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A GENERATIVE PHONOLOGY OF DANISH

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A GENERATIVE PHONOLOGY OF DANISH

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CAROLYN PANZER SOBEL

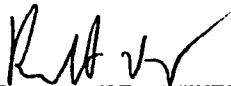
A dissertation submitted to the Graduate Faculty
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1981

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1981

This manuscript has been read and accepted for the Graduate Faculty in Linguistics in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

September 9, 1981



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Abstract

A GENERATIVE PHONOLOGY OF DANISH

by

Carolyn Panzer Sobel

Adviser: Professor Robert M. Vago

This is a treatment of Danish phonology within a generative framework. There is a long tradition of linguistic study in Denmark, dating back to Rasmus Rask and Karl Verner, and including such well-known linguists as Otto Jespersen and Louis Hjelmslev. More recently, Hans Basbøll and Jørgen Rischel have presented aspects of Danish phonology from a generative point of view. In the present work a more complete generative analysis is presented.

Chapter II treats the vowel system. A set of underlying vowels is posited, and the necessary rules of allophonic variation are formulated. The major issues of underlying vowel length, the status of schwa, and the relation of the stød, or glottal catch, to vowel length and to the syllable are considered. With respect to underlying vowel length, two sets of underlying vowels are posited, a long set and a corresponding short one. With respect to schwa, it is interpreted as derived in all instances. The stød is analyzed as a suprasegmental assigned early to all long vowels and to short vowels in certain environments, and the necessary rules of stød assignment

and deletion are formulated.

Chapter III is concerned with the consonant system. A set of underlying consonants is posited, and the necessary rules of allophonic variation are formulated. The major problem for linguistic analysis within the area of the consonants of Danish is that of consonant gradation, or lenition. A discussion of the most important recent work on this subject is presented. The conclusion is reached here that previously proposed phonological solutions to the problem are more costly than the morphological solution which is adopted here.

Chapter IV deals with the system of verbal inflections. Underlying forms are posited for the verbal suffixes, and the necessary rules are formulated to relate them to their surface forms. Chapter V treats the system of noun inflections in a similar manner.

From the facts of Danish, especially with respect to the assignment of the stød and the behavior of certain consonants (particularly [ŋ] and the stops involved in consonant gradation phenomena), support is adduced for the inclusion of the notion of the syllable in the grammar.

To my father, Martin Panzer, whose
love of language became mine, and
who very nearly made it all the
way through with me.

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Responsibility for any errors contained in this work is of course mine.

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TABLE OF CONTENTS

ACKNOWLEDGMENTS.....	vii
LIST OF TABLES.....	xv
CHAPTER I. INTRODUCTION.....	1
CHAPTER II. THE VOWEL SYSTEM	
2.1 Introduction.....	7
2.2 Description of the Monophthongal Vocalic Phones.....	9
2.3 Underlying Vowels.....	11
2.4 Rules of Allophonic Variation.....	11
2.4.1 The Long Vowels.....	11
2.4.1.1 The Effect of a Following Voice- less Stop Plus Consonant....	12
2.4.1.2 The Effect of /R/ on long /a:, ɔ:, ɛ:, u:, o:/.....	18
2.4.1.3 Summary.....	22
2.4.2 The Short Vowels.....	23
2.4.3 Summary.....	30
2.4.4 /a(:)/.....	31
2.4.4.1 Long /a:/.....	33
2.4.4.2 Short /a/.....	33
2.4.4.3 Rischel's Argument for an Under- lying Short Low Back Vowel..	37
2.4.5 Summary.....	39
2.5 Underlying Vowel Length.....	40
2.5.1 The Single Underlying Vowel Length Hypothesis.....	42
2.5.1.1 The Shortening Analysis.....	42
2.5.1.2 The Lengthening Analysis.....	44

