PHONOLOGICAL REPRESENTATION AND ANALYSES OF FAST SPEECH PHENOMENA IN ENGLISH

GUANGPING ZHANG

PHONOLOGICAL REPRESENTATION AND ANALYSES OF FAST SPEECH PHENOMENA IN ENGLISH

by

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For Xiuying and Xuhan

ABSTRACT

In spoken North American English, forms undergo a series of changes as the speaking rate increases. These changes involve, among others, three processes: vowel syncopation, initial syllable reduction, and consonant syllabification (or metathesis). In this thesis two phonological frameworks, autosegmental phonology and sonority phonology, are utilized to analyze these three processes in a speech rate I call 'Normal Conversational Speech' or 'NCS".

In NCS, the increase in speaking rate results not only in a general decrease in duration, but also often in the deletion of certain unstressed vowels. Word medially this is called 'syncopation'. Word initially it is called 'initial syllable reduction'. The third process involves the syllabification of certain sonorant consonants as well as the deletion of unstressed vowels. The result of this syllabification is the change of a sonorant consonant + vowel sequence into a syllabic sonorant consonant. It is shown that, in a certain sense, metathesis is another expression of syllabification.

All three processes are shown to occur under strict conditions involving syllable structure. The conditions for the processes are stated and are represented in simple rules within both the frameworks. Furthermore, a phonological explanation for the conditions is attempted on the basis of the two phonological frameworks. Finally, the shared characteristics and distinctions of the three processes are represented. In terms of the analysis in the thesis, it is evident that the three processes share some characteristics and have some distinctions. The shared characteristics are the result of the nature of the weakening processes of which each of the processes is an example. The distinctions are the result of the difference in position in which the processes occur.

Despite the fact that most phonological analyses are based on slow, careful speech, in everyday communication NCS is much more commonly used than slow speech or very rapid speech. NCS is, therefore, the most important form of English to master for general communicative purposes. Since syncopation, initial syllable reduction, and syllabification are salient aspects of NCS, this thesis

will, thus, have practical applications in designing speech synthesis programs, and in teaching English as a foreign language.

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My deepest thanks also go to Stuart Milliken. This thesis is largely based on another thesis and data supervised and offered by him, when I studied in China with him as my advisor. At that time we often discussed the subject for hours and hours in great detail. His remarks have greatly deepened my understanding of linguistics and enriched my knowledge of the theme.

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Chapter One

Introduction

It is a common assumption that certain phonological reductions and deletions occur as speaking rate increases. In the spoken English of North America (i.e. Canada and the United States), forms do, in fact, undergo a series of changes as a result of this increase in tempo. These changes involve many processes, such as vowel syncopation, consonant syllabification, metathesis, and cluster simplification, among others. Spoken Canadian English is somewhat different from spoken American English (e.g. spoken Canadian English, unlike spoken American English, seldom undergoes metathesis), but, on the whole, both of them observe similar phonological rules of transformation from slow speech to fast speech. This thesis does not attempt to describe all dialects of English; for the purposes of this thesis, 'English', from this point on, will refer only to North American English. In this thesis I will discuss some of the phonological processes involved in the transformation from Slow Speech (hereafter SS) to a speech rate I call 'Normal Conversational Speech' (hereafter NCS).

For practical purposes, speech rates can be divided into three categories: Slow Speech, Normal Conversational Speech, and Rapid Speech. Rapid Speech refers to very fast speech, which is rarely

used in everyday life and is not my primary concern in this thesis. SS and NCS are relative concepts. SS is a tempo in which every word is pronounced fully and clearly, as when an instructor teaches a foreign language to beginners. NCS, on the other hand, is relatively more rapid and is used commonly in everyday life. Sometimes phonetic forms found in NCS can even become lexicalized when they are popular enough, as is illustrated in later chapters.

In Zhang 1990, I did some preliminary work on two processes in the NCS of English: syncopation and sonorant syllabification. In this thesis more detailed studies will be done on these two processes and two additional ones: initial syllable reduction, and metathesis.[1] Nonlinear phonology is taken as the basis for discussion. From a theoretical perspective, I present two (nonlinear) phonological frameworks, and utilize them to analyze these phonological processes in NCS. These are autosegmental phonology and sonority phonology. Each of them takes a somewhat different approach to analyzing syllable structures. Briefly described, sonority phonology assumes that the "sonority cycle" is the key to syllable structures and, thus, that the processes can be explained using the sonority cycle and the sonority features of the segments in question. The approach of autosegmental phonology is that syllable structures consist of several tiers which are related to each other by means of association lines, and that the processes are caused by the

[1] Metathesis is actually the same process as sonorant syllabification, as discussed in later chapters. Therefore, only three processes are actually described in this thesis.

assimilation or dissimilation of the autosegments' laryngeal and supralaryngeal features on different tiers. One of the main concerns of the thesis is to compare the advantages and disadvantages of each framework for analyzing the phonological processes in NCS.

1.1. A Review of the Literature

Fast speech is a phenomenon which few linguists have dealt with in their studies, especially from a phonological point of view. One linguist who has considered the phonology of fast speech is Ellen Kaisse. Kaisse (1985) is concerned with certain aspects of fast speech phenomena, such as the flapping rule, the realization of nasal consonants, the derivation of the clitic variants of *don't* , and initial *ə*-Deletion (but to very limited extent). She has described some of the fast speech phenomena, but without exploring the underlying factors that determined these phenomena.

Dalby (1986), on the other hand, has made a detailed study of the fast speech phenomena in American English. He describes how in fast or casual speech the number of syllables of a word is often reduced (as compared with that in careful pronunciation of the same word), due to the deletion of certain unstressed vowels. What is significant is that he noticed the relationship between syllable structure, stress pattern, environments, and fast speech rules. He comments (Dalby 1986:v):

> "Since many of the rules that govern the distributions of allophonic and sub-allophonic variants of phonological

> segments refer to syllable structure and since both the number of syllables in a word and the stress pattern associated with those syllables appear to be important aspects of speech production and perception, an explanation of the variation in syllable and prosodic structure that occurs across style shifts is an important part of the theory of spoken language.
>
> Results of the analysis show that in both conversational and very fast speech, the frequency of occurrence of unstressed syllable deletions is determined by the position in the word and the number and type of segments adjacent to the unstressed vowel."

Dalby has produced some excellent arguments. However, his analysis is, on the whole, a phonetic one. He has not provided any phonological explanations for the processes associated with fast or casual speech.

1.2. Significance of This Thesis

Fast speech, unlike slow standard speech, has its own unique characteristics. To assess these characteristics, and to develop explanatory principles and rule schemata for them are a challenge for any phonologist. In this thesis, the three processes to be analyzed are only part of the whole fast speech phenomenon. However, they, as indicated in later chapters, reveal something of the nature of fast speech and indicate certain principles that all fast speech processes follow. This thesis, I hope, may contribute something to the study of fast speech phenomena as a whole.

The two frameworks used in this thesis represent two aspects of non-linear phonology: sonority phonology and autosegmental phonology. Each of the two frameworks enjoys certain advantages in terms of how it analyzes NCS processes. It is one of the motivations of the thesis to show that the two frameworks have several commonalities, as well as significant distinctions.

In everyday communication, NCS is much more commonly used than either slow speech or very fast speech, and, therefore, NCS is perhaps the most important form of English to master for general communicative purposes. This thesis will, hopefully, contribute towards the analysis of this most commonly used speech tempo.

Chapter Two

Some Theoretical Background

The phonological processes in fast speech, I assume, are largely determined by syllable structure. As stated in the introduction, the phonological processes used in Normal Conversational Speech will be analyzed utilizing two different non-linear frameworks. These two frameworks assume distinctive perspectives towards the phonological processes in fast speech, since they adopt different theoretical methodologies and positions on the nature of syllable structure. Syllable structure is an important factor in determining the phonological patterns in NCS. For the sake of convenience, therefore, in this chapter I provide a brief description of the principles assumed by these two frameworks, with respect to syllable structure, in order to serve as a theoretical background for the discussion in later chapters.

2.1. Autosegmental Phonology

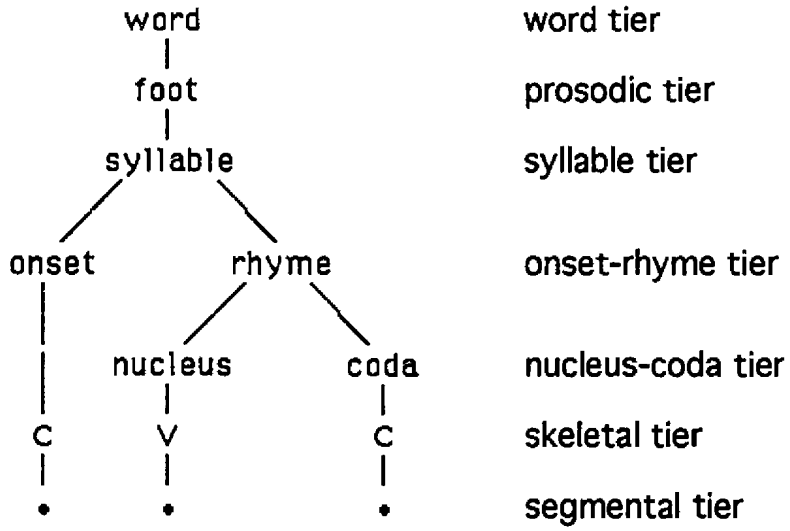
The autosegmental approach (as presented in Clements and Keyser 1983, Goldsmith 1990, Kenstowicz 1993, Odden 1986, and Yip 1988) sees phonology as comprised of several levels or 'tiers'. Each tier consists of a linear arrangement of segments, which are distinct

from others with respect to the features that are specified in them. Each tier is related to the others by means of association lines.

2.1.1. Syllable Structure and Some Principles

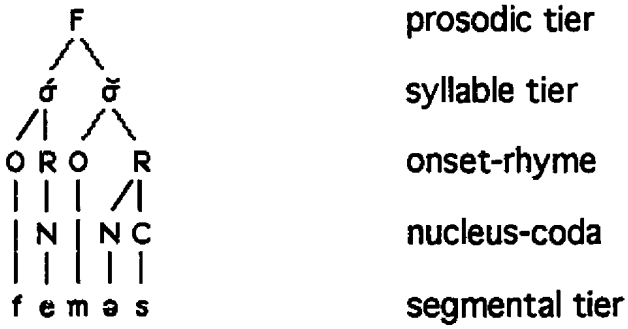
The lowest level is the segmental tier, which consists of bundles of phonological features. Usually there is a skeletal (or CV) tier above this, which identifies syllabic and non-syllabic elements (Clements and Keyser 1983:8-9). As far as syllable structure is concerned, the essential constituent is the syllable peak, which is called the nucleus. Segments preceding and following the syllable peak belong to optional constituents, which are called, respectively, the onset and the coda. The nucleus and the coda together constitute the rhyme. Above the syllable tier there is a prosodic tier; further up is the word tier. As a result, a panorama of the syllable structure would look like this:

(1) Autosegmental Representation of Syllable Structure



Since the skeletal tier is not necessary for the description of syllable structure, for the sake of convenience, it will be omitted in later discussion. For instance, a simplified autosegmental representation of the syllable structure of the word "famous" would take the following form:

(2) Syllable Structure of "famous"[2]



[2] The syllable symbol σ will be marked as stressed or unstressed by diacritics, or unmarked for stress (in the case where both stressed and unstressed are possible) throughout the thesis.

The significant characteristic of the autosegmental approach is that elements on one tier can be totally independent of elements on other tiers. Goldsmith (1990:27) states:

(3) Stability Effect

> "This autonomy in turn leads us to expect that rules whose effect is to delete a segment located on one autosegmental tier will not affect an autosegment with which it was formerly associated. This effect is known as a stability effect."

For autosegmental phonology the fundamental mechanism with regard to phonological change is the association of different tiers. Phonological processes in NCS can be represented by the reassociation of relevant tiers. Autosegmental phonology proposes several distinctive principles concerning such association patterns. The Conjunctivity condition (Goldsmith 1990:39), as cited below, describes the conditions under which a rule applies to a segment in an autosegmental representation.

(4) Conjunctivity Condition

> "If a rule R has the effect of modifying the feature specifications of a segment S, or deleting a segment S, and if the rule explicitly refers to a chart C (i.e., association lines linking two autosegmental tiers), then segment S will undergo the effects of the rule only if all of its association lines in C are explicitly mentioned in rule R."

Autosegmental phonology also assumes the Maximal Onset Principle (Goldsmith 1990:137), which characterizes how an intervocalic consonant associates with respect to syllable structure:

(5) Maximal Onset Principle

> "VCV sequences are almost always resolved in favor of a syllabification that puts the consonant in the onset of the syllable to the right. It appears as if it were more important to the syllable to have an onset than to have a coda; this has been called the Maximal Onset Principle."

These principles help to explain why some forms are subject to the NCS processes, and some are not.

2.1.2. Licensing

According to Goldsmith 1990, every segment must be licensed by a licenser, or will be considered contingently extrasyllabic. To be licensed it must associate with an element in a higher tier. The syllable is the primary licenser, which licenses the onset and the nucleus. The coda is the secondary licenser, which licenses the coda segment. However, this secondary licenser is optional. Goldsmith (1990:123) states that "a given licenser can license no more than one occurrence of the autosegment in question". Goldsmith (1990:124) explains the basic motivation for licensing as follows:

(6) Autosegmental Licensing

> "If we focus simply on the phonologically distinctive features of a language, it has been noted on a number of occasions that there is a very strong tendency for each such feature to be specified no more than once within the combined domain of the onset and the nucleus. ... Thus, there is maximum of one appearance of each distinctive feature over the onset-nucleus span; ... A way of summarizing the point more generally is by noting that phonological systems have a tendency to limit to one occurrence per domain any distinctive feature under their control. For example, in the onset, there may be only one occurrence of the feature [+continuant]; hence an /s/ may never precede a fricative. Similarly, there may be only one occurrence of the feature [labial]; hence a /p/ or a /b/ may never precede the glide /w/."

Another important notion about autosegmental licensing is that, normally, the coda does not license the point of articulation of a segment; instead, it is licensed by the onset of the following syllable (Goldsmith 1990:125).

I will refer back to these basic assumptions of autosegmental phonology in later discussions.

2.2. Sonority Phonology

Another framework related to the analyses of processes in NCS is sonority phonology, which assumes that syllables are units consisting of alternating crescendo and diminuendo sonority cycles. Every segment is assumed to have an inherent sonority: /n/ is more

sonorous than /g/, /ɑ/is more sonorous than /n/, etc. The difference in sonority can be used to define the syllable structure.

2.2.1. The Sonority Scale and the Sonority Cycle

The sonority framework (as presented in Milliken 1988, and a similar proposal is presented in Clements 1987) views the syllable as a unit in which the sonority value of individual segments increases from the left margin to the syllable peak, and then decreases from the syllable peak to the right margin. These alternating crescendos and diminuendos of speech constitute a sonority unit which is called a syllable (Bloomfield 1976:120). Within this framework, all segments can be categorized into one of five major classes: vowel (V), glide (G), liquid (L), nasal (N) and obstruent (O). These five major classes differ along a sonority scale. Milliken (1988:26) adopts a sonority scale ranking the sonority of these segment classes as shown in (7):

(7) Universal Sonority Scale

O N L G V

less sonorous ← → more sonorous

This scale lists vowels as the most sonorous, and obstruents as the least sonorous, with glides, liquids and nasals ranging along the continuum in between. Milliken (1988:35) proposes using the four distinctive features [±sonorant], [±approximant], [±vocoid] and [±open]

to define the sonority characteristics of these five classes of sounds. Using these features, the sonority values of the classes are shown in (8). (See also Clements 1987 for a similar proposal.)

(8) Sonority Feature Values of the Major Classes

O	N	L	G	V	
-	-	-	-	+	[open]
-	-	-	+	+	[vocoid]
-	-	+	+	+	[approximant]
-	+	+	+	+	[sonorant]
0	1	2	3	4	Sonority Rank

Using these values for the major classes, we can define a 'sonority cycle', which Milliken (1988:30) expresses as follows:

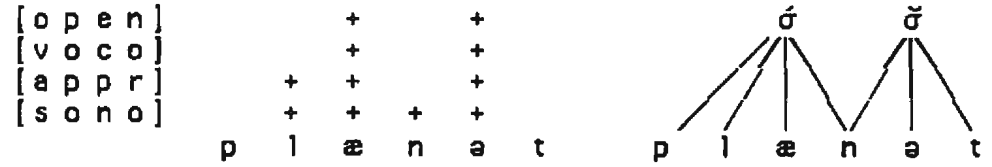
(9) Definition of Sonority Cycle

> "A sonority cycle is a maximal string of one or more continuous segments characterized by at most one continuously rising sonority contour preceding the highest sonority level in the contour and at most one continuously declining sonority contour following the highest sonority level in the contour."

Each sonority cycle is assumed to consist of one syllable, for example, note the sonority analysis of 'planet'[3] which follows:

[3] Please note that the (North American) English example words are transcribed, using IPA symbols, in a very broad phonetic transcription (e.g. 'rain' /ren/ rather than [rejn]). To indicate that this is a broad transcription, the forms are (normally) enclosed in slant brackets, rather than square brackets.

(10) Sonority Cycle and Syllable Structure of 'planet'

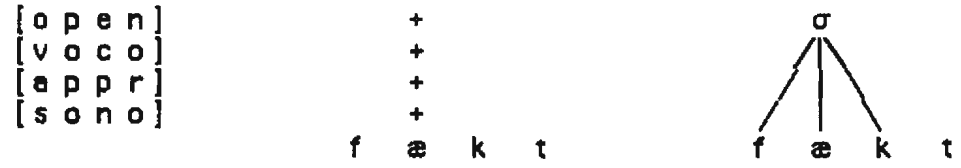


The figure on the left displays two cycles centered around the two sonority peaks. Based on these cycles the syllable structure of the word is that given in the right-hand figure. The nasal /n/ is ambisyllabic (a member of both syllables simultaneously), since it lies at the boundary of two sonority cycles.

