervocalic consonant, much like the Arab context in English. A Closed Syllable Adjunction rule will be proposed to that effect. Fourth, initial secondary stresses tend to be more prominent than medial secondary stresses. We will attribute this to a rule of higher-level Rhythmic Adjustment that is also operative in phrases.

As in English, we will take reducibility to schwa as an indication of lack of stress. There is a complication as compared to English, however, as vowel reduction to schwa is not an automatic phenomenon in Dutch. Instead, reduction is optional and style-dependent, and for some part even considered a sub-standard phenomenon. Nevertheless, it offers a 'window into (Dutch) metrical structure'. In particular, there is a considerable amount of evidence pointing to the conclusion that vowel reduction is actually sensitive to metrical constituency, since adjunct syllables inside constituents generally reduce more easily, when identical vowels are compared.

The question whether Dutch has cyclic stress assignment, and secondary stresses of cyclic origin, will not be discussed nor answered here. The reason is that phenomena exist which point to cyclic stress assignment, but that these are easily affected by destressing rules. The complex interaction between cyclic secondary stress, syllable weight, and rhythm would require a rather lengthy discussion, which is beyond the limitations of the present work.

This chapter is organized as follows. In section 2 we will discuss the basic secondary stress patterns. In section 3, the literature on secondary stress will be reviewed. In section 4, we will confront the predictions about secondary stress made by our analysis of chapter 4 with the actual secondary stress patterns. We will propose an analysis to adapt the level-1 output of our analysis by level-2 stress adjustment rules. In section 5, we will discuss specific factors affecting vowel reduction, such as vowel quality and position in the word. In section 6, we will review the literature on vowel reduction. In section 7, we will show what advantages our analysis of secondary stress has with respect to describing hierarchies of vowel reduction among stressless syllables. In section 8, we will summarize the results of this chapter.

2. The distribution of secondary stress

2.1 Introduction

The first question to be answered when discussing secondary stress is how it is defined. Just as in English, two possible criteria are (a) the potential of bearing a *pitch accent* (i.e. accentability) and (b) the the impossibility of being *reduced* (i.e. irreducibility). We will assume that each accentable syllable (outside the primary stress) has secondary stress. Also, we will assume that each reducible syllable is stressless. Hence, reducible syllables cannot be accented.

However, as in English, there is no two-way implication. That is, there are irreducible syllables which nevertheless cannot be accented. In such cases, another criterium should decide whether syllables are stressed or stressless.

In positions where stressed syllables cannot be accented for independent reasons, we must rely on the relative strength in word-internal rhythmic patterns and partly on reducibility. For instance, the third syllable in *onomatopée*, while irreducible and rhythmically strong, is nevertheless inaccentable. However, its inaccentability can be explained by observing that in a string of three lexically stressed positions (*ònomàtopée*), the medial one is generally unaccented for rhythmic reasons, a well-known observation lying at the root of most 'rhythm rules' presented in the literature. In such words, the initial syllable is accentable. Hence, here we have a medial secondary stress that is not realizable as a pitch accent, the initial syllable having priority - another typical case of peripherality in word stress (Prince 1983).

The final major observation is that in Dutch, as in English, irreducible syllables following the primary stress can never bear an accent. This is probably due to the circumstance that the final accent in some domain is obligatorily interpreted as the *integrative* accent, that is, the accent that can place the entire word *in focus*.

The syllable with the primary stress is the integrative accent position of the word, and therefore no syllable with (secondary) stress following the primary stress can be accented without being incorrectly interpreted as integrative, hence as primary[1]. As syllables following the primary stress cannot be accented, we cannot take accentability as the criterion for secondary stress here. Then the other criterion, irreducibility, remains. However, there is a clear complication for this criterion in Dutch post-primary-stress syllables, as final open syllables do not reduce, even if they are stressless from a distributional point of view. That implies that we can only invoke rhythmic intuitions for final syllables, and reducibility for non-final post-stress syllables. According to these criteria, secondary stress following the primary stress is as below:

```
(1)a.  *           b.  *
       *  .            *  .  *
       ga la           pa na ma
```

The stressless status of the penult in (1b) is based on reducibility. Notice, however, that the final syllable of (1a) is not reducible, in spite of its being stressless. Irreducibility of final syllables (more accurately: of final vowels) is general, as remarked above, and for this reason we cannot take it to indicate stress in (1a). But a stress is assumed on the final syllable of (1b) because of the *rhythmic* difference with (1a). In the literature on secondary stress to be discussed in section 3, these patterns are generally assumed. But of course, the arguments for the distribution of primary stress, presented in chapter 4, form independent evidence.

2.2 **Basic patterns of secondary stress**

In this section, we will discuss secondary word stress to the left of the primary stress. The distribution of secondary stress can be shown by rhythmic patterning, and by comparing the reducibility of light syllables in different positions.
Judging from rhythmic patterning, the basic secondary stress patterns of underived words are those of (2):

```
(2)a.     *    b.         *    c.           *    d.              *
        . *         *  .  *         *  .  .  *         *  .  *  .  *
       to maat     au to maat      lo ko mo tief      o no ma to pee
```

That is, while *dóminee* and *coryfée* are not rhyming pairs, they can be so under embedding in compounds and rhythmic shift: *dórps-dominèe* and *dórps-coryfèe*, cf. Visch (forthcoming).
Just as in English, these patterns show the basic rhythmic nature of secondary stress, where secondary stresses keep at a respectful distance from the primary stress and from each other. Initial pretonic syllables (2a) are rhythmically weak, and so is the second syllable in a sequence of three syllables to the left of primary stress (2c). Perfect binary alternation is found in (2b,d).
Truly underived examples with five or more syllables preceding the primary stress hardly occur, but in *derived* words with five syllables preceding the primary stress, a medial secondary stress can be located either on the third or on the fourth syllable (cf. Hoeksema & Van Zonneveld 1984):

```
(3)a.                *       b.                    *
       *  .  .  *  . *         *    .  *  .  .  *
       periodiciteit           extrametriciteit
       encyclopedoloog         endocrinologie
       individualist           individualist
       automobiliseer          autobiografie
       semasiologie            parasitologie
```

However, the status of these examples is unclear to say the least, since all have an internal morphological structure that may be responsible for different patterns of secondary stresses. Unfortunately, no long underived words occur which can be used to test these predictions.

Secondary stress is clearly correlated with the initial syllable (which was noted as early as Zwaardemaker & Eyckman 1928). That is, a secondary stress tends to fall on initial syllables that are not directly followed by the primary stress.
The initial secondary stresses of (2bcd) correspond with accentability, which can be shown by embedding words with a similar rhythmic structure in phrases, under stress clash (Kager & Visch 1988, Visch forthcoming):

(4) a. rèlatíef - rèlatieve éenvoud
b. èducatíef - èducatieve míddelen
c. àdministratíef - àdministratieve rómpslomp

The medial secondary stress in (2d) does not match with accentability. As indicated above in the introduction, the middle one of a sequence of three lexical stresses has a moderate potential of being realized with a pitch accent. Hence, its secondary stress can be made up only from its rhythmic strength and irreducibility.
The rhythmic patterning of (2) can be supported by the reducibility of rhythmically weak syllables, and the irreducibility of rhythmically strong syllables. Examples are in (5), where reducible syllables have been underlined:

(5) a.	b.	c.	d.
banáan	kàramél	àbracadábra	èncyclòpedíe
koníjn	kòlonél	èconomíe	pàrallèllográm
metáal	pròcedé	àntecedént	
minúut	pòlitíek	fèlicitéer	

2.3 Syllable weight and secondary stress

Apart from rhythm, syllable weight is an important factor affecting both stress value, reducibility and accentability of syllables. Heavy (closed or diphthongal) syllables tend to be irreducible in most positions where light (open) syllables are reducible. Moreover, heavy syllables contrast with light syllables in accentability in some positions.
This section will discuss systematic differences between light and heavy syllables in secondary stress. Section 2.3.1 is devoted to initial pretonic syllables, section 2.3.2 to other positions. Section 2.3.3 will address the restricted types of closed syllables that do not follow the generalizations made in this section, but behave as light syllables instead.

2.3.1 Syllable weight and initial pretonic syllables

Initial pretonic syllables serve best to illustrate differences between light and heavy syllables in reducibility. Vowel reduction is inhibited in the second member of each pair, which has a closed syllable, but possible in the first member, which has an open syllable:

(6)		
frequent - spektakel	raket - praktijk	politie - soldaat
legaal - pregnant	lacune - laxeer	kolonie - folklore
precair - textiel	staket - taktiek	kolom - dolfijn
repliek - September	kapittel - capsule	kolos - kompas
depot - Neptunus	fataal - fatsoen	konijn - fontein
metaal - retsina	Machiel - magneet	kroket - trompet
regie - techniek	fragiel - fragment	profijt - pompoen
senator - centraal	banaan - bandiet	rotonde - contant
penibel - pendule	fanaat - sandaal	toneel - spontaan
secuur - lektuur	kaneel - kanteel	rivier - pincet
tenor - tentakel	kanon - kanton	kritiek - briljant
memorie - membraan	kameel - framboos	minuut - Vincent
clematis - templaat	galei - galjoen	figuur - dictator
select - Celtona	kalender - kalkoen	muziek - structuur

Vowel reduction to schwa in closed syllables is inhibited as compared to open syllables (Martin 1968, Booij 1981). Of course, this distinction of syllable closure matches the more general syllable weight distinction that was motivated for purposes of primary stress placement in chapter 4. And indeed, precisely as closed syllables, diphthongs resist vowel reduction:

(7)	P<u>au</u>line	s<u>au</u>cijs	pl<u>ei</u>dooi
	l<u>au</u>rier	t<u>au</u>gee	s<u>ei</u>zoen

This makes the correspondence between irreducibility and syllable weight even more telling. The generalization is that heavy syllables tend to be irreducible, whereas light syllables tend to be reducible. This strongly points to the fact that vowel reduction is blocked in syllables that are inherently stressed by their syllable weight, i.e. by their *melodic complexity*.

The second contrast between light and heavy syllables to be observed in initial pretonic syllables is a certain tendency for heavy syllables to be *accentable*, and for light syllables to be non-accentable. As noted by Visch & Kager (1984), disyllabic words with final stress are subject to phrasal rhythm slightly more easily if their initial syllable is closed. We will illustrate this below[2]:

(8)a.	contánt	- còntant géld	b.	galánt	- *?gàlant vóorstel
	aktíef	- àktief óptreden		riánt	- *?rìant húis
	forméel	- fòrmeel kénmerk		fatáal	- *?fàtaal óngeval
	centráal	- Cèntraal Plánbureau		brutáal	- *?brùtaal ántwoord
	Marcél	- Màrcel Próust		Maríe	- *?Màrie Kóenen
	Paulíne	- Pàuline Bróekema		Heléen	- *?Hèleen Hórdijk
	spontáan	- spòntane spráak		faméus	- *?fàmeuze gráp
	antíek	- àntieke klókken		kritíek	- *?krìtieke stélling
	spectráal	- spèctrale kénmerken		steríel	- *?stèriele wátten
	frontáal	- fròntale áanval		banáal	- *?bànale ópmerking
	textíel	- tèxtiele wérkvorm		paráat	- *?pàrate kénnis
	fictíef	- fìctieve pláats		pikánt	- *?pìkante sáus

Accentability is fairly regular for initial pretonic heavy syllables. As will be shown in section 2.3.3, a restricted number of exceptions occur, which are inaccentable and reducible. These fall into restricted classes by their segmental composition, however.

Nevertheless, inaccentability of initial pretonic light syllables is only a tendency, since cases occur that are easily accentable:

(9)	Michíel	- Mìchiel Schápers	vocáal	- vòcale stéun
	legáal	- lègale míddelen	neutráal	- nèutrale ópstelling
	locáal	- lòcale búi	primáir	- prìmaire kénmerken
	kubíek	- kùbieke méter	modáal	- mòdale ínkomens

Recall from chapter 4 section 5, that light syllables can be lexically stressed, as /e/ in final position in *coryfée*. Although the variation between (8b) and (9) as to rhythmic shift to initial pretonic syllables (comparable to English cases) is clearly lexically governed, we suggest that lexical stress distinguishes the forms in (9) from those in (8b).

2.3.2 Syllable weight and other positions

Other positions than 'initial pretonic' conform to the observations made above, that the reducibility of heavy syllables is systematically less in comparison to that of open syllables. Again, syllable weight comes out as a relevant factor in reducibility contrasts, and in word-internal rhythmic patterning. This will be shown for interstress positions in (10), for medial pre-stress positions in (11), and medial post-stress positions in (12, 13).

(10)	pèrmanént -	chimpansee	pantalon -	nostalgie
	boekanier -	transplanteer	baldakijn -	didactiek
	fontanel -	evangelie	metropool -	autopsie
	methanol -	substantief	integraal -	impregneer
	unaniem -	romantiek	discipline -	solipsisme
	vitamine -	infantiel	keramiek -	heraldiek
	karamel -	semantiek	limonade -	demonstreer
	monopolie -	confronteer	kolonel -	secondant
(11)	àntecedént -	epilepsie	temperatuur -	egelantier
	catechetiek -	dialektiek	rozemarijn -	salamandrijn
	asymmetrie -	introspektief	abracadabra -	Kilimanjaro
	centripetaal -	intercepteer	adrenaline -	tierelantijn
	apocalyps -	anabaptist	karikatuur -	manufactuur
	economie -	horizontaal		
(12)	àntecedént -	investituur	galvanoscoop -	kaleidoscoop
	ingenieus -	dysenterie	capaciteit -	Constantinopel
	adrenaline -	authentiseer	amanuensis -	infanterie
	experiment -	serendipisme	anakoloet -	melancholiek
	ingrediënt -	solemniseer	eucharistie -	mercantilisme
	valeriaan -	electoraat	cavalerie -	recalcitrant
	acetyleen -	eclecticisme	lokomotief -	accordeon
	certificaat -	episcopaat	antropoloog -	gerontoloog
	organiseer -	emancipeer	antagonist -	evangelist
(13)	àntropòlogíe -	gerontologie	econometrie -	refractometrie

Apart from impaired reducibility of the heavy syllables in the examples above, some of (12) and (13) display rhythmic deviations from parallel examples with light syllables. Here, a light initial syllable optionally goes without a secondary stress, so that the first stress in the word is on the heavy second syllable, as in (14b):

```
(14)a.          *       b.          *       c. melancholiek
        * *  .  *          .  *  .  *          gerontoloog
       kaleidoscoop       kaleidoscoop         electoraat
```

Although a clear tendency exists towards the pattern (14a), the pattern (14b) is well possible. The optional absence of initial secondary stress distinguishes the members of most pairs in (12) whose initial syllable is light. Absence of initial secondary stress in light syllables can be matched by reducibility: [kəlɛidOskop].

Another way to demonstrate the secondary stress in the righthand members of (12) with initial light syllables, is embedding such words in phrases where a strong rhythmic beat precedes. The initial stress is then easily rhythmically inhibited by the primary stress on a preceding word - as in the examples below (partly from Van der Hulst & Moortgat 1981):

```
(15)a.                *        b. zèer recàlcitránt
           *          *           zèer melàncholíek
        .  *   . *  . *           een gròot elèctoráat
      een goed evangelist
```

The difference in rhythmic structure with the righthand members of pairs in (11), which have equal length but different syllabic make-up, appears from the impossible rhythmic structures below:

```
(16)a.              *     b. *de bèrg Kilìmanjáro
           *        *        *hàlf-horìzontáal
       .   *   . * .  *      *vríj paràdoxáal
     *een goed anabaptist
```

2.3.3 Stressless closed syllables

Irreducibility does not generalize to all closed syllables in secondary stress patterns. In this section we will inventarize the types of closed syllables that are reducible, and the restrictions as to the position in which reduction occurs. Such cases are of considerable importance to the question whether vowel reduction is directly affected by syllable closure (as has been assumed in most of the literature), or only indirectly, by the stress value of the closed syllable. Our conclusion will be that in some positions, reduction of closed syllables is conditioned by the adjacency of stressed syllables of certain composition, much as the Arab Rule in English. This seems to imply that some kind of destressing is involved in such positions, as reduction does not only depend on the segmental composition of the syllable affected, but also on that of an adjacent syllable. This points to an indirect conditioning of reduction in closed syllables, via context-sensitive destressing.

There are closed syllables which are generally reducible in the contexts of reduction of light syllables, cf. (5). Three types of syllables are in this class: (a) syllables closed by /r/, (b) syllables closed by /s/, and (c) syllables with a short front vowel - /ɛ/, /I/, or /oe/ - plus a sonorant. There are some exceptions to the generalizations, cf. (6) and (8).

Initial pretonic syllables composed of a short vowel followed by /r/ are easily reducible (Martin 1968, Booij 1977), cf. (17a). Also, syllables of this type tend to be reducible in medial positions where light syllables are reducible as well, cf. (17bcd)[3]:

```
(17)a. persóon  karton b. àdvertéer  b. pàrafernália c. dèterminéer
       servet   partij    energie       universeel      tuberculose
       Berlijn  garnaal   observeer     hierarchie      fraterniseer
       serpent  karwei    deserteer     metamorfose     paternalistisch
       percent  marmot    aubergine                     appartement
       vernis   circuit   alterneer                     conservatief
       fervent  surprise  bombardeer                    alternatief
       servies  gordijn   anarchie                      gouvernement
       termijn  cursief   Lombardije
       portiek  turbine   informeer
       surprise fornuis   colporteur
```

The reducibility of short vowel syllables closed by /s/ (Booij 1981) can be illustrated for the same positions:

```
(18)a. festíjn  pastoor  b. mòlestéer  c. mànifestéer d. màjestuéus
       presteer kastanje    amnestie      Alabastine       cholesterol
       mesties  biscuit     clandestien   eucharistie      anesthesist
       prestige muskiet     Palestijn                      aristocraat
       kostuum              minuscuul
                            elastiek
                            desastreus
                            statistiek
                            industrie
```

Finally, syllables with short front vowels /ɛ/, /I/, /oe/, closed by a sonorant consonant, tend to be reducible in the same positions as (17) and (18):

(19) a.	benzíne	signaal	b.	ìdentíek	paviljoen	c.	àlimentátie
	ventiel	miljoen		concentreer	carillon		incidenteel
	sensatie	cultuur		authentiek	infiltreer		sentimenteel
	tendens	vulkaan		exemplaar	postiljon		referendaris
	tentamen	biljart		commentaar	delinquent		
				compenseer	champignon	d.	ìdentitéit
				inventaris	faculteit		eventueel
				contempleer	resultaat		nomenclatuur

Booij (1981) claims that, more generally, syllables closed by sonorants reduce better than syllables closed by obstruents. This would especially hold for medial pretonic positions like (19bc). However, we observe that reducibility extends to the complete set of positions, including (19ad), with only a slight preference for medial positions.

The second context facilitating the reduction of closed syllables is the following. Closed syllables in interstress position that are preceded by a syllable with a short vowel followed by one intervocalic consonant are often reducible:

(20)	ànekdóte	selecteer	adapteer	stalagmiet	amalgaam
	direkteur	effectief	bataljon	tarantel	
	collectief	annexeer	stalactiet	adopteer	
	Alexander	carambole	balanceer	quarantaine	

In most cases, the short vowel in the initial syllable optionally arises by an initial shortening rule to be discussed in section 4.4.3. That is, the interstress syllable in *directeur* can be reduced both in [dIrəktØr] and in [dirəktØr], but the latter realization is much less natural, and when the initial syllable has a long vowel, the non-reduced realization [dirɛktØr] is preferred.

Quite remarkably, the reduced closed syllables in (20) are of types that can hardly occur reduced in other positions, cf. (6), and (10) through (13).

The favorable effect of a short vowel followed by one consonant in the initial syllable is very reminiscent of the Arab Rule in English, cf. chapter 1, section 5.1. In section 4.4.3, we will analyse it by means of a similar destressing rule.

Finally, a class of words remains with reducible heavy syllables which are outside the categories discussed so far. That is, the reduced closed syllables in these words are not of the type (17-19), nor do they follow a short vowel syllable with a single intervocalic consonant[4]:

(21)	projektiel	perspectief	avontuur
	accepteer	elektrode	compagnie

Summarizing, reduction in closed syllables is a restricted phenomenon as to segmental context. One class of closed syllables - those of (17-19) - reduces fairly independently of position, being restricted only by the generalizations made for light syllables in section 2.2. The remaining types of closed syllables mostly require an interstress position and a preceding syllable of specific composition in order to reduce (20).

2.4 Differences among secondary stresses

Assuming secondary stresses to be *located* as motivated in the preceding sections, we will now discuss prominence differences between them. The initial of two secondary stresses is usually the more prominent one. As observed in section 2.3, some words with light initial syllables and heavy second syllables which are not directly before primary stress, optionally have their strongest secondary stress on the second syllable (22b):

```
(22)a. chìmpansée     b. kalèidoscoop / kàleidoscoop
       Kìlimanjáro
       Cònstantinópel
       ònomatopée
```

In the other cases of (22a), the secondary stress on the first syllable is always rhythmically stronger than other secondary stresses.

2.5 **Conclusions**

Judged by position in the word and syllable weight, the secondary stress pattern can be described as follows. First, abstracting away from the factor syllable weight, secondary stresses are rhythmically spaced at distances of minimally one and maximally two stressless syllables. Second, initial syllables are strong candidates for secondary stress, especially if no stress directly follows. Third, heavy (closed and diphthongal) syllables tend to have a secondary stress, as is clear from their impaired reducibility and increased accentability as compared to light (open) syllables. Since the distribution of primary stress, discussed in chapter 4, requires a similar definition of syllable weight, this invites the conclusion that vowel reduction has access to syllable weight distinctions by means of stress, inherently present on heavy syllables. Fourth, closed syllables are reducible in a limited set of contexts.

We will now discuss some earlier accounts of secondary stress and see in which ways these capture secondary stress patterns.

3. **Secondary stress in earlier analyses**

Abstracting away from notational differences, two types of analyses of secondary stress have been proposed in the literature.

The first way is to assign secondary stresses by a rhythmic 'alternator' at both sides of the primary stress. In this view, which has been called the '*main stress first theory*' by Van der Hulst (1984), secondary stress is a rhythmic 'echo' of primary stress. Its first proponents were Booij (1981) and Van Zonneveld (1980, 1983).

The second way is to assign a binary stress value by one iterative rule, selecting primary stress by an End Rule. In this view, secondary stress is no echo of primary stress, but the result of the binary principle that is evidently controlling primary stress as well. This analysis of secondary stress was introduced in metrical analysis by Neyt & Zonneveld (1982), and elaborated (particularly) by Kager (1985) and Kager, Visch & Zonneveld (1987). To distinguish it from the main stress first theory, we refer to this theory as the '*stress first theory*'.

Generally, earlier analyses of secondary stress have ignored the role of syllable weight. Differences between full vowels and schwa were observed from the earliest analyses onwards, but the role of syllable weight distinctions by closure or diphthongs was given some serious attention only in Kager & Visch (1983) and Langeweg (1985). Instead of factors inducing secondary stress, both syllable closure and diphthongs are assumed to be directly affecting vowel reduction. Still, as has been pointed out in section 2, this misses the generalization that these syllable types count as heavy in primary stress placement, i.e. as inherently stressed, so that their reduction properties can be directly related to their stress values.

It is the purpose of this section to present and evaluate both theories of the origins of Dutch secondary stress. In section 4, we will give an analysis supporting the 'stress first theory'.

There we will show that a special secondary stress rule is superfluous, because most of its properties, in particular binarity and Q-sensitivity, result from the iterative rule motivated for primary stress in chapter 4.

3.1 Main stress first analyses

The major assumption behind main stress first analyses is that secondary stresses are assigned after primary stress, by a late rhythmic process, cf. Van Zonneveld (1980, 1982, 1983, 1985), Booij (1981), Hoeksema & Van Zonneveld (1984), Van der Hulst (1984), Langeweg (1985).

Primary stress is assumed to be determined by either lexical marking or by a linear primary stress rule, as discussed in chapter 4, section 3.3. The evidence in favor of main stress first analyses is the *mirror-image* nature of secondary stress. Secondary stress tends to be placed at the word edges - at a maximal distance from primary stress - while avoiding stress clashes, cf. (2), and (23) below:

```
(23)a.   *     b.  *       c. *
         * .       * . *      *  . . *
        gala      panama      infinitief
```

Secondary stress is placed on peripheral syllables, cf. (2bcd), (23bc). This generalization is called the Hammock Principle in Van Zonneveld (1985) and Hoeksema & Van Zonneveld (1984), and 'antipole stress' in Van der Hulst (1984). Formulated rule-wise, its effects are fairly similar to the End Rule (Prince 1983), cf. chapter 0, section 2.4.4.

Secondary stresses can be added between primary stress and peripheral secondary stress, under the no-clash restriction, cf. (2d). Such a situation can only occur in trisyllabic or longer strings of stressless syllables. The mechanisms proposed to capture alternating patterns resemble Perfect Gridding (Prince 1983).

The proposals mainly differ in the starting points from which (and the direction into which) secondary stresses are iteratively assigned. This direction is of importance mainly for secondary stresses in interstress sequences. Let us discuss the proposals and their motivation.

Van Zonneveld (1985) locates secondary stress at maximal distances from the lexical primary stress by the *Rhythmic Hammock Rule* (RHR). The alternating stresses are assigned from left to right through the word by the *Trochee Principle* (TP). Finally, an *Alternation Condition* (AC) is invoked to delete the first of two rhythmically strong syllables[5]:

```
(24)a. motíef  b. àutomáat   c. lòkomotíef  d. ònomàtopée
          s             s              s               s
  RHR   s s       s    s        s     s       s       s
  TP    ---       s  w s        s w s s       s w s w s
  AC    w s        ---          s w w s         ---

    e. éland   f. ólifànt   g. ínfinitìef
       s          s            s
  HP   ---        s   s        s      s
  TP   s w        s w s        s  w s s
  AC   ---         ---         s  w w s
```

The rhythmically strong syllables in (24acg) that are suppressed by the Alternation Condition, always pretonic beats, are claimed to have special properties in vowel reduction. The evidence will be discussed in section 7.2 below. Van Zonneveld refers to these as *Janus Syllables*, for their rhythmically ambiguous behavior.