2.5.2 Vowel Lengthening.....	46
2.5.3 Summary.....	50
2.6 The Schwa.....	51
2.6.1 Erteschik's Argument for Underlying /ə/.....	53
2.6.2 Austin's Argument for Underlying /ə/.....	54
2.6.3 Arguments for Derived [ə].....	56
2.6.4 Summary.....	59
2.7 The <u>Stød</u> : Its Relation to Vowel Length and to the Syllable.....	59
2.7.1 Articulation of the <u>Stød</u>	60
2.7.2 Status of the <u>Stød</u>	61
2.7.3 Distribution of the <u>Stød</u>	61
2.7.4 Basbøll's Discussion of the <u>Stød</u> ...	63
2.7.5 The <u>STØD</u> -PLACEMENT Rule.....	68
2.7.6 Theoretical Implications of the <u>STØD</u> -PLACEMENT Rule.....	71
2.7.7 Summary.....	72
2.8 Conclusion.....	73
Footnotes to Chapter II.....	75
CHAPTER III. THE CONSONANT SYSTEM	
3.1 Introduction.....	76
3.2 Description of the Consonant Phones.....	79
3.2.1 The Stops.....	79
3.2.2 The Fricatives.....	80
3.2.3 The Nasals, Laterals and Glides....	80
3.3 Underlying Consonants.....	81

3.4 Rules of Allophonic Variation.....	81
3.4.1 The Fricatives.....	81
3.4.1.1 /f/.....	82
3.4.1.2 /s/.....	82
3.4.1.3 /R/.....	85
3.4.1.4 /h/.....	87
3.4.2 The Liquids: /l/.....	87
3.4.3 Summary.....	89
3.4.4 The Nasals.....	90
3.4.4.1 /m/ and /n/.....	90
3.4.4.2 Summary.....	97
3.4.4.3 Basbøll's Regressive Assimila- tion Rule.....	98
3.4.4.4 Summary.....	103
3.4.4.5 Progressive Assimilation.....	104
3.4.4.6 Austin's Analysis of [ŋ].....	110
3.4.4.7 Summary.....	110
3.4.5 The Glides.....	112
3.4.5.1 /y/.....	112
3.4.5.2 /w/.....	112
3.4.5.3 Summary.....	115
3.5 The Stop System.....	117
3.5.1 Facts of Distribution.....	118
3.5.2 The Syllable: Its Relation to Danish Phonology.....	126
3.5.3 Categories of Solutions to the Problem of Consonant Gradation...	131
3.5.4 Rischel's Analysis.....	132

3.5.5 Austin's Analysis.....	141
3.5.6 Basbøll's Analysis.....	146
3.5.7 The Morphological Analysis.....	150
3.5.8 The Underlying Stops and their Phonetic Alternants.....	154
3.5.8.1 The Voiceless Stops /p t k/..	154
3.5.8.2 The Voiced Stops /b d g/.....	154
3.5.9 Summary.....	156
3.6 Conclusion.....	160
Footnotes to Chapter III.....	161
Tables to Chapter III.....	163
CHAPTER IV. THE SYSTEM OF VERBAL INFLECTIONS	
4.1 Introduction.....	165
4.1.1 The Strong Verbs.....	165
4.1.2 The Weak Verbs.....	167
4.2 Motivation for Epenthetic [ə].....	171
4.3 The Infinitive.....	173
4.3.1 Apparent Exceptions to Infinitive Formation.....	173
4.3.2 Summary.....	178
4.4 The Present Tense.....	179
4.4.1 Analysis of /R/-final Stems in the Present Tense.....	180
4.4.2 Analysis of the Present Tense Form [nɒʔ].....	183
4.4.3 Summary.....	185
4.5 The Preterite.....	186
4.5.1 Constraints on Sequences of Segments Occurring with /ed/ Suffix.....	187

4.5.2 Summary.....	188
4.6 The Past Participle.....	189
4.7 The Present Participle.....	189
4.8 The Passive.....	189
4.9 The Imperative.....	190
4.10 Stems Surfacing in a Final Vowel.....	191
4.10.1 Motivation of Consonant-Final Stems.....	192
4.10.2 Evidence for Underlying /g/.....	193
4.10.3 Summary.....	194
4.10.4 Infinitive Forms without Suffix...	195
4.11 Summary.....	196
4.12 Weak Verbs of Class 2.....	197
4.12.1 The Preterite.....	198
4.12.2 The Past Participle.....	199
4.12.3 Summary.....	199
4.13 Conclusion.....	199
Footnotes to Chapter IV.....	201
Tables to Chapter IV.....	203
CHAPTER V. THE SYSTEM OF NOUN INFLECTIONS	
5.1 Introduction.....	211
5.2 Nouns with Ablaut.....	212
5.3 Nouns with Variation in Singular and Plural Endings.....	214
5.3.1 Underlying Form of the Plural Suffix [p]: Consonant-Final Stems.....	218
5.3.2 Underlying Form of the Plural Suffix [p]: Vowel-Final Stems...	220