2.2.2. Extraprosodicity

Another aspect of syllable structure is extraprosodicity. Extraprosodicity is motivated by the sonority cycle. For example, the word 'fact' has the sonority cycle and syllable structure illustrated in (11):

(11) Sonority and Syllable Structure of 'fact'



The consonant /t/ is extraprosodic, or more specifically, 'extrasyllabic', for it is no less sonorous than the preceding segment /k/. Sometimes such a segment as /t/ is referred to as an 'orphan', because it does not belong to any syllable.

In addition to this kind of orphan extrasyllabicity, Milliken (1988:93, revised by Milliken) proposes another kind which he calls 'rule-based extraprosodicity'. He defines it as follows:

(12) Definition of Rule-based Extraprosodicity

> "Rule-based extraprosodicity is a kind of extraprosodicity arising through the application of rules which delink a segment from some prosodic node even though no principles of syllable structure or language-specific conditions are violated."

Rule-based extraprosodicity and orphan extrasyllabicity are two different concepts. A case of orphan extrasyllabicity only refers to an extrasyllabic segment which is excluded from a syllable because of the nature of the word's sonority contour. Rule-based extraprosodicity, however, covers a wide range of concepts, including orphan extrasyllabicity. It may include 'extranuclearity', resulting from a rule delinking a nuclear segment from the nucleus, and 'extrasyllabicity' resulting from a rule delinking a segment from the syllable altogether. It may also include 'extrapedality', resulting from a rule delinking an entire syllable from the foot structure above it.

This rule-based extraprosodicity is constrained by a principle called the Peripherality Condition (Hayes 1982, etc.), which is given in Kiparsky (1985:118) as follows:

(13) The Peripherality Condition

> "Extraprosodicity is only permitted in peripheral positions."

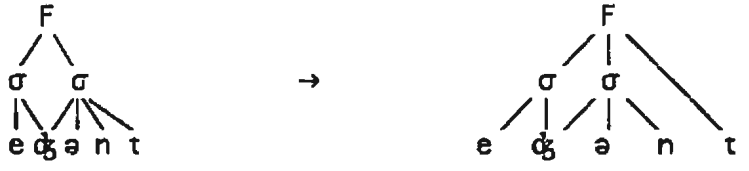
Milliken (1988:99) revises the Peripherality Condition along the following lines:

(14) Revised Peripherality Condition

> "An element (such as a segment) may be extraprosodic with respect to some level of structure (the foot, the syllable, etc.) if it is in a peripheral position in the next-higher level of structure."

This means, for example, that an extrasyllabic segment is only permitted at the edge of a foot. The word 'agent' illustrates extrasyllabicity, as constrained by the Revised Peripherality Condition.

(15) Extrasyllabicity in 'agent'



The segment /t/ is peripheral with respect to the foot, and thus is exempted from belonging to the one-step lower structure of syllable.

These assumptions concerning syllable structure and extrasyllabicity serve as the basis for the discussion in later chapters.

Chapter 3

Phonological Processes of Transformation

As speaking rate increases, several different phonological processes are manifested. Certain reduced vowels delete, especially schwa. Some obstruents delete. Some sonorous consonants become syllabified, and, in some dialects, are subsequently also metathesized. In the following sections I will discuss the three processes which I call syncopation, initial syllable reduction, and sonorant syllabification.[4]

For syncopation in English NCS, I take *A Pronouncing Dictionary of American English* (Kenyon and Knott 1944) as a source of data, since it records many syncopated forms. Other data for initial syllable reduction and sonorant syllabification and metathesis come from Stuart Milliken (personal communication). All of the data have been confirmed by several native speakers of American or Canadian English, and were verified by my supervisor, Dr. A. Steinbergs.

3.1. Syncopation

In English, unstressed vowels most often reduce to /ə/ɚ/ɹ̩/. In NCS these vowels, when unstressed, are usually subject to a series of phonological processes, in certain environments. In NCS, the

[4] Sonorant syllabification also includes the process of metathesis.

increase in speaking rate results not only in a decrease in duration of words and sentences, but also often results in the deletion of certain unstressed vowels. When this occurs in a word-medial syllable, it is called syncopation. In this chapter I discuss syncopation involving the unstressed vowels mentioned above.

3.1.1. Conditions for Syncopation

Syncopation in NCS is a puzzling phenomenon since apparently contradictory examples occur. To describe the process, I will start with the simplest cases. The following data show syncopating as well as non-syncopating forms in NCS. (The potential targets of syncopation are italicized 'SS' means 'Slow Speech'.)

(16) Syncopating and Non-syncopating Forms

		SS	NCS
a.	porcelain	/'pɔrs*ə*lən/	/'pɔrslən/
b.	aspirin	/'æsp*ə*rɪn/	/'æsprɪn/
c.	reasonable	/'riz*ə* nəbl̩/	/'riznəbl̩/
d.	imaginative	/ɪ'mædʒ*ə*nətɪv/	/ɪ'mædʒnətɪv/
e.	nationalize	/'næʃ*ə*nəl,ajz/	/'næʃnəl,ajz/
f.	separability	/,sɛp*ə*rə'bɪlətɪ/	/,sɛprə'bɪlətɪ/
g.	method	/'mɛθ*ə*d/	*/'mɛθd/
h.	famous	/'fem*ə*s/	*/'fems/
i.	consideration	/kən,sɪd*ə*reʃən/	*/kən,sɪd'reʃən/
j.	memorize	/'mɛm*ə*,rajz/	*/'mɛm,rajz/

In (16a-f) all the target vowels that undergo syncopation in NCS are in unstressed syllables. Thus, I propose that syncopation in NCS occurs only in an unstressed syllable. In (16g-j), however,

unstressed vowels do not delete. Compare these two sets of data and we can see that the systematic difference between them has to do with the stress on following syllables. In (16a) and (16b) the syncopation target is followed by one unstressed syllable. In (16c) and (16d) the syncopation target is followed by two unstressed syllables. In (16e) and (16f) the syncopation target is followed by one unstressed syllable and a stressed syllable. To generalize, the target syllables of syncopation in (16a-f) are all immediately followed by one unstressed syllable. Thus, syncopation occurs in an unstressed syllable which is followed by at least one other unstressed one.

In contrast, in (16g) and (16h) the target vowel is in the final syllable and so is obviously not followed by an unstressed syllable. Also, in (16i) and (16j) the target syllable is followed by syllables that are stressed to some degree, whether primary or otherwise. Thus, syncopation does not occur if the unstressed syllable is followed by a stressed one, nor does it occur in a word-final syllable. Further evidence that syncopation never occurs when followed by a stressed syllable can be found by comparing the contrasting pairs given in (17).

(17) Contrast Pairs for Syncopation

	SS	NCS
a. separate(adj.)	/'sɛpərɪt/	/'sɛprɪt/
b. separate(verb)	/'sɛpə,ret/	*/'sɛp,ret/

c. memory	/'mɛmə ri/	/'mɛmri/
d. memorize	/'mɛmə,rajz/	*/'mɛm,rajz/
e. temporal	/'tɛmpərəl/	/'tɛmprəl/
f. temporary	/'tɛmpə,rɛri/	*/'tɛmp,rɛri/

The difference in each pair is that the unstressed vowel in (a), (c), and (e) is followed by an unstressed syllable while that in (b), (d), and (f) is followed by a syllable that is stressed to some degree. We can therefore summarize the evidence from (16) and (17) as follows:

(18) Condition I for Syncopation

> English syncopation in NCS can only occur in an unstressed syllable which is immediately followed by another unstressed syllable.

As it stands, however, Condition I offers only one of the conditions for syncopation, for one might ask why in 'separability' in (16) only the second syllable should syncopate. The penultimate syllable is also unstressed and is followed by an unstressed syllable, so in accordance with Condition I syncopation should apply there as well. The result, however, would be the incorrect */,sɛpərə'bɪlɪti/. Other similar examples, listed in (19), also show that further conditions must exist for syncopation.

(19) Evidence for the Existence of Further Conditions

	SS	NCS
(a) One possible syncopation position*		
reconnaissance	/rɪ'kɑn ə səns/	*/rɪ'kɑnsəns/
accidence	/'æksə dəns/	*/'æksdəns/
diligence	/'dɪlə dʒəns/	*/'dɪldʒəns/
competent	/'kɑmp ə tənt/	*/'kɑmptənt/
innocent	/'ɪn ə sn̩t/	*/'ɪnsn̩t/
president	/'prɛzə dənt/	*/'prɛzdənt/
(b) Two possible syncopation positions		
fashionable	/'fæʃ ə n ə bl̩/	*/'fæʃənbl̩/
imaginative	/ɪ'mædʒ ə n ə tɪv/	*/ɪ'mædʒəntɪv/

Although all of the forms in (19a) satisfy Condition I, if syncopated, they give the incorrect outputs shown in the right-hand column. In section (b), both the antepenultimate and the penultimate syllables in each case satisfy Condition I, yet the syncopated outputs in the right-hand column are not acceptable if the penultimate syllable undergoes syncopation. As it turns out, the data in (19) have a special characteristic which blocks syncopation.

Consider the data in (20). These forms show that the nature of the consonant immediately following the target vowel is significant.

(20) Data for Syncopation Environment

	SS	NCS
azimuth	/'æzɪməθ/	/'æzməθ/
pyramid	/'pɪrə mɪd/	/'pɪrmɪd/
predicament	/prə'dɪkə mənt/	/prə'dɪkmənt/

experiment	/ɪks'pɛrə mənt/	/ɪks'pɛrmənt/
accompanist	/ə'kʌmpə nɪst/	/ə'kʌmpnɪst/
imaginable	/ɪ'mædʒ ɪ nəbl̩/	/ɪ'mædʒnəbl̩/
listener	/'lɪsə nɚ/	/'lɪsnɚ/
tetanus	/'tɛtə nəs/	/'tɛtnəs/
bachelor	/'bætʃə lər/	/'bætʃlər/
benevolence	/bə'nɛvə ləns/	/bə'nɛvləns/
catholic	/'kæθə lɪk/	/'kæθlɪk/
porcelain	/'pɔrsə lən/	/'pɔrslən/
aspirin	/'æspə rɪn/	/'æsprɪn/
dangerous	/'deɪndʒ ə rəs/	/'dendʒrəs/
natural	/'nætʃə rəl/	/'nætʃrəl/
deliverance	/dɪ'lɪvə rəns/	/dɪ'lɪvrəns/

There is an obvious distinction between (19) and (20): the data in (20) show syncopation when the target vowel is followed by an unstressed syllable beginning with one of the sounds /m/, /n/, /l/, or /r/. These four sounds all share the feature [+sonorant]. The target vowels in (19), however, are followed by consonants which are [-sonorant]. This indicates that the syllable which immediately follows the syncopated vowel must not only be unstressed but also begin with a sonorant consonant (A few apparent exceptions are discussed later.). Thus the feature [+sonorant] is a significant factor in NCS syncopation. I, therefore, propose another condition as follows:

(21) Condition II for Syncopation

> The unstressed syllable immediately following the target of syncopation must have a [+sonorant] onset.

Conditions I and II together handle all of the data in (19) and (20). The above two conditions, however, are still not sufficient. The following examples show that there exist other conditions for syncopation in NCS:

(22) Evidence for the Existence of Other Conditions

	SS	NCS
abdominal	/æb'dɑmə nəl/	*/æb'dɑmnl̩/
immanence	/'ɪmə nəns/	*/'ɪmnəns/
eminent	/'ɛmə nənt/	*/'ɛmnənt/
eminence	/'ɛmə nəns/	*/'ɛmnəns/
ominous	/'ɑmə nəs/	*/'ɑmnəs/
synonymous	/sɪ'nɑnə məs/	*/sɪ'nɑnməs/
disarmament	/dɪs'ɑrmə mənt/	*/dɪs'ɑrmmənt/
firmament	/'fɚmə mənt/	*/'fɚmmənt/

All of the forms in (22) satisfy the two conditions, yet they give the incorrect syncopated forms in the right-hand column. To cover these exceptions, I propose another condition. Note that the target unstressed vowels in (22) are both immediately preceded and followed by nasals while the syncopated vowels in (20) are not. Now let us consider if this generalization holds for obstruents, liquids, and glides, as well as nasals.

Obstruents pose no problems, since Condition II in (21) blocks syncopation when the target vowel is flanked by two obstruents. As for the remaining two major classes, liquids and glides, the generalization evidently holds for them as well. So far I have not found a vowel that syncopates when immediately preceded and followed by either both liquids or both glides. This fact is compatible with the above generalization. Hence I assume that the generalization holds not only for nasals but for other major classes as well. However, syncopation does take place if the schwa is flanked by two sonorants of different classes, such as a nasal and a liquid. (See, for example, 'memory' /mɛmərɨ/ which becomes /mɛmri/ in NCS). In other words, syncopation in NCS is blocked if the target vowel is flanked by two segments of the same class of sonorants. I thus propose a third condition for syncopation in NCS:

(23) Condition III for Syncopation

> The two segments flanking the target vowel must be from different manner of articulation classes.

The above condition thus accounts for the non-syncopating forms in (22). The reason why segments from the same sonorant class have such a blocking effect will be discussed in section 4.2.

Another generalization true for the data throughout this chapter is that each of the target syllables has an onset. Therefore the word "bayonet" will never undergo syncopation, as indicated below:

(24) Target Syllable without an Onset

	SS	NCS
bayonet	/'be ənɛt/	*/'benɛt/

Syncopation is blocked because the target syllable has no onset.

To sum up, English syncopation in NCS can only occur under the following conditions:

(25) Statement of Syncopation in NCS

(a) The target syllable must be an unstressed one, and must have an onset.

(b) The target syllable must be immediately followed by another unstressed syllable which has a sonorant onset.

(c) The two segments flanking the target vowel must be from different manner of articulation classes.

This statement covers all the examples discussed so far.

3.1.2. Supplement to the Statement

The statement in (25) is adequate for the data discussed so far. However, there are still some very special exceptions to the statement, as listed in (26), which remain to be explained:

(26) Special Exceptions to the Statement

	SS	NCS
a. abominable	/ə'bɑmə nəbl̩/	/ə'bɑmnəbl̩/
b. examinable	/ɪg'zæmɪ nəbl̩/	/ɪg'zæmnəbl̩/
c. vegetable	/'vɛdʒə təbl̩/	/'vɛdʒtəbl̩/
d. estimable	/'ɛstə məbl̩/	*/'ɛstməbl̩/
e. questionable	/'kwɛstʃənəbl̩/	*/'kwɛstʃnəbl̩/

At first glance, the data in (26) are all exceptions to the statement. In (26a-b), syncopation occurs in the environment ruled out by point (c) of the statement. But each of these two examples contains a sequence of three consecutive unstressed syllables. I propose that the first unstressed vowel in such a sequence deletes in NCS, regardless of the segmental environment. In other words, a sequence of three consecutive unstressed syllables in NCS is not allowed.

(26c) serves as evidence to support the claim for (26a-b). As given in point (b) of the statement, the syllable immediately following the target vowel must have a sonorant onset. Although the target consonant in (26c) is not a sonorant, syncopation still applies, since there is a sequence of three consecutive unstressed syllables.

However, (26d-e) seem to be counterexamples against such a claim. But this dilemma can be easily solved by considering syllable structure. In the right-hand column in (26d-e), the attempted syncopation creates two triconsonantal clusters: /stm/ and /stʃn/. For the blocking effect of these clusters, autosegmental and

sonority phonology have distinct explanations. In terms of autosegmental phonology (see Goldsmith 1990:113), neither of the clusters can be permitted, since the only three consonant cluster which is permitted in English is *s + voiceless stop + liquid or glide*. In a word, syncopation will be blocked if it creates a cluster which contravenes the phonotactic constraints of the language.

In terms of sonority phonology, each of the two triconsonantal clusters contains an extrasyllabic consonant in word-medial position. The reason is that adjacent /s/ and /t/ come from the same major class and therefore cannot be tautosyllabic, since they have the same sonority value. Nor can adjacent /s/ and /tʃ/be tautosyllabic for the same reason. On the other hand, neither /tm/ nor /tʃn/can occur syllable-initially in English in accordance with the phonotactic constraints of the language. As a result, /t/ and /tʃ/ become extrasyllabic. In other words, if syncopation should occur in (26d-e), it would create a triconsonantal cluster which includes an extrasyllabic segment. As is known, NCS is a kind of fast speech which requires as concise a sequence as possible. A cluster including an extrasyllabic segment will reduce the speaking rate mechanically, and is usually avoided in NCS. Therefore syncopation is blocked in (26d-e).

To sum up the discussion concerning the data in (26), I suggest a supplement to the statement in (25).

(27) Supplement to the Statement

> For a word that does not satisfy the statement, syncopation can still occur, provided that the word has a sequence of three unstressed syllables, and provided that syncopation does not create a triconsonantal cluster at word-medial position. In each word, only the leftmost syncopation position is allowed.

With this supplement to support it, the statement can satisfactorily explain syncopation processes in NCS.

3.1.3. Other Aspects of Syncopation

Although supported by the supplement, the statement cannot rule out all exceptions. There are numerous exceptions in the lexicon, many of which are dialectic and idiolectic. The same word can be pronounced differently by different individuals. For example, some people pronounce the word 'athlete' as /'æθlit/.Others pronounce it as /'æθəlit/.

The commonness of a word plays a role in syncopation process. Common words refer to those which are popular in everyday conversation. Uncommon words refer to those which are rarely heard in everyday conversation.

For instance, there is no syncopation for the word 'numerate' /'njumərɪtéven though it satisfies the statement. The reason is that 'numerate' is an uncommon word. Some uncommon words do not undergo syncopation. Words like 'numerate' may not syncopate

because they occur much more often in written, rather than spoken English; thus, native speakers of English rarely hear (and therefore rarely say) these words. Thus, they have little or no opportunity to practise producing such words. Speakers typically do not apply optional syncopation process to them. On the other hand, some very common words undergo syncopation even in Slow Speech (SS). Hence I assume that common words syncopate at relatively slow speeds; rare words syncopate at relatively high speeds. The following words are all common and so they syncopate in both SS and NCS.