Unlike Van Zonneveld, Booij (1981) has no special rule for assigning the peripheral stresses. Instead, he derives them by means of an alternating secondary stress rule running from the primary stress in both directions towards the word edges. It avoids clashes, so that it will not assign a secondary stress in (25ae). Furthermore, when a span of three syllables at the word edge is encountered, two instead of one syllable is skipped, to guarantee peripheral stress, cf. (25cg):

```
(25)a. motief   b. automaat  c. lokomotief  d. onomatopee
         - 1       2  - 1       2 - - 1        2 - 2 - 1

    e. eland    f. olifant   g. infinitief
       1 -         1 - 2        1  - - 2
```

Secondary stresses iterate binarily from the primary stress to the left, allowing for ternary spans only at the word edge, cf. (25bdf).

Empirically, the difference between Van Zonneveld (1985) and Booij (1981) is in words with uneven numbers of syllables before the primary stress, with a length of minimally five syllables. Van Zonneveld (1985) predicts pattern (26a) here, Booij (1981) pattern (26b):

```
(26)a.                   *       b.              *
       *    .  *    .  . *          *  .  . *  . *
       èx tra mè tri ci téit        pè ri o di ci téit
```

Because of the derived status of such examples, and the resulting possibilities of cyclic secondary stresses, there is no point in favoring one of the predictions here.

Hoeksema & Van Zonneveld (1984) use Van Zonneveld's Hammock Principle, but do not include a directional alternating stress rule. Instead, a set of non-directional principles is assumed, imposing the minimal rhythmic structure compatible with avoidance of clashes and lapses between the primary stress and the peripheral secondary stresses. Hence, (26a) and (26b) are free variants. They assume four stress levels making prominence distinctions between strong syllables, cf. (22): primary, secondary (for peripheral strong syllables), tertiary (for medial strong syllables), and stressless[6].

Van der Hulst (1984) translates the Hammock Principle into an arboreal theory by means of the *antipole stress foot*, after a proposal by Rischel (1982). The tree consists of two constituents: a *stress foot*, containing the lexical primary stress and any following syllables, and an *antipole stress foot*, whose head is the initial syllable. Alternating secondary stresses result from associating a *rhythmic melody* of grid structure to the syllable carrying primary stress, as a kind of rhythmic 'echo' of the primary stress:

```
(27)           /\
              /  \
             /    \    /\
            /      \  /  \
           /_______\ /____\
           s  w  w  w  s
           o no ma to pee
           *          *
           |          |
...   * * * * *  *  * * *  *  * ...
        *   *    *    *    *
```

By anchoring the perfect grid to the primary stress, Van der Hulst makes the same predictions as does Booij (1981), cf. (26b)[7].

Langeweg (1985) is the only main stress first analysis paying attention to syllable weight. However, most of the examples used have an internal morphological structure whose secondary stress pattern may be partly due to cyclicity. Although she denies the relevance of cyclic derivation for words derived with level-1 (Romance) suffixes, she does not support this claim by showing similar secondary stress patterns in comparable underived words.
Summarizing, main stress first theory captures the rhythmic properties of secondary stress (i.e. peripheral beats and alternation) in a fairly straightforward way. However, it also has serious drawbacks, since the alternating nature of secondary stress is left unrelated to the fact that primary stress placement is crucially bounded as well. Moreover, the similarities in Q-sensitivity between the patterns of primary and secondary stress are left unexpressed by main stress first analyses.

3.2 **Stress first analyses**

In sharp contrast to main stress first analyses, stress first analyses claim that primary stress is selected from stresses laid down by one iterative stress rule. The evidence in favor of this analysis for Dutch is as follows. First, the alternating nature of secondary stresses matches the bounded nature of primary stress, which is no further from the word end than three syllables (save exceptions discussed in chapter 4, section 2.3.3). Second, secondary stress is Q-sensitive in a way that highly resembles the Q-sensitivity of primary stress placement. However, only one stress first analysis (Kager & Visch 1983) takes syllable weight into consideration, so that this aspect will largely be ignored in the following review.

3.2.1 **Neyt & Zonneveld (1982)**

Neyt & Zonneveld (1982), cf. chapter 4, section 3.5.1, constitutes a step towards a stress first analysis. Binary foot assignment is iterative, which captures the generalization that the default foot type for both primary stress and secondary stress is binary:

```
(28) Syllables that have not been grouped into feet [i.e. monosyllabic
     or ternary feet] are grouped into binary feet from right to left.
```

All feet are grouped into a right-branching word tree that is labeled w-s. The Liberman & Prince counting algorithm, cf. chapter 0 (32), is assumed to explain that the leftmost (least embedded) weak foot is the most prominent one:

```
(29)a.            b.               c.      /\                d.       / \
                                          /  \                       /   \
      /\               /\                /    s                     /     s
     /  \             /  \              /    / \                   /     / \
    Fw  Fs          Fw    Fs           Fw  Fw   Fs               Fw    Fw   Fs
    |   |           / \   |            |   / \  |                / \   / \  |
    to máat       au  to  máat         lo ko mo tíef             o no ma to pée
```

Initial monosyllabic default feet are constructed in words that have an uneven number of syllables preceding primary stress - as in the analysis of Hayes (1981) for English. And as in Hayes (1981), two kinds of action are required to bridge the gap between (29) and actual secondary stress (or reducibility). First, the initial foot in (29a) seems to preclude the reducibility of words such as (5a). Neyt & Zonneveld do not invoke some initial Pre-Stress Destressing rule here, but propose that the reduction has the weak foot as its domain, and is

blocked in strong syllables[8]. The initial syllable in (29a) is reducible, since it is in a weak foot, and not labeled strong. We will return to this in section 6.3.4.
Second, (29c) incorrectly predicts that the second syllable in a string of three syllables before the primary stress is irreducible, whereas the initial syllable is falsely predicted to be reducible. The correct reduction pattern is (5c), where only the second and third syllable can reduce. To remedy this defect, Neyt & Zonneveld propose a restructuring rule of transformational format, which fuses the weak monosyllabic foot and the following foot into the required ternary foot:

```
(30)         /\
            /  \                           /\
           /    s                         /  \
          /    / \                      Fw    \
         /    /   \                     /\     \
       Fw   Fw     Fs                  s  \     Fs
        |   / \    |                  / \  \    |
        σ  σs  σw  σ                 σs σw σw   σ
       lo  ko  mo tief      =>       lo ko mo tief
```

The output of this restructuring equals that of Post-Stress Destressing (Hayes 1981), cf. chapter 1 (151)[9].

3.2.2 **Booij (1982a)**

Booij (1982a) proposes an analysis with a left-to-right bounded iterative footing rule, the relevance of which to primary stress will not be discussed. For secondary stress, this yields results different from Neyt & Zonneveld (1982) in words with odd numbers of syllables before primary stress:

```
(31)a.              b.              c.                 d.       / \
                                           /\                  /   \
                           /\             /  s                /     s
         /\               /  \           /  / \              /     / \
       Fw Fs            Fw    Fs       Fw  Fw Fs           Fw    Fw   Fs
        |  |            / \    |       / \  |  |           / \   / \   |
       to máat         au to máat     lo ko mo tíef       o no ma to pée
```

In contrast to Neyt & Zonneveld's (29c), (31c) needs no restructuring to match the surface secondary stress pattern. The second syllable is weak, hence reducible, whereas the third syllable is structurally similar to the initial one of (31a). However, a problem for the analysis is that the iterative left-to-right footing rule can hardly be extended to primary stress[10].

3.2.3 **Kager & Visch (1983)**

Kager & Visch (1983) is the first stress first analysis which seriously investigates the role of syllable weight in secondary stress. As remarked in chapter 4, section 3.5.3, this analysis is rather exotic from a theoretical viewpoint. The principles which determine the selection of stress feet are essentially equal for primary and secondary stress feet. This means that closed syllables tend not to be placed in a weak position of a secondary stress foot. Let us first discuss syllables of lesser weight, i.e. open syllables:

```
(32)a.            b.              c.        /\            d.       / \
                                           /  \                   /   \
       /\               /\                /    \                 /     s
      /  \             /  \            Fw       \               /     / \
     Fw Fs           Fw    Fs         s \        Fs           Fw    Fw   Fs
     |  |           / \    |         / \ \       |            / \   / \   |
    to máat       au to máat        lo ko mo tíef            o no ma to pée
```

The two principles which select the structures of (32) as being optimal are the following. First, binary feet are rated higher than monosyllabic and ternary feet. Second, the total number of feet must be minimized. In (32a), no choice exists. The binary foot in (32b) matches both criteria, as compared to a sequence of two monosyllabic feet. In (32c) the ternary foot is not optimal, but no alternative analysis is possible for strings of three syllables which does not involve uneven feet. Hence, the number of feet is minimized by the second criterion. Finally, (32d) perfectly matches both criteria. Two relevant cases with heavy syllables come out as follows:

```
(33)a.     /\            b.    /\
          /  \                /  \
         /    s              /    s
        /    / \            /    / \
       Fw Fw    Fs         Fw   Fw   Fs
       |  |    / \         |   / \   |
       e van ge lie        me lan cho liek
       VV VC VV  VV        VV  VC  VV VVC
```

Here, the heavy syllables in second position tend to be kept from weak positions in a direct weighing against light syllables. This keeps the second syllables in (33) from a weak position in a binary and ternary foot, respectively.

3.2.4 **Kager (1985), Kager, Visch & Zonneveld (1987)**

These analyses are the first where *iterative* footing is crucial to the location of primary stress, since a non-peripheral foot may be labeled strong by the LCPR. And since the iterative footing rule is binary and Q-sensitive, cf. chapter 4 section 3.5.5, so must be the secondary stress pattern. The authors do not go into consequences of Q-sensitivity to secondary stress however, but focus on the consequences of iterative footing, and metrical restructuring.

The output of the analysis equals Neyt & Zonneveld (1982) for the words in (29). Therefore it produces structure (29c), which falsely predicts secondary stress on the second syllable. To eliminate the medial branching foot, Kager, Visch & Zonneveld (1987) formulate an adjunction rule in the format of Hayes (1984)[11]:

```
(34) In    ... X Y ... DTE ...    : adjoin Y to X
```

Since adjunction is subject to the Maximality Principle, cf. chapter 2 (151), X can only be a syllable in a non-branching foot.

```
(35)      / \                                / \
         /   s                              /   \
        /   / \                            /     \
      Fw  Fw   Fs                         Fw       Fs
      |  / \   |         Adjoin          / \       |
      lo ko mo tief        =>          lo  ko mo tief
```

To readjoin the third syllable into the tree, a second adjunction rule is proposed, which is *right*-dominant[12]:

```
(36) In   ... Y DTE ...   : adjoin Y to DTE
```

This rule applies as shown below:

```
(37)a.                              b.      / \                   / \
        /\                                 /   \                 /   \
       /  \                               /     \               /     \
      Fw Fs               F             Fw       Fs           Fw       Fs
      |  |               / |           / \       |           / \      / |
      to maat   =>   to maat         lo ko mo tief   =>    lo ko mo tief
```

KVZ claim that the resulting division *loko/motief* is more in line with rhythmic intuitions than *lokomo/tief* of (30). However, the R-dominant adjunction rule (36) is in fact nothing more than a patching up for the absence of Initial Pre-Stress Destressing and Stray Syllable Adjunction. Moreover, the R-dominance of the rule conflicts with the L-dominance of footing, which makes it suspect as a non-structure-preserving rule. The final objection against the analysis is that it ignores syllable weight in secondary stress, although it predicts it to be relevant.

3.3 **Conclusions**

Our review of the literature on secondary stress leads to the following conclusions. First, both main stress first and stress first analysis have largely ignored the role of syllable weight in secondary stress. Most analyses assume that distinctions between open and closed syllables as to vowel reduction are to be captured by vowel reduction, which is in a sense Q-sensitive. However, such an approach misses the generalization that closed syllables tend to be irreducible since they are heavy - i.e. inherently stressed - by the same definition as can be motivated for primary stress placement. Second, binarity is captured by rather different mechanisms in main stress first and stress first analyses. Attempts to generalize patterns of primary and secondary stress, as in stress first analyses, are attractive, but still run into problems by unsatisfactory types of destressing rules. Third, hardly any attention is paid to prominence differences between secondary stresses.

4. **An analysis of secondary stress**

4.1 **Introduction**

The analysis of primary stress that we proposed in chapter 4 was based on the properties of Q-sensitivity and boundedness. In section 2 we have illustrated essentially the same properties of secondary stress. It is therefore no surprise that we try to generalize the analysis of primary stress to secondary stress.

In this section we will test the predictions about secondary stress made by this analysis against the actual secondary stress patterns motivated in section 2. On the whole, the outcome will support the hypothesis that secondary stresses result from the same mechanisms as primary stress. But there are nevertheless four types of adjustment required to bridge the output of the level-1 stress rules and the actual stress pattern found at the surface. First, as in English, Syllable Adjunction must *reapply* to eliminate the secondary stress on the second syllable in words such as *lòkomotíef*. Second, a certain type of closed syllable, as the initial syllable in *persóon*, surfaces without secondary stress, by the operation of a rule of deweighting, we submit. Third, a level-2 'Arab Syllable Adjunction' rule is to destress medial syllables as the one in *dìrektéur*. Fourth, higher level adjunction has to be operative to bring about prominence relations between the secondary stresses, subordinating medial secondary stresses with respect to initial ones, as in *ònomàtopée*.

4.2 Testing the predictions

We will start out by closely examining the output of (level-1) QS and Syllable Adjunction, as applied to the domain preceding primary stress.

If this portion consists of only one syllable, our analysis predicts its stress value to directly depend on its weight. The output of the level-1 stratum is (38a,b) for words with a light and a heavy initial syllable, respectively:

```
(38)a.     *        b.        *
        .  *              *   *
        v  -              -   -
        to maat           con tant
```

The predicted stress contrast on the initial syllable is in line with the general trend for initial pretonic syllables as discussed in section 2.: impaired reducibility and increased accentability due to syllable weight. However, the analysis incorrectly predicts that closed syllables, which are heavy by definition, are stressed regardless of their composition. This prediction is incorrect in the face of examples such as *persóon* (17), whose initial closed syllable varies between full and reduced.

Turning to words with sequences of light syllables preceding the primary stress (2), the analysis predicts patterns as (39):

```
(39)a.         *      b.         *      c.              *
        (*  .) *          . (*  .) *         (*  .)(*  .) *
        v   v  -          v  v  v  -         v   v  v  v  v
        au to maat        lo ko mo tief      o  no ma to pee
```

The patterns (39a) and (39c) match the location of surface secondary stresses discussed in section 2.2. However, pattern (39b) is incorrect, the secondary stress being incorrectly placed on the second syllable, instead of the initial syllable. Moreover, the relative prominence of the secondary stresses in (39c) is not captured.

Words with heavy syllables before primary stress (10-13) are assigned the structures below:

```
(40)a.             *  b.          *   c.           *    d.              *
         *    *    *    (*  .)  *   *      . (*    .) *       .  *  (*  .) *
         -    -    v    v   v   -   v      v  -    v  -       v  -  v   v  v
       chim pan see     e  pi lep sie     me lan cho liek    ge ron to lo gie
```

These secondary stress patterns fairly well match the surface patterns discussed in section 2. Each heavy syllable carries a secondary stress, while the stress values of the remaining light syllables corresponds to the single correct surface value (40b), or at least one of the optional surface stress values (40cd).

They fail to represent the following properties, however. First, (40ab), as (40d), fail to reflect the relative strength of the initial secondary stress. Second, (40cd) represent only one of the two optional stress patterns of (14). In particular, the light initial syllables of (40cd) are stressless, whereas they are optionally (even preferably) stressed at the surface. Third, the secondary stress on a light initial syllable becomes mandatory in cases like *evangelie*, cf. (10), which receive the following incorrect structure:

```
(41)a.            *
        .   *   (*  .)
        v   -   v   v
        e  van  ge lie
```

Finally, medial closed syllables in words such as *direkteur*, cf. (20), receive stress, while they are optionally stressless and reduced at the surface.

We see that the stress output of the level-1 lexical stratum fairly well matches the surface distribution of secondary stresses. The Q-sensitive, binary distribution of secondary stress, motivated in section 2, closely resembles the distribution of primary stress, and should therefore follow, in a maximally generalizing fashion, from the same principles.

However, we have also found various differences between predicted stress patterns and actual stress patterns in a well-defined set of cases. They can be summarized as follows. First, specific types of closed syllables, discussed in section 2.3.3 (17-19), are predicted to be inherently stressed, by their weight. However, these syllables behave as if light, since they are reducible in the same positions as light syllables are, cf. (5). Second, secondary stresses are predicted to fall on every light syllable that is at an even distance from a following stress, by iterative application of Syllable Adjunction. These secondary stresses are omitted, however, in positions directly following stray syllables, as *lokomotief* (2c) illustrates. Third, medial closed syllables are reducible in a position between a short vowel syllable with only one intervocalic consonant and the primary stress - the 'Arab' context, cf. (20). Fourth, no prominence differences between secondary stresses are present in the level-1 output. However, a clear tendency exists for the initial secondary stress to be more prominent than other secondary stresses (22a). The initial beat is optionally omitted in cases such as (22b).

We will now present an analysis of these phenomena in the form of a set of level-2 stress adjustment rules, applying to the output of level-1 stress assignment as proposed in chapter 4.

4.4 Level-2 adjustments

4.4.1 Deweighting

In section 2.3.3 we concluded that three types of closed syllable behave as light syllables with respect to vowel reduction: (a) syllables closed by /r/, (b) syllables closed by /s/, and (c) syllables with short front vowels (/ɛ/, /I/, /œ/), and closed by a sonorant. All of (42) below can have optionally reduced vowels at the surface:

(42) a.	persóon	b.	kastánje	c.	benzíne
	àdvertéer		èlastíek		ìdentíek
	ùniverséel		àlabastíne		àlimentátie
	dèterminéer		chòlesteról		ìdentitéit

Still, these syllable types are heavy at level-1, as is clear from their being unskippable as penults, cf. the 'closed penult restriction' of chapter 4, (7c):

(43) a.	Laértes	b.	Madagáskar	c.	rododéndron
	Libértas		Wladiwóstok		Agamémnon
	Ropárco		Sonésta		Urénco

It is important to point out that the only type of closed syllable that can be skipped in penultimate position contain *underlying* schwa, cf. chapter 4 (34b), and are weightless at level-1[13]:

(44) a.	ínterval	Pásternak	b.	májesteit	c.	Déventer
	lánterfant	pímpernel				

Since vowel reduction is optional in Dutch, the non-alternating schwa's in the words in (44) can be safely assumed to be present at underlying level. Clearly, Dutch differs from English here, where sonorant-closed syllables with full vowels are more or less absent at the surface in the Sonorant Destressing context.
The conclusion is that specific types of closed syllable are heavy at level-1, but light at the surface. This asymmetry as to syllable weight between levels points to some late (we will assume level-2) process of deweighting. We will formulate it as below:

(45) **Deweighting** (level-2)

```
   σ      σ          Segmental conditions:
  / \     |          a. C = /r/, or
  m m  => m          b. C = /s/, or
  | |     |\         c. V = [-back] and C = [+son].
  V C     V C
```

Deweighting automatically leads to loss of stress, hence reducibility. Notice that Deweighting produces monomoraic syllables, i.e. syllables that would be excluded at level-1 by the bimoraic constraint. However, we have good reasons to assume that bimoraic minimality cannot be true at level-2, since it is at this level that (a) monomoraic schwallables originate, so that schwa may appear in word-final position, cf. chapter 3, (b) vowel reduction takes place, also leading to monomoraic syllables. Therefore, Deweighting does not violate a constraint holding at its level of application.

4.4.2 Syllable Adjunction

The second level-2 stress adjustment rule to be discussed is reapplication of Syllable Adjunction, cf. chapter 4 (99). Such reapplication is motivated by words such as *lòkomotíef* (5c). The underlined reducible light syllable, at an even distance from the next stress, loses its status as a head of a binary foot by being adjoined leftward to the preceding syllable.

(46) **Syllable Adjunction** (level-2)
Adjoin a syllable place-holder leftward.

As in English, the reapplying version of this rule is restricted to the adjunction of light syllables, which follows from the QS wellformedness condition, protecting inherent line-1 grid marks over heavy syllables.
As discussed in chapter 2, the adjunction is subject to the Maximality Principle, cf. chapter 2 (151), which restricts its application to contexts where a stray syllable precedes the target syllable place-holder. It was pointed out in chapter 2 that the reapplication of Syllable Adjunction, being a reapplying stress rule, may destroy constituent boundaries, and is not subject to the Free Element Condition. Consider (47):

```
(47)             *                    *
       . (*  .)  *          (*  .) .  *
       v  v  v   -           v  v  v   -
      lo ko mo tief    =>   lo ko mo tief
```

Crucially, Deweighting feeds Syllable Adjunction, as in the derivations below, cf. (17-19):

```
(48)a.              *                         *                        *
        . (*    .)  *              . (*    .) *              (*   .)   .  *
        v  -    v   -      (45)    v  v    v  -      (46)    v  v    v  -
      cho les  te rol      =>    cho les  te rol     =>     cho les  te rol

   b.          *                         *                         *
        .  *   *                  .  .   *                  (*   .)   *
        v  -   -          (45)    v  v   -          (46)    v  v     -
        i den tiek         =>     i den tiek         =>     i den tiek
```

Syllable Adjunction is blocked in all cases where it would adjoin a truly heavy syllable, cf. (10), (12):

```
(49)a.            *                         *
        . (*    .) *          (*  .)    .   *
        v  -    v  -          v   v     v   -
       me lan cho liek  =/=>  me lan cho liek    (*[mèləŋχolík])

   b.          *                    *
        .  *   *             (*  .) *
        v  -   -             v   v  -
       se man tiek      =/=> se man tiek         (*[sèməntík])
```

This concludes our discussion of level-2 Syllable Adjunction.

4.4.3 **The Dutch Arab Rule**

The third level-2 stress adjustment rule is a level-2 version of the English Arab Rule, i.e. Closed Syllable Adjunction (86b) of chapter 2. It is motivated by cases such as *dìrectéur* ([dIrəktØr]), cf. (20). The rule has essentially the same context as its English level-1 counterpart, that is, a preceding syllable with a short vowel followed by an intervocalic consonant. Before we will discuss the rule, some remarks as to the origin of the short vowel in the initial syllable are in order.

In most of the relevant words, the short vowel in the initial syllable alternates with a long counterpart. Alternations of this type occur in many more cases where the medial syllable is open instead of closed. A selection of alternating pairs is below. It has to be pointed out that alternations between [a] and [α] are very common, and that alternations between other vowels are slightly sub-standard:

```
(50)a. [a]/[α]     b. [o]/[O]     c. [e]/[I]     d. [i]/[I]
       pàradíjs       pòlitíek       tèlefóon       dìrectéur
```

The scope of the phenomenon is considerably wider, as it extends to at least initial syllables that do not have non-primary stress:

```
(51)a. banáan     b. polítie     c. meláats     d. minúut
```

In the literature on the process - Heeroma (1960), Martin (1968), Booij (1977), Ketelaar (1988), Kager, Visch & Zonneveld (1987) - it is claimed to be a partial reduction from a long vowel to a short vowel. Different opinions exist as to the exact context of shortening, but all authors agree that it affects at least initial syllables outside primary stress. Moreover, shortening affects only long vowels in open syllables that are followed by a consonant in the following syllable[14]:

```
(52)a. [laɛrtɛs] (Laértes)  b. *[lαɛrtɛs]
```

Abstracting away from the exact contextual restrictions as to stress and position in the word, the alternation can be formulated as below:

(53) **Vowel Shortening** (level-2)

```
     σ     σ          σ     σ
    / \   /          / \   /
    m m   m          m m   m
    \ / /|           |   \/|
     V C_oV    =>    V   C_oV
```

Notice that Vowel Shortening creates an ambisyllabic consonant. The output of the rule can be subject to further vowel reduction in case the syllable ends up as stray, typically in initial pretonic position:

(54) a. [banan]   b. [bɑnan]   c. [bənan]

Let us now continue our discussion of the Dutch 'Arab Rule'. The process necessarily involves a deweighting of the closed syllable to be adjoined leftward. The weight class of this syllable is to be stated in the rule, for the reasons pointed out in chapter 2, section 4.2. This can be done as below:

(55) **Dutch Arab Rule** (level-2)
Adjoin the place-holder of a short vowel syllable leftward if its onset consonant is ambisyllabic.

An application of (55) is given below for illustration:

```
(56)                 *                             *
          *    *     *               (*   .)       *
                     σ                             σ
         σ    σ      σ \              σ   σ        σ \
        / \  / \    / \ |            / \  |       / \ |
        m m  m m    m m |            m m  m       m m |
        /| |/| |    /\ / |          /| |/|\       /\ / |
       d I r ɛ k t  Ø   r    =>    d I r ɛ k t   Ø   r
```

A crucial difference between (55) and Closed Syllable Adjunction in English (the Arab Rule) is that the English rule applies at level-1 before prominence assignment, whereas the Dutch rule applies at level-2. If the latter were level-1, it would lead to strong primary stress retraction.
Let us now turn to the final stress adjustment rule, Rhythmic Adjustment.