5.3.3 Underlying Form of the Plural Suffix [ɒ]: Stems in Final [ə]..	222
5.3.4 Nouns in the Plural Suffix [ə].....	223
5.3.5 Summary.....	223
5.4 Nouns in a Zero Plural Suffix.....	225
5.5 Articles: Definite and Indefinite.....	225
5.5.1 The Singular Articles.....	228
5.5.2 The Plural Articles.....	228
5.5.3 Underlying Forms of the Articles Used with Modified Nouns.....	229
5.5.4 Underlying Forms of the Articles Used with Unmodified Nouns.....	232
5.5.4.1 The Definite Article: Singu- lar.....	232
5.5.4.2 The Definite Article: Plural.	233
5.5.5 Summary.....	234
5.6 Conclusion.....	235
Footnotes to Chapter V.....	236
APPENDIX.....	237
REFERENCES.....	244

LIST OF TABLES

2.1.	The monophthongal vocalic phones.....	8
2.2.	Examples of distinctive vowel length.....	10
2.3.	The proposed underlying vowels.....	11
2.4.	The underlying long vowels and their phonetic realizations.....	23
2.5.	The phonetically occurring back vowels.....	27
2.6.	The underlying short vowels and their phonetic realizations.....	31
3.1.	The consonant phones.....	78
3.2.	The proposed underlying consonants.....	81
3.3.	Feature specification of stops and fricatives....	118
3.4.	The distribution of [p t k ʃ ɣ].....	119
3.5.	Austin's rules of consonant gradation.....	144
3.6.	Derivations illustrating the phonological rules pertaining to consonants.....	163
4.1.	Principle parts of weak verbs, Class 1.....	170
4.2.	Derivations illustrating the analysis of /R/- final stems.....	182
4.3.	Weak verbs of Class 2.....	198
4.4.	Underlying suffixes of the verb system.....	203
4.5.	Derivations of Class 1 verbs.....	204
4.6.	Derivations of Class 2 verbs.....	208
5.1.	Nouns in different types of stem-final segments..	216
5.2.	Derivations of singular and plural nouns.....	226
5.3.	The form and position of articles--common gender.....	230
5.4.	The form and position of articles--neuter gender.....	231
5.5.	Underlying forms of articles.....	235

CHAPTER I

INTRODUCTION

Denmark has a long tradition in the field of linguistics and has produced linguists of international renown. In the early part of the nineteenth century Rasmus Rask contributed much of the basis for the comparative study of languages. Later in the century Karl verner's insight with respect to Proto-Indo-European stress and its relation to the voicing of Germanic voiceless fricatives not only served to account for specific exceptions to established sound changes, but also broadened the scope of the phenomena to which linguists must attend in seeking explanations.

In the twentieth century Otto Jespersen contributed to the field of phonetics and many other areas of linguistic study; and Louis Hjelmslev sought by means of the theory of glossematics to establish linguistics as an exact science. The work of Danish scholars, among whom these are some of the most well known, was not always concentrated on the Danish language; but was concerned largely with laying the groundwork for linguistic study in general.

There are of course scholars who have dealt specifically with Danish grammar, both syntax and phonology, generally seeking to elucidate certain classic problems which the language presents. Most of these works stem from

a traditional approach to the study of language. Of course some treated Danish subjects; for example Hjelmslev's important paper "Outline of the Danish Expression System with Special Reference to the Stød" (that trademark of the Danish language, the glottal stop or catch) appeared in 1951, and anticipated some of the notions of generative phonology.

Among other scholars whose research is concerned with such problems is Aage Hansen, whose works include Stødet i Dansk, also dealing with the stød, (1943), Udtalen i Moderne Dansk (1956), which is an important source of data about the phonology of Danish, and Den Lydlige Udvikling i Dansk fra ca. 1300 til Nutiden (1962), which traces the development of sound change in Danish over the past seven centuries.

Studies of the Danish language by non-Scandinavian researchers are not abundant. One important such work is André Martinet's La Phonologie du Mot en Danois, a comprehensive description of Danish phonology, which appeared in 1937.