(28) Syncopation in SS and NCS

	SS	SS & NCS
recovery	/rɪkʌvəri/	/rɪkʌvri/
average	/'ævərɪdʒ/	/'ævrɪdʒ/
experiment	/ɛks'pɛrə mənt/	/ɛk'spɛrmənt/
fashionable	/'fæʃə nəbl̩/	/'fæʃnəbl̩/
favorite	/'fevə rɪt/	/'fevrɪt/
reasonable	/'rɪzənəbl̩/	/'rɪznəbl̩/

The syncopated forms in the right-hand column in (28) are very common even in SS. They have found their way into the lexicon. Syncopation is like a bridge. It connects NCS to SS. A syncopated word in NCS would eventually settle down in the lexicon when it becomes common enough, and would thus make its way into SS. There are also a lot of common words in which syncopation has become lexicalized. That is, even in SS the unstressed vowel is lost historically. For example, many speakers pronounce 'vegetable'

always as /'vɛdʒtəbl̩/, and never as/'vɛdʒətəbl̩/, indicating that, for them, the syncopated form has become lexicalized. For the same reason, presumably an uncommon word would eventually undergo syncopation when it becomes common.

3.1.4. Summary

To sum up, in NCS, English syncopation can only occur under the following conditions:

(a) The target syllable must be an unstressed vowel, and must have an onset.

(b) The target syllable must be immediately followed by another unstressed syllable which has a sonorant onset.

(c) The two segments flanking the target vowel must be from different manner of articulation classes.

However, there are a few special cases which are exceptions to the above conditions. Hence a supplement is proposed to back up the statement:

For a word that does not satisfy the statement, syncopation can still occur, provided that the word has a sequence of three unstressed syllables, and provided that syncopation does not create a triconsonantal cluster at word-medial position. In each word, only the leftmost syncopation position is allowed.

With the statement and the supplement, the syncopation process in NCS can be accounted for satisfactorily. As stated in the previous section, there are still some very special exceptions which are incompatible with the statement and the supplement. The most obvious exceptions are uncommon words. The reason, I assume, is that speakers typically do not apply the optional syncopation process to uncommon words.

However, one might be still skeptical about the syncopation conditions by posing the following questions:

Why must the target vowel be immediately followed by an unstressed syllable?

Why must the consonant immediately following the target vowel be a sonorant?

Why must the consonants flanking the target vowel come from different classes?

Why must the target syllable have an onset?

These questions will be discussed within the frameworks of autosegmental phonology and sonority phonology in Chapter Four.

3.2. Initial Syllable Reduction

In addition to syncopation (in which an unstressed vowel deletes in a word-medial syllable), it also commonly occurs that in NCS an unstressed vowel deletes in a word-initial syllable. I refer to this as Initial Syllable Reduction (hereafter ISR). ISR can occur several times within the same sentence, as illustrated below (with the target syllables italicized; data in this section provided by Dr. Milliken and verified by Dr. Steinbergs and others):

(29) Sample Sentences with ISR

Suppose he can't come tonight? (Then what?)
Suppose the cement is still wet? (Then what?)
Suppose the wires don't connect? (Then what?)
Suppose your balloon floats away? (Then what?)
Suppose there are fatalities? (Then what?)
Suppose telepathy doesn't work? (Then what?)
Suppose the tomatoes aren't ripe yet? (Then what?)
Suppose the cement isn't dry by then? (Then what?)
Suppose he was only being facetious? (Then what?)
Suppose we can't finagle it out of him? (Then what?)
Suppose he can't come 'til December? (Then what?)

Suppose the electricity in the garage is out? (Then what?)
Suppose vanilla is the only variety they have? (Then what?)
Suppose they select bad potatoes? (Then what?)
Suppose the disease is hereditary? (Then what?)
Suppose the Canadian police show up? (Then what?)
Suppose the petroleum pipeline doesn't connect with Chicago? (Then what?)

This process of ISR is systematically different from syncopation. The following are some of the words undergoing ISR:

(30) ISR Examples

	NCS		NCS
a. With sonorant consonants following the target vowels			
balloon	/bˈlun/	barrette	/bˈrɛt/
binoculars	/bˈnɑkjələrz/	bonanza	/bˈnænzə/
calamity	/kˈlæmɪɾi/	Canadian	/kˈneɾiən/
cement	/sˈmɛnt/	chameleon	/kˈmɪljən/
connect	/kˈnɛkt/	Connecticut	/kˈnɛɾɪkət/
delight	/dˈlajt/	demand	/dˈmænd/
direct	/dˈrɛkt/	finagle	/fˈnegl̩/
galactic	/gˈlæktɪk/	garage	/gˈrɑʒ/
genetic	/ʤˈnɛɾɪk/	giraffe	/ʤˈræf/
hallucination	/hˈlusɪnéʃn̩/	heroic	/hˈroɪk/
hilarious	/hˈlæriəs/	jalopy	/ʤˈlɑpi/
Laredo	/lˈreɾo/	laryngeoscope	/lˈrɪnʤəs,kop/
Lorraine	/lˈren/	miraculous	/mˈrækjələs/
molasses	/mˈlæsɪs/	parade	/pˈred/
phonetic	/fˈnɛɾɪk/	police	//pˈlɪs/
schematic	/skˈmæɾɪk/	select	/sˈlɛkt/
shellac	/ʃˈlæk/	sporadic	/spˈræɾɪk/
stalactite	/stˈlæktajt/	synopsis	/sˈnɑpsɪs/
telepathy	/tˈlɛpəθi/	tenacity	/tˈnæsəɾi/
thermometer	/θˈmɑməɾɚ/	thoracic	/θˈræsɪk/
tomato	/tˈmeɾo/	Toronto	/tˈrɑnɾo/
vanilla	/vˈnɪlə/	variety	/vˈrajəɾi/

veronica	/v'ranɪkə/	voluminous	/v'lumnəs/

b. With obstruent consonants following the target vowels

catastrophe	/k'tæstrəfi/	Chicago	/ʃ'kəgo/
decay	/d'ke/	December	/d'sembər/
facetious	/f'siʃəs/	fatality	/f'tælərɪ/
gazette	/g'zɛt/	Japan	/dʒ'pæn/
Pacific	/p'sɪfɪk/	petroleum	/p'trəljəm/
potassium	/p'tæsjəm/	potato	/p'terə/
potential	/p'tenʃl̩/	September	/sp'tembər/
spaghetti	/sp'gɛrɪ/	staccato	/st'kərə/
suppose	/s'poz/	topography	/t'pəgrəfi/

The examples in (30) indicate that whether the consonant immediately following the target vowel is a sonorant or not, the form will undergo ISR provided that:

(i) the target syllable is an unstressed one,

(ii) the target vowel is a reduced one,

(iii) one consonant comes immediately after the target vowel,

(iv) the syllable immediately following the target syllable is stressed.

Forms which fail to meet these environments usually do not undergo ISR, since some effects block the process. Consider the following examples (with the target vowel italicized):

(31) Non-ISR Forms

	SS	NCS
a. catastrophic	/ˌkæta'strɑfɪk/	*/ˌkta'strɑfɪk/
b. terrible	/'tɛrəbl̩/	*/'trəbl̩/
c. illustrate	/'ɪləstret/	*/'ləstret/
d. aboriginal	/ˌæbə'rɪdʒənl̩/	*/ˌbə'rɪdʒənl̩/

e. migration	/maɪ'greʃn̩/	*/m'greʃn̩/
f. reaction	/rɪ'ækʃn̩/	*/r'ækʃn̩/
g. creation	/krɪ'eʃn̩/	*/kr'eʃn̩/

In (31a-d) the target syllables are stressed at least to some extent, in (31e) the target vowel is not reduced, and in (31f-g) the target syllable is immediately followed by a syllable without an onset. Thus, ISR is blocked for all of them. Detailed discussion of this follows in later chapters, utilizing the frameworks of autosegmental and sonority phonology.

As for forms in which the target syllable is immediately followed by an unstressed syllable, it is impossible to find any, since the English stress template is such that unstressed initial syllables are (almost) always followed by stressed syllables. If the target syllable is immediately followed by an unstressed one, then the target syllable must be a stressed one, which will disqualify it from the process of ISR. That is why I cannot find a form which can meet all the other ISR conditions except the one requiring an immediately following stressed syllable.

Some one may argue that the forms in (31c-d) do not undergo ISR, not because the target vowels are stressed but because the target syllables have no onsets. That is not the case, since we can find some examples in which the target syllables have no onsets but still undergo ISR, as illustrated in (32):

(32) With the Target Syllables Having No Onsets

	SS	NCS
elastic	/ɪ'læstɪk/	/'læstɪk/
electric	/ɪ'lɛktrɪk/	/'lɛktrɪk/
erosion	/ɪ 'roʒn̩/	/'roʒn̩/
erratic	/ɪ'rærɪk/	/'rærɪk/

Forms in (32) show that the lack of an onset does not block the target syllable from undergoing ISR. One might also wonder if the target vowel flanked by consonants from the same manner of articulation class will be disqualified for the process, as is the case with syncopation. Let us consider the following examples:

(33) With Flanking Consonants of the Same Manner of Articulation Class

	SS	NCS
Manassas	/m ə'næsəs/	/m'næsəs/
monastic	/m ə'næstɪk/	/m'næstɪk/

The forms in (33) undergo ISR although the target vowels are flanked by two nasals. This means that it poses no problem for the target vowel to be flanked by consonants of the same manner of articulation class.

Based on the above discussion, the conditions for ISR can be summed up as follows:

(34) Conditions for ISR

a. The target syllable must be word-initial, unstressed, and reduced;
b. The target syllable must be immediately followed by a stressed syllable;
c. The syllable immediately following the target syllable must have an onset.

Some of the example in (30) are very rarely used words. In my examination of the data, I found that, for native speakers, the conditions in (34) are applicable for commonly used words, but optional for uncommon ones. This is understandable. For a native speaker, an uncommonly used word is usually pronounced slowly and clearly, thus, the tempo would be too slow to be classified as NCS. On the other hand, the norm for commonness differs from person to person. That is why some forms undergo ISR for some speakers but do not for others. For example, the following uncommon words undergo ISR in some idiolects, but not in others (N/A = not applicable):

(35) Uncommon Forms for ISR

	SS	NCS
jalopy	/dʒəlάpi/	/dʒlάpi/or N/A
potassium	/pətésiəm/	/ptésiəm/or N/A
topography	/təpάgrəfi/	/tpάgrəfi/orN/A
hallucination	/həlùsɪnéʃn̩/	/hlùsɪnéʃn̩/or N/A

3.3. Sonorant Syllabification/Metathesis

The increase in speaking rate often results in the syllabification of certain sonorant consonant. The result of this phonological process is the change of a *sonorant consonant + vowel* sequence into a syllabic sonorant consonant. This phenomenon is called sonorant syllabification (hereafter 'syllabification'), and is very common in Normal Conversational Speech (NCS). Metathesis is, in a sense, another expression of the same process, as is discussed later in this section.

3.3.1. Syllabification Statement

Syllabification occurs under specific phonological conditions. It is also restricted geographically; thus, not all dialects of North American English undergo this process. Canadian English does not, and neither do some American dialects. (The same is true for Metathesis).

First let us consider the syllabification process occurring in the following forms (target segments are italicized; /ɚ/ is used to represent a syllabic /r/):

(36) Examples Which Undergo Syllabification

	SS	NCS
With /r/ as the target consonant		
asynchronous	/e'sɪŋkrə nəs/	/e'sɪŋkɚ nəs/
calligraphy	/kə'lɪgrə fi/	/kə'lɪgɚ fi/
democracy	/də'mɑkrə si/	/də'mɑkɚ si/
fabricate	/'fæbrɪˌket/	/'fæbɚˌket/
grammatical	/grə'mætɪkl̩/	/gɚ'mætɪkl̩/
microphone	/'majk rəˌfon/	/'majkɚ ˌfon/
professor	/p rə'fɛsɚ/	/p ɚ'fɛsɚ/
sacrifice	/'sækrəˌfajs/	/'sækɚˌfajs/
With /l/ as the target consonant		
amplitude	/'æmplɪtud/	/'æmpl̩tud/
application	/ˌæplɪ'keʃn̩/	/ˌæpl̩'keʃn̩/
complicated	/'kɑmplɪˌketəd/	/'kɑmpl̩ˌketəd/
compliment	/'kɑmplɪmənt/	/'kɑmpl̩mənt/
diplomatic	/ˌdɪplə'mætɪk/	/ˌdɪpl̩'mætɪk/
encyclopedia	/ɪnˌsajklə'pidiə/	/ɪnˌsajkl̩'pidiə/
exclamation	/ˌɛkskləˈmeʃən/	/ˌɛkskl̩'meʃən/
problematic	/ˌprɑbləˈmætɪk/	/ˌprɑbl̩'mætɪk/

Consider the characteristics of the slow speech forms above. The consonant which undergoes syllabification in (36a) is /r/, while the one in (36b) is /l/; thus, the target consonant is either /r/ or /l/. In other words, the segments subject to the process are exclusively liquids.

One may wonder if the process is applicable to sonorant consonants other than liquids. The other two kinds of sonorant consonants are glides and nasals. As is well known, glides in English never become syllabified. Nasals behave differently. In

certain cases in English, /m/ or /n/ can become syllabic. However, that does not mean that the process is applicable to nasals in NCS. Consider the following forms:

(37) With a Nasal as the Target Consonant

stigmatize	/'stɪg*m̩*ətajz/	*/'stɪgm̩ˌtajz/
magnitude	/'mæg*n̩*ˌtud/	*/'mægn̩ˌtud/

The application of syllabification to these words would yield incorrect outputs; thus, the examples indicate that /m/ and /n/ are not subject to the process. Therefore, nasals, unlike liquids, do not undergo syllabification (the reason why the process is not applicable to nasals will be discussed in later chapters). As a result, of all the sonorant consonants, only liquids can undergo syllabification.

The vowel which deletes in the syllabification process in (36) is always unstressed. In other words, a stressed syllable cannot undergo syllabification. Consider the following forms:

(38) With a Stressed Syllable as the Target Syllable

	SS	NCS
contribute	/kən'tr*ɪ*bjut/	*/kən'tərbjut/
proposition	/ˌp*ɹ*əpə'zɪʃən/	*/ˌpəpə'zɪʃən/
completion	/kəm'pl*i*ʃən/	*/kəm'pl̩ʃən/
inclusion	/ɪn'k*l*uʒən/	*/ɪn'kl̩ʒən/

If syllabification applies to the forms in the middle column, it gives the incorrect outputs in the right-hand column. Thus, we see that target syllables must always be unstressed.

Forms in (36) show that each target liquid is immediately preceded by a consonant, and each target vowel is immediately followed also by a consonant. If these conditions are not met, syllabification does not take place. Consider the two forms in (39):

(39) Forms Which do not Meet the Conditions

	SS	NCS
a.arrogant	/'æɹəgənt/	*/'æəgənt/
b.recreation	/ˌɹɛkɹi'eʃən/	*/ˌɹɛkə'eʃən/

Syllabification does not apply to (39a) since the target consonant is not immediately preceded by another consonant. Syllabification does not apply to (39b) because the target vowel is not immediately followed by a consonant.

The examples in (36) also suggest some other environments in which syllabification occurs, that is, the target syllable is always penultimate or earlier; no target syllable is in word-final position. Consider the two examples below:

(40) With the Target Syllable in Word-final Position

	SS	NCS
problem	/'pɹɑb ləm/	*/'pɹɑbl̩m/
vagrant	/'vejg ɹənt/	*/'vejgənt/

The two outputs in the right-hand column are unacceptable in NCS because the target syllable is in word-final position. These two

examples show that a final unstressed syllable does not undergo this process.

Thus, English Syllabification in NCS can only occur under the following conditions:

(41) Statement of Syllabification in NCS

(a) The target consonant must be a liquid.

(b) The target syllable must be unstressed.

(c) The target syllable must be penultimate or earlier.

(d) The target consonant must be immediately preceded by another consonant.

(e) The target vowel must be immediately followed by a consonant.

This statement covers most cases of syllabification in NCS, and all of the data in (36) agree with it. This analysis is also supported by forms which usually do not undergo syllabification in NCS. Consider the following non-syllabified examples:

(42) Non-Syllabifying

		SS	NCS
a. Liquid condition not met			
i.	stagnant	/'stæg*n*ənt/	*/'stægn̩nt/
ii.	stigmatize	/'stɪg*mə*,tajz/	*/'stɪgm̩,tajz/
iii.	magnitude	/'mæg *nə*,tud/	*/'mægn̩,tud/
b. Stress condition not met			
i.	gritty	/'g*rɪɾ*i/	*/'gəɾi/
ii.	providence	/'p*rɑ*vədəns/	*/'pəvədəns/
iii.	glottis	/'g*lɑɾ*ɪs/	*/'gl̩ɾɪs/
c. Pre-final syllable condition not met			
i.	fragrant	/'freg*rə*nt/	*/'fregənt/
ii.	sacred	/'sekr*ɪ*d/	*/'sekəd/
iii.	immigrant	/'ɪmɪg*rə*nt/	*/'ɪmɪgənt/
d. Preceding consonant condition not met			
i.	parallel	/'pæ*rə*lɛl/	*/'pæəlɛl/
ii.	foreigner	/'fɑ*rɪ*nər/	*/'fɑənər/
iii.	politics	/'pɑ *lə* tɪks/	*/'pɑl̩tɪks/
e. Following consonant condition not met			
i.	embryo	/'ɛmbr*ɪ*o/	*/'ɛmbəo/
ii.	creative	/kr*i*'etɪv/	*/kə'etɪv/
iii.	bibliography	/ˌbɪb*lɪ*'ɑg *rə*fi/	*/ˌbɪbl̩'ɑgərfi/

None of the forms in (42) are in accordance with the statement in (41) and thus give incorrect outputs in the right-hand column if syllabification is attempted. In (42a) the target consonants are not /r/ or /l/. In (42b), the target syllables have /r/ or /l/, but are

stressed and thus are unqualified since stressed syllables do not undergo syllabification. In (42c), the target syllables are in word-final positions and thus are unqualified since syllabification is not allowed in word-final position. In (42d), the target consonants are preceded not by a consonant but by a vowel and thus are unqualified. In (42e), the target vowels are followed by another vowel instead of by a consonant and thus are unqualified. The forms in (42) thus show that the statement in (41) is correct.