4.4.4 **Rhythmic Adjustment**

The final adjustment process to be discussed is Rhythmic Adjustment, an adjunction between line 1 elements in the grid. This rule is motivated for Dutch by the prominence relations between the secondary stresses preceding the primary stress, the first of which is the stronger one, cf. (22a):

(57) a. chìmpànsée   b. Kìlimànjáro   c. ònomàtopée   d. Cònstàntinópel

Only in words of type (57d) whose initial syllable is light, the initial strengthening is optional. Words of this type display rhythmic variation between a pattern with initial strongest secondary stress and a pattern lacking an initial secondary stress - cf. (22b).
In chapter 2 we assumed two versions of this rule for English, a version applying in the lexical phonology, and another version applying in the post-lexical phonology. But Dutch

and English differ as to words of the type (English) *ènc̆yclopédia* versus (Dutch) *Cònstàntinópel*, with three syllables preceding the primary stress, the first and second of which are heavy. In English, such words display variation in the location of the strongest secondary stress, in Dutch they do not. Therefore, there is no need to distinguish two versions of Rhythmic Adjustment for Dutch, as will be seen.

Let us first discuss the cases which have an initial secondary stress by the level-1 rules - stress on a heavy syllable or a syllable in a binary constituent. These cases all obligatorily undergo initial strengthening.

We assume that Dutch differs from English by identical lexical and post-lexical versions of Rhythmic Adjustment, i.e. the formulation by Hayes (1984). This version has been motivated for phrasal application in Dutch by Kager & Visch (1988):

```
(58) Rhythmic Adjustment (level-2 and post-lexical version)
     In the configuration ... X Y DTE ..., adjoin Y to X.
```

The lexical application is shown in the derivations below:

```
(59)a.        *   b.          *     c.            *  d.            *
      *   *   *    (*  .) *  (*  .)  (*  .)(*  .) *    *   (*   .)(*  .)
      -   -   -     v  v  -   v  v    v  v  v  v  v    -    -   v  -  v
    chim pan see   Ki li man ja ro    o no ma to pee  Con stan ti no pel

              *               *                   *                *
     (*   .)  *    (*     .)  *      (*     .)    *   (*    .)     *
      *   *   *    (*  .) *  (*  .)  (*  .)(*  .) *    *   (*   .)(*  .)
      -   -   -     v  v  -   v  v    v  v  v  v  v    -    -   v  -  v
    chim pan see   Ki li man ja ro    o no ma to pee  Con stan ti no pel
```

The Textual Prominence Preservation Condition (TPPC), cf. chapter 1 (132), governs the output of Rhythmic Adjustment, as has been discussed in chapter 2 for English. That is, the primary stress is automatically raised to line 3 in case a secondary stress at line 2 arises.

Let us now discuss cases where the initial syllable is stressless by the level-1 stress rules. For such words, we assume that Rhythmic Adjustment applies while assigning secondary prominence to the initial syllable. As there is no line 1 landing site for the rule, it creates one, under the restriction that the resulting column must correspond to a syllable:

```
(60)a.       *        b.             *
      .  *   *              . (*    .) *
      v  -   -              v  -    v  -
     se man tiek           me lan cho liek

             *                           *
     (*  .)  *             (*  .)        *
      *  *   *              * (*    .) *
      v  -   -              v  -    v  -
     se man tiek           me lan cho liek
```

The difference in optionality between (60a) and (60b) is probably due to eurhythmicity, as the syllabic distance in (60a) is smaller as compared to (60b). Accordingly, the rhythmic gain of applying adjustment to (60b) is less than in (60a).

4.5 Secondary stress following the primary stress

The secondary stress pattern of the portion of the domain following the primary stress is a topic that deserves some special attention. In main stress first analyses such as Van Zonneveld (1985) and Booij (1981), a mirror-image pattern is claimed to exist with respect to the portion of the domain preceding the primary stress. Actually, our analysis has the virtue of automatically accounting for the rhythmic pulse on the final syllable in words with antepenultimate stress:

```
(61)a.        *           b.  *             c.  *
      (*  .)(*  .)   *       (*    .)   *      (*  .)   *
       v  v  v  v    v        -    v    -       v  v    -
      Pa ra ma ri <bo>em     al ma <nak>em      o li <fant>em
```

Notice that words with antepenultimate stress always carry a secondary stress on their final syllable, as it is either (a) lexically stressed, or (b) inherently stressed by syllable weight. As to words with penultimate stress, we deviate from the stress patterns with final stressless syllables that are claimed to be accurate by main stress first analysts. That is, our analysis predicts final secondary stress to be correlated with final syllable weight, or lexical stresss. To our mind, the secondary stress patterns below are largely accurate:

```
(62)a.        *           b.  *             c. *
      (*  .)(*   .)           *   *            *    *
       v  v  v   v            v   v            -    -
      pa no ra <ma>em        ka <jak>em       Ro <land>em
```

There is a way to test the presence versus absence of final secondary stresses. In Dutch compounds, which tend to have initial primary stress, rightward rhythmic adjustments may occur that are the mirror-images of leftward phrasal rhythmic adjustments (see Kager & Visch 1987, Visch forthcoming). This phenomenon is known also from other languages, such as German (Kiparsky 1966) and Polish (Hayes & Puppel 1985). In Dutch, rightward adjustment can inverse the word-internal prominence relations in underived disyllabic words embedded in compounds such as those of (63a), but not in those of (63b), see also Visch (forthcoming):

```
(63)a. árbeid    - dwáng+arbèid   b. pínda   - *vlíes+pindà
       líchaam   - blóed+lichàam     sáldo   - *dóel+saldò
       áltaar    - húis+altàar       ólie    - *áard+olìe
       hérberg   - jéugd+herbèrg     róbot   - *húis+robòt
       éiland    - schíer+eilànd     bívak   - *véld+bivàk
```

Final superheavy syllables, such as those of (63a), can be strengthened more easily than other types of syllables (63b). This relation between syllable weight and rhythmic strengthening provides some evidence for the claim that secondary stress following the primary stress is at least partly governed by syllable weight[15].

4.6 **Summary**

In this section, we have proposed an analysis of Dutch secondary stress that has the following properties. First, it identifies level-1 Syllable Adjunction and QS as the basic mechanisms producing secondary stresses. Second, it contains level-2 stress adjustments to bridge the gap between the output of level-1 and surface stress patterns. The adjustments that we proposed to fulfil this role were (a) deweighting, (b) reapplication of Syllable Adjunction, (c) a level-2 Closed Syllable Adjunction rule, and (d) Rhythmic Adjustment. Third, we showed the secondary stress pattern following the primary stress to be well in line with the pattern resulting from the analysis of primary stress of chapter 4.

5. Patterns of vowel reduction

5.1 Introduction

Vowel reduction will be discussed separately from secondary stress for the following reason. Our analysis of secondary stress was partly designed to account for the fact that certain syllables outside primary stress are (ir)reducible as a function of their composition (weight) and position (constituency). That is, we were interested in reducibility as a binary property, viewed from the perspective of factors that we argued to be relevant to stress, both primary and secondary. However, we abstracted away from properties of vowel reduction that are not related to the pure presence or absence of (secondary) stress. For instance, we abstracted away from hierarchies according to which stressless, reducible syllables are actually reduced. Such hierarchies can be constructed as a function of vowel quality, and as a function of position. Especially the latter type of hierarchy is very interesting as it presents a possibility of validating the various types of stressless positions (*stray*, or *adjunct* in a constituent) that our analysis predicts to exist. In order to present a sharper picture of the vowel quality and position hierarchies, we need to discuss a number of other factors relevant to reduction, such as segmental contexts that inhibit or favor reduction. Let us first introduce some general properties of Dutch vowel reduction.

In contrast to English, vowel reduction to schwa is a far less automatic phenomenon in Dutch, and even considered sub-standard in many cases. Reduction is far more variable than in English, which means that the role of such factors as style, lexical frequency, and vowel quality, is increased. First, however, Martin (1968) shows that word frequency in itself is not a decisive factor in vowel reduction to schwa. Extremely infrequent words may allow for reduction, especially of the vowel /e/:

(64) acetyléen fenegríek dekretálen metáthesis polysíndeton
nomenclatúur excremént sideráal oneréus

A high word frequency is therefore only significant as far as it is a necessary condition of use among "reductionist" sub-standard speakers.

Second, the optionality (or even partial sub-standard status) of vowel reduction does not deny it the status of a rule-governed phenomenon, as within the range of potential reductions, it is clearly blocked under specific circumstances. For instance, vowel reduction is possible (even if considered sub-standard) in the initial syllable of *radijs*, while it is clearly impossible in the initial syllable of *adres*, as in all vowel-initial words. Obviously, a set of factors facilitate and inhibit vowel reduction in specific environments. We will clarify these factors as far as they are *phonological*. Five factors are reported as relevant in the literature: stress, syllable closure, segmental context, vowel quality, and position. The first two of these factors have already been discussed in earlier sections 2.2 and 2.3, so that we will limit our discussion of these to a minimum. We will not further go into what are essentially *performance* factors such as word frequency, tempo, etc.

5.2 Stress

The first and most salient factor that is mentioned in the literature is stress: naturally, vowels under primary stress do not reduce to schwa, and, furthermore, rhythmic (secondary) stress inhibits reduction (cf. Martin 1968, Booij 1981). See (65), where the underlined vowels are irreducible[16]:

(65) a. gála b. pàradíjs

5.3 Syllable structure

Another major factor in vowel reduction that was discussed implicitly in earlier sections is syllable structure, i.e. the phenomenon that closed and diphthongal syllables tend to resist reduction. We have analysed the phenomenon as being due to inherent stress by syllable weight, the same factor which proved to be relevant in our analysis of primary stress of chapter 4. The obvious advantage of this analysis is that it eliminates direct reference to syllable closure and diphthongs in the rule of vowel reduction, and generalizes the blockade against reduction to the factor mentioned in 5.2, (secondary) stress. In this case, however, the stress is due to weight, not to constituency or prominence.
We have also discussed *reducible* closed syllables in earlier sections, cf. 4.4.1 and 4.4.3, and proposed deweighting rules to account for these in a restricted set of contexts.

5.4 Segmental context

5.4.1 Preceding segments

Only vowels that are immediately preceded by a consonant reduce, or said otherwise, onset-less syllables cannot reduce. The blocking effect of a 'zero onset' is one of the most reliable factors in vowel reduction, in particular in word-initial vowels (cf. Martin 1968, Booij 1977, 1981):

(66)	elíte	etappe	apostel	agent	opaal	oranje	idee	uniek
	egáal	epistel	adres	anijs	ovaal	orakel	idool	uranium
	ellíps	editie	april	azijn	olijf	Olympisch	ikoon	utopisch

Interesting enough, /h/ patterns with empty onsets, since reduction seems to be excluded in (67) below (cf. Martin 1968, Booij 1977, Reker 1983)[17]:

(67)	heláas	Herodes	habijt	Hatema	hobo	hibiscus	humeur
	heróisch	heráut	hachee	Havanna	hotel	hybride	humaan

In medial positions, the effects of the constraint are slightly obscured by the fact that zero-onsets and /h/ may be replaced by intervocalic glides inserted by the post-lexical rule of Homorganic Glide Insertion, cf. chapter 3, section 4.1. This rule does not apply if the preceding vowel is /a/, however, and this type of cases confirms the constraint, as reduction is blocked:

(68) Fáëton Báobab maëstóso aëróob aëronáut Maoíst

Glides inserted after other vowels than /a/ behave as syllable onsets as to reduction, although reduction may still be slightly inhibited in such cases (cf. Martin 1968, Booij 1982b)[18]:

(69)	poëzíe	pianóla	dialéct	Béatrix
	theoríe	diamánt	hyacínt	Papiaméntoe

Vowels after underlying medial /h/ may reduce if /h/ is dropped at the surface (in less formal styles). If /h/ follows a consonant, it simply drops (70a), but if /h/ follows a vowel, the resulting hiatus is filled by a glide that is homorganic to the preceding vowel (70b).

(70) a.	inherént	b. cohérént
	sánhedrin	Téheran

Next to forms with [h] and full vowels - [In.he.rɛnt], [ko.he.rɛnt] - forms with dropped /h/ and schwa occur - [Inə.rɛnt], [ko.wə.rɛnt]. But forms with [h] and schwa are marginal - *[In.hə.rɛnt], *[ko.hə.rɛnt].

5.4.2 Following segments

Apart from syllable closure, segments following vowels affect reduction to schwa, even if these are in the following syllable. Especially /r/ is favorable (cf. Martin 1968, Booij 1982b)[19]. For the remaining consonants, there is some difference between following sonorants and obstruents (cf. Koopmans - Van Beinum 1982). But many examples occur of vowels being reducible even before obstruents.

This will be illustrated for initial pretonic syllables with /e/, where examples with /r/ in (71a), sonorants in (71b), and obstruents in (71c), in all of which reduction is possible:

(71) a.	veránda	sereen	b.	meláats	plenair	c.	Jesája	metaal
	Jeruzalem	steriel		delirium	crematie		Peseta	methode
	Veronica	perikel		seniel	senaat		medaille	frequent

The consonant hierarchy comes out only when taking into consideration the cases of (72), where reduction is inhibited or even impossible. The remarkable effect is the rarity of irreducible /e/ before /r/ (72a) and sonorants (72b), as compared to obstruents (72c):

(72) a.	?sclerόse	b.	?chemíe	c.	decémber	decaan	Becel	detail
	?Merano		?demotisch		Thesaurus	metriek	methaan	deposito
	?Peru				mechanica	Breda	Medusa	cesuur

In the literature (cf. Martin 1968, Trommelen & Zonneveld 1979, Booij 1981) it is claimed that reduction requires a following consonant, prevocalic vowels being irreducible. However, this constraint seems to hold for initial pretonic syllables (73a) only, since reduction in the medial prevocalic vowels of (73b) is perhaps slightly inhibited, but still possible:

(73) a.	Kaíro	Laertes	b.	mozaíek	dadaïsme	c.	fárao	Michael
	Maori	naïef		cocaïne	prozaïst		Israel	Kanaän

We have selected examples with /a/, since after this vowel no glides are inserted by Homorganic Glide Insertion, cf. chapter 3, section 4.1.

Similarly to the zero-onset constraint discussed in section 5.4.1, /h/ behaves as a zero-consonant. Reduction before /h/ is more difficult in initial pretonic syllables (74a) than in medial syllables (74b):

(74) a.	Bahámas	Sahara	Swahili	Johanna	mihoen	b.	ábraham	Galahad
	vehikel	mahonie	Tahiti	Mohammed	mohair		alcohol	tomahawk

Again, Homorganic Glide Insertion interferes with the effects of absent consonants. In the literature (cf. Martin 1968, Booij 1982b), vowels before glides are claimed to be irreducible. This statement is too strong, as will be shown. First, it does not hold for lexical glides, as following lexical glides behave as true consonants. Reduction is possible in the words below:

(75)	lawáai	trawánt	kajúit	rayón	Kárajan
	lawíne	Karawánken	majóor	mailló t	

If there is any problem in reducing among other vowels than /a/ here, it is probably due to vowel quality: /o/ in *pro̲jéct* etc. hardly reduces.

Second, the prohibition against vowel reduction before glides holds for (inserted) glides in initial pretonic positions (76a), but seems to be slightly overrestrictive for medial cases (76bcde), at least for /e/. Reduction of other vowels than /e/ follows the same pattern as (76), be it clearly more inhibited by vowel quality - the inherent reluctance of the remaining vowels /o/, /i/ to reduce:

(76)	a. the̲áter	b. oce̲áan	c. alíne̲a	d. tore̲adór	e. accorde̲ón
	ko̲ala	hero̲ïne	alo̲ë	collo̲idaal	alkalo̲ide
	pi̲ano	idi̲oot	radi̲o	mari̲onet	ammoni̲ak

Reduction in the examples of (76a) is blocked, which is in sharp contrast with the examples in (5a), whose vowels are followed by consonants. Yet, reduction to schwa is slightly better for the cases in (76b-e).

The medial stressless /e/'s of the latter examples can also be realized as /I/, a common observation in the literature (cf. Martin 1968, Trommelen & Zonneveld 1979). Trommelen & Zonneveld (1979) characterize this process as raising, possibly triggered by the high glide /j/ that is inserted into the hiatus after /e/. Alternatively, if it is assumed that /I/ and /e/ are not height variants but just length variants, the process can be typified as a vowel shortening in stressless syllables. The height value 'mid' for /I/ - instead of 'high' - is well-motivated phonetically, see for instance the vowel triangle of Nooteboom & Cohen (1984:76).

Instead of reducing to schwa, /i/ may coalesce to the glides inserted after them (*k*[w]*ala*, *p*[j]*ano*). There is no intermediate schwa-stadium in this process, however.

Summarizing, vowel reduction to schwa before inserted glides seems to be blocked in initial pretonic positions, but possible in other positions. It is not so salient in these positions however, for two reasons. First, other reduction processes apply here (vowel raising/shortening, gliding, elision). Second, the vowels that do not so easily fall victim to these alternative reduction processes are inherently harder to reduce (we will come back to the relation between vowel quality and reduction below).

5.4.3 **Conclusion**

We conclude this section by recapitulating our findings. No differences of crucial importance were found between consonants following the vowel. However, the presence as such of a following consonant was found to be a factor of some importance in vowel reduction to schwa: prevocalic vowels do not reduce in initial pretonic positions, even if followed by glides inserted by Homorganic Glide Insertion or /h/, but medial vowels reduce much easier under these circumstances.

5.5 **Vowel quality**

5.5.1 **Introduction**

Vowel quality is quite an important factor for vowel reduction to schwa. In the literature, it is reported that *high* vowels (/i/, /y/, /u/) are harder to reduce than mid and low vowels (/e/, /a/, /o/, /ø/) (cf. Booij 1981). In addition to vowel height, vowel *rounding* is reported to inhibit vowel reduction (cf. Booij 1982b). As we will see, high unrounded /i/ reduces easier than the high rounded /y,u/.

As opposed to height and rounding, *backness* is only marginally relevant. Among the unrounded non-high vowels /e/ and /a/, /e/ reduces best. There is a clear difference

between /e/ and other vowels as to the stylistic interpretation of vowel reduction. For stressless /e/ vowel reduction is possible even in formal styles. But for the remaining vowels, reduction is traditionally called *sub-standard*, or at least restricted to the less formal styles of speech (cf. Booij 1977, 1981, 1982b).
Hence, a reduction hierarchy of vowel quality arises from the literature from /e/, /a/, /o/, /ø/, /i/, to /y,u/. We will illustrate this hierarchy for initial pretonic vowels only, since position in the word does not change the hierarchy, although it has influence of its own, as we will see later. However, we will first go into another important issue that is related to vowel quality, i.e. the issue whether an obligatory vowel reduction rule for /e/ exists in the lexical phonology.

5.5.2 **Underlying schwa or reduction schwa?**

Before discussing the effects of vowel quality on reduction, an important problem should be addressed. As is generally accepted, /e/ is number one in the reduction hierarchy as to vowel quality. At the same time /e/ seems to be far less involved than other vowels in alternations between full vowel and schwa, i.e. in alternations of the type that we defined as relevant for productive vowel reduction. Clearly, /e/ reduces so easily that it is hard to distinguish between an underlying schwa and reduction schwa from /e/. In interstress position, for instance, the distinction between /e/ and schwa is almost completely eliminated, favoring the latter, cf. (77). Of the large number of non-alternating schwa's in this position many are historically derived from /e/. The value of a once full vowel has become completely unrecoverable in the synchronic phonology (cf. Booij 1982b):

(77)	anemoon	desperado	generiek	obelisk	veteraan
	asthenie	element	lateraal	opereer	
	atheneum	federaal	liberaal	referendum	
	ceremonie	genereus	mathematica	vademecum	

Clearly, the extreme productivity of vowel reduction of /e/ has become lexicalized. The question is if this lexicalization takes the form of an obligatory lexical reduction rule affecting /e/ in certain positions, or if the forms in (77) simply contain underlying schwa. It is clear that a distributionally satisfactory analysis cannot stop at simply postulating underlying schwa, since this would leave the near surface gap of /e/ in interstress and other stressless positions unexplained.
A strong argument for deep reduction comes from alternations between an obligatory schwa and a full /e/ in a morphologically related word. These types of alternations are discussed in Trommelen & Zonneveld (1979), who focus on the nearly obligatory reduction of /e/ that can be motivated by alternations such as those below. In (78a), /e/ in the base word alternates with schwa in the derived word; in the (rare) cases of (78b) the reverse situation holds:

(78)	a.	compléet-comple̲téren	planéet-plane̲tárium
		proféet-profe̲téren	atléet-atle̲tíek
		proléet-prole̲tárisch	diéet-die̲tist
		probléem-proble̲mátisch	fenoméen-fenome̲náal
		juwéel-juwe̲líer	gén-ge̲nétisch
	b.	éthe̲r-ethérisch	miníste̲r-ministérie
		ge̲níe-gèniáal	

Another argument for an obligatory lexical reduction rule, put forward in Trommelen & Zonneveld (forthcoming) is the absence of full /e/ word-finally in poststress position of trisyllabic and longer words. That is, next to disyllabic words such as *tóffee*, and longer words as *dóminee*, no longer words such as **domínee* occur, with penultimate stress. This gap can be explained, according to Trommelen & Zonneveld, if it is assumed that a lexical reduction rule obligatorily reduces underlying /e/'s that are stressless. Words such as *tóffee* and *dóminee* survive, since their final syllable may have a lexical stress, a marking that is distributed freely through the lexicon, cf. chapter 4, section 5.2. However, words as **domínee* cannot have a final lexical stress, because of their penultimate stress. Therefore, such words must undergo lexical reduction, wich explains the surface absence of final /e/ in trisyllabic or longer words with stress on the penult.

Notice that this analysis makes two assumptions about lexical reduction. First, it applies word-finally, in contrast to the optional post-lexical vowel reduction rule. Second, it must be obligatory, because no alternations between /e/ and schwa occur in word-final position, and hardly any in medial position.

However, there is a weakness in this proposal which justifies rejecting it. Crucially, assuming underlying full /e/ for surface non-alternating schwa's severely undermines the generalizations of Kager & Zonneveld (1986), cf. chapter 3, section 6.3. For instance, it incorrectly predicts the existence of words ending in velar nasal + velar fricative + schwa, diphthong + [r] + schwa, and [h] + schwa, as well as real violations of the decreasing sonority generalization before schwa[20].

As a conclusion, there seem to be arguments for an obligatory reduction rule of stressless /e/ in the lexical phonology. However, we have argued against an extension of such a rule to final positions.

5.5.3 The vowel quality reduction hierarchy

Let us now discuss the vowel quality reduction hierarchy. First, as illustrated in (71) above, reduction of /e/ is overwhelming, since only few words, mostly with obstruents after /e/, resist reduction. Second, reduction of /a/ is quite usual (79a). In fact, it is difficult to find examples where reduction to schwa is strongly inhibited; this is the case only in extremely infrequent words (79b)[21]:

(79) a.	banáan	papaver	kabaal	b.	lakéi
	kaneel	kapot	tabak		grafiek
	kanon	patat	kabouter		placebo
	kameel	sateh	radijs		latent
	kadaver	katoen	tapijt		banier
	garage	raket	papier		strateeg
	karakter	vakantie	manier		trapezium
	paraat	fabriek	patent		macaber

Third, initial pretonic reduction of /o/ has a quite informal appearance even in frequent words such as (80a). Actually it is hardly possible in the majority of cases, cf. (80b):

(80) a.	koníjn	politie	b.	toníjn	roman	moreel	totaal
	komiek	profijt		komijn	kopie	lokaal	proces
	tomaat	produkt		komeet	proleet	motief	loket
	kolonie	kroket		moment	Molukken	notaris	toneel

Fourth, /Ø/ hardly occurs in stressless positions, such as initial pretonic position. Still, some reducible cases (81a) and irreducible cases (81a) can be found:

(81) a.	neuróse	neurotisch	b.	Teutóon	pleuritis

Since /Ø/ is so rare, it is difficult to assess its position in the reduction hierarchy. We will group it with /o/ for its feature composition [+round, -high].
Fifth, /i/ is close to /o/ in its reduction potential. It is difficult to find easily reducing examples of /i/ (82a), compared to the numerous reluctant cases (82b):

```
(82)a. minúut   Michiel     b. divérs   pikant    spinazie kwitantie
       mirakel  bikini         gitaar   tribune   bizar    klimaat
       visite   figuur         citroen  pineut    zigeuner piloot
       rivier   vizier         likeur   niveau    diploma  privé
```

Finally, the round high vowels are extremely resistant to reduction. Rare examples of reducing /y/ and /u/ are in (83a) and (84a), and irreducible cases in (83b) and (84b):

```
(83)a. muziek   b. punaise  bureau   fluweel  butaan    sukade   student
       rumoer      funest   puree    juweel   brutaal   publiek
                   tumult   furore   stupide  futiel    rubriek

(84)a. Suzuki   b. couplet  toupet   foedraal couveuse  bougie
                   coupon   routine  boeket   bouvier
```

Summarizing, only /e/ and /a/ are regularly reducing, /o/ and /i/ reduce only in very informal speech, whereas /y/, /u/, and /Ø/ hardly reduce if at all. For the moment, we make up a reduction hierarchy (85):

```
(85) Reduction hierarchy based on vowel quality
     a. /e/: [-high, -round]
     b. /a/: [-high, -round]
     c. /o/: [-high, +round]
        /Ø/: [-high, +round]
     d. /i/: [+high, -round]
     e. /u/: [+high, +round]
        /y/: [+high, +round]
```

The hierarchy seems to reflect the feature contrasts between schwa and full vowels, where schwa is [-high, -round]: the more a vowel differs from schwa in its feature values, the harder it reduces. As schwa is phonologically feature-less, and phonetically an unrounded mid vowel, the more the feature specifications of a vowel differ from the reduction vowel, the harder it will reduce. This matches, for example De Schutter (1978), who characterizes vowel reduction as a neutralization process eliminating the specifications for the vocalic place features[22]. It may then be asked why /e/ is better reducible than /a/. Presumably, /a/'s lowness - as opposed to /e/'s mid character - is of importance.

5.6 Position

In a sense different from secondary stress by constituency, position in the word is relevant to vowel reduction. First, reducible positions may differ as to reduction order. For example, in a string of two stressless medial syllables - as in *lòkomotíef* - the first reduces much more easily than the second (cf. Booij 1977, Van Zonneveld 1980). Second, position is crucial because final open syllables are irreducible (cf. Booij 1977), even if they are analysed as stressless according to the analysis of chapter 4.