It is quite clear that the Danish sounds and sound system have been carefully studied. Data exist in many works, from those which have been mentioned as having appeared between the nineteen-thirties and the nineteen-sixties, up to the current work of Danish phoneticians and phonologists, among whom Eli Fischer-Jørgensen, Jørgen

Rischel and Hans Basbøll are prominent.

However, there has not been a great deal of work in Danish phonology within a generative framework. Rischel and Basbøll have produced a number of papers dating from the early and middle nineteen-seventies, which do treat various subjects in Danish phonology from a generative standpoint, and which have been crucial to the present work both as sources of data and as the first and most important analyses of this nature of the Danish language to date.

The only other work produced as a strictly generative approach to Danish is John Austin's unpublished doctoral dissertation of 1971, "Topics in Danish Phonology". It is plain that there is much to be done within the generative approach to Danish; the present work seeks to provide a more comprehensive generative analysis of the phonology of Danish.

In Chapter II the low-level rules which affect the vowels of Danish are described. The question of underlying vowel length is discussed and the assumption of long and short underlying vowels is motivated. The segment [ə], which plays a large role in Danish phonology, is accounted for. The Danish stød is discussed with respect to its relation to the syllable, and it is argued that since the stød is a suprasegmental whose placement ranges over vowel and consonant, the linguistically significant generalization that it is the syllable to which it is assigned,

and not the segment, is missed unless the notion of the syllable is included in the grammar.

Chapter III describes the low-level rules which affect the consonants of Danish. The analysis of both the segment [ŋ] and the phenomena involved in consonant gradation lends support to the claim that the notion of the syllable is required in the grammar in order to capture generalizations which are otherwise missed.

In Chapter IV the system of verbal inflections is described and underlying forms are motivated. Since the system is not complex, a few additional rules, along with those formulated in the preceding chapters, suffice to generate the surface forms.

In Chapter V the noun inflections of Danish are analyzed. Underlying forms for all of the suffixes are motivated. Since the suffixes in some instances resemble phonologically certain of the suffixes of the verbs, the set of rules already proposed accounts in large measure for them as well.

The Appendix contains a list of rules formulated in Chapters II, III and IV.

The dialect of Danish which is examined here is the Standard dialect, spoken in the area of Copenhagen by the generations intermediate between the old, whose language is sometimes called "Conservative Standard Danish", and the young, whose language has been termed by Basbøll "Advanced Standard Copenhagen".

Some of the data upon which the analyses in this work are based come from native Danish informants, three residing in Denmark and one now residing in the United States. In addition, the analyses are based in part on my own knowledge of Danish, obtained during a one-year residence in Copenhagen in 1973/74, a three-month stay in 1977, and several other visits of shorter duration. The remaining data are drawn from published works referred to in the body of the text.

In presenting the data, in all cases except where specifically noted, the phonetic notation used here has been standardized to avoid confusion. The notation used in much of the previous research reflects, for example, the assumption of an underlying voiced/voiceless distinction between the sets of stop consonants though the distinction is not realized phonetically as such. Phonetic representations are given in standard (generally IPA) phonetic transcription. All translations from the Danish are mine.

The forms considered in the following analysis belong mainly to the class of native forms, that is, both those derived from older Scandinavian forms and also those German words which constitute a part of the current Danish lexicon. Both of these types conform to Danish phonological patterns, particularly the pattern of stress, in which primary stress falls on the initial syllable. In general, the data will be restricted to this class of words, which

comprise a large portion of the Danish lexicon.

CHAPTER II

THE VOWEL SYSTEM

2.1 Introduction

This chapter treats the vowel system of Danish. Table 2.1 presents the monophthongal vocalic nuclei occurring in the variety of standard Danish under consideration; in section 2.2 each of these is described and its orthographic representation(s) given. Section 2.3 presents the proposed set of underlying vowels, and in 2.4 the rules of allophonic variation which relate them to the phones listed in Table 2.1 are formulated. Certain of the vowels present difficulties which have been treated in the literature, and these analyses are discussed. In section 2.5 the question of underlying vowel length is treated, and the various hypotheses that have been put forward are discussed. The analysis consistent with the two sets of underlying vowels posited, one long and one short (section 2.3), is motivated. Section 2.6 concerns the status of schwa in Danish. The various treatments of this segment in the recent literature are reviewed, and evidence is given in support of the analysis that it is always derived. In section 2.7 the facts concerning the stød, or glottal catch, are presented, and the more recent analyses of this subject are discussed. A rule of STØD-PLACEMENT is formulated and its ordering with respect to certain other rules which affect the vowels is motivated. Finally, the theoretical implications of the formula-

tion of this rule with respect to the place of the syllable in the grammar are discussed.