3.3.2. Comparison of Syllabification and Metathesis

Metathesis in NCS usually occurs in American English rather than in Canadian English. In this thesis I use it to refer to an alternation in the sequence from consonant-vowel to vowel-consonant. In most cases, the consonants (/r/ and /l/) involved in syllabification are the same ones which are subject to metathesis. Consider the following examples:

(43) Metathesis

	SS	NCS
Metathesis, rV - Vr		
abrogate	/'æbrəget/	/'æbərget/
acrobat	/'ækrə,bæt/	/'ækər,bæt/
calligraphy	/kə'lɪgrəfi/	/kə'lɪgərfi/
democracy	/də'mɑkrəsi/	/də'mɑkərsi/
extricate	/'ɛkstrɪ,ket/	/'ɛkstər,ket/
fabricate	/'fæbrɪ,ket/	/'fæbər,ket/
grammatical	/grə'mætɪkl̩/	/gər'mætɪkl̩/

Labrador	/'læbrə,dɔr/	/'læbər,dɔr/
microphone	/'majkrə,fon/	/'majkər,fon/
predicament	/prɪ'dɪkəmənt/	/pər'dɪkəmənt/
segregation	/,sɛgrɪ'geʃn̩/	/,sɛgər'geʃn̩/

Metathesis, IV -VI

application	/,æplɪ'keʃn̩/	/,æpəl'keʃn̩/
complicated	/'kɔmplɪ,kɛrəd/	/'kɔmpəl,kɛrəd/
compliment	/'kɔmplɪmənt/	/'kɔmpəlmənt/
diplomatic	/,dɪplə'mætɪk/	/,dɪpəl'mætɪk/
encyclopedia	/ɪn,sajklə'pidiə/	/ɪn,sajkəl'pidiə/
problematic	/,prɔblə'mætɪk/	/,prɔbəl'mætɪk/

A careful study of the examples in (43) indicates that the environments for metathesis are the same as those for syllabification. It is my assumption that metathesis and syllabification represent two descriptions of the same end product, as illustrated in the diagram below (taking /r/ as an example):

(44) The Processes of Syllabification and Metathesis

a. Syllabification

r ə → ɾ → ɚ
↓
ø

b. Metathesis

r ə → ə r

On the one hand, the inputs for both syllabification and metathesis are identical, that is, /rə/. On the other, there is no phonological difference between the end product of syllabification and the end product of metathesis. Even phonetically, [ɚ] and [ər] are acoustically identical. Dr. Dobrovolsky (in his reading of this thesis)

suggests that this is a pseudo-issue caused by the fact that North American phonetic transcription transcribes a syllabic 'r' as [ər] or [ɚ] (depending on the narrowness of the transcription), while IPA defines it by transcription as a rhotic vowel [ɚ]. Since the diagram in (44) indicates that the inputs for the two processes are identical, and since the difference between the outputs [ɚ], [ɚ] and [ər] has no significance both phonologically and phonetically, I assume that syllabification and metathesis are two descriptions of the same process. Consider the following examples:

(45) Contrast of Syllabification and Metathesis

	Syllabification	Metathesis
democracy	/də'mɑkɚsi/	/də'mɑkərsi/
grammatical	/gɚ'mætɪk̩/	/gər'mætɪk̩/
diplomatic	/ˌdɪp̩'mætɪk/	/ˌdɪpəl'mætɪk/
encyclopedia	/ɪnˌsajk̩'pidiə/	/ɪnˌsajkəl'pidiə/

Both syllabification and metathesis can be said to apply to the same forms under the same conditions. There is no phonological difference between them. They are essentially the same process. In later discussion, therefore, I will use only the term 'syllabification' to refer to this process.

3.3.3. Optional Application of the Syllabification Statement

Although the statement in (41) accounts for the occurrence of syllabification, it does not apply equally to /r/ and /l/. The

frequency with which it operates on the sequences with /r/ as the target consonant (hereafter '/r/ sequences') far outstrips the frequency of its operation on the sequences with /l/ as the target consonant (hereafter '/l/ sequences'). As a matter of fact, the statement operates on /r/ sequences in almost all cases but on /l/ sequences in only selected cases. Consider the paradigm below:

(46) Cases of Non-syllabifying with /l/ Sequences

	SS	NCS
acclimate	/'æk*l*ə,met/	*/'æk]ˌmet/
inclination	/ˌɪnk*l*ə'neʃən/	*/ˌɪnk]'neʃən/
reclamation	/ˌrɛk*l*ə'meʃən/	*/ˌrɛk]'meʃən/

All the forms in the middle column can meet the conditions listed in the statement in (41), yet the syllabification outputs in the right-hand column are probably unacceptable for most speakers who syllabify. This fact indicates that the statement in (41) holds for all /r/ sequences but holds only partially for /l/ sequences. A suggestive factor responsible for the difference is that, the English /r/ is produced with a very open, vowel-like articulation, while the tongue position for /l/ is much closer tc the roof of the mouth. Syllabification is a necessary feature of vowels; thus, it may be that, having a more vowel-like articulation, English /r/ undergoes syllabification more readily than /l/.

There may be a systematic phonological difference between the /l/ sequences that do undergo syllabification and those in (46) that

do not; if so, it is not readily apparent. However, it appears evident that /l/ sequences undergo syllabification only in common words. In uncommon words /l/ sequences tend not to undergo syllabification. This can be verified by the data in (36) and (46). By 'common' and 'uncommon' I mean the frequency and familiarity with which people use the words in daily life. Of course commonness can be very difficult to define in an objective way. Some words may be common for some people but uncommon for others. Thus it is not yet possible to predict exactly which words qualify as common and therefore undergo syllabification. The following are a few examples which usually do undergo syllabification and some which normally do not:

(47) Forms for Syllabification

	SS	NCS
a. Syllabification, lV -]		
diplomatic	/ˌdɪpləˈmætɪk/	/ˌdɪpl̩ˈmætɪk/
encyclopedia	/ɪnˌsajkləˈpidiə/	/ɪnˌsajkl̩ˈpidiə/
problematic	/ˌprɑbləˈmætɪk/	/ˌprɑbl̩ˈmætɪk/
b. Failure of Syllabification, lV -]		
acclimate	/ˈækləˌmet/	*/ˈækl̩ˌmet/
inclination	/ˌɪnkləˈneʃən/	*/ˌɪnkl̩ˈneʃən/
reclamation	/ˌrɛkləˈmeʃən/	*/ˌrɛkl̩ˈmeʃən/

Chapter 4

Phonological Analyses of the Processes and the Conditions

In the previous chapter, I posed some conditions and questions concerning certain phonological processes in NCS. Since the increase in speaking rate involves the deletion of certain syllables in a word, or an alternation of a syllable component, as well as the decrease of duration for each syllable, these processes are necessarily concerned with syllable structure. Different phonological viewpoints on syllable structure sometimes result in disparate explanations of the processes. It is the main motivation of this chapter to account for the processes within the frameworks of autosegmental and sonority phonology.

An examination of the NCS processes presented to this point reveals a principle that plays a central role in fast speech phenomena. Here I would like to establish the principle as the Priority Principle and represent it below for the sake of convenience of later analyses of the phonological processes in NCS:

(48) The Priority Principle

> The preservation of the original basic syllable and foot structure is prior to the three phonological processes in NCS.

The meaning of this principle is that, unless delinked directly in connection with the processes, the original basic structures of the target syllable, the neighboring syllables, and the foot dominating these syllables, whether branched or non-branched, should remain the same throughout the application of the processes, and that any elements of the neighboring syllables should not be delinked as a result of the NCS processes.

4.1. The Analysis within Autosegmental Phonology

In this section, an autosegmental phonology approach will be used to analyze the three processes in NCS. Within the framework of autosegmental phonology, a number of distinctive feature systems are in use to describe the phonetic characteristics of segments. In this thesis, I will use a version of the popular Halle-Sagey model (as proposed in Halle 1992) in the analysis of the NCS processes.

According to autosegmental phonology, segmental phonological rules are sensitive to syllable structure in three ways (Goldsmith 1990:112):

(49) Three Ways of Rule Application

> "First, phonological rules can be conditioned to apply to a segment when the structure of the segment's syllable satisfies a condition.
>
> Second, a phonological rule may be conditioned to apply to a segment just in case that segment is in a specific location in the syllable.

> A third way in which segmental rules are sensitive to syllable structure emerges when we consider rules of vowel epenthesis and deletion. Rules of epenthesis typically apply in phonological contexts which cannot be straightforwardly syllabified as they stand. On the other hand, rules of vowel deletion apply not infrequently just in case their output is consistent with the principles of syllabification of the language."

In the following section, I will use autosegmental approach to characterize the three NCS phonological processes, by analyzing the syllable structure in which they occur.

4.1.1. Syncopation

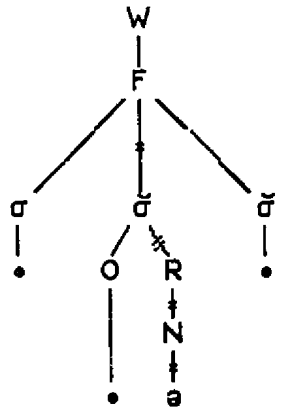
In NCS the reduced vowel schwa undergoes syncopation as a result of the increase in speaking rate. From the point of view of autosegmental phonology, syncopation is the process of deleting the schwa by delinking it, as illustrated below:

(50) Schwa Delinking in Syncopation

Something very singular about this process is that the deletion of schwa affects the existence of the whole syllable, since schwa, as indicated above, constitutes the nucleus of the syllable, and the

nucleus is the core of the syllable. The deletion of the core surely means the deletion of the rhyme and, furthermore, the deletion of the whole syllable, if there is no other kind of compensation. Resyllabification assigns the remaining consonant in the onset to the neighboring syllable in accordance with syllabification rules of English. As a result, the autosegmental representation of syncopation would look like this:

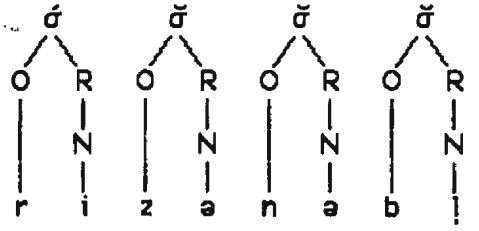
(51) Whole Delinking Process in Syncopation



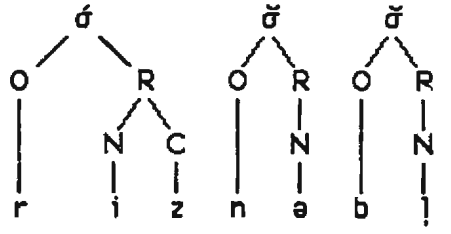
The delinking spreads upward for four tiers and stops at the foot tier. Based on the autosegmental perspective, the process of syncopation in NCS for "reasonable" would be as diagramed below (for the sake of simplicity, the foot tier is omitted):

(52) Syncopation Process for "reasonable"

a. Before Syncopation



b. After Syncopation



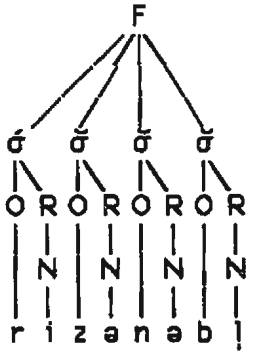
Before syncopation, there are four syllables. After syncopation, one of the syllables is deleted. The remaining onset of the deleted syllable becomes the coda of the preceding syllable. However, the syllable structure of the following syllable remains unchanged. The resyllabification meets English syllable structure satisfactorily. Therefore, syncopation in NCS is a process of syllable deletion and resyllabification.

Using autosegmental phonology, some of the questions posed in section 3.1.4. can be explained to some degree. The reason why the target syllable must be immediately followed by an unstressed syllable has to do with foot structure. English foot structure is often a trochaic (a stressed + unstressed syllable) or a dactylic (stressed + unstressed + unstressed syllable) pattern. With the

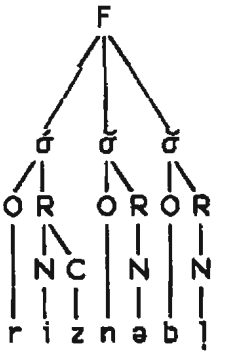
target syllable immediately followed by an unstressed syllable, the original branched foot structure can be preserved, as illustrated in (51). If the target syllable is immediately followed by a stressed syllable, or is in word-final position, this original branched foot structure will be destroyed, which is a violation of the Priority Principle in (48). Note the foot structure of "reasonable /rizə nəbl̩/":

(53) Foot Structure of "reasonable"

a. Before Syncopation



b. After Syncopation

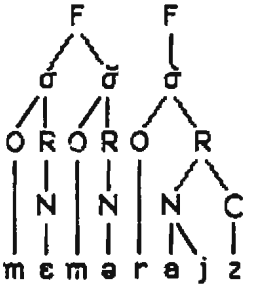


Both before and after syncopation, the original branched foot structure has not been altered. This preservation of the original foot structure has another significance, that is, the original stress rhythm of speech remains the same throughout the process. If, however, the target syllable is immediately followed by a stressed syllable, the following syllable must then begin a new foot. Thus, the original branched foot structure will become non-branched after syncopation, and the syncopation output will violate the preferred stress template of English, or create some unacceptable words,

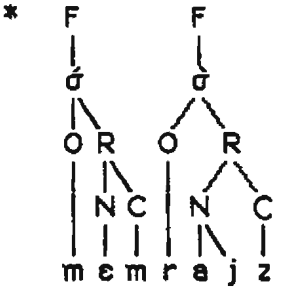
since syncopation is a syllable-deleting process. Consider the foot structure of "memorize /'mɛmə,rajz/":

(54) Target Syllable Followed by a Stress Syllable

a. Before Syncopation



b. After Attempted Syncopation



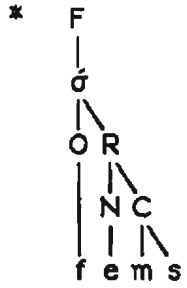
The original branched foot structure on the left becomes the non-branched one on the right after attempted syncopation. Furthermore, the attempted syncopation creates a stress template in which two stressed syllables are adjacent to each other. It is a violation of the preferred stress template (although, in this example, the following syllable is stressed only to some extent). Thus, the target syllable cannot be immediately followed by a stressed syllable.

Can the target syllable be in word-final position? No, absolutely not. We can also find some explanations for this within the framework of autosegmental phonology. Consider the syllable structure of the word "famous /'feməs/":

(55) Target Syllable at Word-final Position

a. Before Syncopation

b. After Attempted Syncopation



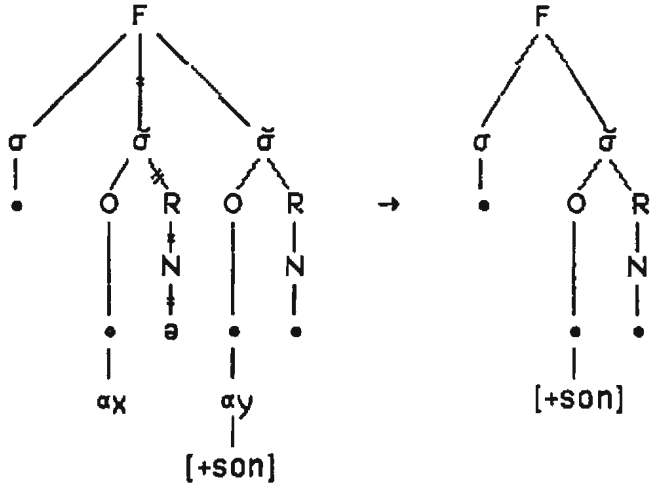
Again, the attempted syncopation changes the original branched foot structure to a non-branched one. The original stress rhythm is altered.. In both cases, the attempted syncopation violates the Priority Principle, and is, therefore, blocked. Based on the above discussions, autosegmental phonology supports the condition that the target syllable must be immediately followed by another unstressed syllable. Other questions concerning the conditions will be discussed within the framework of sonority phonology in section 4.2.1.

The conditions for syncopation in (25) can be represented as a rule within the autosegmental framework (where α = manner of articulation class[5], and $x \neq y$):

---

5 As Dr. Dobrovolsky has mentioned (p.c.) in his comments, current feature theory rejects the necessity for a Manner Node in the feature hierarchy. However, in order to correctly describe the environment for this process, it appears that the distinctive feature tree would, in fact, need a Manner Node.

(56) Syncopation Rule in Autosegmental Representation



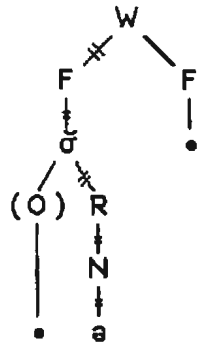
Thus: in NCS syncopation, a word-medial unstressed schwa, if it has an onset and is immediately followed by an unstressed syllable which has a sonorant onset, and if the two onsets are from different manner of articulation classes, deletes, together with the syllable dominating it. The remaining onset is taken care of by general syllable structure constraints, usually by the Maximal Onset Principle in (5). In most cases, it is integrated into the coda of the preceding syllable. Thus, from an autosegmental point of view, syncopation is a schwa delinking, and thus, syllable-deleting process.