5.6.1 **Final syllables**

First, vowel reduction is blocked in (open) final syllables (cf. Booij 1982b, Slootweg & Wester 1986). The blockade is absolute in word-final vowels, and the following examples can be extended with many more[23]:

(86)	cóla	taugee	foto	koffie	Malmö	accu	opoe
	Hema	sateh	kilo	herrie	Stafleu	Pripu	hindoe

Nevertheless, certain types of final syllables, with short vowels and a single closing consonant, are claimed to be reducible (cf. Booij 1977, 1982b). Much lexical variation exists, and reduction is inhibited as compared to non-final positions. Still, final syllable reduction is a real option in the cases to be discussed below.

The set of reducible final closed syllables more or less coincides with those that can be reduced non-finally - and that were argued to undergo Deweighting (45), cf. section 4.4.1: syllables with short vowels that are closed by /r/, syllables with short front vowels - /I/, /oe/, and /ɛ/ - closed by /s/ or sonorants. Vowel reduction to schwa is slightly easier in final syllables preceded by primary stress (87). Reduction in words stressed on the antepenult is more difficult, though possible in some cases (88).

(87)a.	mótor	b. Mózes	Hermes	Artis	c. ídem	pronomen
	professor	Hades	Mercedes	kermis	harem	honing
	doctor	praeses	Celebes	dosis	item	Strepsil
	radar	diabetes	Andes	ibis	totem	Persil
	Kaspar	mores	herpes	salaris	amen	denim

(88)a.	lúcifer	b. rábies	Genesis	c. réquiem
	Jupiter	Aristoteles	clitoris	Jeruzalem

Furthermore, words in *-us* and *-um*, cf. chapter 4 (37-38-39), can be added to the cases in (87,88b) and (87,87c), respectively.

Reduction is clearly lexically governed, because non-reducible cases are numerous. A selection is represented below:

(89)a.	dónor	b. ágnes	atlas	kokos	c. móslim	Kremlin	Karin
	mónitor	lítotes	ananas	albatros	ínterim	Zeppelin	Nasivin

The clearest systematic difference with the set of syllables undergoing Deweighting (45) is the exclusion of final reduction in final /Os/ and /ɑs/.

As expected, vowel reduction is blocked in any other final short vowel syllable, which our analysis predicts to be stressed. This can be shown for short back vowels plus /s/ in (90a), short back vowels plus sonorant in (90b), and short vowels plus obstruents - other than /s/ in (90c), the syllable types that do not undergo Deweighting (45)[24]:

(90)a.	hárnas	b. Mírjam	slálom	c. Bíbeb	Tíbet	Brócacef
	Jonas	sesam	Sodom	kretek	álfabet	únicef
	sinas	mustang	molton	Opec	Asef	Tóeareg
	kosmos	rotan	claxon	sorbet	Amev	Márrakesj
	kokos	sambal	menthol	sovjet	Prokófjev	Elízabeth

The final cluster /Ik/ deserves some special attention, as it reduces in words such as *perzik, tonic, havik, mierik*. It is not clear whether the 'full vowel variant' [Ik] is just a realization of an underlying schwa, colored by the following consonant. This is especially so in the case of /Ik/ and /Iŋ/, where ə may be raised (palatalized) by the following consonants (cf.

Trommelen 1983). For this reason, we will stick to the generalization that before obstruents no reduction takes place.
Summarizing, vowel reduction in final syllables is strictly blocked in vowel-final syllables (86), and in syllables that are outside the scope of Deweighting (45), but allowed - with much lexical variation - in the syllable types that were argued to undergo Deweighting in section 4.4.1.

5.6.2 **Non-final syllables**

Among non-final syllables, a reduction hierarchy according to position in the word is claimed to exist (cf. Martin 1968, Booij 1977, 1981, 1982b, Van Zonneveld 1980, 1982, 1983, 1985, Slootweg & Wester 1986).
First, syllables in interstress position - preceding primary stress and following a rhythmic secondary stress - reduce very easily. Interstress reduction of /e/ is overwhelming (cf. Martin 1968), so that it is even hard to find alternating pairs for /e/-ə, cf. (91a).

```
(91)a. pròcedé          b. pàradíjs   limonade   jubileum
       miserabel           vitamine   mayonaise  aspirine
       leukemie            apparaat   chocola    seminarie
       conferentie         mandarijn  monopolie  privilege
```

Second, post-tonic positions are claimed to facilitate reduction (cf. Martin 1968). Again, alternating /e/-ə pairs are hard to find (92a):

```
(92)a. résedà          b. cárnavàl Salomon     dominee
       omega              ananas   katalogus   risico
       epenthesis         marathon alcohol     minimum
       Andromeda          alfabet  piccolo     alibi
```

Third, in a sequence of stressless medial syllables, the first syllable reduces more easily than the second syllable. This can be seen best in sequences of stressless syllables with identical vowels (cf. Booij 1977):

```
(93) èugenetíek   abracadabra  lokomotief  feliciteer
     antecedent   reparateur   fonologie   certificaat
     acceleratie  declaratief  economie    solliciteer
```

Fourth, the initial pretonic position more or less matches the (medial) pretonic position of the words in (93) as to reducibility (cf. Van Zonneveld 1985). Possibilities of reduction in these positions are roughly similar but certainly fewer than those in interstress (92) and medial post-tonic position (93). This can be illustrated by pairing examples with similar vowels according to their position as in (94). The reducibility contrast is shown for /o/ and /i/, which reduce easily in interstress and medial post-stress position (94a), but hardly if at all in initial pretonic and medial pretonic position (94b).

```
(94)a. àutomáat  - àutomatíek   b. motíef  - lòkomotíef
       specifiek - specificeer     citeer  - feliciteer
```

The similarities between the positions in (94) will be analysed in section 7.2 below.

5.7 **Vowel shortening and reduction to schwa**

As has been discussed in section 4.4.3, long vowels in initial syllables outside primary stress may shorten. We assumed a shortening rule to this effect, which requires a consonant following the focus vowel. However, a subset of the vowels undergoing shortening may also be reduced to schwa. This subset consists of vowels in initial pretonic syllables:

(95)	a. [a]-[ɑ]-[ə]	b. [o]-[O]-[ə]	c. [i]-[I]-[ə]	d. [e]-[I]-[ə]
	banaan	politie	minuut	select
	kanarie	kolos	rivier	relatie

Heeroma (1960) suggests that vowel reduction to schwa is the final stage in a series of reduction steps. Free (long) vowels go to schwa through an intermediating checked (short) vowel. Martin (1968) remarks that this reductional sequence is characterized by a weakening of the articulatory effort: stress weakening elicits decreases in both duration and quality of the reducing vowel. Some further evidence for step-wise reduction is the fact that the three reductional phases are on one line in the vowel triangle, from which it follows, for example, that centralization from /e/ to /ə/ has /I/ as a natural intermediate phase.

If this is correct, the obvious question is whether *underlyingly* short vowels reduce as well. The answer turns out to be positive:

(96)	a. terréin	b. ballón	c. commíssie	d. syllábe	e. pullóver
	perron	grammatica	collega	misschien	supporter
	terras	cassette	commando		suppoost
	dessert	rapport	communie		buffet
	messias	matthijs	commode		summier

Nevertheless, there is lexical variation, as reduction seems to be blocked in (97):

(97)	a. dresséer	b. barráge	c. sonnét	d. millénium	e. ---
	meccano	passaat	correct	diffuus	
	dressoir	bassin	fossiel	missaal	

Since vowel reduction is possible in a large number of examples, there are no reasons for considering the short vowels of (96) to be in closed syllables on the basis of vowel reduction.

5.8 Conclusions

In this section, we have shown that vowel reduction is an optional and lexically governed phenomenon, whose application is either inhibited or stimulated by at least five phonological factors (we did not take other types of factors into consideration): stress, syllable structure, segmental context, vowel quality, and position. For the final three of these factors, an essentially gradual influence was demonstrated. In the following discussion of the literature on vowel reduction, we focus on two factors, *vowel quality* and *position* in the word. The interaction of these factors will later (in section 7.2) be shown to have interesting properties that can be interpreted as evidence for the representation of stressless syllables that we have argued for in section 4.

6. The literature on Dutch vowel reduction

6.1 Introduction

In this section, we will review the phonetic and phonological literature on vowel reduction in Dutch, in as far it has not been covered already by the descriptive statements discussed in section 5. The principal aim of this discussion is to review phonetic and phonological points of view with respect to the factors *position* in the word, and *vowel quality*.

6.2 Dutch vowel reduction from a phonetic point of view

In this section, we will review the literature on vowel reduction in Dutch that is directly relevant to our purposes, i.e. primarily vowel reduction to schwa as a function of vowel quality and position in the word.
Phonetically, vowel reduction to schwa is the endpoint of an essentially gradual centralization in the vocalic space, as defined by the two lower formants F_1 and F_2. This centralization is seen as a consequence of the fact that speakers tend to minimalize their articulatory effort, within the limits defined by sufficient intelligibility on the hearer's part (cf. Koopmans-van Beinum 1980). Diminishing the articulatory effort leads to shortening of vowels, and a resulting failure to reach the target values of the basic formants. Gradual centralization is not limited to vowels that are phonologically 'stressless', but can affect any vowel depending on the presence or absence of pitch accent, style of speech, tempo, and vowel quality (cf. Nooteboom & Cohen 1984)[25].
From a phonetic perspective, the term "vowel *contrast* reduction" is more accurate than vowel reduction as such to distinguish the *spectral* aspect of vowel reduction from the *durational* aspect that is involved. Although it is generally assumed that the shorter duration of stressless syllables leads to centralization by the failure of reaching target formant values of the vowels, the acoustic measures of duration and centralization are different. We will follow this distinction, and review the literature in two parts, one on spectral reduction and one on durational reduction.

6.2.1 Spectral reduction

Koopmans-van Beinum (1980) studies vowel contrast reduction acoustically and perceptually. In a perceptual experiment, subjects were asked to identify isolated vowels in three conditions, (a) vowels produced in isolation, (b) accented vowels from isolated words, and (c) non-accented vowels from free conversation. The results are as follows. First, the percentage of correctly identified vowels decreases as a function of the three conditions (a-c). In all conditions, identification turned out to be different per vowel. For the vowels in condition (c), the differences were most substantial. The proportion of correctly identified vowels are then as follows:

(98)	/a/	/e/	/ɛ/	/ø/	/o/	/ɑ/	/ɪ/	/y/	/i/	/ɔ/	/u/	/ə/
	3.8	4.6	18.8	19.5	20.6	29.5	34.7	37.7	38.3	48.9	68.5	68.9

Koopmans-van Beinum concludes that "the so-called 'long' vowels [i.e. /a/, /e/, /ø/, /o/], and possibly the vowel /ɛ/ too, seem to obtain too short a duration in free conversation to be identified correctly." In this condition, 82.7% of the 'long' vowels were incorrectly identified as 'short' ones. Also, the 'long' vowels /a/ and /e/ were used least as identification category in general.
Koopmans-van Beinum (1982) remarks that [e] and [ɛ] reduce so easily because of their relatively centralized place in the vowel triangle. Moreover, she remarks that consonants

may have a centralizing effect on the preceding vowel, especially [r] and other sonorant consonants.

6.2.2 **Duration**

Nooteboom (1972) finds that durational differences between stressless vowels, measured in nonsense words with identical syllables, are related to the number of syllables preceding and following in the word. Moreover durational differences between stressless vowels were found to be related to the position of the syllable before a stressed or stressless vowel. Some of his conclusions are the following:

a. The duration of the vowel in a stressless syllable is negatively affected by the number of syllables in the word that remains to be produced.
b. The duration of the vowel in a word-initial stressless syllable is markedly longer than in a medial stressless syllable.
c. The duration of a vowel in an initial stressless syllable is shorter when immediately preceding a stressed syllable than when immediately preceding a stressless syllable.
d. The duration of the stressless vowel in the final syllable of the word is nearly as long as the duration of the stressed vowel in the same position.

These conclusions were confirmed fairly well by a perceptual experiment in which subjects were asked to optimally adjust the length of vowels in various positions according to their intuitions.

Interestingly, Nooteboom argues that the durational effects on vowels of position and stress are due to linguistic factors: "many details in the durational build-up of speech are reflected in the implicit knowledge language users have about their language, and as such, are a legitimate object of linguistic description which cannot easily be accounted for in the discrete linguistic specification of speech."

Slootweg (1988) elaborates on the findings of Nooteboom (1972), and also relates duration and relative prominence in arboreal metrical trees, as resulting from the proposal by Slootweg & Wester (1986). Her findings can be summarized as follows. The durational pattern of the portion of the word that precedes the primary stress shows rhythmic properties. In strings of two, three, or four syllables preceding the primary stress, the initial syllable is the longest (*automáat, lokomotíef, onomatopée*). The relative duration of the remaining syllables in such strings depends on their position. In a sequence of two medial syllables (*lokomotief*), the rightmost one is a bit longer than the leftmost one. In a sequence of three medial syllables (*onomatopee*), the middle one is longer than the leftmost and rightmost syllables, which themselves do not differ in duration. The relative duration of medial stressless syllables in words such as *onomatopee* casts doubts on Nooteboom's conclusion that the duration of stressless syllables simply decreases with the number of syllables that remain to be produced. Instead, a clear rhythmically alternating durational pattern exists[26].

As to the relative duration of peripheral syllables, Slootweg supports Nooteboom's findings. Final stressless syllables are always long, about as long as that of the syllable with primary stress. Furthermore, their duration is fairly independent of the position of the primary stress on the penult or antepenult. Initial syllables are generally longer than medial syllables, and slightly shorter when primary stress immediately follows.

6.3 Dutch vowel reduction from a phonological point of view

6.3.1 Introduction

Several properties of phonological vowel reduction can be understood by inspection of phonetic factors. However, vowel reduction has properties which are completely unpredictable from a phonetic point of view, the most important being its language-specific properties and its lexical idiosyncracy. The acoustic realization of a vowel depends upon its value after the phonological component, including optional vowel reduction to schwa, as well as the degree to which it falls victim to phonetic vowel contrast reduction. Phonological vowel reduction to schwa (historic or synchronic) is the grammaticization of the "natural" phonetic principle of minimal effort (cf. Booij 1982b).
In this section, we will review phonological literature on Dutch vowel reduction, as far as relevant to the observations made in section 5.6. We will concentrate on reduction hierarchies as a result of position in the word.

6.3.2 Booij (1977, 1981)

Booij's contribution consists of formalizing Dutch vowel reduction as a style-dependent phenomenon, composed of different rules with their own stylistic "thresholds". To express this claim, Booij invokes Dressler's (1975) hypothesis that style-dependent rules are major rules in informal speech, but minor rules in formal speech. The application of rules of less formal styles of speech entails the application of rules of more formal styles of speech[27]. According to Booij, a rule which reduces the first in a sequence of stressless vowels with identical vowel contents (cf. 93) applies in rather formal speech, or Style II. The rule which reduces medial pretonic vowels, such as the second in a sequence of stressless vowels (93), applies in a more informal style of speech, Style I. This accounts for the order in which the vowels of *lok<u>o</u>m<u>o</u>tief* reduce:

```
(99) Style III (very formal)  : [lokomotif]
     Style II (rather formal) : [lok∂motif]
     Style I (informal)       : [lok∂m¶tif]
```

By Dressler's hypothesis, the application of a rule of Style I entails the application of all rules applicable in Style II. Therefore, the form *[lokom∂tif] is excluded.

6.3.3 Van Zonneveld (1980, 1982, 1983, 1985)

Van Zonneveld analysed Booij's observation about the reduction order in words such as *lokomotief* as being due to the rhythmic ambiguity of the second in the string of medial syllables. This rhythmic ambiguity is the consequence of two, rhythmically opposed, forces. First, an alternating rhythmic principle, the *Trochee Principle*, cf. section 3.1, assigns a strong-weak pattern starting from the word beginning. By this principle, a syllable at uneven distance from the word beginning (initial, third, etc.) will be rhythmically strong. Second, a clash avoidance principle is at work, according to which the pretonic third syllable in *lokom<u>o</u>tief* must be rhythmically weak. The result of these opposed tendencies is referred to as the *Janus Syllable* by Van Zonneveld:

```
(100)a.  s  w s/w  s        b. s/w  s
         lo ko mo  tief        to   maat
```

Notice that initial pretonic syllables are Janus Syllables by the same criterion. Here, the Hammock Principle (or even the Trochee Principle, starting from the word beginning) would predict rhythmic strength, but clash avoidance predicts otherwise.

The reduction hierarchy among the medial syllables in (100a) reflects the rhythmic ambiguity of the Janus Syllable. The first of the two is weak by any criterion, and reduces prior to the rhythmically ambiguous Janus Syllable.

6.3.4 **Neyt & Zonneveld (1982)**

Neyt and Zonneveld (1982) argue that the domain of vowel reduction is the foot, more specifically the *weak* foot. Assuming a general condition that metrically strong syllables cannot be reduced, reducible syllables are (a) metrically weak syllables in weak feet, cf. (101bd), and (b) metrically unspecified syllables in weak feet, cf. (101ac):

```
(101)a.            b.     /\           c.    /\           d.       / \
          /\             /  \               /  \                  /   \
         /  \           /    \             /    Fs              Fw     \
        Fw Fs          Fw     Fs          Fw    /\              /\      Fs
        |   |          / \    / \         |    /\ \            /\ \     |
        ba naan      ma ca  ro ni         Je ru za lem       lo ko mo tief
```

This analysis is an attempt to account for the irreducibility of final stressless syllables (101bc), based on the fact that such syllables occur in *strong* feet. However, the analysis falsely predicts that penultimate syllables in words with antepenultimate stress (101c) are irreducible, since these occur in *strong* feet as well. A second criticism that can be raised against this analysis is the theoretically odd move to reduce the head of a monosyllabic foot (101a). In the theory of Selkirk (1980) that served as Neyt & Zonneveld's framework, the head of a foot is stressed by definition, regardless of its s/w label.

6.3.5 **Slootweg & Wester (1986)**

Slootweg & Wester (1986) make an attempt to derive reduction orders from relative prominence values, as predicted by the counting algorithm that is proposed in Liberman & Prince (1977), cf. chapter 0 (32). The trees assumed are essentially the same as the ones of Neyt & Zonneveld (1982), with an important difference as to the final syllable. The reluctance of final syllables to reduce is taken to reflect their relatively high prominence value, i.e. the second prominence in the word. This is achieved by marking final (non-superheavy) syllables extrametrical and adjoining them by Stray Syllable Adjunction to the root of the tree, instead of to the preceding foot, cf. (102abc):

```
(102)a.        /\              b.   /\             c.              d.
              s  \                 s  \                                 /\
             / \  \               / \  \                 |\            /  \
           Fw   Fs \            Fw  Fs  \                Fs\          Fw  Fs
           / \   |  \            |   |   \               |  \         |    |
         ma  ca  ro <ni>em      ko  lo <nie>em          ga <la>em     ba naan
          3   4   1   2          3   1   2               1   2         2   1
```

The counting algorithm identifies such syllables as the least embedded weak nodes, and therefore assigns the relative value '2'. Notice that a vowel's relative prominence value does not correspond to an absolute threshold of reduction, since the syllable marked '2' in (102d) is reducible, but the final syllables with the same relative prominence (102abc) are not. Also, the syllable marked '3' in (102b) is reducible, but the syllable with the same value in (102a) is not. Therefore, the explanatory force of the proposal with respect to final vowel irreducibility (or actually, the reduction possibilities of individual syllables) is moderate. The second objection concerns the use of syllable extrametricality in order to derive '2-stress' for final syllables. Apart from the theoretical oddity of promoting extrametrical material, we have shown in chapter 4 that the generalizations of primary stress placement in Dutch are not compatible with rule-based syllable extrametricality applying before constituent construction.

6.3.6 **Kager, Visch & Zonneveld (1987)**

Kager, Visch & Zonneveld (1987) base vowel reduction on the presence or absence of stress, in stead of relative prominence, as Van Zonneveld and Slootweg & Wester propose. Final vowel irreducibility can therefore not be derived from secondary stress values, or from position in a foot, but must be stipulated as such. Reducibility of non-final syllables is accounted for as follows. First, only syllables that are in the weak position of a foot can reduce - notice the deviation from Neyt & Zonneveld (1982). The consequence of this assumption is that initial pretonic syllables must be adjoined as weak syllables to the following foot, cf. section 3.2.4. Second, it is assumed that the stray syllable that results after applying leftward adjunction (34) is adjoined rightward by (36), so that it ends up in the same structural position as initial pretonic syllables:

```
(103)a.            b.      /\             c.       / \
                          /  \                    /   \
                         /    \                  /     \
            F           Fw     Fs               Fw      Fs
           / |          / \    / \              / \    / |
         ba naan      ma ca ro ni          lo ko mo tief
```

The stressless syllables adjoined rightward in (103ac) match the Janus Syllables of Van Zonneveld (1980, 1985). Therefore, the vowel reduction rule can refer to a weak syllable's position with respect to the head of the foot, in order to account for reduction orders. The disadvantage of this analysis is the odd rightward adjunction rule that must be assumed in order for these generalizations to be made. As we remarked in section 3.2.4, the resulting right-dominant foot type radically deviates from the left-dominant binary feet that is basic in Dutch word stress.

6.4 **Conclusions**

After reviewing the literature on Dutch vowel reduction, we can conclude that attempts have been made to relate a syllable's position in the word and its (relative) reducibility. Partly, these attempts took duration as the key notion (cf. Nooteboom 1972, Slootweg 1988, Slootweg & Wester 1986). Such approaches attribute the crucially gradual nature of reduction to the inherently gradual nature of duration. Nevertheless, we have found that complete reduction to schwa, the phenomenon that we are interested in here, also requires an essentially binary distinction between irreducible and reducible syllables. For instance, the Slootweg & Wester analysis does not cover the fact that initial secondary stress blocks reduction, and in fact fails to capture the absolute nature of irreducibility in final vowels. Therefore, approaches based on relative prominence, durational or not, must be supplemented by the notion of secondary stress, and as it seems, by some absolute prohibition against final vowel reduction. In other approaches, such as those based on word-internal rhythmic strength (cf. Van Zonneveld 1985), a promising distinction is made between 'regular' weak syllables, 'Janus syllables', and 'strong syllables', which may be a basis for analysing the more absolute properties of reducibility. The use of strong syllables matches our notion of (secondary) stress. In the sections below, we will reinterpret the distinction between regular weak syllables and 'Janus syllables' as one between adjunct syllables and stray syllables.

7. Secondary stress and vowel reduction to schwa

7.1 Introduction

In this section we will discuss the relation between metrical structure and vowel reduction in some more detail, and more specifically, present evidence in favor of the distinction between stressless stray syllables and stressless syllables that are adjuncts in binary constituents. This section is organized as follows. Departing from observations on orders of vowel reduction related to position in the word (cf. Van Zonneveld 1985, Booij 1981), we will argue that a dichotomy exists between two types of positions as to vowel reduction. First, positions directly following a stressed syllable; these are most favorable to vowel reduction. Second, positions that do not follow a stressed syllable, but directly precede a stressed syllable; these are slightly less favorable to vowel reduction. Then we will show that these positions can be typified in our framework in a maximally generalized way as *adjunct* positions and *stray* positions. Structural equivalence between positions will be shown to correlate in a direct way to equivalence between the positions in their vowel reduction possibilities. The key idea is formulated as the hypothesis in (104):

(104) Structurally identical positions behave identically with respect to vowel reduction to schwa.

We will show that hypothesis (104) accurately describes reducibility in various positions, when (a) applied to the output representations of rules such as level-2 Syllable Adjunction (46), and (b) relativized to vowel quality and stylistic level.

In this section we will investigate the relevance of the observations in the literature, and extend or refine them when possible. Our extensions and refinements of the observations will be supported by representative data from a large collection. Wherever possible, underived words will be used as examples; we cannot always guarantee this, since words that are both underived and long enough are scarce. We will trace the interaction of the vowel quality hierarchy and the positional hierarchy by comparing different vowels in different positions, within the (stylistic) range of formal to less formal speech. Our conclusions support hypothesis (104).

7.2 The interaction between the vowel reduction hierarchies

It has been pointed out by Booij (1977) that in sequences of stressless syllables with identical vowels, a position hierarchy exists according to which the vowels reduce, cf. (94). Booij concludes that vowel reduction is not a unitary phenomenon, but a conglomerate of (at least) two vowel reduction rules in different stylistic strata, in the sense of Dressler (1975).

This phenomenon of reduction orders brought Van Zonneveld (1985) to the notion of 'Janus syllable', cf. (100). According to Van Zonneveld, the Janus syllable is a syllable that, on the one hand, is entitled to rhythmic strength for its place as counted from the word begin, but, on the other hand, inhibited in rhythmic strength because of its adjacency to the following primary stress.

Apart from this positional vowel reduction hierarchy, a hierarchy as to vowel quality is mentioned in the literature. The feature specifications [+high] and [+round] are known to inhibit vowel reduction to schwa, cf. section 5.5.3.

By hypothesis (104) of section 7.2, structurally similar positions will exhibit similar reduction behavior. As far as representations like (38, 47) reflect a specific theory of stress, the validity of this theory may well be tested by confronting the representations with phenomena that were outside their original scope. Let us first inventarize the similar stressless positions that our analysis predicts to exist. Essentially, two types of stressless positions can be distinguished, adjunct (bound) positions as in (105a), and stray (free) positions as in (105b):

```
(105)a. (*  .)    b.  .
            _         _
```

These positions arise in a range of prosodic structures, the most common of which are below for adjunct (106) and stray (107) positions:

```
(106)a.         *    b.            *     c.             *    d.  *
      (*  .)    *       (*  .) .   *       (*  .)(*  .) *       (*  .) *
       v  v     -        v  v  v   -        v  v  v  v  v        v  v  -
       a po theek        lo ko mo tief      o no ma to pee       Sa lo mon

(107)a.    *         b.            *
        .  *            (*  .) .   *
        v  -             v  v  v   -
       mo tief          lo ko mo tief
```

For these positions, we will illustrate the following generalization:

```
(108) For vowels whose reducibility depends on position, reduction is
      generally easier in adjunct positions than in stray positions.
```

Let us now consider adjunct and stray positions and try to determine the stylistic level of reduction for individual vowels. This will be done by estimating the 'minor' or 'major' rule character of vowel reduction of a specific vowel, according to the three stylistic strata that are assumed in Booij (1977): Style I (informal), Style II (rather formal), and Style III (very formal). We will abstract away from the factor word frequency, evaluating the reducibility of individual vowels on the basis of a large number of words.