	<u>Front</u>	<u>Central</u>	<u>Back</u>
Higher High	i ü i: ü:		u u:
Lower High	I		
Higher Mid	e ö e: ö:		o o:
Lower Mid	ɛ æ ɛ: æ:	ə	ɔ ɔ:
Higher Low	æ æ:	ʌ	
Lower Low		a	ɑ a:
			ɒ ɒ:

Table 2.1: The monophthongal vocalic phones

2.2 Description of the Monophthongal Vocalic Phones

The phones presented in Table 2.1 may be described as follows:

- [i] a high tense front unrounded vowel represented in regular orthography by i. Example: vise 'show' [vi:sə]
- [ü] a high tense front rounded vowel represented in regular orthography by y. Example: kyse 'scare' [k^hü:sə]
- [u] a high tense back rounded vowel represented in regular orthography by u. Example: hulde 'gracious' [hulə]
- [I] a somewhat less high lax front unrounded vowel represented in regular orthography by i. Example: vist 'certain' [vIst]
- [e] a mid tense front unrounded vowel represented in regular orthography by e or i. Examples: en 'a' [en]; minde 'remind' [menə]
- [ö] a mid tense front rounded vowel represented in regular orthography by ø or y. Examples: døbe 'baptize' [tö:pə]; dyppe 'dip' [töpə]
- [o] a mid tense back rounded vowel represented in regular orthography by o. Example: god 'good' [ko:ʔö]
- [ɛ] a somewhat lower mid lax front unrounded vowel represented in regular orthography by æ or e. Examples: bæk 'brook' [pæk]; seng 'bed' [sɛʔŋ]
- [æ] the corresponding mid lax front rounded vowel represented in regular orthography by ø. Example: bønne 'bean' [pœnə]
- [ə] a mid lax central more or less unrounded vowel represented in regular orthography by e. Example: koge 'boil' [k^hö:ʔə]
- [ɔ] a lower mid lax back rounded vowel represented in regular orthography by å, o, or u. Examples: gå 'walk' [kɔʔ]; lunde 'grooves' [lɔnə]; koge 'boil' [k^hɔ:ʔə]

- [æ] a low lax front unrounded vowel represented in regular orthography by a. Example: masse 'mass' [mæse]
- [ʌ] a low lax central slightly rounded vowel represented in regular orthography by o. Example: godt 'good' (neuter) [kʌt]
- [a] a low lax central unrounded vowel represented in regular orthography by a. Example: takke 'thank' [tʰakə]
- [ɑ] a still lower lax back unrounded vowel represented in regular orthography by a. Example: bare 'only' [pɑ:Rə]
- [ɒ] a very low and quite retracted rounded vowel represented in regular orthography by er or ar. Examples: siger 'says' [si:ɒ]; star 'stands' [stɒ:ʔ]

All of these vowel segments, except [ɪ] and those described as central ([ə, ʌ, a]), occur both long and short. Among them some occur with length distinctive on the surface, as illustrated by the following pairs, drawn from Diderichsen (1972) and Austin (1971).

	<u>Long</u>		<u>Short</u>	
[i]	<u>hvile</u> 'rest'	[vi:lə]	<u>vilde</u> 'wild'	[vilə]
[e]	<u>mene</u> 'think'	[me:nə]	<u>minde</u> 'remind'	[menə]
[ɛ]	<u>læse</u> 'read'	[lɛ:sə]	<u>læsse</u> 'load'	[lɛsə]
[ü]	<u>hyle</u> 'howl'	[hü:lə]	<u>hylde</u> 'shelf'	[hülə]
[ö]	<u>døbe</u> 'baptize'	[tö:pə]	<u>dyppe</u> 'dip'	[töpə]
[u]	<u>hule</u> 'cave'	[hu:lə]	<u>hulde</u> 'gracious'	[hulə]
[ɔ]	<u>låne</u> 'borrow'	[lɔ:nə]	<u>lunde</u> 'groves'	[lɔnə]

Table 2.2: Examples of distinctive vowel length

Two vowels posited below as underlying are omitted from this list: [o], because, with certain few exceptions,

this sound occurs only long for most speakers of the dialect under consideration, and [a], because of the facts of its distribution, which are discussed later on in this chapter.