4.1.2. Initial Syllable Reduction

Initial syllable reduction is quite different from syncopation in that the target syllable is in word-initial position and must be immediately followed by a stressed syllable. As a result of this

distinctive environment (and bearing in mind the preferred English stress template), the target syllable alone is dominated by an individual foot, and as a result of ISR, the foot deletes together with the target syllable. The autosegmental representation of ISR would look like this:

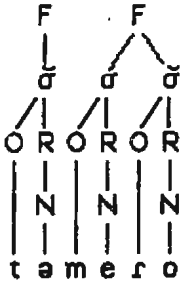
(57) ISR Delinking Process



Unlike syncopation, the delinking spreads upward for five tiers. The foot is delinked because it contains only a single syllable, which ISR deletes. The remaining onset, if any, becomes part of the onset of the following syllable. The Priority Principle in (48) still holds for ISR. In terms of autosegmental phonology, the application of ISR on "tomato /t'meɾo/" would be represented as follows:

(58) ISR for "tomato"

a. Before ISR



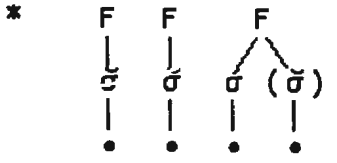
b. After ISR

Before ISR, there are three syllables and two feet. After ISR, the initial syllable deletes together with the foot above it. The remaining consonant merges into the onset of the following syllable. Thus, one of the characteristics of ISR is that not only are the schwa and the target syllable deleted, but the foot dominating the target syllable is also deleted, since the target syllable is always immediately followed by a stressed syllable and, as a result, the foot dominating the target syllable is always non-branched. Since non-branching feet are the least preferred type of feet, it is not surprising that they are avoided, either by deletion (as in this case) or by the avoidance of deletion (as in the case of "memorize" which did not undergo syncopation).

One may wonder why the target syllable must be immediately followed by a stressed syllable. The reason is very simple. The English stress template does not permit two consecutive unstressed syllables in word-initial position. One of them must be stressed, at

least, to some degree.[6] Autosegmental phonology also provides a rationale for this phenomenon. If the target syllable is immediately followed by an unstressed syllable, the word must have at least three syllables, since every word is obliged to have a stressed syllable. In that case, the preferred trochaic nature of English foot structure makes it inevitable for the word to have two consecutive non-branched feet at word-initial position, as is illustrated below (The figure below is only a putative one, since, in accordance with the phonotactic constraints of English, such a foot structure is nowhere to be found):

(59) Foot Structure for a Putative Word



This kind of foot structure is illegal. Within English phonology, it is impossible for a word with three or more syllables to have two consecutive non-branched feet at word-initial position. For such a word, either the first or the second foot is branched, that is to say, either the first or the second syllable is stressed. Since the first syllable is the target syllable (which is surely unstressed), the

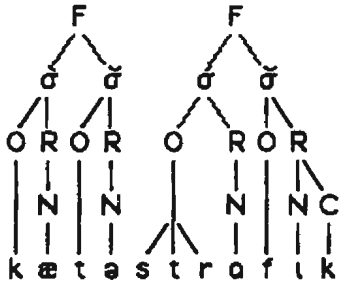
[6] In certain dialect there do appear to be words with two consecutive unstressed syllables in word-initial position: for example, "understand" or "macaroon". This would be an example of an anapestic foot (- - x). However, such words are not common, and always have an alternate pronunciation with a pattern of intial secondary stress as well.

second syllable must be stressed. Therefore, the target syllable must be immediately followed by a stressed syllable.

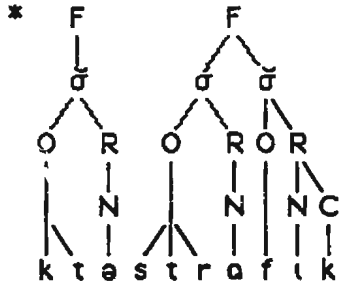
One may wonder why the target syllable cannot be stressed, at least, to some extent. Let us consider the syllable structure of "catastrophic /ˌkætəˈstrɑfɪk/ " as an example:

(60) The Target Syllable Stressed

a. Before ISR



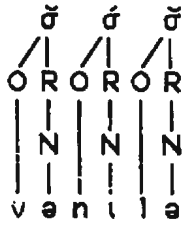
b. After Attempted ISR



The target syllable is stressed to some extent. Before ISR, the foot containing the target syllable is branched. After attempted ISR, the foot becomes non-branched, which is a violation of the Priority Principle stated in (48). On the other hand, if the attempted ISR output is feasible, it will pose another problem: whether the ISR rule reapplies on the output, since the output satisfies all the ISR conditions. It is critical that there should be no reapplication of the ISR rule on the same word. In order to avoid these problems, we can establish the stressed syllable as a barrier for ISR, that is, ISR is blocked if the initial syllable is stressed. Therefore the target syllable can never be a stressed one.

Another question is why the target syllable cannot be immediately followed by an onset-less syllable. Before developing this discussion one thing must be clarified: how a consonant between two vowels is assigned to syllable membership. According to the Maximal Onset Principle, a single intervocalic consonant is always assigned to the following syllable, for example, the syllable structure of "vanilla /vəˈnɪlə/" would look like this:

(61) Form with an Intervocalic Consonant

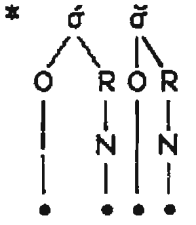


As shown above, the intervocalic consonant is always assigned to the onset of the following syllable (in accordance with language-specific syllabification principles). In the forms undergoing ISR, all the target-following syllables have an onset. Lack of such an onset would block ISR application. It is difficult, if impossible, to find a word which meets all the other conditions except for the onset condition. However, let me present a putative example form to illustrate why the target syllable cannot be immediately followed by a syllable without an onset. Suppose there were such a form which had three syllables and which satisfied the above description:

(62) A Putative Form without an Onset

a. Before ISR

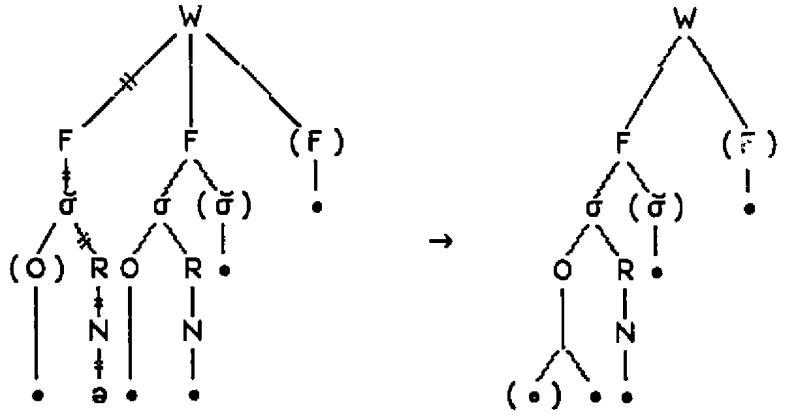
b. After Attempted ISR



On the left, the syllable immediately following the target syllable is non-branched without an onset. On the right, the syllable immediately following the target syllable becomes branched since an onset is attached to it. This kind of de:,ation from the original syllable structure violates the Priority Principle. Both neighboring foot and syllable structures should remain the same throughout the phonological processes in NCS, even though a particular individual target syllable or foot is deleted. Therefore a form is not subject to ISR if its target-following syllable does not have an onset.

We have now discussed some of the questions concerning the ISR conditions in (34). These conditions can be represented as a rule within the framework of autosegmental phonology:

(63) ISR Rule in Autosegmental Representation

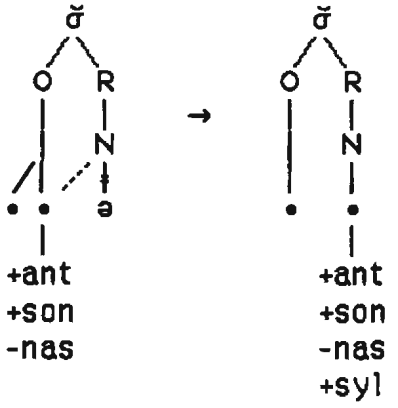


Thus: in NCS initial syllable reduction, a word-initial unstressed schwa, if it is immediately followed by a stressed syllable which has an onset, deletes, together with the syllable and foot dominating it. The remaining onset, if any, is integrated into the onset of the following syllable. From an autosegmental point of view, ISR is a schwa delinking process which results in foot deletion.

4.1.3. Sonorant Syllabification/Metathesis

Like syncopation and ISR, syllabification also involves the deletion of schwa. What is different about syllabification is that, in addition to the schwa deletion, certain sonorant consonants become syllabified and replace schwa as the syllable nucleus. This means that, unlike syncopation or ISR, no syllable or foot deletes; syllable structure is maintained. The autosegmental representation of syllabification is shown as follows:

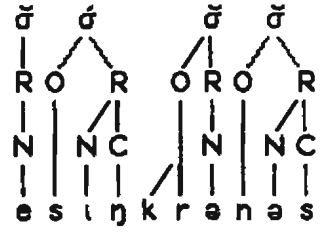
(64) Autosegmental Representation of Syllabification



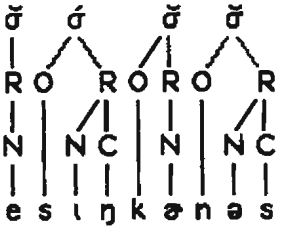
Delinking is restricted to the segmental tier. The onset of the target syllable must have two segments since it is the second one which will replace the delinked schwa as the nucleus. Consider the syllable structure change of "asynchronous" before and after syllabification:

(65) Comparison of Syllable Structure

a. Before Syllabification



b. After Syllabification

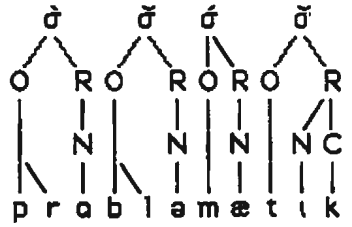


Before syllabification, the schwa is the nucleus and the sonorant /r/ is part of the onset. After syllabification, the schwa deletes and is replaced by a syllabic /r/. No deletion of syllables or nuclei

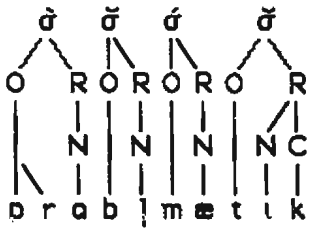
is involved in the process. The same is true with /l/. Note the syllable structure of "problematic" before and after syllabification:

(66) With /l/ as the Target Consonant

a. Before Syllabification



b. After Syllabification



Both derivations indicate the deletion of the schwa and the transfer of the sonorant consonant from the onset to the nucleus. Unlike syncopation or ISR, the whole process is restricted to the target syllable, and no neighboring syllables are involved.

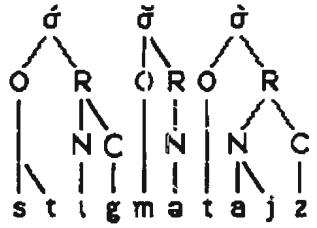
The syllabification statement in (41) poses some questions to be answered. I shall now approach these questions from the perspective of autosegmental phonology.

The first question is why the target consonant must be a liquid but not a nasal. As the examples have shown, in English only liquids and nasals undergo the syllabification process. An obvious fact about the forms in (36) is that the target consonant is always immediately preceded by a stop. This stop and the target consonant are within the same syllable; that is, the stop and the liquid together constitute the onset of the target syllable, as illustrated in (64). However, if the target consonant is a nasal rather than a liquid, the stop and the nasal will be assigned to different syllables,

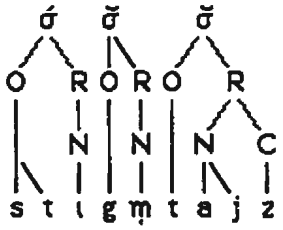
since, assuming the phonotactic constraints of English, no sequence of *stop + nasal* can be found within the onset of a syllable. Consider the derivation of "stigmatize":

(67) With Nasals as the Target Consonant

a. Before syllabification



b. After attempted syllabification

* 

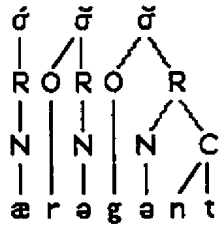
Before syllabification, /g/ is the coda of the preceding syllable. After attempted syllabification /g/, in accordance with the Maximal Onset Principle, becomes the onset of the target syllable. However, this is a violation of the the phonotactic constraints of English; English does not allow syllable onsets of *stop + nasal.* Therefore nasals are not qualified to be the target consonants in this process.

In some special forms (to be discussed in a later section), the consonants immediately preceding the target consonants are fricatives instead of stops. However, those few forms with preceding fricatives are the outputs of syncopation. However, even for those few forms, syllabification cannot apply, since English phonotactics permit only */s/ + nasal* onset clusters. Since the possibility for nasals to be the target consonants has been ruled out, only liquids are qualified to be targets.

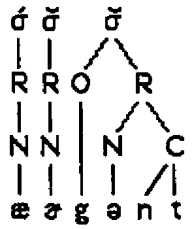
Another question is why each target consonant must be immediately preceded by a consonant. We take "arrogant" as an example to see what would happen if the target consonant were not preceded by a consonant.

(68) A Form without a Preceding Consonant

a. Before syllabification



b. After attempted syllabification

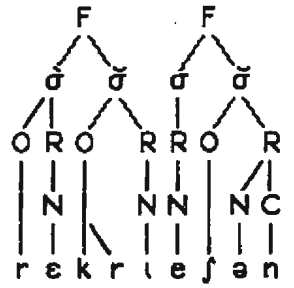
* 

If the target consonant were not preceded by a consonant, the target syllable would, after the attempted syllabification, change from an original branched syllable to a non-branched one; this violates the Priority Principle in (48). Therefore the target consonant must be preceded by a consonant.

The last question is why the target-following syllable must have an onset. Note what would happen if this syllable had no onset, as illustrated in the derivation of "recreation" below:

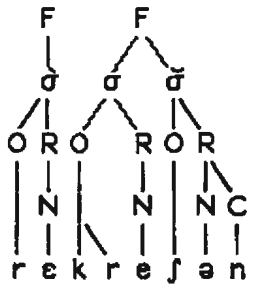
(69) The Following Syllable without an Onset

a. Before syllabification



b. After attempted syllabification

*

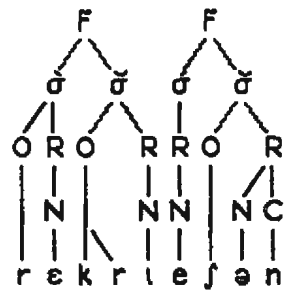


In (69a), the target-following syllable has no onset. In (69b), the target vowel has deleted, but instead of syllabifying, the target liquid consonant, along with its preceding stop, has become the onset of the following syllable, in accordance with the Maximal Onset Principle. Both the original foot and syllable structures on the left have changed, which goes against the Priority Principle.

One may wonder if it is possible for the target liquid, rather than joining the onset of the following syllable, to undergo syllabification regardless, as illustrated below:

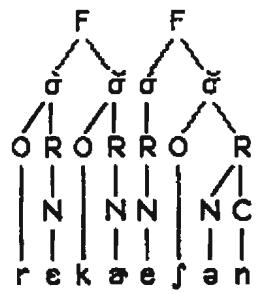
(70) The Following Syllable without an Onset

a. Before syllabification



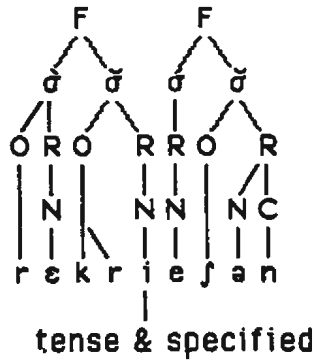
b. After attempted syllabification

*



Apparently some effect blocks the process if the target vowel is followed by another vowel instead of a consonant. By a general rule of English, the target vowel would have to be tense (such as the one above), if it were followed by another vowel. NCS syllabification can be thought of as consisting of the spreading of features from the sonorant consonant onto the following unmarked vowel position. Reduced (untense) vowels can be considered unspecified for (many) features, and therefore they are likely to accept spreading of features from adjacent segments. Tense vowels (i.e., those specified for some (or more) features) would be resistant to spreading, unless their existing features were explicitly delinked. As evident from the data in previous sections, all of the target vowels which successfully undergo syllabification are lax, without exceptions. In English, any vowel immediately followed by another vowel is labelled [+tense] and is, thus, unqualified as a target, as indicated below:

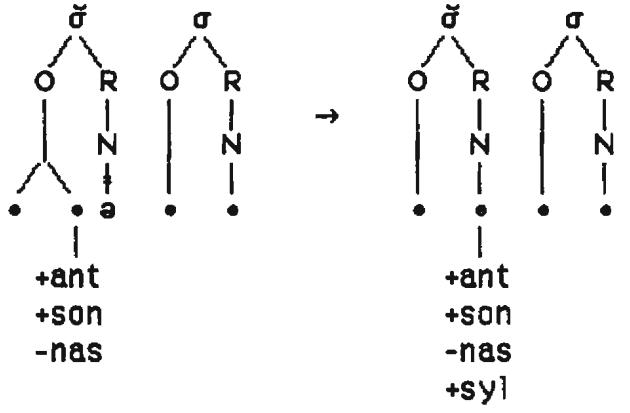
(71) Blocking Effect of [+tense]



In (71), /i/ has the feature [+tense], since it is immediately followed by another vowel. As a result, syllabification itself is blocked, since a [+tense] vowel is specified and thus blocks the spreading process of syllabification. Therefore the target-following syllable must have an onset.

The statement in (41) lists all the conditions for syllabification in NCS. An autosegmental representation of the conditions, in the form of a rule, would look as follows:

(72) Syllabification Rule in Autosegmental Representation



Thus: in NCS syllabification, an unstressed schwa deletes, if its syllable onset consists of a consonant on the left and a liquid on the right, and if it is immediately followed by a syllable which has an onset. The liquid becomes syllabified and replaces the deleted schwa as the syllable nucleus. On the whole, the target syllable remains unchanged throughout the process. From an autosegmental point of view, syllabification is a schwa-deleting and syllable-peak shifting process.