First, reduction of /e/ is very common, and as we said before, schwa's alternating with [e] are scarce, suggesting an accumulation of favorable factors to a point of reduction becoming almost obligatory. Clearly, this type of reduction is a major rule even in Style III (formal), for both adjunct (109) and stray (110) positions:

```
(109)a. pròcedé     b. lìteratúur  c. èncyclòpedíe    d. résedà
        atheneum       acceleratie    representatief     omega
        anemie         adrenaline     systematiseer      cinema
        leukemie       hegemonie      proletariaat       Andromeda
        halleluja      temperatuur    econometrie        Genesis

(110)a. medáille    b. àntecedént
        senaat         hypothenusa
        clematis       epidemie
        veranda        anesthesie
        melange        filatelie
```

Second, reduction of /a/ is also quite common, but stylistically it must be categorized as Style II (less formal) for both types of positions:

```
(111)a. kàramél     b. àbracadábra  c. pàrallèllográm   d. álmanàk
        paradijs       amanuensis      bagatelliseer       ananas
        sigaret        eucharistie     syllabificeer       Panama
        mandarijn      calamiteit      representatief      Jeruzalem
        permanent      cavalerie       collaborateur       alfabet
```

(112) a.	radíjs	b. àbracadábra
	banaan	literatuur
	kameel	panoramiek
	karakter	rozemarijn
	kalender	apocalyps

Turning to /o/ and /i/, differences arise between the two basic stress positions, adjunct and stray. For these vowels, reduction in an adjunct position is a Style II rule, cf. (113), whereas reduction in a stray position is a Style I rule, cf. (114)[28].

(113) a.	chòcolá	b. lòkomotíef	c. ònomàtopée	d. trémolò
	karbonade	economie	parallellogram	piccolo
	limonade	automatiek	etymologie	Salomon
	polonaise	laboratorium	antropologie	katalogus
	peloton	adolescent	mythologiseer	alcohol
	rèlikwíe	kàrikatúur	ìndivìduéel	dóminèe
	discipline	certificaat	specificiteit	lilliput
	vermicelli	feliciteer	politicoloog	spiritus
	jubileum	individu	mythologiseer	Olivier
	politiek	participeer	etymologie	alibi

(114) a.	polítie	b. lòkomotíef
	konijn	economie
	tomaat	ceremonie
	kolonie	anakoloet
	koraal	categorie
	pikánt	cèrtificáat
	minuut	hallucineer
	visite	pacificeer
	rivier	individu
	vizier	acetyleen

We turn to the high rounded vowels, finding an even greater reluctance to reduction. In adjunct position, reduction of /u/ and /y/ is informal, cf. (115), but in stray position, it is wellnigh excluded, cf. (116):

(115) a.	àlumínium	b. mànufactúur	c. nàturàlisée r	d. prímulà
	formulier	illumineer		stimulus
	populier			Hercules
	communist			
	monument			
	jàloezíe	---		
	tamboerijn			
	camouflage			
	limousine			
	entourage			

(116)	a. muziek	b. spèktakuláir
	punaise	partikulier
	rumoer	vocabularium
	tumult	tuberculose
	fluweel	
	soeláas	---
	poelet	
	roulette	
	moeras	
	boeket	

The reducibility of individual vowels in adjunct and stray positions can be summarized as in (117):

(117)	**Adjunct positions**	**Stray positions**
/e/	Style III	Style III
/a/	Style II	Style II
/o/, /i/	Style II	Style I
/y/, /u/	Style I	excluded

7.3 Reduction orders among syllables in the same word

Apart from the stylistic levels of reduction for individual vowels that have been estimated in the previous section, there is a second way of demonstrating a hierarchy between stray and adjunct positions. This is a direct comparison of reducibility between vowels in the same word. First we will consider sequences of identical vowels. Then we will compare different vowels, and test the predictions that arise from the stylistic levels of reduction of different vowels with respect to position that we have motivated in section 7.2.

First we will observe the reduction order in sequences of two identical stressless vowels, in words such as *lokomotief*. These words are of the type which Booij (1977) and Van Zonneveld (1980) have used to illustrate a positional reduction hierarchy between stressless syllables:

(118)	a. èugenetíek	b. àbracadábra	c. lòkomotíef	d. fèlicitéer
	antecedent	reparateur	economie	individu
	confederatie	declaratief	filosofie	certificaat

First, satisfactory examples with sequences of /e/ are hard to find, due to the almost obligatory schwa's in these positions (as an illustration, consider the word *evenement*, with two obligatory schwa's in a row). This makes a comparison between two /e/'s in a sequence difficult. However, there is certainly no large difference in reduction potential between both positions, since all possibilities seem to be well-formed: *eug*[e]*n*[e]*tiek*, *eug*[ə]*n*[e]*tiek*, *eug*[e]*n*[ə]*tiek*, *eug*[ə]*n*[ə]*tiek*. This is in conformity with our finding of section 7.2, that reducibility of /e/ is a major rule in Style III for both stray and adjunct positions.

Second, turning to /a/ in (118b), we predict that all four possibilities of reduction occur, since reduction is a major rule in Style II for both adjunct and stray positions. Interestingly, in the literature different claims are made about the reduction order of the stressless syllables in *abracadabra*. Booij (1977) claims the realization *abr*[a]*c*[ə]*dabra* to be ruled out, whereas Slootweg & Wester (1986) exclude *abr*[ə]*c*[a]*dabra*. Although perhaps Booij's judgement may be somewhat more accurate, the [a]-[ə] form simply cannot be completely ruled out. To our mind, the most accurate statement is that different realizations are not very far apart in their acceptability.

The hierarchy between adjunct syllables and stray syllables becomes mandatory, however, when considering the remaining vowels /o/ and /i/ in (118cd). The realization with a full vowel followed by schwa is ruled out for both /o/ and /i/: **lok*[o]*m*[ə]*tief*, **cert*[i]*f*[ə]*caat*. Of course these are the well-known reduction orders, which match the observations on vowel reduction as to positions on their own, that have been made in section 7.2.
Let us now turn to sequences of non-identical vowels. Generally, our predictions are as follows. For a vowel sequence consisting of a first vowel that is higher on the reduction hierarchy than the second vowel, it is predicted both by position and quality that the first vowel reduces prior to the second. The forces of vowel quality and position are directed equally here. The prediction correctly exludes *ac[e]t[ə]leen:

(119) e-a: sùprematíe, adrenaline, literatuur, temperatuur, encefalitis
e-o: hègemoníe, categorie, allegorie
e-i: àcetyléen, aperitief, catechiseer
a-o: ànakolóet, anatomie, farmacoloog, pinacotheek
a-i: càpacitéit, hilariteit

Now, it is interesting to see what happens if the post-stress vowel is not higher, but lower on the reduction hierarchy than the second vowel. Here, vowel quality and position operate in opposed directions. If /e/ is the second in a sequence of two non-identical vowels, it is the first to reduce:

(120) a-e: fìlatelie, bilateraal, paragenese, intraveneus
o-e: àdolescént, fenomenaal, hypothenusa, isomerie, logopedie
i-e: èpidemíe, desideratum

From the ungrammaticality of, e.g., **fil*[ə]*t*[e]*lie*, **ad*[ə]*l*[e]*scent*, and **ep*[ə]*d*[e]*mie*, it follows that pre-stress /e/ is higher up in the reduction hierarchy than post-stress /a/, /o/ or /i/. This matches our observations from section 7.2, where we concluded that reduction of /e/ in stray positions is a major rule in Style III, while reduction of the vowels /a/, /o/, /i/ in adjunct positions is at least Style II.
If /a/ follows a vowel lower on the reduction hierarchy, such as /o/ and /i/, no clear reduction order exists, since all of the realizations that are possible (*lab*[ə]*r*[*a*]*torium*, *lab*[*o*]*r*[ə]*torium*, *lab*[ə]*r*[ə]*torium*) seem to be well-formed. This is the case in (121):

(121) o-a: làboratórium, apocalyps, decoratief, panoramiek
i-a: kàrikatúur, nominatief, indicatief

Therefore, the vowel quality difference between /a/ and /o/, /i/ seems to be largely compensated for by the opposite effect of position.
Finally, from the closeness between /o/ and /i/ on the vowel reduction hierarchy, it is predicted that sequences of /o/-/i/ and /i/-/o/ behave much like sequences of identical vowels. This prediction is borne out in the words below:

(122) o-i Nàpolitáan
i-o crìminolóog, encyclopedisch

The realizations **Napol*[ə]*taan*, **crimin*[ə]*loog*, and **encycl*[ə]*pedisch* are clearly worse than *Nap*[ə]*litaan*, *crim*[ə]*noloog*, *enc*[ə]*clopedisch*.
Words in which the vowel sequences contain [y] or [u] are not relevant for the purpose of establishing reduction orders, since these vowels hardly reduce at all. Let us summarize the results below:

```
(123) a. in sequences of /e/'s and /a/'s, no clear reduction order
         exists.
      b. in sequences of identical /o/'s and /i/'s, the post-stress
         vowel reduces prior to the pre-stress vowel.
      c. in sequences of non-identical vowels, the post-stress vowel
         reduces prior to the pre-stress vowel if it is higher on the
         reduction scale; if it is lower on the reduction scale, the
         order is as follows: pre-stress /e/ reduces prior to any vowel,
         pre-stress /a/ comes about equal to post-stress /o/ and /i/.
```

7.4 Analysis

How do we account for the observations of the preceding sections? By adopting the 'stylistic stratum' framework as introduced for Dutch by Booij (1977), and assuming that each vowel in each position (adjunct, stray) has one stylistic stratum in which it applies as a major rule, the following set-up will do (repeated from 117). In each cell the stylistic stratum of application is mentioned, where the numbers 1-3 refer to the stylistic strata (III: very formal, II: rather formal, and I: informal):

(124)

	adjunct	**stray**
/e/	III	III
/a/	II	II
/o/,/i/	II	I
/y/,/u/	I	-

Table (124) accounts for the observed vowel reduction hierarchies in the various positions. It says that in very formal style, only reduction of /e/ occurs as a major rule, that in rather formal style adjunct /a/, /o/, /i/, and stray /a/ reduce (whereas all /e/'s must be reduced), and finally, that in informal style stray /o/, /i/, and adjunct /u/, /y/ reduce.

There is a second way in which (124) accounts for reduction data: from this table, reduction orders between vowels in the same underived word can be deduced. Generally, orders are excluded which involve reduction of a vowel reducing in a stylistic stratum s_i before a vowel reducing in a stylistic stratum s_{i-1}. Therefore, the reduction of the stray /o/ in *lokom<u>o</u>tief*, which is restricted to the stylistic stratum I, cannot take place before the reduction of the adjunct /o/ in the same word, as the latter reduces already in the stylistic stratum II. But no restrictions operate on reduction orders between vowels with identical stylistic reduction classes; thus, in words containing identical sequences of /e/ (such as *eugenetiek*) or /a/ (such as *abracadabra*), all logical possiblities occur, perhaps with minor preferences due to factors left uncaptured by (124); likewise, non-identical vowel sequences such as /a/-/o/ or /a/-/i/ do not show a strict reduction order (*laboratorium*, *karikatuur*).

The exact number of stylistic levels is not essential to the argument, and it is possible that refinements can be made with respect to the stylistic stratal values to specific vowel-position combinations. What counts is that a restricted number of positions (i.e. adjunct versus stray) suffices to describe the effects of position on reduction of vowels of different quality in underived words.

7.5 Conclusions

The structural generalization made here exactly captures Van Zonneveld's distinction between *regular weak* syllables and *Janus*-syllables, without stipulating it as such. Let us again go through the argument. Syllable Adjuntion, cf. chapter 4 (99), renders post-stress syllables as adjuncts to the initial syllable, whereas pre-stress syllables end up in stray position:

```
(125)         *                         *
       . (*  .) *     =>     (*  .) .  *
      lo ko mo tief          lo ko mo tief
```

Notice that this rule was motivated exclusively by the reducibility *as such* of the second syllable in such words. The relocation of the third syllable from adjunct to stray position is a fully automatic result of our analysis, which had not been motivated empirically. However, such evidence has been put forward to support its position.

That is, the stray medial pretonic syllable is structurally identical to the stray initial pretonic syllable of words such as *motief* in reduction possibilities, while the adjunct post-stress syllable is parallel to the interstress syllable of words such as *limonade*.

Notice that the output structure of (125b) results from an independently motivated reapplication of Syllable Adjunction. This rule was motivated by the reducibility *as such* of the second syllable in similar words, not by the *order* of vowel reduction of this second syllable as compared to other syllables. Likewise, the relocation of the syllable in the third position in (125) from an adjunct to a stray position is a completely automatic side-effect of Syllable Adjunction under the premises of our theory, which restricts stress constituents to a strictly binary size. And as far as representations such as (125) reflect a specific theory of stress, the validity of this theory is tested by confronting the representations with phenomena that were outside its original scope.

7.6 Word-final position

Some final remarks are in order as to the absolute prohibition against reduction of word-final vowels. As we already suggested while discussing the data and the literature on reduction patterns, there is no absolute prohibition against reducing final syllables, but rather against reducing final vowels. We will assume that the inhibited vowel reduction of final vowels is due to the more general phenomenon of boundary strengthening. This takes the form of increased duration of vowels in word-final syllables (Nooteboom 1972). Increased length may be assumed to inhibit the reduction potential.

From the literature many wholesale statements against vowel reduction in final syllables can be gathered (most explicitly in Slootweg & Wester 1986). However, the picture is more complex than this, as was shown in the section on reduction of final closed syllables.

A tempting possibility to analyze the failure of reduction in word-final vowels is the following. First, assuming that vowel reduction requires a short(ened) focus vowel in order to apply (cf. Heeroma 1960, Martin 1968), a vowel shortening rule generalized to initial and non-initial positions would be required. Second, since vowels need a following consonant to be shortened, word-final vowels cannot be shortened, and are therefore not reducible. Third, the condition that shortening requires a following consonant might then be related to the fact that no short vowels can occur in open syllables, cf. chapter 3. It must then be assumed that vowel shortening automatically leads to the resyllabification of the following consonant as ambisyllabic. A shortening analysis thus has the advantage of correlating two major observations. First, short vowels do not occur in open syllables. Second, vowel reduction to schwa presupposes vowel shortening.

This analysis runs into the following problems, however. First, it is incorrectly predicted that pre-vocalic vowels are irreducible, as such vowels, like word-final ones, cannot be shortened. However, words such as *Michael* (cf. 73) illustrate the incorrectness of this prediction. Second, the fact that word-final vowels are irreducible can be related equally well to their increased duration by final position (cf. Nooteboom 1972, Slootweg 1988). This increased duration is probably due to the general tendency of final or pre-pausal lengthening. Third, the condition that syllables are minimally bimoraic, that was motivated for level-1 syllabification in chapter 3, cannot be extended to level-2, since here monomoraic syllables with schwa's arise. Moreover, we have argued that reducible closed syllables require an analysis by a level-2 deweighting rule, which also produces monomoraic syllables.

For these reasons, we reject an account of final vowel irreducibility as being based on a blocked generalized shortening rule.

8. Conclusion

In this chapter, we have analysed secondary stress and vowel reduction in Dutch. First, we have shown that our analysis of primary stress of chapter 3, when extended to the portion of the word preceding primary stress, provides a useful basis for describing secondary stress. The most attractive aspects of this extension are twofold. First, the bounded, rhythmically alternating character of secondary stress is derived from Syllable Adjunction, a rule which produces only binary constituents. Second, the fact that closed syllables and syllables with diphthongs do not at all or only rarely reduce is related to the fact that these syllables count as heavy for primary stress assignment, which is Q-sensitive. Therefore, binarity and irreducibility of heavy syllables need not be accounted for in a separate rule of secondary stress.

We have suggested various level-2 stress adjustment rules to bridge the gap between the secondary stress patterns (and possibilities of vowel reduction) that are predicted by the level-1 stress rules and the actual surface patterns. These adjustment rules included reapplication of the Syllable Adjunction rule, Deweighting for a restricted class of closed syllables, a so-called Dutch Arab Rule, and higher level adjunction, or Rhythmic Adjustment.

Furthermore, we have found evidence for the distinction between adjunct and stray stressless syllables, as implied by our analysis of secondary stress. The evidence consists of systematic differences in reducibility between various positions that will be classified under our analysis as adjunct and stray positions. The systematic nature of these differences can be brought to light by relating positions and relative reducibility of various vowels.

Footnotes to chapter 5:

1 See for the notion integrative accent Fuchs (1976). See for an analysis of Dutch accentuation in the focus-accent theory Gussenhoven (1984) and Baart (1987).

2 As shown in Visch (forthcoming), the presence or absence of a final flection schwa in phrases such as (8) and (9) does not systematically affect the possibilities of rhythmic shift.

3 In very informal styles of speech the closing /r/ may be dropped: *k*[ə]*tón*. According to Booij (1977), a stylistic implicational relation exists between the drop of the consonant and vowel reduction in initial pretonic syllables, the latter implying the former. However, forms such as *k*[ə]*rtón* are incorrectly excluded by Booij, we submit.

4 Typically, the reduced closed syllables are in interstress position in these cases, and contain /ɛ/.

5 Van Zonneveld employs the notation of Schane (1979), where s = strong, and w = weak.

6 Actually, Hoeksema & Van Zonneveld argue that Dutch stress is to be represented autosegmentally, i.e. as a system of rhythmic layers, associations between layers, and conditions on associations. They assume autosegmental principles, like the Obligatory Contour Principle, to rule out strings of strong or weak syllables.

7 Van der Hulst claims universal status for this theory, claiming various theoretical advantages. First, it is explained that universally, the iterative assignment of secondary stresses runs from the edge of the word where the primary stress is located. Second, the rhythmic melody is associated to the 'accented' syllable exactly as in tone languages tonal melodies are associated with the accented syllable. However, main stress first theory predicts the existence of systems where primary stress is laid down by an unbounded rule, and secondary stress by the rhythmic melody association. For instance, languages are expected to occur which have primary stress on the rightmost heavy syllable, and otherwise on the initial syllable, and secondary stress on every even syllable on either side of the primary stress. To the best of our knowledge, such languages do not occur. Clearly, the generalization is missed that languages with bounded secondary stress have a bounded primary stress rule.

8 Compare the filter against [-stress] dominated by strong nodes proposed by Liberman & Prince (1977), cf. chapter 1 (121).

9 However, this analysis fails to reduce all stress assignment to binary footing, as it explicitly states the (segmental) conditions under which right-peripheral ternary stress feet are built, for primary stress placement, cf. chapter 4, section 3.5.1.

10 The main problem is that this analysis cannot generate penultimate stress in words of uneven length, nor antepenultimate stress in words of even length.

11 In Kager (1985), this rule much resembles Post-Stress Destressing (Hayes 1981), cf. chapter 1, (151):

(i) F => 0 / $\underset{|}{\mathrm{F}}$ ___ $\mathrm{F_s}$

The difference with PoSD is the fact that (i) is generalized to delete non-branching focus feet, which is motivated as a minor rule for closed syllables such as in *ànekdóte*, where the medial syllable can reduce.

12 (36) is a notational variant of the Pre-Stress Destressing rule proposed in Kager (1985), which deletes a non-branching foot that directly precedes the primary stress.

13 With few exceptions, discussed in chapter 4 section 2.3.2.

14 Actually, the rule conspires to the effect that short vowels cannot occur in open syllables, even at level-2.

15 Embedded disyllabic words ending in non-superheavy syllables can be rhythmically strengthened only in lexicalized compounds such as *átlas-Bós+atlàs*, *pásta-tánd+pastà*.

If the embedded word has antepenultimate stress in isolation, rhythmic shift tends to be far better possible: *márathon* - *véld+marathòn*, and *dóminee* - *dórps+dominèe*.

16 The behavior of the prefix /re-/ is peculiar, as far as it may reduce in initial position without primary stress immediately following:

(ii)	r<u>e</u>feráat	r<u>e</u>petéren	r<u>e</u>quisítie	r<u>e</u>tiráde
	r<u>e</u>formátie	r<u>e</u>prodúctie	r<u>e</u>volútie	r<u>e</u>pertóire

17 As observed by Martin (1968), the lack of reduction in (66) and (67) conforms to a morpheme structure condition: no lexical words are schwa-initial, or begin with [hə] (cf. Cohen e.a 1959:83). Non-lexical examples of initial schwa's are the articles 'n [ən], 't [ət] and clitic pronouns such as *'m*, *'r*, etc. (see Berendsen 1986 for discussion).

18 Actually, Booij (1982b) claims that vowel reduction is blocked after glides. This statement is certainly too strong, since reduction is very well possible after lexical glides, as in the words below:

(iii) Jerúzalem   Jesaja   Jeronimus   jaloers

19 Phonetically, /r/ has a centralizing effect on a preceding vowel. This effect has clearly phonologized in the case of preceding /e/, as there are hardly any alternations between /e/ and schwa before /r/, especially in medial positions (5bcd), where schwa is pervasive.

20 Marginal exceptions such as *Joure*, *Eire*, *drachme*, *ritme*, and suffix *-isme*, *-asme* do occur, but these are too rare to fully compensate for the loss of empirical adequacy of the schwallable generalizations.

21 Initial pre-stress long /a/ is realized almost obligatorily as short [ɑ], even in formal speech, cf. section 4.4.3, and 5.7 below.

22 According to Mascaró (1986), vowel reduction can be described as deletion of features within underspecification theory. In stressless vowels, lexically specified values are deleted, their unmarked values being filled in by complement rules.

23 Martin (1968) claims that final /e/ in words such as *andánte*, (*cum*) *láude*, (*nota*) *béne*, are easy to reduce. However, the pronunciation with full vowels /e/ are extremely marginal here as compared to schwa, so that these words are better not considered cases of final *reduction*, but cases of *underlying* schwa.

24 The only exceptions are *Józef*, *Mohámmed*, *ávond*.

25 See Den Os (1988) for the effects of tempo on vowel reduction.

26 However, Nooteboom did not examine words with four stressless syllables preceding the primary stress.

27 We will not discuss the precise formulation of Booij's vowel reduction rules, as these are not essential to the central argument. The generalizations expressed in the rules have been largely mentioned while discussing the vowel reduction pattern in section 5.

28 Booij (1981) observes that stressless /i/ in suffixes such as *-iteit* and *-iseer* reduces less well than /i/ in similar underived words.

Epilogue

Let us summarize the major conclusions and results of this study, and make a comparison between the English and Dutch word stress systems.

1. Conclusions

We have developed a theory of word stress which decomposes word stress into three properties that are more or less autonomous: *syllable weight*, *binary constituency*, and *prominence*. We have assumed the bracketed-grids framework of Halle & Vergnaud (1987), but introduced a number of changes in it. Most importantly, we have given up the assumption that metrical constituency is exhaustive, and launched the hypothesis that metrical constituency is strictly binary. The Strict Binarity Hypothesis implies that each constituent contains minimally and maximally two adjacent grid elements, one of which is subordinated with respect to the other. This hypothesis excludes unbounded constituents and constituents containing only one grid element. We have supported Halle & Vergnaud's claim that line 1 elements (stresses) are partly independent of constituency. Let us now discuss the three primitives of our theory one by one.

Heavy syllables are automatically stressed in systems with a *syllable weight* distinction, such as English and Dutch. Stress is not inserted on heavy syllables by an accenting rule, as in Halle & Vergnaud (1987), but follows from a wellformedness condition valid in all or specific strata. This wellformedness condition says that a heavy syllable has minimally a line 1 grid element. This renders superfluous statements to this effect, such as the *stressless foot* of Hayes (1987). By this direct correspondence between syllable weight and stress, stress resulting from syllable weight cannot be lost unless the weight itself is lost as well. Although a universally marked option, deweighting was proposed to fulfil this function in English and Dutch. Deweighting affects the moraic structure of closed syllables, thereby destressing them.

Constituency results from adjunction of two elements in the grid, and is therefore always binary. Adjoining a grid element implies subordinating it to the element it is adjoined to. In case a place-holder of a syllable (a line 0 element) is adjoined, a line 1 element (a stress) results over the line 0 element that is the adjunction target. Syllable Adjunction is subject to the following constraints. First, the elements to be adjoined must be adjacent in the grid. Second, a structural relation has to hold between the adjoined element and the target element as formulated in the Maximality Principle (Hayes 1984). Third, the Free Element Condition (Prince 1985) affects applications of Syllable Adjunction that serve to lay the groundwork for prominence selection by the End Rule. In English and Dutch, level-1 applications are constrained by the FEC in this way. Fourth, Syllable Adjunction cannot lead to a result that is incompatible with Q-sensitivity, or the requirement that heavy sylables are stressed. Therefore, Syllable Adjunction cannot adjoin a place-holder of a heavy syllable to an adjacent syllable place-holder without violating the basic wellformedness condition correlating syllable weight and stress. Again, the only escape route is deweighting a heavy syllable while adjoining it, a privilege that is universally marked, and restricted to adjunction rules that mention specific classes of syllables.

Prominence, or higher level stress, results from two sources: End Rules, and higher level applications of metrical adjunction. Primary stress is always selected by an End Rule, which promotes a stress at some level in the grid (typically at line 1) to a higher level in the grid (typically at line 2). Essentially, we have adopted the theory of End Rules as proposed by Prince (1983). This theory says that if there is no 'landing site' for an End Rule operating at some level in the grid, the End Rule defaults one level down.

If adjunction takes place at line 1, a line 2 element arises over the line 1 target of the adjunction. This type of adjunction, which in English and Dutch is restricted to the lexical level-2 stratum, takes the function of rules such as Beat Addition and the Rhythm Rule in other theories. Essentially, it is an adapted version of Rhythmic Adjustment, a rule proposed for phrasal rhythm in Hayes (1984). The application of higher level metrical adjunction is governed by the Textual Prominence Preservation Condition (Selkirk 1984), which ensures that the primary stress is never subordinated to secondary stress level by some rhythmic stress adjustment rule.

Let us now summarize and compare the analyses of the two stress systems that were studied in this thesis, viz. English and Dutch.

2. English versus Dutch

In analyzing English and Dutch, we did not go into the similarities and differences between both stress systems. However, since our analyses of the systems were not identical, we implicitly assumed various differences to exist, next to some similarities that we will first mention.

English and Dutch both display the three basic properties Q-sensitivity, binary constituency, and prominence. Although differences were found as to the basic syllable weight distinctions, the Syllable Adjunction rules operative at the level-1 lexical stratum, as well as the End Rule, were found to be similar. That is, line 0 constituents result from a Syllable Adjunction rule which adjoins a syllable place-holder of a light syllable leftward to an adjacent syllable place-holder. This adjunction rule is Q-sensitive only indirectly, as its output must respect the wellformedness condition relating syllable weight and stress. Syllable Adjunction makes its pass through the domain from right to left. Both systems have an End Rule that promotes the rightmost metrical syllable with a line 1 element to primary stress, by inserting a line 2 element over it.

Both systems have stress-relevant lexical markings of some kind. Lexical stresses were motivated for both systems. In addition to this, we assumed that English has lexically marked extrametricality of both syllables and consonants, whereas Dutch has lexically marked late extrametricality of syllables.

Let us now discuss five differences between the systems.

First, we assumed Dutch schwa to be weightless in lexical representation, in contrast to monomoraic short vowels. For English, we did not assume a similar underlying distinction between schwa (a segmentally unspecified vowel) and other short vowels. Our reasons for assuming weightless schwa in Dutch were mainly based on syllabification, where schwa behaves very differently from short full vowels, cf. chapter 3, section 6. The property of underlying weightlessness also explains why schwa determines stress placement, attracting primary stress immediately before it, cf. chapter 4, section 2.3.1.2. In addition to underlying schwa, Dutch has schwa's that originate at a much more shallow level, from vowel reduction. Crucially, the sources of schwa are distinguishable at the surface. Vowel reduction is essentially optional, so that optionally alternating schwa's must be due to reduction, whereas non-alternating schwa's must be underlyingly present, especially in final positions, where reduction does not apply. In contrast, English schwa can be derived by reduction in all positions where it occurs. English vowel reduction applies fairly automatically. Hence it is much harder to find evidence for a distinction between underlying weightless schwa and reduction schwa, as compared to Dutch. Also, schwa does not seem to determine syllabification and stress placement. English clearly has underlying segmentally unspecified vowels (schwa's), but these do not behave differently from segmentally specified short vowels. These differences in lexical representation can be portrayed as follows:

```
(1)a. English          b. Dutch

      m    m m              m   m m
      |    \ /              |   \ /
     v/ə    v            ə  v    v
```

This leads us to a second difference between English and Dutch, the fact that Dutch level-1 lexical syllabification excludes short vowels in open syllables, whereas at the comparable level of syllabification in English such syllables are wellformed. The distributional arguments for assuming Dutch short vowels to be in closed syllables are largely related to the absence of short vowels word-finally and pre-vocalically, as well as to the systematic absence of specific segments after short vowels, cf. chapter 3, section 4. Although English also excludes (non-low) short vowels in word-final positions, and all short vowels in pre-vocalic positions, the surface distribution can be accounted for by a lengthening analysis rule motivated as early as SPE. In contrast, a lengthening analysis is less adequate for Dutch, for reasons pointed out in chapter 3. In particular, lengthening would presumably have to apply to pre-consonantal vowels in open syllables, which are long in the unmarked case. But pre-consonantal lengthening is not exceptionless, and additional ad-hoc lexical marking would be required to govern its application, which would make it a very opaque process.

The third difference between English and Dutch involves the conditions of syllable weight. We assumed that the English weight distinction is a moraic one, where open syllables with short vowels are light, and closed syllables and syllables with long vowels are heavy. In contrast, Dutch was assumed to have a distinction based on melodic complexity, where open syllables with non-diphthongal long vowels are light, and closed syllables and syllables with diphthongs are heavy. The major difference resides in open syllables with non-diphthongal vowels, which are heavy in English, but light in Dutch. The argument for this is the fact that Dutch long vowels may appear in stressless open syllables, cf. *tómbo̲la*. Since a lengthening analysis for such cases is inadequate, as remarked above, there is no choice but to conclude that open syllables with long vowels are actually light in Dutch. In contrast, English long vowels may not appear in open stressless syllables, except for one well-established context: that of (prevocalic and word-final) vowel lengthening, which is a well-motivated process.

The fourth difference is that only English, but not Dutch, has a rule of Closed Syllable Adjunction at level-1 feeding primary stress selection. Stated differently, only English has strong retraction of primary stress. The arguments for such a difference between the two systems is the following. The English primary stress retraction pattern, as described in detail in chapter 1, section 3.1.2, and chapter 2, section 2.1, is characterized by a clear gap in the data. For instance, hardly any words occur with primary stress on their second syllable if that is a sonorant-closed long vowel syllable before a stressed suffix: *désultòry*, not *desúltory*. Even though various exceptions occur, the pattern is clear enough to justify a level-1 rule to account for it. In many cases, the underlying value of the vowel in the skipped syllable cannot be determined, and must be left unspecified, or assumed to be schwa. But the pattern also extends to cases where underlying vowel quality can be made up from alternations, cf. *álternàte-altérnative* etc.

Therefore, alternations and the data gap in the retraction pattern argue for a phonological process, instead of an analysis with underlying schwa (or syllabic sonorants) in skipped syllables. Precisely the latter analysis is adequate, however, for Dutch cases like *pímpernel*, in which primary stress is retracted across a closed syllable with a schwa. This schwa is arguably lexical, since it does not optionally alternate with a full vowel, as is typically the case for reduction schwa. Weightlessness of the medial schwa in *pimpernel* etc. will therefore guarantee its being unstressable at level-1, where primary stress is assigned. Moreover, no alternations exist among words of the type mentioned above for English. Hence, it can be safely concluded that no strong retraction of primary stress occurs in Dutch.

The fifth difference between the systems is an echo of the fourth: only Dutch, but not English, has a level-2 rule of Closed Syllable Adjunction to destress closed syllables. Moreover, we argued that the Dutch version of Closed Syllable Adjunction is restricted to the 'Arab context' (hence the name Dutch Arab Rule). Thus, one difference between English *ánecdòte* and Dutch *ànecdóte* is that the medial closed syllable adjoins at level-1 in the former case, but at level-2 in the latter. We argued earlier that Dutch lacks level-1 Closed Syllable Adjunction, because it lacks strong primary stress retraction. The reason for denying English level-2 Closed Syllable Adjunction was stated in chapter 2, section 8.7. Since the reapplication of level-1 adjunction rules at level-2 does not respect the Free Element Condition, the level-2 reapplication of Closed Syllable Adjunction would incorrectly destroy binary constituents whose head is a closed syllable (*Tìcònderóga*).

Recapitulating the two last-mentioned differences between English and Dutch, we find that both systems have Closed Syllable Adjunction, but in different lexical strata. As compared to Dutch, English has Closed Syllable Adjunction deeper in the lexical component, at level-1,where it feeds the End Rule:

(2)	**English**	**Dutch**
level-1	Light Syllable Adjunction Closed Syllable Adjunction End Rule	Syllable Adjunction --- End Rule
level-2	Light Syllable Adjunction ---	Syllable Adjunction Closed Syllable Adjunction

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Glossary

Aaron	*Aaron*
Abba	*Abba*
Abenolax	(trade name)
Abimelech	*Abimelech*
Abinadab	*Abinadab*
Abiram	*Abiram*
Abisag	*Abisag*
Abraham	*Abraham*
Absalom	*Absalom*
Abutilon	(trade name)
Adelheid	(first name)
Adidas	*Adidas*
Adolf	*Adolf*
Adriaan	*Adrian*
Aegon	(trade name)
Aeneas	*Aeneas*
Afganistan	*Afghanistan*
Agamemnon	*Agamemnon*
Agnes	*Agnes*
Ahasveros	*Ahasuerus*
Ahikam	*Ahikam*
Ajalon	*Ajalon*
Alabastine	(trade name)
Alberto	*Alberto*
Alcatraz	*Alcatraz*
Aldebaran	*Aldebaran*
Aleida	(first name)
Alexander	*Alexander*
Alexandrië	*Alexandria*
Alfons	*Alphonse*
Alfred	*Alfred*
Alkmaar	(place name)
Alphen	(place name)
Ambon	*Ambon*
Amenhotep	*Amen Hotep*
Amerika	*America*
Amerongen	(place name)
Amev	(trade name)
Amminadab	*Amminadab*
Amro	(trade name)
Ananias	*Ananias*
Andes	*Andes*
Andreas	*Andreas*
Andries	*Andrew*
Angora	*Angora*
Anita	*Anita*
Antarctica	*Antarctica*
Arafat	*Arafat*
Ararat	*Ararat*
Archimedes	*Archimedes*
Argos	*Argus*
Ariadne	*Ariadne*
Aristona	(trade name)
Aristoteles	*Aristotle*
Arkansas	*Arkansas*
Armageddon	*Armageddon*
Arnold	*Arnold*
Arthur	*Arthur*
Aschkenazim	*Ashkenazim*
Ashurbanipal	*Ashurbanipal*
Astoreth	*Ashtoreth*
Astrid	*Astrid*
Atjeh	*Atjeh*
Augias	*Augeas*
Australië	*Australia*
Azië	*Asia*
Baarn	(place name)
Babylon	*Babylon*
Bagdad	*Bagdad*
Balesteros	*Balesteros*
Balkan	*Balkan*
Baloe	*Ballou*
Baltazar	*Balthazar*
Barnabas	*Barnabas*
Bastiaan	*Sebastian*
Beatrijs	*Beatrice*
Beatrix	*Beatrix*
Beelzebub	*Beelzebub*
België	*Belgium*
Belial	*Belial*
Benjamin	*Benjamin*
Berlijn	*Berlin*
Bernardo	*Bernardo*
Bethlehem	*Bethlehem*
Betuwe	(place name)
Bibeb	(name)
Biotex	(trade name)
Bogota	*Bogota*
Bolivar	*Bolivar*
Bolke	(first name)
Bombay	*Bombay*
Bonalkolax	(trade name)
Bosatlas	(trade name)
Boudewijn	(first name)
Brandaris	(trade name)
Brazilië	*Brasil*
Breda	(place name)
Brinta	(trade name)
Brocacef	(trade name)
Bunschoten	(place name)
Calimero	(name)
Campina	(trade name)
Canada	*Canada*
Caracas	*Caracas*
Carvancevitam	(trade name)
Casema	(trade name)
Celebes	*Celebes*
Celtona	(trade name)
Ceylon	*Ceylon*
Chiquita	(trade name)
Chocomel	(trade name)
Chrysler	*Chrysler*
Cineac	(trade name)
Cito	(trade name)
Citronella	(trade name)
Coevorden	(place name)
Conimex	(trade name)
Constantijn	*Constantine*
Constantinopel	*Constantinople*
Cosatu	*Cosatu*
Creool	*Creole*
Cristobal	*Cristobal*
Dada	*Dada*
Dafne	*Daphne*
Daimler	*Daimler*
Damocles	*Damocles*
Daniel	*Daniel*
David	*David*
Deelder	(surname)
Demjanuk	*Demjanuk*
Demosthenes	*Demosthenes*
Dessaur	(surname)
Deventer	(place name)
Diana	*Diana*
Diarbakir	*Diarbakir*
Diogenes	*Diogenes*
Dionysos	*Dionysus*
Dolores	*Dolores*
Donau	*Danube*
Dralon	(trade name)
Dubrovnik	*Dubrovnik*
Duralex	(trade name)
Ecu	*Ecu*
Edam	(place name)
Edammer	*from Edam*
Eddy	*Eddy*
Edmonton	*Edmonton*
Eelko	(first name)
Efraim	*Ephraim*
Egypte	*Egypt*
Eire	*Eire*
Elias	*Elias*
Elifaz	*Eliphaz*
Elimelech	*Elimelech*
Elizabeth	*Elisabeth*
Ellis	*Ellis*
Els	(first name)
Else	(first name)
Elzevier	*Elzevir*
Erechtheion	*Erechtheum*
Eros	*Eros*
Erres	(trade name)
Eskimo	*Eskimo*
Eskisehir	*Eskisehir*
Esmeralda	*Esmeralda*
Esopet	(name)
Esperanto	*Esperanto*
Etna	*Etna*
Euripides	*Euripides*
Eva	*Eve*
Everdingen	(place name)
Evoluon	(trade name)
Exocet	*Exocet*
Exodus	*Exodus*
Ezau	*Esau*
Ezecheël	*Ezekiel*
Farizeeër	*Pharisee*
Faëton	*Phaëthon*
Fiat	*Fiat*
Firato	(trade name)
Gabriel	*Gabriel*
Galahad	*Galahad*
Galapagos	*Galapagos*
Ganges	*Ganges*

Garmt	(first name)	Jochebed	*Jochebed*	Manusama	(surname)
Genesareth	*Gennesaret*	Jodocus	(first name)	Maoist	*Maoist*
Genesis	*Genesis*	Johan	*John*	Maori	*Maori*
Gerard	*Gerard*	Jojachin	*Jojachin*	Marcel	*Marcel*
Gerrit	(first name)	Jolanda	(first name)	Marga	*Margaret*
Gert	(first name)	Jonas	*Jonas*	Marie	*Mary*
Gevu	(trade name)	Jonathan	*Jonathan*	Marion	*Marion*
Gibraltar	*Gibraltar*	Josina	(first name)	Marjon	*Marion*
Goirle	(place name)	Joure	(place name)	Marnix	(first name)
Goliath	*Goliath*	Jozef	*Joseph*	Marokko	*Morocco*
Granada	*Granada*	Judas	*Judas*	Marrakesj	*Marrakesh*
Gullit	(surname)	Judith	*Judith*	Martinus	*Martin*
Gulliver	*Gulliver*	Jupiter	*Jupiter*	Mathilde	*Mathilda*
Haarlem	*Harlem*	Kajafas	*Caiaphas*	Matthias	*Mathias*
Habakuk	*Habakkuk*	Kalimantan	*Kalimantan*	Matthieu	*Mathew*
Hamilcar	*Hamilcar*	Kalkar	(place name)	Maya	*Maya*
Hannibal	*Hannibal*	Kanaan	*Canaan*	Mefiboseth	*Mephibosheth*
Hanomag	(trade name)	Kapernaum	*Capernaum*	Melanchton	*Melanchthon*
Hans	*Hans*	Karadeniz	*Karadeniz*	Melchizedek	*Melchizedek*
Hatéma	(trade name)	Karin	*Karen*	Mendelejev	*Mendelyeev*
Havanna	*Havana*	Kartofilex	(trade name)	Menelaos	*Menelaus*
Havezate	(place name)	Kaspar	*Caspar*	Mercedes	*Mercedes*
Hazeu	(surname)	Kasparov	*Kasparov*	Messias	*Messiah*
Heleen	*Helen*	Kazachstan	*Kazakhstan*	Methusalem	*Methuselah*
Helma	(first name)	Keijsper	(surname)	Michael	*Michael*
Helmer	(first name)	Kekkonen	*Kekkonen*	Mieke	(first name)
Helsinki	*Helsinki*	Kemenade	(surname)	Mierlo	(place name)
Heracles	*Heracles*	Kenau	(name)	Mirjam	*Miriam*
Hercules	*Hercules*	Kilimanjaro	*Kilimanjaro*	Mohammed	*Mohammed*
Herodes	*Herod*	Kitekat	(trade name)	Moldau	*Moldau*
Herodotus	*Herodotus*	Kodak	*Kodak*	Molotov	*Molotov*
Hindeloopen	(place name)	Krakatau	*Krakatao*	Mondriaan	(surname)
Hindi	*Hindi*	Krakau	*Kraków*	Moskou	*Moscow*
Hoevelaken	(place name)	Kreidler	(trade name)	Moslim	*Moslem*
Honduras	*Honduras*	Kremlin	*Kremlin*	Moulinex	(trade name)
Husqvarna	(trade name)	Labrador	*Labrador*	Multiplex	(trade name)
Ikon	(name)	Laertes	*Laertes*	Naäman	*Naaman*
Ilias	*Iliad*	Lampo	(surname)	Napels	*Naples*
Immanuel	*Immanuel*	Leonidas	*Leonidas*	Napoleon	*Napoleon*
Indië	*India*	Leukoplast	(trade name)	Napolitaan	*Neapolitan*
Ingrid	*Ingrid*	Leviathan	*leviathan*	Nassau	*Nassau*
Iraklion	*Iraklion*	Libanon	*Lebanon*	Natalie	*Natalie*
Ismael	*Ismail*	Libertas	*Libertas*	Nathanael	*Nathanael*
Israel	*Israel*	Libië	*Libya*	Nazareth	*Nazareth*
Istanbul	*Istanbul*	Liesbeth	*Elisabeth*	Nebukadnezar	*Nebuchadnezzar*
Ivo	(first name)	Lilian	*Lilian*	Nepal	*Nepal*
Izaak	*Isaak*	Lilliput	*Lilliput*	Neptunus	*Neptune*
Jacob	*Jacob*	Linge	(place name)	Niagara	*Niagara*
Jacobus	*Jacobus*	Lissabon	*Lisbon*	Nijmegen	(place name)
Jaffa	*Jaffa*	Lombardije	*Lombardy*	Nimrod	*Nimrod*
Jahveh	*Jahveh*	Lombok	*Lombok*	Ninive	*Niniveh*
Jakoba	*Jacoba*	Lorelei	*Lorelei*	Noach	*Noah*
Jamin	(trade name)	Lucas	*Luke*	Norit	(trade name)
Japan	*Japan*	Luxor	*Luxor*	Oberon	*Oberon*
Jehoram	*Jehoram*	Maarten	*Martin*	Oblomov	*Oblomov*
Jehova	*Jehovah*	Machiel	*Michael*	Odorex	(trade name)
Jellinek	(surname)	Madagaskar	*Madagascar*	Odyssee	*Odyssey*
Jeronimus	*Jerome*	Madrid	*Madrid*	Odysseus	*Odysseus*
Jeruzalem	*Jerusalem*	Makassar	*Macassar*	Oerle	(place name)
Jesaja	*Josiah*	Mammon	*mammon*	Oetker	(trade name)
Joachim	*Joachim*	Manitoe	*Manitou*	Olivier	*Oliver*
Jochanan	*Jochanan*	Manoach	*Manoah*	Olympisch	*Olympic*

Opec	*Opec*
Ordina	(trade name)
Organon	(trade name)
Orlon	(trade name)
Ortahisar	*Ortahisar*
Oscar	*Oscar*
Oslo	*Oslo*
Otto	*Otto*
Pakistan	*Pakistan*
Palembang	*Palembang*
Palestijn	*Palestinian*
Palestina	*Palestine*
Panama	*Panama*
Papiamento	*Papiamento*
Papoea	*Papua*
Paraguay	*Paraguay*
Paramaribo	*Paramaribo*
Parmenides	*Parmenides*
Parodontax	(trade name)
Pasternak	*Pasternak*
Pauline	*Pauline*
Penelope	*Penelope*
Persil	(trade name)
Pheidippides	*Pheidippides*
Phidias	*Phidias*
Philemon	*Philemon*
Pierlala	(name)
Pleistoceen	*Pleistocene*
Pontiac	*Pontiac*
Portugal	*Portugal*
Poseidon	*Poseidon*
Potifar	*Potiphar*
Pripu	(name)
Prolog	*Prolog*
Pygmalion	*Pygmalion*
Pythagoras	*Pythagoras*
Rafael	*Raphael*
Rehoboth	*Rehoboth*
Roeland	*Roland*
Roland	*Roland*
Röntgen	*Röntgen*
Roparco	(trade name)
Rosalie	*Rosaline*
Rowenta	(trade name)
Rudolf	*Rudolf*
Sabbat	*Sabbath*
Sabena	(trade name)
Sahel	*Sahel*
Salomon	*Salmon*
Samuel	*Samuel*
Sanskriet	*Sanskrit*
Santanolix	(trade name)
Sanyasin	*Sanyasin*
Satan	*Satan*
Scalextric	(trade name)
Scheveningen	(place name)
Schijndel	(place name)
Sebastiaan	*Sebastian*
Sebastopol	*Sebastopol*
Semarang	*Semarang*
Senegal	*Senegal*
Sèvres	*Sèvres*
Sinaï	*Sinai*
Sodom	*Sodom*
Soedan	*Sudan*
Sofokles	*Sophocles*
Sokrates	*Socrates*
Sonesta	(trade name)
Sowjet	*soviet*
Spaarne	(place name)
Spartak	*Spartak*
Spoetnik	*Sputnik*
Stafleu	(surname)
Stalker	*Stalker*
Stimorol	(trade name)
Strepsil	(trade name)
Stockholm	*Stockholm*
Stroganov	*Stroganoff*
Suez	*Suez*
Tabu	(name)
Tarzan	*Tarzan*
Teheran	*Teheran*
Teleac	(trade name)
Terpsichore	*Terpsichore*
Thomas	*Thomas*
Tiberias	*Tiberias*
Tibet	*Tibet*
Timboektoe	*Timbuctoo*
Timotei	(trade name)
Tobias	*Tobiah*
Toetanchamon	*Tutankhamen*
Toonder	(surname)
Torremolinos	*Torremolinos*
Trinidad	*Trinidad*
Troje	*Troy*
Trotsky	*Trotsky*
Tsjernobil	*Tchernobil*
Unesco	*Unesco*
Unicef	*Unicef*
Unitas	*Unitas*
Uranus	*Uranus*
Urenco	(trade name)
Uriel	*Uriel*
Uruguay	*Uruguay*
Valentijn	*Valentine*
Veluwe	(place name)
Vendet	(trade name)
Veritas	*Veritas*
Veronica	*Veronica*
Viditel	(trade name)
Vincent	*Vincent*
Volvo	(trade name)
Voorne	(place name)
Walhalla	*Walhalla*
Warschau	*Warsaw*
Weesp	(place name)
Weleda	(trade name)
Welirang	*Welirang*
Whiskas	(trade name)
Winschoten	(place name)
Wisconsin	*Wisconsin*
Wladiwostok	*Vladivostok*
Wodan	*Woden*
Woensel	(place name)
Woerden	(place name)
Wubbo	(first name)
Xenocrates	*Xenocrates*
Xerxes	*Xerxes*
Zacharias	*Zachariah*
Zanzibar	*Zanzibar*
Zeppelin	*Zeppelin*
Zoeloe	*Zulu*
aamt	*swollen udder*
aantoon	*to demonstrate*
aantoonbaar	*demonstrable*
aarde	*earth*
aardolie	*petroleum*
aarzel	*to hesitate*
abdis	*abbess*
ablatief	*ablative*
ablaut	*ablaut*
abracadabra	*abracadabra*
abrikoos	*apricot*
accepteer	*to accept*
accordeon	*accordion*
accu	*battery*
accuratesse	*accuracy*
accusatief	*accusative*
aceton	*acetone*
acetyleen	*acetylene*
acrostichon	*acrostic*
activisme	*activism*
adapteer	*to adapt*
adder	*viper*
adelaar	*eagle*
adem	*breath*
adieu	*goodbye*
adios	*goodbye*
adjectief	*adjective*
administratief	*administrative*
admiraal	*admiral*
adolescent	*adolescent*
adopteer	*to adopt*
adrenaline	*adrenalin*
adres	*address*
adverteer	*to advertise*
aëronaut	*aeronaut*
aëroob	*aëroob*
afrodisiac	*aphrodisiac*
agenda	*agenda*
agent	*agent*
agrariër	*farmer*
akela	*girl guide leader*
akelei	*columbine*
aktief	*active*
albatros	*albatross*
alcazar	*alcazar*
alcohol	*alcohol*
alfa	*alpha*
alfabet	*alphabet*
algebra	*algebra*
alias	*alias*
alibi	*alibi*
alimentatie	*alimony*
alkoof	*alcove*