4.2. The Analysis within Sonority Phonology

The central concept of this framework is the sonority value of a segment. Within this perspective, syllable structure can be determined by the sonority value of segments and the sonority cycle. Each sonority cycle constitutes one syllable. As stated in section 2.2., all the segments can be categorized into five major classes: vowel (V), glide (G), liquid (L), nasal (N) and obstruent (O) in accordance with their sonority value. The universal sonority scale for the five classes is illustrated below:

O N L G V

less sonorous ← → more sonorous

Goldsmith (1990:111) describes the sonority hierarchy in a more detailed classification, as shown below:

(73) Sonority Hierarchy

- vowels
  - low vowels
  - mid vowels
  - high vowels
- glides
- liquids
- nasals
- obstruents
  - fricatives

affricates
stops

Selkirk (1982, cited by Goldsmith 1990:112) further sharpens the sonority hierarchy by giving each segment a sonority index:

(74) Sonority Index

Sound	Sonorityindex
a	10
e, o	9
i, u	8
r	7
l	6
m, n	5
s	4
v, z, ð	3
f, θ	2
b, d, g	1
p, t, k	0.5

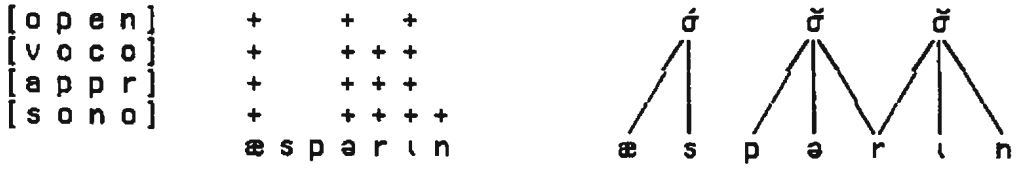
Although reference will be made to the sonority hierarchy and the sonority index shown above, I will primarily utilize the sonority system of Milliken and, thus, the sonority features presented in (8) for my analysis in this chapter.

4.2.1. Syncopation

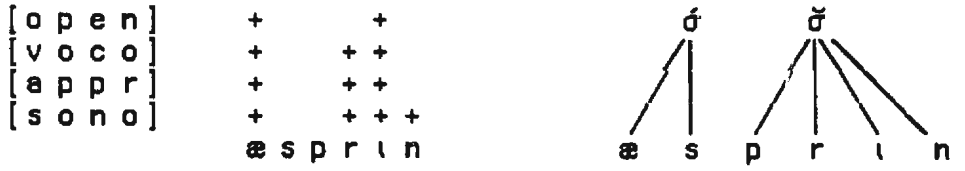
In the sonority framework, syncopation is a syllable-deleting process. Consider the syncopation process of the word "aspirin":

(75) Syncopation in Sonority Viewpoint

a. Before Syncopation



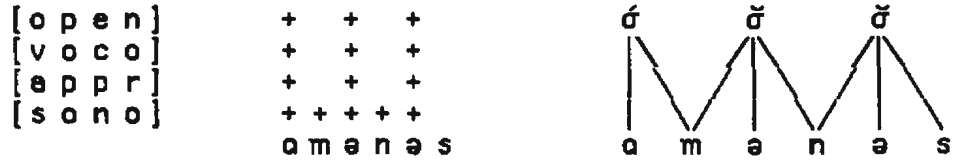
b. After syncopation



Before syncopation there are three syllable peaks and, thus, three syllables. The consonant /r/ is ambisyllabic, since its sonority value is lower than that of the two segments flanking it. After syncopation the schwa is deleted, together with the syllable dominating it, because the schwa represents one of the original syllable peaks. The remaining consonants are all assigned to the following syllable in accordance with the sonority value of the relevant segments. The consonant /r/ becomes tautosyllabic instead of ambisyllabic, since its sonority value is inferior only to that of the segment immediately following it.

Now I will discuss some of the questions posed in section 3.1. Consider first why the consonants flanking the target vowel must come from different manner of articulation classes. Recall that, in (22), the process is blocked when the target vowels are both immediately preceded and followed by nasals. Syncopation in such an environment would make the two nasals (which have identical sonority values) adjacent to each other. Remembering the definition of sonority cycle in (9), this would give rise to a 'hiatus' in the syllable structure, since according to the Universal Sonority Scale given in (7) no nasal is more or less sonorous than another. (Hiatus is defined by Milliken (1988:30) as a word-internal plateau in the sonority contour, creating a division in the syllable structure.) Consider the sonority cycle and syllable structure of 'ominous' shown below:

(76) Sonority Cycle and Syllable Structure of 'ominous'



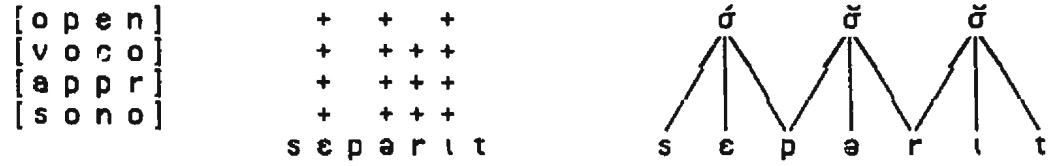
As shown in (77), after attempted syncopation /m/ and /n/ would become adjacent. Since, however, they have identical sonority values, they become heterosyllabic, creating a hiatus.

(77) After Attempted Syncopation

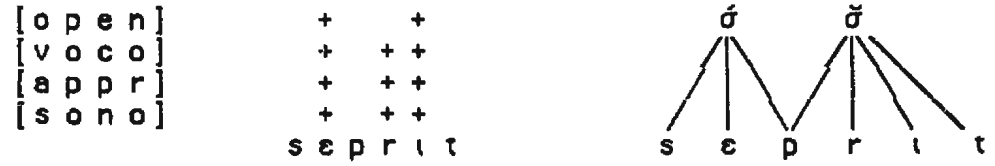
I suggest that syncopation is blocked in 'ominous' in order to avoid forming a hiatus. The forms in (22) would all have such a hiatus after attempted syncopation, while the data in (20) would not. I take the adjective 'separate' as an example to show why syncopation does not create a hiatus in all the forms in (20).

(78) Syllabic Structure of 'separate (ADJ)'

(a) Before Syncopation



(b) After Syncopation



There is no hiatus after syncopation as /p/ and /r/ are not equal in sonority values. Hence syncopation is not blocked. This fact suggests that syncopation in NCS cannot create a hiatus in the syllable structure. This claim gains further support from the examples in (79):

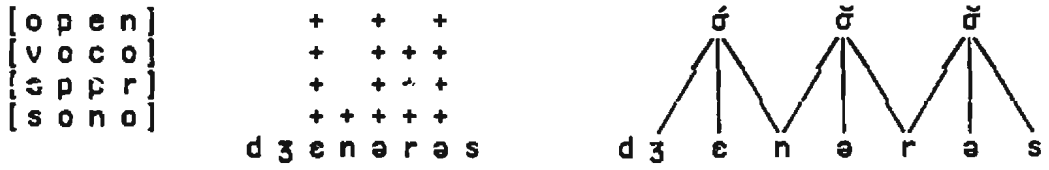
(79) Flanking Sonorants with Different Sonority Values

	SS	NCS
generous	/'dʒɛnəras/	/'dʒɛnras/
numerous	/'njumaras/	/'njumras/
assimilable	/ə'sɪməlabl̩/	/ə'sɪmlabl̩/
clamorous	/'klæməras/	/'klæmras/
memory	/'mɛməri/	/'mɛmri/
emerald	/'ɛmərald/	/'ɛmrald/

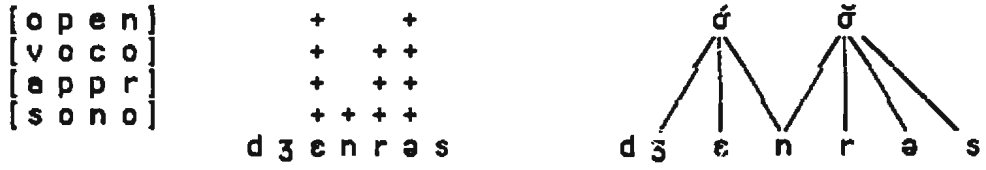
Although in each case the segment immediately preceding the target vowel is a nasal, the segment immediately following the target vowel is a sonorant other than a nasal. This difference in sonority value prevents the creation of a hiatus and, thus, syncopation is not blocked. I take 'generous' as an example to show why syncopation is not blocked.

(80) Syllable Structure of 'generous'

(a) Before Syncopation



(b) After Syncopation



Here the two segments on both sides of the target vowel have different sonority values and, thus, no hiatus appears in the syllable structure of the syncopation output. Hence syncopation is not blocked. The analysis for (80) provides, from another point of view, the evidence for the claim that syncopation in NCS cannot create a hiatus in the syllable structure.

Here one might wonder why in (80b) /nr/ is allowed syllable-initially, since /nr/ clusters do not normally occur syllable-initially in English. Such conditions, however, are generally defined on tautosyllabic clusters. /n/ is ambisyllabic and is therefore beyond the domain of the condition.

Note now the example of 'reconnaissance':

(81) Syllable Structure of 'reconnaissance'

(a) Before Syncopation

(b) After Attempted Syncopation

*

Although no hiatus occurs after attempted syncopation, syncopation is still blocked. The reason is that 'reconnaissance' does not satisfy Condition II in (25) which states that the target syllable must be immediately followed by another unstressed syllable which has a sonorant onset.

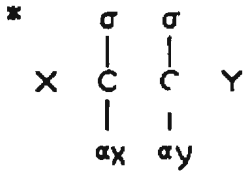
As discussed in section 3.1, this hiatus claim holds for all other major classes besides nasals. Actually condition III for syncopation is a hiatus condition which can be represented as follows:

(82) Hiatus Condition

> Syncopation in NCS is blocked if it would create a hiatus in the syllable structure of the output.

This hiatus condition can also be expressed schematically (α = sonority value, x = y) as follows:

(83) Schema for the Hiatus Condition



The hiatus condition serves to block syncopation when the two consonants on either side of the target vowel are of equal sonority value or from the same manner of articulation class.

However, one might still wonder why the target vowel must be immediately followed by an unstressed syllable, and why the consonant immediately following the target vowel must be a sonorant. To answer these questions, we must again consider syllable structure.

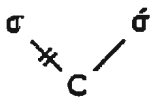
Cross-linguistically, targets of syncopation are usually (if not always) immediately followed by a consonant. (This is especially true in English. In her dissertation, Selkirk (1981:122) cites Zwicky

(1968) as saying that syncopation occurs only before one of the three consonants /r/, /l/ or /n/.). In other words, syncopation typically does not occur when the target vowel is immediately followed by another vowel. Furthermore, in languages with syncopation, the same process typically does not delete word-final vowels. These facts indicate that syncopation does not occur in open syllables. Thus, evidently syncopation is a phenomenon particular to closed syllables.

Let us return to the question--why the target vowel must be immediately followed by an unstressed syllable. Suppose that there is only one consonant between a given pair of syllables and that the first syllable is unstressed and the following one is stressed. Assuming the effect of the 'Hiatus Rule' (which is proposed in Milliken (1988:40) and which holds throughout this thesis), resyllabification assigns the intervening consonant exclusively to the following stressed syllable, as illustrated below:

(84) The Hiatus Rule and Its Application

(a) The Hiatus Rule



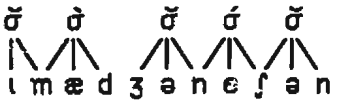
(b) Its Application

This rule and its application indicate that an ambisyllabic consonant (linked to a preceding unstressed syllable and a following stressed syllable) is delinked from the preceding syllable and

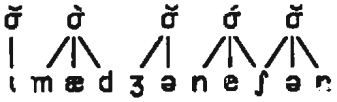
becomes tautosyllabic. As a result, the preceding unstressed syllable becomes open. Recall that syncopation is a phenomenon restricted to closed syllables. If, however, the syllable immediately following the target syllable is stressed, the target syllable will become open by the Hiatus Rule and the target vowel will be disqualified for syncopation. Consider, for example, the syllable structure change of the word 'imagination' under the Hiatus Rule.

(85) Resyllabification of 'imagination' under the Hiatus Rule

(a) Before the Hiatus Rule



(b) After the Hiatus Rule



This figure shows that a stressed syllable deprives the immediately preceding syllable of its coda, and the presence of a coda after the target vowel is a necessary qualification for syncopation. Hence, the target vowel must be immediately followed by an unstressed syllable.

As to why the following consonant must be a sonorant, there is no ready answer available. However, some roundabout evidences can be found in syllabification to support the claim. Note that in any language a segment must have a certain degree of sonority in order

to be qualified as a possible syllable peak, or, in other words, to be syllabic. While this sonority threshold differs from language to language (some languages do allow syllabic obstruents), for English, obstruents are evidently not eligible syllable peaks. Note also that the target vowel is always a reduced one. In NCS the target vowel is reduced so greatly (because of the increase in speaking rate) that it is, so to speak, merged into the immediately following sonorant consonant. Recall that the target vowels are always followed by one of the four sonorants /l/, /m/, /n/ or /r/, as shown in (16). All four of these sonorants can be syllabic. The target unstressed vowel /ə/ or /ɪ/ when immediately followed by a sonorant consonant in a word, is reduced so much in NCS that some linguists such as Selkirk (1981) are inclined to call the sonorant consonant syllabic and consider that the unstressed vowel as such has been lost. Selkirk (1981:123) claims as follows:

(86) Claim to the Effects of Sonorants vs. Obstruents

> "Sometimes it is difficult to say whether the unstressed vowel is really lost or not, but what is clear is that an unstressed vowel preceding a sonorant is far more reduced than one preceding a non-sonorant."

Selkirk (1981:123) gives some evidence to back up her claim that an unstressed vowel preceding a sonorant is far more reduced than one preceding a non-sonorant.

(87) Evidence for the Claim

Will John go	[wl̩]	vs.	with John gone	[wɪð]
She wants an apple	[n̩]	vs.	She works at Apple	[ət]

Of course, the above discussion does not provide a direct answer to the question. Nevertheless, it is evident that an unstressed vowel preceding a sonorant is more likely to delete completely in NCS than to be simply reduced. The following pairs of forms show a different behavior of unstressed vowels preceding a sonorant or an obstruent.

(88) Effects of Obstruents vs. Sonorants

	SS	NCS
anniversary	/ˌænəˈvɚsəri/	/ˌænəˈvɚsri/
university	/ˌjunəˈvɚsətɪ/	*/ˌjunəˈvɚstɪ/
dangerous	/ˈdendʒəɹəs/	/ˈdendʒɹəs/
calamitous	/kəˈlæmətəs/	*/kəˈlæmtəs/
pyramid	/ˈpɪɹəmɪd/	/ˈpɪɹmɪd/
prohibited	/proˈhɪbɪtəd/	*/proˈhɪbtəd/
deliverance	/dɪˈlɪvəɹəns/	/dɪˈlɪvɹəns/
residence	/ˈɹɛzədəns/	*/ˈɹɛzdəns/
inviolable	/ɪnˈvajələbl̩/	/ɪnˈvajləbl̩/
imitable	/ˈɪmɪtəbl̩/	*/ˈɪmtəbl̩/
bachelor	/ˈbætʃələɹ/	/ˈbætʃlɚ/
ambassador	/æmˈbæsədɚ/	*/æmˈbæsdɚ/
cabinet	/ˈkæbənɪt/	/ˈkæbnɪt/
opposite	/ˈɑpəzɪt/	*/ˈɑpzɪt/

These pairs show that in NCS an unstressed vowel deletes when preceding a sonorant but remains unchanged when preceding an obstruent.

The last question is why the target syllable must have an onset. The answer concerns the preservation of syllable structure as stated in the Priority Principle in (48). Consider the sonority representation of the syllable structure of the word "bayonet":

(89) Target Vowel without a Preceding Consonant

(a) Before Syncopation

(b) After Attempted Syncopation

Before syncopation the target-preceding syllable has no coda, while after attempted syncopation it obtains one. The syllable structure of the neighbouring syllable is not preserved. As a result, the attempted syncopation on a form without a target-preceding consonant yields an output which violates the Priority Principle. Therefore the target vowel must be immediately preceded by a consonant.

I have discussed some of the questions concerning English syncopation in NCS within the framework of sonority phonology. As a matter of fact, the statement for syncopation in (25) can also be represented in a simple rule within the framework of sonority

phonology, as illustrated in the following diagram (where α = sonority value, and $x \neq y$):

(90) Syncopation Rule in Sonority Phonology

$$\breve{V} \rightarrow \varnothing \; / \; \underset{\alpha x}{C} \; \_\_\_ \; \underset{\substack{\alpha y \\ [+son]}}{C} \; \breve{V}$$

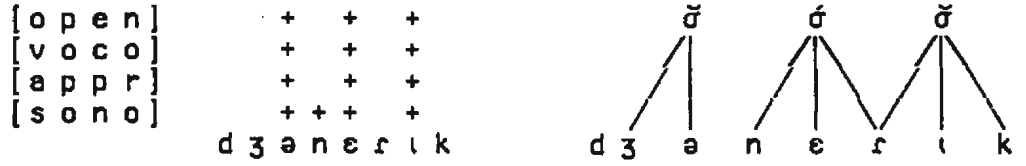
Thus: in NCS syncopation, an unstressed vowel deletes if it is immediately preceded by a consonant and immediately followed by both a sonorant consonant and an unstressed syllable, and if the two consonants flanking it have different sonority value.