allegorie	*allegory*
alligator	*alligator*
allooi	*alloy*
almanak	*almanac*
aloë	*aloe*
alpine	*Alpine*
altaar	*altar*
alternatief	*alternative*
alterneer	*to alternate*
aluminium	*aluminum*
amalgaam	*amalgam*
amanuensis	*amanuensis*
amaril	*amaryllis*
ambassadeur	*ambassador*
ambigu	*ambiguous*
amfibie	*amphibian*
ammoniak	*ammonia*
amnestie	*amnesty*
amok	*amuck*
amorf	*amorphous*
ampul	*ampulla*
anabaptist	*Anabaptist*
anaconda	*anaconda*
anakoloet	*anacoluthon*
ananas	*pine-apple*
anarchie	*anarchy*
anatomie	*anatomy*
andante	*andante*
andijvie	*endive*
anekdote	*anecdote*
anemie	*anaemia*
anesthesist	*anaesthesist*
angel	*sting*
angina	*angina*
anijs	*anise*
annexeer	*to annex*
anonymus	*anonymus*
anorak	*Eskimo jacket*
ansjovis	*anchovy*
antagonist	*antagonist*
antecedent	*antecedent*
antiek	*antique*
antropologie	*anthropology*
antropoloog	*anthropologist*
aperitief	*apéritif*
apocalyps	*apocalypse*
apocope	*apocope*
apostel	*apostle*
apostrof	*apostrophe*
appartement	*apartment*
appendix	*appendix*
april	*April*
aquarium	*aquarium*
arbeid	*labor*
arbeidzaam	*industrious*
archipel	*archipelago*
arena	*arena*
arend	*eagle*
argwaan	*suspicion*
aristocraat	*aristocrat*
armoede	*poverty*
aroma	*aroma*
arsenicum	*arsenic*
artisjok	*artichoke*
asbest	*asbestos*
asfalt	*asphalt*
asterisk	*asterisk*
astma	*asthma*
astrakan	*astrachan*
astronaut	*astronaut*
asymmetrie	*asymmetry*
asyndeton	*asyndeton*
atheneum	*athenaeum*
atlas	*atlas*
aubergine	*egg-plant*
augurk	*gherkin*
aurora	*aurora*
authentiek	*authentic*
authentiseer	*to authenticate*
auto	*car*
autobiografie	*autobiography*
automaat	*automaton*
automatiek	*automat*
automobiliseer	*to automobilize*
autopsie	*autopsy*
avenue	*avenue*
avocado	*avocado*
avond	*evening*
avontuur	*adventure*
azijn	*vinegar*
azuur	*azure*
baar	*stretcher*
bacil	*bacillus*
badminton	*badminton*
bah	*bah!*
bakkes	*mug*
balanceer	*to balance*
baldakijn	*canopy*
balk	*beam*
balkon	*balcony*
ballast	*ballast*
ballon	*balloon*
balustrade	*balustrade*
bamboe	*bamboo*
bami	*noodles*
banaal	*banal*
banaan	*banana*
bandiet	*bandit*
bank	*bank*
bankroet	*bankrupt*
baobab	*baobab*
bariton	*baritone*
barok	*baroque*
baron	*baron*
basilicum	*basil*
basilisk	*basilisk*
bastaard	*bastard*
basterd	*bastard*
bastion	*bastion*
bataljon	*batallion*
bauxiet	*bauxite*
bazoeka	*bazooka*
bedierf	*to spoil* (past tense)
beemd	*meadow*
begonia	*begonia*
behemoth	*behemoth*
beklemtoon	*to stress*
beklemtoonbaar	*stressable*
bengel	*urchin*
benzine	*gasoline*
benzoë	*benzoë*
bevoordeel	*to favor*
biatlon	*biathlon*
bibliotheek	*library*
biceps	*biceps*
bidet	*bidet*
bidon	*cycle bottle*
bijwoord	*adverb*
bijwoordelijk	*adverbial*
bikini	*bikini*
bilateraal	*bilateral*
biljart	*billiards*
binocle	*binnacle*
bios	*cinema*
bisam	*musk*
biscuit	*biscuit*
biskwie	*biscuit*
bisschop	*bishop*
bistro	*restaurant*
bivak	*bivouac*
bizon	*buffalo*
blasfemie	*blasphemy*
bloedlichaam	*blood corpuscle*
bodega	*bodega*
boekanier	*buccaneer*
boeket	*bouquet*
boemerang	*boomerang*
boerde	*farce*
boernoes	*burnouse*
bolero	*bolero*
bombardeer	*to bombard*
bombardon	*wind-instrument*
bonbon	*bonbon*
bongerd	*orchard*
bordes	*balcony*
borg	*bail*
bougie	*spark plug*
boycot	*boycott*
bravo	*bravo*
brevet	*patent*
briljant	*brilliant*
bronchitis	*bronchitis*
bruidegom	*bridegroom*
brutaal	*bold*
bruusk	*brusque*
bui	*shower*
buizerd	*buzzard*
bult	*hunch*
burcht	*castle*
bureau	*desk*
buste	*bust*
butler	*butler*
cabaretesk	*cabaret-like*
cachet	*stamp*
café	*pub*

calorie	*calory*
calvados	*calvados*
camera	*camera*
camouflage	*camouflage*
canon	*canon*
canvas	*canvas*
capaciteit	*capacity*
capsule	*capsule*
carambole	*cannon*
caravan	*caravan*
carbon	*carbon*
caries	*caries*
carillon	*carillon*
carnaval	*carnival*
catalogus	*catalogue*
catamaran	*catamaran*
catechetiek	*catechetic theory*
catechiseer	*to catechize*
categorie	*category*
causatief	*causative*
cavalerie	*cavalry*
centaur	*centaur*
centimeter	*centimetre*
centraal	*central*
centripetaal	*centripetal*
centurion	*centurion*
ceremonie	*ceremony*
certificaat	*certificate*
champignon	*mushroom*
chaos	*chaos*
charitas	*charity*
charlatan	*charlatan*
chemie	*chemistry*
chimpansee	*chimpanzee*
chirurgie	*surgery*
chocola	*chocolate*
cholera	*cholera*
cholesterol	*cholesterol*
cichorei	*chicory*
cinema	*cinema*
cipres	*cypress*
circuit	*circuit*
clandestien	*clandestine*
claxon	*horn*
claxonade	*horn sound*
clematis	*clematis*
climax	*climax*
clitoris	*clitoris*
cobra	*cobra*
coherent	*coherent*
cohesie	*cohesion*
collectief	*collective*
colporteur	*hawker*
comestibles	*comestibles*
comite	*committee*
commando	*command*
commentaar	*commentary*
communist	*communist*
compagnie	*company*
comparatief	*comparative*
compendium	*compendium*
compenseer	*compensate*
compositum	*compound*
compromis	*compromise*
concentreer	*to concentrate*
concert	*concert*
confederatie	*confederation*
confronteer	*to confront*
congres	*congress*
conjunctief	*conjunctive*
conservatief	*conservative*
consul	*consul*
contant	*cash*
contempleer	*to contemplate*
continu	*continuous*
contrast	*contrast*
cordon	*cordon*
corduroy	*corduroy*
correct	*correct*
correctheid	*correctness*
corvee	*fatigue duty*
coryfee	*coryphee*
crematie	*cremation*
criminoloog	*criminologist*
criterium	*criterion*
crucifix	*crucifix*
culte	*cult*
cultuur	*culture*
curator	*guardian*
curiosum	*curiosity*
cursief	*italics*
daalder	*Dutch coin*
dag	*day*
damp	*vapor*
dank	*thanks*
datief	*dative*
debet	*debit*
decennium	*decade*
decibel	*decibel*
decimeter	*decimetre*
declaratief	*declarative*
decoratief	*decorative*
decorum	*decorum*
deerne	*lass*
dekaan	*dean*
dekretalen	*decretal*
delict	*offence*
delinquent	*delinquent*
delirium	*delirium*
demokratie	*democracy*
demon	*demon*
demonstreer	*to demonstrate*
denim	*denim*
deposito	*deposit*
depot	*depot*
desastreus	*disastrous*
deserteer	*to desert*
desideratum	*desideratum*
detective	*detective*
determineer	*to determine*
diabetes	*diabetes*
diabolo	*diabolo*
diafragma	*diaphragm*
diagram	*diagram*
dialect	*dialect*
dialektiek	*dialectic*
diamant	*diamond*
diameter	*diameter*
diarree	*diarrhoea*
dictator	*dictator*
dictee	*dictation*
didactiek	*didactics*
difterie	*diphtheria*
diftong	*diphthong*
dilemma	*dilemma*
diploma	*diploma*
direkt	*direct*
direkteur	*director*
discipline	*discipline*
divan	*couch*
doelsaldo	*goal balance*
dolfijn	*dolphin*
dolk	*dagger*
dominee	*clergyman*
domino	*domino*
dompteur	*animal trainer*
dooi	*thaw*
dorpscoryfee	*village coryphee*
dorpsdominee	*country parson*
douane	*customs*
draai	*to turn*
drachme	*drachma*
dragon	*tarragon*
dragonder	*dragoon*
drogist	*chemist*
drogisterij	*chemist's*
dromedaris	*dromedary*
duizel	*to grow dizzy*
duizend	*thousand*
duplo	*duplicate*
dwangarbeid	*forced labor*
dynamo	*dynamo*
dynastie	*dynasty*
dysenterie	*dysentery*
echo	*echo*
eclecticisme	*eclecticism*
econometrie	*econometry*
economie	*economy*
editie	*edition*
educatief	*educational*
effectief	*effective*
effekt	*effect*
egaal	*plain*
egelantier	*eglantine*
eiland	*island*
eland	*elk*
elastiek	*elastic*
eldorado	*Eldorado*
electoraat	*electorate*
elegie	*elegy*
elektrode	*electrode*
elektron	*electron*
elevator	*elevator*
elite	*élite*
ellips	*ellipse*

elpee	*album*
emancipeer	*to emancipate*
embargo	*embargo*
emerald	*emerald*
emeritus	*emeritus*
emir	*emir*
encefalitis	*encephalitis*
encyclopedie	*encyclopedia*
encyclopedisch	*encyclopedic*
encyclopedoloog	*encyclopedist*
endocrinologie	*endocrinology*
energie	*energy*
enfant terrible	*enfant terrible*
engel	*angel*
ensemble	*ensemble*
entourage	*surroundings*
envelop	*envelope*
epenthesis	*epenthesis*
epidemie	*epidemic*
epilepsie	*epilepsy*
episcopaat	*episcopacy*
epistel	*epistle*
epitheton	*epithet*
epos	*epic*
epsilon	*epsilon*
equator	*equator*
ernst	*earnest*
essay	*essay*
estafette	*relay*
etappe	*stage*
ethos	*ethos*
etui	*case*
etymologie	*etymology*
eucharistie	*Eucharist*
eugenetiek	*eugenism*
eunuch	*eunuch*
euvel	*insolence*
evangelie	*gospel*
evangelist	*evangelist*
eventueel	*possible*
excrement	*excrement*
excursie	*excursion*
exemplaar	*copy*
experiment	*experiment*
expres	*express*
extase	*ecstasy*
extrametriciteit	*extrametricality*
extreem	*extreme*
faculteit	*faculty*
fakir	*fakir*
falanx	*phalanx*
fameus	*famous*
fanaat	*fanatic*
fantasie	*phantasy*
farao	*Pharaoh*
farmacie	*pharmacy*
farmacoloog	*pharmacist*
fase	*stage*
fataal	*fatal*
fatsoen	*decency*
faun	*faun*
fauteuil	*arm-chair*
favorem	*favor*
fazant	*pheasant*
februari	*February*
feliciteer	*to congratulate*
fenegriek	*medicinal herb*
fenomenaal	*phenomenal*
fervent	*passionate*
festijn	*feast*
festival	*festival*
feuilleton	*serial*
fictief	*fictitious*
fiets	*bicycle*
figuur	*character*
filantropie	*philanthropy*
filatelie	*philately*
filosofie	*philosophy*
finesse	*the ins and outs*
flamingo	*flamingo*
flexibel	*flexible*
flottielje	*flotilla*
fluit	*flute*
fluitist	*flute-player*
fluoride	*fluoride*
fluweel	*velvet*
fobie	*phobia*
foezel	*fusel oil*
folklore	*folklore*
fontanel	*fontanel*
fontein	*fountain*
formeel	*formal*
formule	*formula*
formulier	*form*
fornuis	*kitchen-range*
foton	*photon*
foxtrot	*foxtrot*
fragiel	*fragile*
fragment	*fragment*
framboos	*raspberry*
franje	*fringe*
fraterniseer	*to fraternize*
fregat	*frigate*
frequent	*frequent*
frontaal	*head-on*
funest	*fatal*
furore	*furore*
futurum	*future*
gaarne	*gladly*
gala	*gala*
galant	*gallant*
galei	*galley*
galjoen	*galleon*
galop	*gallop*
galvanoscoop	*galvanoscope*
gamelan	*gamelan*
ganglion	*ganglion*
garnaal	*shrimp*
gazon	*lawn*
gelei	*jelly*
genitief	*genitive*
geranium	*geranium*
gerontologie	*gerontology*
gierst	*millet*
gladiator	*gladiator*
gladiool	*gladiolus*
gloeilamp	*bulb*
goelasj	*goulash*
goeroe	*guru*
goh	*gosh!*
gordijn	*curtain*
gotspe	*effrontery*
gouvernement	*government*
graad	*degree*
gradeer	*to graduate*
grafiek	*graph*
gravel	*gravel*
gymnasium	*gymnasium*
habijt	*habit*
habitat	*habitat*
hachee	*hash*
hagedis	*lizard*
hallucineer	*to hallucinate*
hamer	*hammer*
hamster	*hamster*
handicap	*handicap*
hannes	*yarn*
hanze	*hanze*
harakiri	*hara-kiri*
haring	*herring*
hark	*rake*
harmonie	*harmony*
harmonieus	*harmonic*
harmonika	*accordion*
harmonisch	*harmonic*
harmonium	*harmonium*
harnas	*armor*
harp	*harp*
harpij	*harpy*
harpist	*harpist*
harpoen	*harpoon*
hasjiesj	*hashish*
hectometer	*hectometre*
heester	*shrub*
hegemonie	*hegemony*
heinde	*far (and near)*
helaas	*alas*
helikopter	*helicopter*
helm	*helmet*
hengel	*fishing-rod*
hepatitis	*hepatitis*
heraldiek	*heraldry*
heraut	*herald*
herberg	*inn*
herfst	*fall*
herfstig	*autumnal*
hermandad	*hermandad*
hernia	*hernia*
heroisch	*heroic*
heros	*hero*
herpes	*herpes*
hertog	*duke*
hertogdom	*duchy*
hiaat	*hiatus*
hibiscus	*hibiscus*
hierarchie	*hierarchy*

hilariteit	*hilarity*
hinde	*hind*
hobbel	*bump*
hobo	*oboe*
hoera	*hurray*
holster	*holster*
hond	*dog*
honderd	*hundred*
honorarium	*fee*
honorem	*honor*
hoofdstad	*capital*
horizon	*horizon*
horizontaal	*horizontal*
hospita	*landlady*
hospitaal	*hospital*
hotel	*hotel*
huh	*ugh*
huisaltaar	*home altar*
huisdeur	*street-door*
huisrobot	*home robot*
humaan	*humane*
humanitas	*humanity*
humeur	*mood*
hupsakee	*oops!*
hyacint	*hyacinth*
hybride	*hybrid*
hymne	*hymn*
hypnose	*hypnosis*
hypothenusa	*hypothenuse*
hè	*huh?*
ibidem	*ibidem*
idee	*idea*
identiek	*identical*
identiteit	*identity*
idioticon	*idioticon*
idool	*idol*
idylle	*idyll*
ijver	*zeal*
ijzel	*glazed frost*
ikoon	*icon*
illumineer	*to illuminate*
impregneer	*to impregnate*
inchoatief	*inchoative*
incidenteel	*incidental*
index	*index*
indicatief	*indicative*
indicator	*indicator*
indigo	*indigo*
individu	*individual*
individualist	*individualist*
individueel	*individual*
industrie	*industry*
infanterie	*infantry*
infantiel	*infantile*
infiltreer	*to infiltrate*
infinitief	*infinitive*
informeer	*to inform*
ingenieus	*ingenious*
ingrediënt	*ingredient*
inherent	*inherent*
inspan	*to strain*
inspannend	*strenuous*
integraal	*integral*
intercepteer	*to intercept*
interessant	*interesting*
interim	*interim*
interval	*interval*
intraveneus	*intravenous*
introspektief	*introspective*
inventaris	*inventory*
investituur	*investiture*
ironie	*irony*
ischias	*sciatica*
isomerie	*isomerism*
jaguar	*jaguar*
jaloers	*jealous*
jaloezie	*jealousy*
jamboree	*jamboree*
januari	*January*
japon	*dress*
jargon	*jargon*
jeugdherberg	*youth hostel*
joh	*sonny*
jubileum	*jubilee*
judo	*judo*
juffrouw	*miss*
junior	*junior*
junta	*junta*
kaats	*to play at ball*
kabeljauw	*cod-fish*
kadaster	*land registry*
kado	*present*
kaftan	*caftan*
kajak	*kayak*
kakatoe	*cockatoe*
kaketoe	*cockatoe*
kakkerlak	*cockroach*
kalebas	*calabash*
kaleidoscoop	*kaleidoscope*
kalender	*calendar*
kaliber	*calibre*
kalief	*caliph*
kalkoen	*turkey*
kalm	*calm*
kalmeer	*to calm*
kameel	*camel*
kameleon	*chameleon*
kamille	*camomile*
kampong	*campong*
kandij	*candy*
kaneel	*cinnamon*
kangoeroe	*kangaroo*
kano	*canoe*
kanon	*cannon*
kanteel	*crenel*
kanton	*canton*
kapittel	*chapter*
kapoen	*capon*
karakter	*character*
karakterloos	*characterless*
karamel	*caramel*
karbonade	*chop*
karbouw	*buffalo*
kardemom	*cardamom*
kariboe	*caribou*
karikatuur	*caricature*
karkas	*carcass*
karn	*to churn*
karper	*carp*
karton	*cardboard*
karwei	*job*
karwij	*caraway*
kassei	*brick*
kast	*cupboard*
kastanje	*chestnut*
katalogus	*catalogue*
katapult	*catapult*
katjang	*sugared peanuts*
katrol	*pulley*
keramiek	*ceramics*
kerk	*church*
kerker	*dungeon*
kersouw	*daisy*
ketchup	*ketchup*
kibboets	*kibbutz*
kiekeboe	*bo-peep*
kierewiet	*crackers*
kievit	*lapwing*
kiezel	*gravel*
kilo	*kilogramme*
kilometer	*kilometre*
klimrek	*climbing frame*
klooster	*cloister*
knal	*crack*
knibbel	*haggle*
knudde	*flop*
koala	*koala*
kobalt	*cobalt*
kobold	*gnome*
koekoek	*cuckoo*
koeskoes	*millet dish*
koffie	*coffee*
kokos	*coco-nut*
kolibrie	*humming-bird*
kolofon	*colophon*
kolom	*column*
kolonel	*colonel*
kolonie	*colony*
kolonne	*column*
kolos	*colossus*
komkommer	*cucumber*
komma	*comma*
kompas	*compass*
komplex	*complex*
komplot	*plot*
konijn	*rabbit*
koning	*king*
kool	*cabbage*
koorts	*fever*
kopie	*copy*
kopij	*copy*
koraal	*coral*
kornoelje	*cornel*
kosmos	*cosmos*
kostuum	*costume*
krakeling	*cracknel*

kristal	*crystal*
kritiek	*criticism*
kroepoek	*prawn crisps*
kroket	*croquet*
krokodil	*crocodile*
kubiek	*cubic*
kubisme	*cubism*
kwart	*quarter*
kwartaal	*quarter*
kwarts	*quartz*
kwebbel	*chatterbox*
laboratorium	*laboratory*
labyrint	*labyrinth*
lachte	*to smile* (past tense)
lacune	*vacancy*
lade	*drawer*
lakei	*footman*
laks	*indolent*
lama	*llama*
lamp	*lamp*
lampion	*Chinese lantern*
lamprei	*lamprey*
landouw	*meadow*
lanterfant	*laze about*
lariks	*larch*
larynx	*larynx*
laurier	*laurel*
lava	*lava*
lavendel	*lavender*
lawaai	*noise*
lawine	*avalanche*
laxeer	*to relax the bowels*
leem	*loam*
legaal	*legal*
legbatterij	*egg factory*
lektuur	*reading*
lemma	*headword*
lepra	*leprosy*
lethargie	*lethargy*
leukemie	*leukaemia*
lexicon	*lexicon*
libido	*libido*
libre	*billiards game*
lichaam	*body*
lijm	*glue*
lijster	*thrush*
lilliput	*Lilliputian*
limerick	*limerick*
limonade	*lemonade*
limousine	*limousine*
linoleum	*linoleum*
litanie	*litany*
literatuur	*literature*
litotes	*litotes*
liturgie	*liturgy*
livrei	*livery*
locaal	*local*
locatief	*locative*
loempia	*egg-roll*
logopedie	*speech-training*
logos	*logos*
lokomotief	*locomotive*
lommerd	*pawnbroker*
lover	*foliage*
luister	*to listen*
luxe	*luxury*
lyceum	*lyceum*
lysol	*lysol*
maagd	*virgin*
maan	*moon*
macaroni	*macaroni*
machine	*engine*
macro	*macro*
maëstoso	*maestoso*
magie	*magic*
magiër	*magician*
magneet	*magnet*
magnetron	*magnetron*
magnificus	*magnificus*
majesteit	*majesty*
majestueus	*majestic*
mammoet	*mammoth*
mandarijn	*tangerine*
mandril	*mandrill*
mangaan	*manganese*
maniak	*maniac*
manifesteer	*to manifest*
mannetje	*little man*
manoeuvre	*manoeuvre*
manufactuur	*drapery*
manuscript	*manuscript*
maraboe	*marabou*
marathon	*marathon*
markt	*market*
marmer	*marble*
marmot	*marmot*
marsepein	*marchpane*
marxist	*marxist*
mascara	*mascara*
mascotte	*mascot*
matras	*mattress*
mausoleum	*mausoleum*
mazzel	*luck*
mecenas	*Maecenas*
medaille	*medal*
mededeel	*to announce*
mededeelzaam	*communicative*
melaats	*leprous*
melaatsheid	*leprosy*
melancholiek	*melancholy*
melisse	*balm-mint*
melodie	*melody*
membraan	*membrane*
memorie	*memory*
menu	*menu*
mercantilisme	*mercantilism*
merinos	*merino*
merites	*merits*
merrie	*mare*
mesjokke	*barmy*
mesties	*mestizo*
metaal	*metal*
metamorfose	*metamorphosis*
metathesis	*metathesis*
methanol	*methanol*
methode	*method*
metropolis	*metropolis*
metropool	*metropolis*
mevrouw	*lady*
miauw	*miaow*
mica	*mica*
micron	*micron*
midden	*middle*
mieters	*smashing*
mikado	*mikado*
milieu	*environment*
miljoen	*million*
millimeter	*millimetre*
minaret	*minaret*
minister	*minister*
minstreel	*minstrel*
minuscuul	*tiny*
minuut	*minute*
mirakel	*miracle*
mobile	*mobile*
mocassin	*moccasin*
modaal	*modal*
modder	*mud*
model	*model*
moeflon	*moufflon*
moeras	*marsh*
moesson	*monsoon*
molesteer	*molest*
moloch	*Moloch*
molton	*swanskin*
monarchie	*monarchy*
monarchist	*monarchist*
monitor	*monitor*
monopolie	*monopoly*
monument	*monument*
mormon	*Mormon*
moskee	*mosque*
mosterd	*mustard*
motief	*motive*
motorisch	*motor*
moussaka	*Greek dish*
muesli	*oatmeal dish*
museum	*museum*
musketon	*matchlock*
muskiet	*mosquito*
mustang	*mustang*
muzelman	*Muslim*
muziek	*music*
mythologiseer	*mythologize*
naakt	*naked*
napalm	*napalm*
narcis	*narcissus*
natron	*natron*
naturaliseer	*naturalize*
nectar	*nectar*
nemesis	*Nemesis*
neon	*neon*
nerts	*mink*
neuron	*neuron*

neutraal	*neutral*
neutron	*neutron*
nieuw	*new*
nitril	*cyanide*
niveau	*level*
noga	*nougat*
nomenclatuur	*nomenclature*
nominatief	*nominative*
noodlot	*fate*
noodlotig	*fatal*
normaliter	*normally*
nostalgie	*nostalgia*
notaris	*notary*
notulen	*minutes*
nylon	*nylon*
obscuur	*obscure*
observeer	*to watch*
obstruent	*obstruent*
ocelot	*ocelot*
ochtend	*morning*
oelewap	*dud*
oerknal	*Big Bang*
oeuvre	*works*
oever	*shore*
offerte	*offer*
okapi	*okapi*
oktober	*October*
oktrooi	*patent*
olie	*oil*
olifant	*elephant*
olijf	*olive*
onderschat	*underestimate*
onereus	*onerous*
onomatopee	*onomatopoeia*
ontpersoonlijk	*to impersonalize*
oordeel	*judgment*
oorlog	*war*
opaal	*opal*
opera	*opera*
operette	*operetta*
opodeldoc	*opodeldoc*
opoe	*granny*
orakel	*oracle*
oranje	*orange*
orchidee	*orchid*
orde	*order*
ordner	*file*
organiseer	*to organize*
orgasme	*orgasm*
orgel	*organ*
orgie	*orgy*
orientaal	*oriental*
ovaal	*oval*
oxymoron	*oxymoron*
oxytonon	*oxytone*
ozon	*ozone*
pacificeer	*to pacify*
pagina	*page*
palimpsest	*palimpsest*
paljas	*clown*
pancreas	*pancreas*
panorama	*panorama*
panoramiek	*panoramic*
pantalon	*trousers*
pantheon	*pantheon*
pantoffel	*slipper*
papaver	*poppy*
paperas	*papers*
papier	*paper*
papil	*papilla*
papyrus	*papyrus*
paraaf	*initials*
paraat	*ready*
parade	*parade*
paradijs	*paradise*
paradox	*paradox*
parafernalia	*paraphernalia*
paragenese	*paragenesis*
paragraaf	*paragraph*
parallellogram	*parallelogram*
paranimf	*groomsman*
paraplu	*umbrella*
parasitologie	*parasitology*
parasol	*sunshade*
pardon	*pardon*
parfum	*perfume*
parlementariër	*parliamentarian*
parodie	*parody*
participeer	*to participate*
partij	*party*
partikulier	*private*
partner	*partner*
paskwil	*lampoon*
passief	*passive*
pasta	*paste*
pastei	*pie*
pastoor	*parish priest*
pastorie	*presbytery*
patat	*chips*
paternalistisch	*paternalistic*
pathos	*pathos*
pauze	*pause*
paviljoen	*pavilion*
pelgrim	*pilgrim*
pelikaan	*pelican*
peloton	*platoon*
penalty	*penalty*
pendule	*timepiece*
penibel	*painful*
pentagon	*pentagon*
pentatlon	*pentathlon*
percent	*per cent*
perforator	*perforator*
pergola	*pergola*
perikel	*intricacy*
periodiciteit	*periodicity*
perkament	*parchment*
perron	*platform*
persoon	*person*
persoonlijk	*personal*
perspectief	*perspective*
peseta	*peseta*
peterselie	*parsley*
petroleum	*oil*
philodendron	*philodendron*
piano	*piano*
pianola	*pianola*
pias	*clown*
piccolo	*piccolo*
pienter	*clever*
pierewiet	*joker*
pijama	*pyamas*
pikant	*piquant*
pimpernel	*pimpernel*
pinacotheek	*pinacotheca*
pincet	*tweezers*
pinda	*peanut*
pineut	*dupe*
pinguin	*penguin*
pion	*pawn*
piraat	*pirate*
pisang	*banana*
pistache	*pistachio*
pistool	*pistol*
pizza	*pizza*
plankton	*plankton*
plantsoen	*park*
platina	*platinum*
pleidooi	*pleading*
plenair	*plenary*
poeha	*fuss*
poelet	*soup meat*
poespas	*hotch-potch*
poesta	*puszta*
poëzie	*poetry*
politicoloog	*politics schola*
politicus	*politician*
politie	*police*
politiek	*politics*
polka	*polka*
polonaise	*polonaise*
polysindeton	*polysindeton*
pompoen	*pumpkin*
ponton	*pontoon*
populier	*poplar*
portemonnee	*purse*
portiek	*portico*
portret	*portrait*
postiljon	*postilion*
praktijk	*practice*
precair	*precarious*
pregnant	*concise*
premie	*premium*
presteer	*to achieve*
prestige	*prestige*
priester	*priest*
primair	*primary*
primula	*primrose*
privatim	*privatim*
procedé	*process*
proces	*process*
produkt	*product*
proficiat	*congratulations*
profiel	*profile*
profijt	*profit*
profylaxe	*prophylaxis*