4.2.2. Initial Syllable Reduction

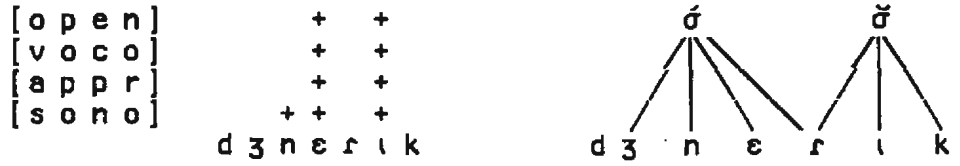
ISR, in the view of sonority phonology, is a syllable-deleting process. A sonority representation of ISR focuses on the sonority value and sonority cycle of the forms undergoing ISR. Some of the remaining consonants of the deleted syllable can be integrated into the following syllables, and some become extrasyllabic, depending on the sonority value of the relevant consonants. Consider the syllable structure of "genetic"

(91) Sonority Representation of ISR

a. Before ISR



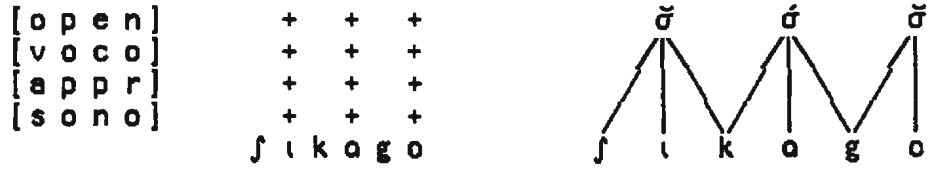
b. After ISR



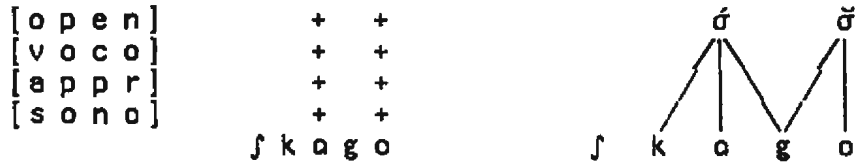
Before ISR, there are three syllables and the onset of the target syllable is an obstruent. After ISR, the schwa deletes, together with the syllable dominating it. The remaining consonant is integrated into the onset of the following syllable, since its sonority value is lower than that of the onset of the following syllable. However, if the two consonants flanking the target vowel have the same sonority values, whether they are obstruents or sonorants, orphan extrasyllabicity (see section 2.2.2.) will result. Note the example of "Chicago":

(92) Target Vowel Flanked by Two Obstruents

a. Before ISR



b. After ISR

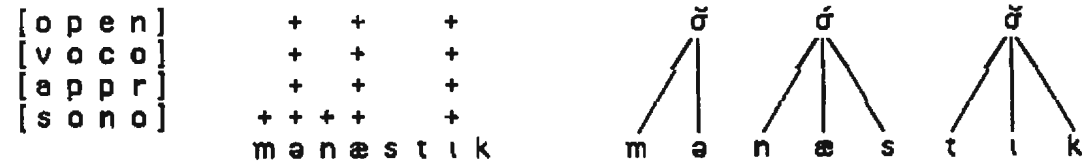


Comparing (91) and (92), we see that in (91) the consonants flanking the target vowel are an obstruent and a nasal respectively and, therefore, have different sonority values, while in (92) the consonants flanking the target vowel are two obstruents and, therefore, have identical sonority values. As a result, there is an extrasyllabic /ʃ/ in the output of (92).

Not only two obstruents flanking the target vowel can create extrasyllabicity but two sonorants can as well. Consider the syllable structure of "monastic":

(93) Target Vowel Flanked by Two Nasals

a. Before ISR



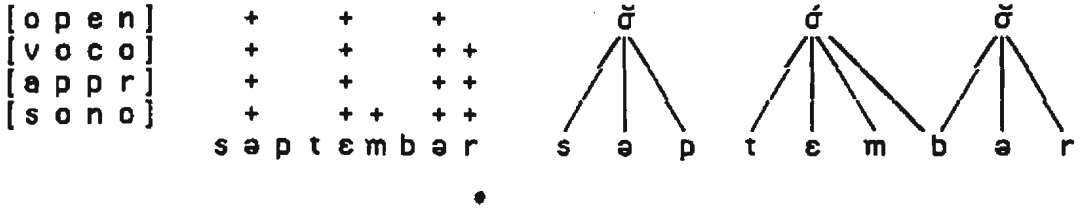
b. After ISR

/m/ and /n/ have the same sonority values and, thus, /m/ is left extrasyllabic in the output.

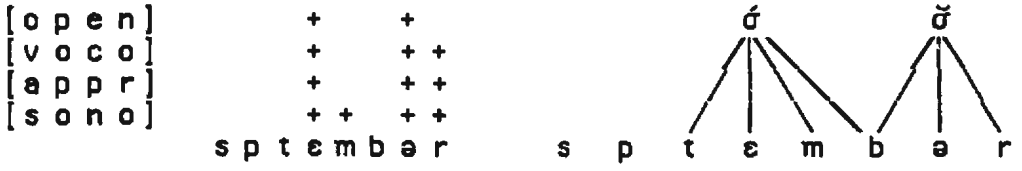
Sometimes even two consonants are made extrasyllabic. For instance, "September" has such a syllable structure:

(94) Form with Two Extrasyllabic Consonants

a. Before ISR



b. After ISR



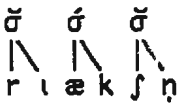
In the above derivation, two obstruents are left extrasyllabic after ISR, since they do not differ in sonority from the following obstruent. On the other hand, they cannot constitute a separate syllable, since they have no sonority values (and therefore, no sonority peak). They must remain extrasyllabic; otherwise the sequence of initial consonants resulting would violate the syllable structure constraints (phonotactic constraints) of English.

Now I will turn to some of the questions concerning the ISR process. First consider why the stressed syllable immediately

following the target syllable must have an onset. As indicated above, an intervocalic consonant is always assigned to the following stressed vowel and becomes the onset of the stressed syllable. If, however, the stressed syllable has no onset, the target vowel and following stressed vowel must become adjacent with no intervocalic consonant in between. After attempted ISR, the basic syllable structure will be altered. Consider the syllable structure change of "reaction" before and after ISR:

(95) Target-following Syllable without an Onset

a. Before ISR



b. After Attempted ISR

Before ISR, the stressed syllable has a coda and no onset. After attempted ISR, the stressed syllable obtains an onset: /r/. This change in syllable structure violates the Priority Principle in (48), and yields the wrong output. Therefore the immediately-following stressed syllable must have an onset. The autosegmental analysis of this condition reached a similar conclusion.

The conditions for ISR in (34) can be represented as a rule within the framework of sonority phonology:

(96) Rule for ISR

$$\breve{V} \rightarrow \varnothing \; / \; \#(C) \_\_\_ \; C\acute{V}$$

In other words: in ISR, an unstressed vowel, if it is in word-initial position and is immediately followed by a stressed syllable which has an onset, deletes.

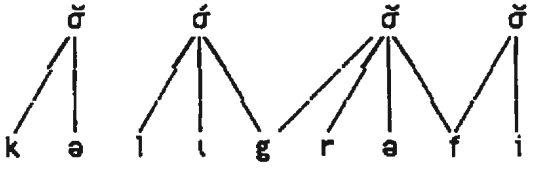
4.2.3. Sonorant Syllabification/Metathesis

Syllabification, unlike either syncopation or ISR, is a syllable-preserving process. In terms of sonority phonology, it involves a syllable peak transference from schwa to a liquid. As a result, the schwa loses its necessity of existence and deletes, but the syllable remains, since the syllabified liquid replaces the schwa as the syllable nucleus. Therefore, syllable preservation is the characteristic of syllabification, as illustrated in the derivation of the word "calligraphy":

(97) Sonority Representation of Syllabification

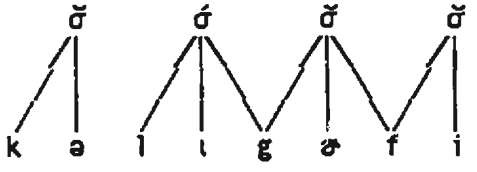
a. Before Syllabification

[open]	+		+		+		+	
[voco]	+		+		+	+		+
[appr]	+	+	+		+	+		+
[sono]	+	+	+		+	+		+
	k	ə	l	ɪ	g	r	ə	f	i



b. After Syllabification

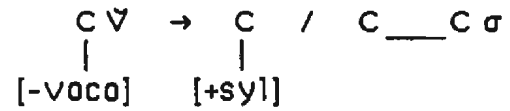
[open]	+		+		+		+	
[voco]	+		+		+		+	
[appr]	+	+	+		+		+	
[sono]	+	+	+		+		+	
	k	ə	l	ɪ	g	ər	f	i



Before syllabification, /r/ is part of the onset of the target syllable, and the schwa is the syllable peak. After syllabification, the schwa deletes and /r/ is higher in sonority value than the segment on either side and, therefore, it acquires an extra sonority value of openness (more open segments are more prone to being [syllabic] (Milliken 1988:31)). As a result, the syllable peak shifts to /r/ and /r/ becomes syllabic. The total number of syllables remains unchanged throughout the process.

In terms of sonority phonology, the statement for syllabification in (41) can be represented by the following rule:

(98) Rule for Syllabification in NCS



Thus: in NCS syllabification, a schwa deletes, if it is immediately preceded by a liquid which is in turn immediately preceded by a consonant, and if the target syllable is penultimate or earlier, and if there is an intervocalic consonant between the target vowel and the following vowel. As a result of the schwa deletion, the liquid becomes syllabic.

With this rule, we can account for most instances of liquid syllabification in NCS. In some special cases, however, this rule appears not to hold. For instance, the rule indicates that the target consonant must be immediately preceded by another consonant. But

for some forms, the target consonant is immediately preceded not by another consonant but by a vowel. Consider the words in (99):

(99) Forms Incompatible with the Syllabification Rule

	SS	NCS
considerable	/kən'sɪdərəbl̩/	/kən'sɪdɚbl̩/
favorable	/'fevərəbl̩/	/'fevɚbl̩/
insuperable	/ɪn'supərəbl̩/	/ɪn'supɚbl̩/
miserable	/'mɪzərəbl̩/	/'mɪzɚbl̩/
numerable	/'numərəbl̩/	/'numɚbl̩/
operable	/'ɑpərəbl̩/	/'ɑpɚbl̩/
pleasurable	/'plɛʒərəbl̩/	/'plɛʒɚbl̩/
separable	//'sɛpərəbl̩/	/'sɛpɚbl̩/
temperature	/'tɛmpərətʃɚ/	/'tɛmpɚtʃɚ/

At first glance, the middle column in (99) is incompatible with the rule. If, however, we take the syncopation process into consideration, the middle column in (99) is no longer a problem. Notice that the forms in the middle column are compatible with the environments of the syncopation rule in (90). Hence if we assume that they first undergo syncopation, the application of the syncopation rule feeds the syllabification rule in (98), giving the correct outputs in the righthand column in (99). Consider, for example, the following derivation:

(100) Derivation of the Word 'favorable'

Application of the syncopation rule

Application of the syllabification rule

The reversed rule order does not yield the desired results. Consider the derivation in (101):

(101) Derivation of 'favorable' in Reversed Order

Application of the syllabification rule

→ (n/a)

Application of the syncopation rule

This derivation cannot produce the form with a syllabic sonorant consonant, and so I assume that the syncopation rule should be ordered before the syllabification rule, but not vice versa.

The syllabification statement in (41) poses some questions to be answered:

(102) Questions Concerning Syllabification

(a) Why must the target consonant be /r/ or /l/ but not be /n/ or /m/ or an obstruent?

(b) Why must the target syllable be unstressed?

(c) Why must the target syllable be penultimate or earlier?

(d) Why must the target consonant be immediately preceded by another consonant?

(e) Why must the target vowel be immediately followed by a consonant?

Most of these questions have been discussed from an autosegmental point of view. Now I would like to discuss them within the framework of sonority phonology. Since /l/ sequences undergo syllabification in essentially the same environments as /r/ sequences, for the sake of simplicity, I will discuss only the syllabification of /r/ sequences with reference to these questions.

Consider the first question--why the target consonant must be /r/ or /l/ but not be /n/ or /m/ or an obstruent. To answer this question, recall the universal sonority scale below, which was first presented in section 2.2.

O N L G V

less sonorous ← → more sonorous

This scale lists vowels as the most sonorous, and obstruents as the least sonorous, with glides, liquids, and nasals ranging in order in between.

Although both /r/ and /l/ are classified as liquids, in the sonority index listed in (74), /r/ is represented as being more sonorous than /l/. This is true for English, as the English /r/ is produced with a more open mouth position (i.e. less oral-central airstream constriction) than is the English /l/. According to the sonority hierarchy in (73) and the sonority index in (74), apart from vowels and glides, /r/ is the most sonorous consonant, /l/ is the second most sonorous, /n/ and /m/ are less sonorous, and obstruents are the least sonorous. In syllabification we find that consonants' ability to undergo syllabification declines as their sonority value decreases. The explanation is simple. Since syllabification involves the process of some consonants becoming syllabic, /r/ and /l/ are more likely to become syllabic than less sonorous consonants. Suppose that /r/, /l/, /n/, /m/, and obstruents all met the syllabification environments stated in the rule in (98), /r/ would become syllabic in all cases, /l/ would become syllabic in selected cases, and /n/, /m/,[7] and obstruents would not become syllabic in any cases, in NCR. That is, the less sonorous the consonant is, the less frequently it undergoes syllabification.

---

[7] English nasals do undergo syllabification in certain positions, such as /'bʌtn̩/ "button", /'opm̩/ "open" etc. But those are lexicalized forms and are, therefore, beyond the domain of NCS processes.

One might wonder if /m/, /n/ or the obstruents would begin to syllabify in even more rapid speech. This turns out not to be the case. No matter how rapid the rate is, no nasals or obstruents undergo syllabification in English. The forms in (42a) show that nasals do not undergo syllabification although they meet all of the conditions of syllabification statement except the first one (that is, the condition which states that the target consonant must be /r/ or /l/). These data show clearly that nasals cannot undergo syllabification. Obstruents in English are never syllabic and, therefore, cannot undergo syllabification in any case. Hence the target consonant must be /r/ or /l/ but not be /n/ or /m/ or an obstruent.

As for the second question--why the target syllable must be unstressed, I suggest that syllabification can be understood as a 'weakening' process. I take 'weakening' to indicate reduction in the sense that forms such as *and* /ænd/ can be weakened or reduced to /ənd/,/ən/,/n̩/,etc. in unstressed contexts. Weakening processes in general tend to occur in unstressed syllables. (Other examples include vowel reduction, loss of aspiration, and vowel devoicing.) Applying this process to a stressed syllable gives an unacceptable result. The following two examples show the different results of syllabification applying to stressed and unstressed syllables.

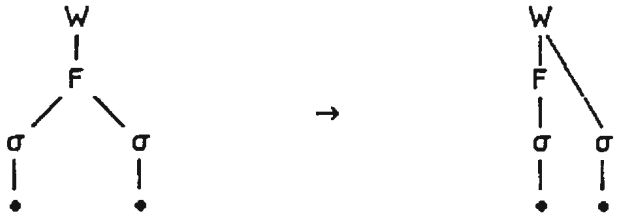
(103) Syllabification in Stressed and Unstressed Syllables

	SS	NCS
(a) grammar	/'græmɚ/	*/'gɚmɚ/
(b) grammatical	/grə'mætɪk!/	/gɚ'mætɪk!/

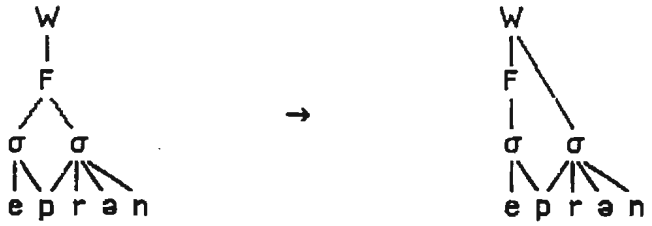
In (103a), syllabification applies to the stressed syllable, giving the incorrect output of */'gɚmɚ/. Hence, syllabification in stressed syllables is incorrect. In (103b), however, the syllable which undergoes syllabification is an unstressed one; this output is acceptable in NCS. I maintain, therefore, that syllabification only applies in unstressed syllables. As a matter of fact, the other two processes of syncopation and ISR are also restricted to unstressed syllables, as they are also weakening processes.

Consider next the third question--why the target syllable must be penultimate or earlier. The reason may have to do with extrapedality. Recall the discussion in section 2.2: extrapedality results when an entire syllable is delinked from the foot structure above it. According to (12), (13) and (14), extraprosodicity, in general, is allowed with respect to several levels of structure (e.g., the foot, the syllable, etc.). However, an element can only be extraprosodic if it is in a peripheral position in the next-higher level of structure. Thus, a final syllable may be extrapedal, or 'unfooted'. Consider extrapedality (Milliken 1988:95) and its application to the word 'apron' below:

(104) Extrapedality



(105) The Extrapedality in 'apron'



The figure in (104) shows that a syllable in a peripheral position in the next-higher level of a foot structure is delinked entirely from the foot structure. The figure in (105) illustrates this using the specific example of 'apron', where the final syllable is unfooted.

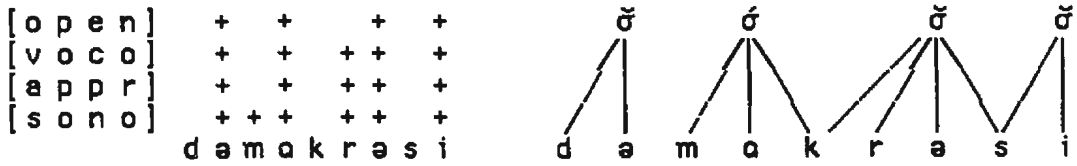
NCS syllabification does not apply in the final syllable since in most cases the final syllable is extrapedal. Thus, it appears that there is a relationship between syllabification and foot structure, such that syllabification is blocked if the target syllable is unfooted. For this argument, however, I cannot provide strong empirical support. The kind of evidence needed would be words with a demonstrably footed final syllable which meets all of the other requirements for syllabification. If such words do in fact undergo syllabification, then footedness would be shown to be a crucial factor. Unfortunately, final footed syllables, such as occur in many

verbs and adjectives, are also generally stressed, and so are not qualified to undergo syllabification. Hence the question is still open for discussion.

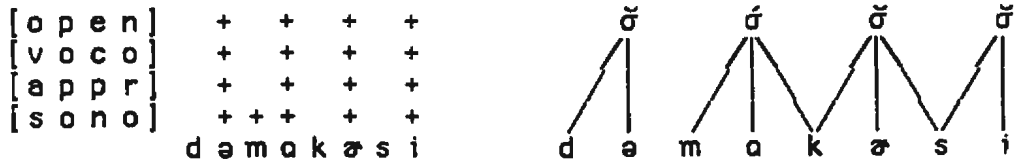
The fourth question is why the target consonant, /r/ or /l/, must be immediately preceded by another consonant (as shown by the examples in (36). Bearing in mind the definition of sonority cycle in (9), a target consonant immediately preceded by another consonant can prevent a hiatus in the sonority contour of the output. Consider the syllable structure of 'democracy'.