projektiel	*projectile*
proleet	*cad*
prompt	*prompt*
promptst	*promptst*
propaganda	*propaganda*
prosodie	*prosody*
prostitué	*prostitute*
proton	*proton*
protozoön	*Protozoa*
psychose	*psychosis*
punaise	*drawing-pin*
pupil	*pupil*
purée	*purée*
puzzel	*puzzle*
pygmee	*pygmy*
pyromanie	*pyromania*
python	*python*
quarantaine	*quarantine*
ra	*yard*
raak	*to hit*
raam	*window*
rabauw	*ugly customer*
rabies	*rabies*
radar	*radar*
radiator	*radiator*
radio	*radio*
ragout	*ragout*
raket	*rocket*
ram	*ram*
ramadan	*Ramadan*
rammenas	*black radish*
ramp	*disaster*
rantsoen	*ration*
rapalje	*rabble*
rapsodie	*rhapsody*
rataplan	*caboodle*
razzia	*razzia*
rebellie	*rebellion*
recalcitrant	*recalcitrant*
recu	*luggage ticket*
referaat	*report*
referendaris	*referendary*
reformatie	*reformation*
refractometrie	*refraction theory*
regie	*staging*
relatief	*relative*
relikwie	*relic*
reliëf	*relief*
reparateur	*repairer*
repertoire	*repertory*
repeteren	*to rehearse*
repliek	*rejoinder*
reproductie	*reproduction*
requiem	*requiem*
requisitie	*requisition*
residu	*residue*
respectabel	*respectable*
resultaat	*result*
retirade	*lavatory*
retsina	*retsina*
reünie	*reunion*
reuzel	*lard*
revisor	*reviser*
revolutie	*revolution*
revue	*revue*
riant	*splendid*
rimboe	*jungle*
rinoceros	*rhinoceros*
ritme	*rhythm*
rivier	*river*
robot	*robot*
rococo	*rococo*
rododendron	*rhododendron*
roman	*novel*
romantiek	*romance*
rondo	*rondel*
rotan	*rattan*
rotonde	*roundabout*
roulette	*roulette*
rouwdouw	*rude person*
rozemarijn	*rosemary*
rumba	*rumba*
rumoer	*noise*
sacristie	*sacristy*
sake	*saké*
salade	*salad*
salamandrijn	*salamandrine*
salaris	*salary*
saldo	*balance*
salon	*drawing-room*
samba	*samba*
sambal	*sambal*
samoerai	*samurai*
samovar	*samovar*
sandaal	*sandal*
sanhedrin	*sanhedrim*
sassefras	*sassafras*
satanisch	*satanic*
sateh	*grilled pork*
saucijs	*sausage*
sauriër	*saurian*
scarabee	*scarab*
schalmei	*shawm*
schema	*diagram*
schibbolet	*shibboleth*
schiereiland	*peninsula*
schurft	*scabies*
schwa	*schwa*
scrambler	*scrambler*
sculptuur	*sculpture*
secondant	*second*
secuur	*accurate*
sedert	*since*
seizoen	*season*
sekte	*sect*
selderij	*celery*
select	*select*
selecteer	*to select*
semantiek	*semantics*
semasiologie	*semasiology*
senaat	*senate*
senator	*senator*
seniel	*senile*
senior	*senior*
sensatie	*sensation*
sentimenteel	*sentimental*
september	*September*
sereen	*serene*
serendipisme	*serendipity*
serpent	*serpent*
servet	*napkin*
servies	*dinner-set*
sesam	*sesame*
sideraal	*sideral*
sieraad	*ornament*
signaal	*signal*
sinas	*orange drink*
sisal	*sisal*
slalom	*slalom*
smaragd	*emerald*
smiespel	*to whisper*
sneeuw	*snow*
sneu	*disappointing*
soelaas	*solace*
soldaat	*soldier*
soldij	*pay*
solemniseer	*to solemnize*
solipsisme	*solipsism*
sonar	*sonar*
sonate	*sonata*
sonorant	*sonorant*
sorbet	*sorbet*
souper	*supper*
specie	*mortar*
species	*species*
specificiteit	*specificity*
specimen	*specimen*
spectator	*spectator*
spectraal	*spectral*
spektakel	*racket*
spektakulair	*spectacular*
spermatozoön	*spermatozoon*
spion	*spy*
spiritus	*methylated spirit*
spontaan	*spontaneous*
staar	*to gaze*
staart	*tail*
stadion	*stadium*
staket	*fence*
stalactiet	*stalactite*
stalagmiet	*stalagmite*
statistiek	*statistics*
stengel	*stalk*
steriel	*sterile*
sterk	*strong*
stierf	*to die* (past tense)
stimulus	*stimulus*
stramien	*canvas*
strategie	*strategy*
stroopwafel	*treacle waffle*
structuur	*structure*
student	*student*
studie	*study*

studio	*studio*
subjunctief	*subjunctive*
substantief	*substantive*
succes	*success*
sultan	*sultan*
suprematie	*supremacy*
surprise	*surprise*
syfilis	*syphilis*
syllabe	*syllable*
symboliek	*symbolism*
symfonie	*symphony*
sympathie	*sympathy*
symposion	*symposium*
symptoom	*symptom*
tabak	*tobacco*
tabberd	*tabard*
taboe	*taboo*
taktiek	*tactics*
talisman	*talisman*
tamboerijn	*tambourine*
tampon	*tampon*
tandpasta	*tooth paste*
tang	*tongs*
tangens	*tangent*
tango	*tango*
taptoe	*taptoe*
tarantel	*tarantella*
tarief	*tariff*
tarwe	*wheat*
taugeh	*soya beans*
taveerne	*tavern*
taxi	*cab*
techniek	*technique*
tekentje	*hint*
tel	*count*
telefonie	*telephony*
telefoon	*telephone*
telefoonboek	*telephone book*
telkens	*again and again*
temperatuur	*temperature*
templaat	*template*
tempo	*tempo*
tendens	*tendency*
tenor	*tenor*
tentakel	*tentacle*
tentamen	*prelim*
term	*term*
termijn	*term*
terras	*terrace*
terriër	*terrier*
terrorem	*terrorem*
terugbetaal	*to refund*
terugbetaalbaar	*repayable*
textiel	*textile*
thee	*tea*
theorie	*theory*
therapie	*therapy*
thermometer	*thermometer*
thesaurus	*thesaurus*
thorax	*thorax*
ticket	*ticket*
tierelantijn	*florish*
tij	*tide*
timbre	*timbre*
timpaan	*tympanum*
tinctuur	*tincture*
tiran	*tyrant*
tirannie	*tyranny*
toendra	*tundra*
toernooi	*tournament*
toffee	*toffee*
tomaat	*tomato*
tomahawk	*tomahawk*
tombola	*tombola*
tonaal	*tonal*
toneel	*drama*
tonsil	*tonsil*
toon	*to show*
topos	*topos*
transplanteer	*to transplant*
traverse	*traverse*
travestie	*travesty*
tremolo	*tremolo*
triatlon	*triathlon*
triomf	*triumph*
trochee	*trochee*
trofee	*trophy*
trompet	*trumpet*
tuberculose	*tuberculosis*
tumbler	*tumbler*
tumult	*tumult*
turbine	*turbine*
tureluur	*redshank*
twaalf	*twelve*
uiver	*stork*
ulevel	*sweet*
ultimatum	*ultimatum*
unaniem	*unanimous*
uniek	*unique*
uniform	*uniform*
universeel	*universal*
uranium	*uranium*
utopisch	*utopian*
vaandel	*flag*
vademecum	*vade-mecum*
valeriaan	*valerian*
vallei	*valley*
valorem	*valorem*
vampier	*vampire*
varieté	*music hall*
vegetariër	*vegetarian*
veldbivak	*bivouac*
veldmarathon	*cross-country*
venster	*window*
ventiel	*valve*
veranda	*veranda*
vermicelli	*vermicelli*
vernis	*varnish*
veroordeel	*to condemn*
vers	*fresh*
verwierf	*to obtain* (past tense)
vijand	*enemy*
vijandelijk	*hostile*
vijandig	*hostile*
violet	*violet*
viool	*violin*
visite	*visit*
vitamine	*vitamin*
vizier	*vizier*
vlagde	*to fly flags* (past tense)
vliespinda	*cuticle peanut*
vocaal	*vocal*
vocabularium	*vocabulary*
voogd	*guardian* (m.)
voogdes	*guardian* (f.)
voorde	*ford*
voordeel	*advantage*
vorst	*monarch* (m.)
vorstin	*monarch* (f.)
vreemd	*strange*
vreemdeling	*stranger*
vreugde	*joy*
vulkaan	*volcano*
waardeer	*to appreciate*
wagon	*carriage*
wajang	*puppet play*
wakker	*awake*
walm	*smoke*
wang	*cheek*
wanorde	*disorder*
warm	*warm*
water	*water*
waterfiets	*pedal boat*
watjekouw	*cuff*
wereld	*world*
wielewaal	*golden oriole*
wierp	*to throw* (past tense)
wingerd	*vineyard*
woestijn	*desert*
woestijnachtig	*desertlike*
worstel	*to wrestle*
wrongel	*curds*
yoghurt	*yogurt*
zalf	*ointment*
zebra	*zebra*
zeem	*shammy*
zeker	*certain*
zenit	*zenith*
zeugma	*zeugma*
zigeuner	*gipsy*
zodiak	*zodiac*
zwaantje	*young swan*
zwezerik	*sweetbread*
zwierf	*to wander* (past tense)

Centraal Planbureau	*economic bureau*
Heleen Hordijk	(name)
Marcel Proust	*Marcel Proust*
Marie Koenen	(name)
Michiel Schapers	(name)
Pauline Broekema	(name)
administratieve rompslomp	*bureaucratic bother*
aktief optreden	*take action*
antieke klokken	*antique clocks*
banale opmerking	*commonplace*
brutaal antwoord	*bold rejoinder*
contant geld	*cash*
cum laude	*cum laude*
de berg Kilimanjaro	*Mountain Kilimanjaro*
educatieve middelen	*educational means*
een goed anabaptist	*a good anabaptist*
een goed evangelist	*a good evangelist*
een groot electoraat	*a vast electorate*
enfant terrible	*enfant terrible*
fameuze grap	*famous joke*
fataal ongeval	*fatal accident*
fictieve plaats	*fictitious place*
formeel kenmerk	*formal property*
frontale aanval	*frontal attack*
galant voorstel	*gallant proposal*
half-horizontaal	*semi-horizontal*
kritieke stelling	*critical position*
kubieke meter	*cubic metre*
legale middelen	*legal means*
locale bui	*local shower*
modale inkomens	*modal salaries*
neutrale opstelling	*neutral position*
nota bene	*nota bene*
parate kennis	*ready knowledge*
pikante saus	*spicy sauce*
primaire kenmerken	*primary features*
riant huis	*splendid house*
spectrale kenkerken	*spectral features*
spontane spraak	*spontaneous speech*
steriele watten	*sterile cotton-wool*
textiele werkvorm	*textile working method*
vocale steun	*vocal support*
vrij paradoxaal	*fairly paradoxical*
zeer melancholiek	*deeply melancholy*
zeer recalcitrant	*highly recalcitrant*

Samenvatting

Dit proefschrift behandelt woordklemtoon binnen de theorie van de metrische fonologie. We onderzoeken twee woordklemtoonsystemen: het Engelse en het Nederlandse, om een bijdrage te leveren aan de volgende theoretische kwesties.

Ten eerste de noodzaak van constituentie in klemtoonrepresentaties, die in twijfel werd getrokken in de zogenaamde *grid-only*-theorie (Prince 1983), maar recent opnieuw werd erkend in de zogenaamde *bracketed-grids*-theorie (o.a. Halle & Vergnaud 1987). Hieraan gerelateerd is de vraag of klemtoon, behalve een eigenschap van constituenten, een inherente eigenschap van de klemtoon-dragers (lettergrepen of morae) kan zijn. We geven argumenten voor zowel *constituentie* als *inherente* klemtoon. Maar anders dan de bracketed-grids-theorie aanneemt, stellen we voor dat klemtoon-constituenten bestaan uit *precies twee elementen*, een voorstel dat we de Stricte Binariteits Hypothese noemen. Aldus elimineren we alle typen constituenten die niet strikt binair zijn: niet-vertakkende constituenten (ook monosyllabische voeten genoemd), en onbegrensde (unbounded) constituenten, die o.a. dienen voor hoofdklemtoon-toekenning. De functie van de eerste wordt overgenomen door (voornamelijk) lettergreep-gewicht, doordat we kwantiteit-gevoeligheid opvatten als een welgevormdheidsconditie op de verhouding tussen lettergreepgewicht en klemtoon. De functie van onbegrensde constituenten voor prominentie wordt overgenomen door Eind-regels (End Rules), bekend uit het werk van Prince (1983).

Constituenten ontstaan door adjunctie van twee elementen op hetzelfde niveau in de grid, zoals lettergrepen. Strikte binariteit volgt nu uit de veronderstelling dat bij adjunctie altijd twee elementen zijn betrokken. Lettergreep-adjunctie is een vorm van adjunctie waartoe ook ritmische aanpassingen in woordgroepen (Hayes 1984) behoren.

De tweede centrale kwestie in dit proefschrift is de relatie tussen regels die klemtoon toekennen en regels die klemtoon verwijderen (*destressing rules*). Ondanks hun verschillen komen deze regel-typen overeen in kwantiteit-gevoeligheid en begrensdheid (binariteit, of ritmische alternantie). Om dit te verklaren heeft Prince (1985) de verhouding tussen beide regel-typen geherinterpreteerd als *primaire-metrische-analyse*-regels versus *metrische-heranalyse*-regels. In feite gaat het om dezelfde regels, maar slechts de eerste zijn onderworpen aan de *Vrije Element conditie*, ofwel de eis dat klemtoonregels slechts mogen worden toegepast op elementen die nog niet eerder in constituenten zijn ondergebracht. Dit voorstel impliceert dat klemtoonregels direkte toegang hebben tot lettergreepgewicht, omdat destressing-regels onderscheid maken tussen beklemtoonde zware en lichte lettergrepen. Daarom nemen we aan dat klemtoon voortkomend uit lettergreepgewicht een inherente, globale eigenschap is van de drager, terwijl klemtoon voortkomend uit constituentie geen inherente eigenschap van de drager is. Zo mogen in het ongemarkeerde geval regels die constituentie wijzigen niet klemtoon verwijderen die een gevolg is van lettergreepgewicht, maar wel klemtoon die een gevolg is de constituentie die ze uitwissen.

We kunnen nu de hoofdstelling van dit proefschrift formuleren: woordklemtoon is een samengestelde eigenschap, bestaande uit (a) binaire constituentie, (b) lettergreepgewicht, en (c) prominentie (klemtoon op hogere niveaus in de grid, zoals hoofdklemtoon). Deze eigenschappen zijn in wezen onafhankelijk, maar interacteren vanwege hun gezamenlijke representatie in de bracketed grid. Ons betoog heeft de volgende opbouw.

In het inleidende hoofdstuk 0 bespreken we enkele kwesties in de huidige theorie over woordklemtoon die van belang zijn voor dit proefschrift. Ook schetsen we onze bijdrage

aan deze kwesties, te weten de decompositie van woordklemtoon in de drie factoren binaire constituentie, lettergreepgewicht en prominentie.
In hoofdstuk 1 introduceren we de data van het ingewikkelde Engelse klemtoonsysteem, en bespreken we de belangrijkste kwesties in analyses uit de afgelopen twee decennia. We bespreken de distributie van beklemtoonde lettergrepen (klemtoonplaatsing en -retractie) apart van de sterkte-verhouding daartussen (prominentie). We laten zien dat destressing-regels steeds verdere generalisering van de klemtoontoekenningsregels hebben mogelijk gemaakt, en dat hierdoor destressing-regels eigenschappen als kwantiteit-gevoeligheid en binariteit hebben gekregen, eigenschappen die aanvankelijk grotendeels beperkt waren tot toekenningsregels. De centrale vraag over binaire klemtoonregels (toekenning zowel als verwijdering) is of deze direkte toegang hebben tot lettergreepgewicht. Enerzijds zijn zware lettergrepen het best op te vatten als inherent beklemtoond, anderzijds blijken de klemtoonwaarden van gesloten lettergrepen gevoelig voor contextuele klemtoon.
Hoofdstuk 2 bevat een analyse van Engelse woordklemtoon binnen een compositionele klemtoontheorie. Kwantiteit-ongevoelige retractie wordt herleid tot twee onafhankelijk gemotiveerde destressing-regels, namelijk *Sonorant Destressing* en de *Arab Rule*. Omdat deze hoofdklemtoonplaatsing voeden, kunnen ze worden opgevat als primaire metrische analyseregels (Prince 1985). Toch schenden ze de Vrije Element conditie, doordat ze constituenten uitwissen. Dit probleem verdwijnt als wordt aangenomen dat constituentie strikt binair is, want de betreffende regels wissen cruciaal nooit binaire constituenten uit. Kwantiteit-gevoeligheid wordt dan geherinterpreteerd als een welgevormdheidsconditie die ondermeer de klemtoonwaarden van *vrije* lettergrepen bepaalt, ofwel lettergrepen die in eerdere analyses monosyllabische voeten vormden. We bespreken andere woordklemtoonsystemen, sommige waarvan eerder zijn aangevoerd als evidentie voor monosyllabische voeten. We laten zien dat deze wel degelijk analyseerbaar zijn binnen onze theorie, en dat bepaalde systemen daarmee zelfs beter geanalyseerd kunnen worden. Dan bespreken we de voordelen van strikte binariteit voor de analyse van het Engels, zoals de overbodigheid van de regel Pre-Stress Destressing. De belangrijke inzichten van Hayes (1981) en Selkirk (1984) wat betreft extrametriciteit en finale klemtoon blijken goed overdraagbaar naar onze analyse. We formaliseren cycliciteit door middel van autosegmentele vlakken (zoals Halle & Vergnaud 1987), waarvan de samenvoeging wordt beheerst door de Elsewhere Condition (Kiparsky 1982). We geven enkele problemen aan voor Kiparsky's analyse, die gedeeltelijk oplosbaar zijn in onze analyse. We motiveren het formaat van lettergreep-adjunctie voor Post-Stress Destressing, de enige metrische-heranalyse-regel die overblijft. De regel wordt herleid tot het opnieuw toepassen op het lexicale niveau-2 van (reeds voor niveau-1 gemotiveerde) lettergreep-adjunctie. We bespreken het verlies van klemtoon door prominentie-verlies, en de gevolgen voor klemtoon van verandering van lettergreepgewicht. Tenslotte analyseren we ritmische aanpassingen binnen woorden.
De hoofdstukken 3 tot en met 5 zijn gewijd aan het Nederlandse woordklemtoonsysteem, dat voor ons interessant is om de volgende redenen. Ten eerste heeft het Nederlands een universeel zeldzaam onderscheid in lettergreepgewicht tussen (lichte) open lettergrepen met lange klinkers, en (zware) gesloten lettergrepen en lettergrepen met tweeklanken. Ten tweede is klinkerreductie gevoelig voor positie-verschillen tussen onbeklemtoonde lettergrepen, die eenvoudig typeerbaar blijken met behulp van de Stricte Binariteits Hypothese. Ten derde gedraagt de lexicale schwa zich als afwezig op niveau-1, waar primaire syllabificatie en klemtoontoekenning plaatsvinden.
In hoofdstuk 3 bespreken we drie aspecten van Nederlandse lettergreepstructuur. Ten eerste formaliseren we *bimorische minimaliteit* (afwezigheid van korte klinkers in open

lettergrepen) via een verplichte regel van Kernlettergreepvorming op niveau-1, verwant aan *Weight by Position* (Hayes 1989), maar geordend voor *Onset Formation*. Ten tweede relateren we maximum-beperkingen op lettergreepgewicht aan beperkingen op medeklinkerclusters buiten de kernlettergreep. Ten derde besteden we aandacht aan de syllabificatie van schwa. Medeklinkerclusters voor schwa gedragen zich distributioneel als behorende tot de voorafgaande lettergreep op niveau-1, een observatie die we formaliseren door aan te nemen dat schwa geen (mora-)gewicht heeft op niveau-1, en pas wordt gesyllabificeerd op niveau-2.

Hoofdstuk 4 behandelt de positie van de hoofdklemtoon in Nederlandse ongelede woorden. Met Lahiri & Koreman (1987) nemen we aan dat het gewichtsverschil tussen enerzijds (lichte) open letergrepen en anderzijds (zware) gesloten lettergrepen en lettergrepen met tweeklanken, samenhangt met het feit dat het Nederlands geen monomorische lettergrepen heeft op niveau-1 (zoals aangetoond in hoofdstuk 3). Doordat het onderscheid tussen monomorische en bimorische lettergrepen ontbreekt, kan een niet-morisch onderscheid optreden, dat we formaliseren in termen van *melodische complexiteit*, dat wil zeggen de hoeveelheid kenmerk-matrices verbonden met een lettergreepkern. Omdat lettergreepkernen met lange eenklankige klinkers er daarvan één hebben, en gesloten en tweeklankige lettergreepkernen twee, zijn de laatste zwaarder. Verder stellen we een lettergreep-adjunctie-regel voor die feitelijk gelijk is aan die van het Engels. Onze analyse van schwa als zijnde gewichtloos op niveau-1 blijkt hier direkt te verklaren dat schwa (a) onbeklemtoond is en (b) de hoofdklemtoon op de lettergreep voor schwa ligt als de klinker daarvan wordt gevolgd door minstens een medeklinker. Deze analyse verantwoordt de belangrijkste generalisaties over de plaats van de hoofdklemtoon, die we onafhankelijk motiveren via gegevens als 'incorrecte' beklemtoning en de plaats van hoofdklemtoon in nieuwe woorden. Daarnaast bespreken we klemtoonpatronen die afwijken van de 'kleine' generalisaties, maar nog steeds binnen de 'grote' generalisaties vallen. De gemarkeerdheid van zulke patronen wordt uitgedrukt via twee soorten lexicale markeringen: *lexicale klemtoon*, en lexicaal geregeerde *late extrametriciteit*. Deze markeringen zijn cruciaal zwak genoeg om de grote generalisaties niet te doen verliezen, en geven aldus inhoud aan het gedeeltelijk 'vrije' karakter van Nederlandse woordklemtoon.

Hoofdstuk 5 behandelt bijklemtoon en klinkerreductie, verschijnselen die onafhankelijke steun opleveren voor de analyse van hoofdklemtoon in hoofdstuk 4. In wezen vertoont het bijklemtoonpatroon de twee belangrijkste kenmerken van hoofdklemtoonplaatsing: binariteit (ritmische alternantie) en kwantiteit-gevoeligheid. Een uitbreiding van onze analyse van hoofdstuk 4 naar de resterende delen van het domein is dan ook voldoende om de belangrijkste generalisaties over bijklemtoon uit te drukken. Toch zijn op niveau-2 aanpassingen nodig om bijklemtoon geheel te verantwoorden. We laten aan de hand van klinkerreductie een hiërarchie tussen onbeklemtoonde lettergrepen zien, die eenvoudig te typeren is als *vrije* posities versus *adjunct*-posities. Gegeven twee identieke klinkers reduceert de klinker in adjunct-positie gemakkelijker dan de klinker in vrije positie. De distributie van deze posities vloeit voort uit het opnieuw toepassen van lettergreep-adjunctie op niveau-2, die onafhankelijk benodigd is voor de beregeling van bijklemtoon. Dit levert evidentie op voor de Stricte Binariteits Hypothese.

Tenslotte worden in de epiloog de belangrijkste conclusies van het proefschrift samengevat, en wordt een korte vergelijking gemaakt tussen het Engels en het Nederlands met betrekking to woordklemtoon.

Curriculum Vitae

René Kager was born in Hilversum on July 17, 1957, where he attended the Alberdingk Thijm College (Gymnasium-ß). He received his bachelor's degree in Psychology at the University of Utrecht in 1982. He studied Dutch language and literature at this university from 1977 to 1984, and received his master's degree cum laude. He was a research assistant at the Dutch Department at Utrecht from 1984 to 1988, and a teaching assistant in linguistics and text-to-speech. From 1986 to 1989, he was a researcher in the Dutch national text-to-speech program "Analysis and Synthesis of Speech" at the Department of Linguistics. He has (co-)authored publications in the fields of phonology and text-to-speech. Currently, he is a lecturer at the Department of Linguistics of the University of California at Los Angeles.