(106) The Syllable Structure of 'democracy'

a. Before Syllabification



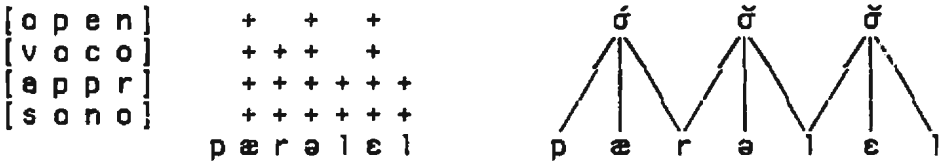
b. After Syllabification



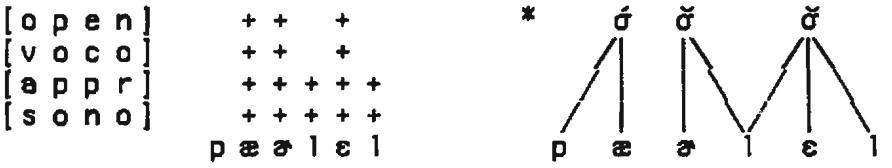
In this diagram, the target consonant /r/ is immediately preceded by /k/, so no hiatus appears in the sonority contour of the output. However, if the target consonant were immediately preceded by a vowel (instead of by a consonant), a hiatus would appear in the sonority contour. Consider below the syllable structure of 'parallel'.

(107) The Syllable Structure of 'parallel'

a. Before Syllabification



b. After Attempted Syllabification



In (107), the target consonant /r/ is immediately preceded by a vowel, and, thus, a hiatus appears in the sonority contour of the output, since /ə/ is syllabic. Syllabification is therefore blocked.

Apparently, the NCS syllabification process includes a condition similar to the one associated with syncopation process discussed previously. The following is the proposed condition:

(108) Condition for Syllabification (The Hiatus Condition)

> Syllabification in NCS must not create a hiatus in the sonority contour of the output. If it does, syllabification is blocked.

One might argue that when the target syllable is at the beginning of a word, syllabification would still be blocked, even if it did not create a hiatus. Consider the following forms:

(109) Forms with Word-initial Target Syllable

	SS	NCS
rapidity	/rə'pɪdəti/	*/ɚ'pɪdəti/
rapacious	/rə'peʃəs/	*/ɚ'peʃəs/
reconnaissance	/rɪ'kɑnəsəns/	*/ɚ'kɑnəsəns/
lament	/lə'mɛnt/	*/l̩'mɛnt/
laryngeal	/lə'rɪndʒiəl/	*/l̩'rɪndʒiəl/
legation	/lɪ'geʃən/	*/l̩'geʃən/

In all of the forms in (109), no hiatus appears in the proposed output. Here it seems that hiatus has nothing to do with the blocking effect. The forms in (109) share some special characteristics, however. All of the target syllables consist exclusively of a sequence of a sonorant consonant followed by an unstressed vowel, and are in word-initial position. Syllabification applied to this sequence in this special position would make a syllabic consonant occur in word-initial position. This is in violation of the universal favoring of CV-initial syllable types. NCS syllabification is a process that enables a speaker to pronounce words more naturally and more fluently. To start a word with a syllabic consonant is highly marked, and so is avoided in NCS. Thus, forms such as those in (109), do not undergo syllabification, even though no hiatus appears in the putative output. However, it must be

noted that the constraint against word-initial syllabic consonants is language specific, and results from an idiosyncracy of English phonotactics, since many African languages, for example, allow words to begin with syllabic consonants (Dr. Steinbergs, p.c.).

The last question is why the target vowel must be immediately followed by a consonant. The answer has to do with the sonority cycle and syllable structure. Consider the attempted derivation of the word 'creative'.

(110) Attempted Syllabification Process of 'creative'

a. Before Syllabification

b. After Attempted Syllabification

In (110a), the target vowel /ɪ/is immediately followed by another vowel and there is a hiatus between them, as they have the same sonority values. The proposed output in (110b) also gives rise to a hiatus, because both the syllabified liquid and the following vowel are syllable peaks; this sequence violates the Hiatus Condition in (108). However, one might very well argue that this hiatus is not

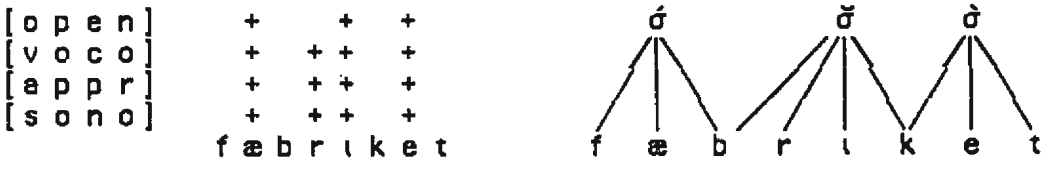
the result of syllabification, as it existed before the process applied.

In addition, one must consider that the target vowel is, in fact, not a reduced vowel. Thus, it would not delete in any case. However, sequences of *reduced vowel + stressed vowel*, without an intervening consonant, are rare (and perhaps impossible) in English, thus, the crucial example is apparently unobtainable.

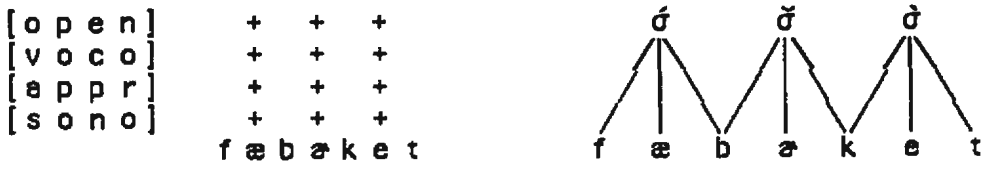
What is salient about syllabification, as well as other processes in NCS, is that hiatus should always be avoided in both input and output in favor of naturalness and smoothness. A target-following consonant can serve to avoid such a hiatus, as is illustrated in the syllabification process of 'fabricate' below:

(111) Syllabification Process of 'fabricate'

a. Before Syllabification



b. After Syllabification



There exists no hiatus in either input or output. This is why all of the forms subject to syllabification have target-following consonants.

Chapter 5

Conclusion

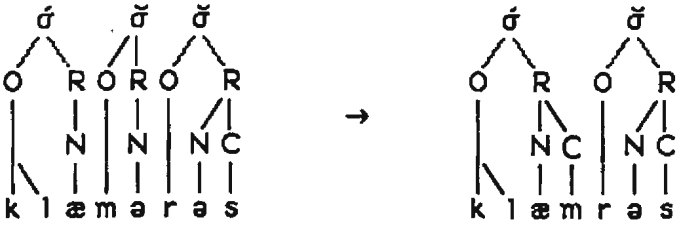
In the preceding chapters, I have discussed the processes of syncopation, initial syllable reduction and syllabification in Normal Conversational Speech, and I have utilized the two frameworks of autosegmental and sonority phonology to try to account for the three processes. In this chapter, I would like to draw conclusions from what I have discussed concerning the three processes in NCS, especially with reference to the two frameworks adopted for the explanation of the processes.

5.1. Comparison of and Comments on the Two Frameworks

The two frameworks of autosegmental and sonority phonology adopt different perspectives on syllable structure; autosegmental phonology focuses on the hierarchical tiers of syllable structure, while sonority phonology emphasizes the sonority cycle of syllable structure. As a result, the autosegmental representation of forms and processes differs from the sonority representation, as illustrated in the description of the syncopation process of the word "clamorous" below:

(112) Comparison of the Two Frameworks

a. Autosegmental Representation



b. Sonority Representation

In (112a), each syllable is an independent entity. Consonants belong to one syllable only; syllable structure is determined by the Maximal Onset Principle, stated in (5). In (112b), ambisyllabic segments are permitted to occur, and the syllable boundary is blurred; syllable structure is determined by the sonority cycle, as defined in (9). Because of their dissimilar perspectives on syllabification, the two frameworks' descriptions of the processes are different. Nevertheless, the two frameworks do share some viewpoints for certain aspects of these NCS processes. A detailed discussion of the distinctions and of the shared characteristics follows.

5.2. Phonological Essence of the NCS Discussions

First I will consider the shared characteristics for the three processes. As indicated in the previous discussions, the three processes have the following shared characteristics:

(113) Shared Characteristics for the Three Processes

(a) the target syllable must be unstressed & and lax

(b) the target vowel must be immediately followed by a consonant.

(c) the target syllable must be penultimate or earlier.

(d) the target vowel deletes.

However, the essential characteristic shared by the processes is that all of them are weakening processes. It is the nature of fast speech phenomena. Using my earlier definition of weakening as type of reduction, all the above four shared characteristics can be explained, at least to some extent.

With respect to the characteristic that the target syllable must be unstressed, it is usually the case that only unstressed syllables can be subject to weakening processes. Although what is to be considered a 'reduced' vowel may vary from language to language, in the great majority of languages, vowel reduction takes place in unstressed syllables. For weakening processes, therefore, an unstressed target syllable is a common, and, for NCS processes, essential condition.

As for why the target vowel must be immediately followed by a consonant, recall the discussion on sonorant syllabification and metathesis in section 4.1.3.: syllabification is a process restricted to syllables whose peaks consist of lax vowels. As a matter of fact, all the weakening processes in NCS are restricted to syllables with lax vowels as their peaks. A target-following consonant can ensure that the target syllable peaks are composed of lax vowels so as to be qualified for the weakening process.

Another shared characteristic is that the target syllable must be penultimate or earlier. This may have to do with extrapedality. Recall the discussion on extraprosodicity in section 2.2. and the discussion on syllabification in section 4.2.3.: an element is extraprosodic if it is in a peripheral position in the next-higher level of structure. In terms of this claim, a word-final syllable is extrapedal or unfooted. It is my assumption that weakening processes do not apply to unfooted syllables. Therefore, the three processes are restricted to penultimate or earlier syllables.

The last shared characteristic is self-evident that the target vowel deletes. All the three processes are weakening ones; deletion is the ultimate reduction. I have not chosen to discuss other vowel weakening processes in this thesis, as they do not occur in NCS. I assume that weakening processes in NCS always mean certain kinds of deletion, either the deletion of reduced vowels or that of consonants, otherwise the whole word cannot be considerably reduced in duration to meet the fast speech requirement.

As is indicated above, the shared characteristics for the three NCS processes are the result of their weakening nature. On the other hand, the distinctions for the three processes are based on the different positions in which they occur, as listed below:

(114) Target Syllable Positions for the Three Processes

a. Syncopation occurs word-medially;

b. ISR occurs word-initially;

c. Syllabification occurs either word-medially or word-initially.

This difference in target syllable position is significant and determines the following distinctions:

(115) The Distinctions for the Three Processes

a. Distinction in Stress Following Target Syllable:

Syncopation target is immediately followed by an unstressed syllable.

ISR target is immediately followed by a stressed syllable.

Syllabification target is immediately followed by either a stressed or an unstressed syllable.

b. Distinction in Consonants Flanking the Target Vowel:

For syncopation they must be from different manner of articulation classes.

For ISR they can be from the same manner of articulation class.

For syllabification they can be from the same manner of articulation class.

c. Onset:

A syncopation target syllable must have an onset (i.e. a syncopation target vowel must have a preceding consonant).

An ISR target vowel can be without a preceding consonant.

A syllabification target vowel must have two immediately preceding consonants, with the second consonant being a liquid.

In what follows I compare syncopation and ISR to see why these distinctions are the result of the difference in position. Evidence from the third chapter indicates that the environment for ISR is distinct from that of syncopation in almost every significant aspect:

(116) ISR Characteristics (as Opposed to Those of Syncopation)

a. The syllable immediately following the target syllable must be stressed
b. The onset of the syllable immediately following the target syllable can be either [+sonorant] or [-sonorant];
c. The target vowel can be flanked by the consonants from the same manner of articulation class;
d. The consonant immediately preceding the target vowel is optional.

These aspects show that ISR is a process quite different from syncopation, although a reduced vowel deletes in both cases. Why are there these systematic distinctions? The essential reason, I think, has a great deal to do with the positions in which the two processes occur, and the answers can be found within the frameworks of autosegmental and sonority phonology. I will discuss these differences one by one in the following paragraphs.

Since syncopation can occur only word-medially and ISR can occur only word-initially, for syncopation, the syllable immediately following the target one must be unstressed in accordance with the Priority Principle in (48). A syncopation target syllable immediately followed by a stressed syllable would yield an output which violates the Priority Principle, as is discussed in the previous chapter. While for ISR, the syllable immediately following the target one must be stressed with reference to the English stress template, which is also discussed in the previous chapter. This accounts of the distinction in (116a).

For syncopation, since the target-following syllable is unstressed, the intervocalic consonant must be ambisyllabic in accordance with its sonority value. This means that the consonant is the coda of the preceding target syllable and the onset of the following syllable at the same time. As stated in section 4.2.1., a sonorant in the coda position of the target syllable can serve to further reduce the target vowel and eventually delete it. For ISR, however, since the target-following syllable is stressed, the

intervocalic consonant(s) must be tautosyllabic in terms of the hiatus rule in (84). This means that the consonant (or the right-most consonant, if there are two) can only be the onset of the target-following syllable. A consonant in this position is not involved in the reduction or deletion process of the target syllable. Therefore, the consonant can be either sonorant or not.

Since syncopation occurs only word-medially, two consonants from different manner of articulation classes flanking the target vowel can avoid a hiatus in the output, while for ISR which occurs only word-initially, the remaining consonants from the process are either integrated into the following syllable or left extrasyllabic. There is no hiatus involvement in the output. As a result, the ISR target vowel can be flanked by the consonants from the same manner of articulation class.

Because of syncopation's word-medial position, a target vowel without a preceding consonant will make two vowels adjacent to each other, which means the target-preceding syllable has no coda. After an attempted syncopation, the syllable will surely obtain a coda, which violates the Priority Principle. Therefore, the consonant preceding the target vowel is obligatory for syncopation. However, ISR is different, since it occurs word-initially. Whether there is a target-preceding consonant or not, the basic structure of the neighboring syllable remains unchanged. Therefore, the target-preceding consonant is optional for ISR.

To sum up, the three NCS processes are weakening ones and, as a result, they share some characteristics which are common for weakening processes. On the other hand, the three NCS processes occur in different positions, and since syllable structures and stress templates can be quite different in different position, the three processes differ in several ways. Therefore, the distinctions are determined by different positions in which the processes occur.

5.3. Linguistically Interesting Principles

In the previous chapters, I have argued for a relationship between word commonness and the tendency to undergo processes of syncopation, initial syllable reduction and syllabification. The phonological processes of syncopation, initial syllable reduction, and syllabification in NCS do not apply to all qualified words equally. The distinction lies in the 'commonness' of a word. 'Commonness', is a relative concept. With the development of a language, some initially 'uncommon' words may be used more and more frequently in everyday life, and eventually become common enough to undergo typical NCS processes. On the contrary, some 'common' words may gradually become out-of-date and fall into obscurity, and thus may not undergo those processes any more (unless their NCS forms have become lexicalized). In addition, the commonness of a word differs from person to person, from group to group, from circle to circle, and even from dialect to dialect of the

same language. Hence the relationship between word commonness and the tendency to undergo the processes of syncopation, initial syllable reduction and syllabification is not fixed. Generally speaking, common words tend to undergo the processes, and uncommon words tend not to.

The above discussion on commonness indicates that, like any other science, linguistic rules or principles have their limitations or domains. Beyond those domains, the rules or principles are usually not applicable. What is characteristic about linguistic rules or principles is that the domain boundary is generally indistinct.

Syllable structure was also shown to play a major role in NCS rules. In the second chapter, I described two frameworks which have certain principles and postulates with respect to syllable structure, concepts such as the Maximal Onset Principle, the sonority scale, sonority cycle, the peripherality condition and extraprosodicity. The discussion in the third and fourth chapters illustrates the applicability of these concepts. For example, we have found that the Maximal Onset Principle and the Priority Principle jointly explain why the syllable immediately following the ISR target syllable must have an onset, as is discussed in section 4.1.2.

The sonority scale and sonority cycle provide phonological explanations for the claim that syncopation is blocked if the target vowel is flanked by two consonants from the same manner of articulation class. The reason is that such two consonants have the

same sonority value. The sonority cycle states that the adjacency of such two consonants would create a hiatus in the sonority contour. If we assume that the outputs of NCS processes prefer unmarked and 'smooth' syllable structure wherever possible, the blocking of syncopation under these conditions is exactly what would be expected.

In the fourth chapter, the same argument is used to explain why the target consonant, /r/ or /l/, must be immediately preceded by another consonant.

Extrasyllabicity plays a prominent role in NCS phenomena, particularly with respect to the supplement in (27). In section 4.2.3., extraprosodicity is adopted to explain why the target syllable must be penultimate or earlier.

Finally, we have said that syncopation, initial syllable reduction, and syllabification can be considered as 'weakening' processes. The target vowel is always either of the two reduced vowels /ə/and /ɪ/. As a result of these processes, the target syllables are further weakened, even to the point of deletion.

5.4. Practical Applications

As far as common communication is concerned, NCS is much more generally used than slow speech or very fast speech. Therefore, NCS is perhaps the most important form of English to master for general communicative purposes. This thesis has some practical

applications in teaching English as a foreign language and in designing speech synthesis programs, since syncopation, initial syllable reduction, and syllabification are salient aspects of NCS.

In teaching English as a foreign language, the speech rate emphasized most should be NCS. The teacher should help students get familiar with the phonological processes in NCS. With an understanding of the rules of syncopation, initial syllable reduction and syllabification, students can pronounce English words more like a native speaker does. In addition, being familiar with these processes can help improve students' listening ability. Therefore, I recommend that ESL teachers become familiar with the phonological processes in NCS.

In designing speech synthesis programs, one should take such processes as syncopation, initial syllable reduction, and syllabification into consideration. (Other processes may include aspiration, assimilation, etc.) Only by dealing with all those processes properly can we hope to synthesize speech as closely to normal conversation as possible. Since the processes of syncopation, initial syllable reduction, and syllabification are expressed in the forms of rules in this thesis, this may make it simpler to adopt them for such programs.

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