2.3 Underlying Vowels

The set of vowels posited to account for the vowel sounds listed in Table 2.1 is listed in the following table:

i	ü	u	i:	ü:	u:
e	ö	o	e:	ö:	o:
ɛ		ɔ	ɛ:		ɔ:
	a			a:	

Table 2.3: The proposed underlying vowels

Thus the proposed system consists of a set of short vowels and a corresponding set of long ones.

2.4 Rules of Allophonic Variation

Since the behavior of the proposed underlying vowels is not precisely parallel in the two sets, the sets will be discussed separately.

2.4.1 The Long Vowels

The main environments which condition alternations of the long vowels are (1) a following voiceless stop plus consonant and (2) a preceding or following /R/.

2.4.1.1 The Effect of a Following Voiceless Stop Plus Consonant

In the following discussion it is argued that an underlying long vowel shortens in the environment of a following voiceless stop plus consonant. That the rule cannot be formulated more generally as

(2.1) VOWEL SHORTENING

[+syll] $\rightarrow$ [-long]/____ [+cons] [+cons]

is shown by the occurrence of forms such as bæst 'beast' [pɛ:ʔst] and fint 'fine' (neuter) [fi:ʔnt]. In the first example the long vowel surfaces with stød when followed by a voiceless continuant plus consonant. (See section 2.7 for discussion of the relation of the stød to vowel length.) In the second example the long vowel surfaces with stød in the environment of a following voiced consonant plus consonant.

The shortening rule must thus be tentatively formulated as

(2.2) VOWEL SHORTENING

[+syll] $\rightarrow$ [-long]/____ $\begin{bmatrix} \text{-cont} \\ \text{-voi} \end{bmatrix}$ [+cons]

The effect of this rule on each underlying long vowel is illustrated below.

/i:/

The following pair illustrates the alternation of

long and short [i]:

(1) hvide/hvidt 'white' (plural and neuter)

[vi:ð̥e~vit]

The underlying form of [vit] is here assumed to be /vi:d+t/, with a long vowel, since the uninflected form hvid (common gender) [vi:ɹ̥ð̥] occurs with støð, which, as discussed in section 2.7, is taken as an indication of an underlying long vowel. The conditioning environment for the application of VOWEL SHORTENING, namely a following voiceless stop plus consonant, is derived in this case by assuming a rule of REGRESSIVE VOICING ASSIMILATION (formulated below as (3.19)), which devoices the stem-final /d/. A subsequent rule of CONSONANT DELETION (formulated below as (3.14)) deletes one of the conditioning consonants, after the vowel has shortened, ultimately deriving the surface form [vit]. The following derivation illustrates the process:

UNDERLYING FORM	/vi:d+t/
REGRESSIVE VOICING	
ASSIMILATION	vi:tt
VOWEL SHORTENING	vitt
CONSONANT DELETION	vit
SURFACE FORM	[vit]

/e:/

In order to obtain pairs which illustrate the predictable alternation of long and short vowels, it is necessary to turn to adjective and verb forms. The reason for this is that it is only in these classes that a suffix

is added which creates the environment which triggers the shortening rule--namely, the suffix [t] (see section 4.1.2). It appears to be the case that there occur no examples of such alternations with the stem vowel /e:/. When long [e:] occurs as the stem vowel of an adjective form which suffixes [t] it is a form which is exempt from both this rule and the rule of REGRESSIVE VOICING ASSIMILATION (see section 3.5.7 for discussion). When it occurs as the stem vowel of a verb which suffixes [t], the form is also exempt from these rules, but in any case, most such verbs suffix not [t] but [æt] (see section 4.1.2) and the environment necessary for the application of the shortening rule is thus absent.

/e:/

The following pair illustrates the effect of the shortening rule on long /e:/:

- (2) slæbe/slæbt 'drag' (infinitive and past participle)
[slɛ:pə ~ slɛpt]

/ü:/

Pair (3) illustrates the shortening rule with respect to long /ü:/:

- (3) snyde/snydt 'cheat' (infinitive and past participle) [snü:ðə ~ snüt]

The derivation of [snüt] follows the same line as that given above for [vit], in which the sequence of application of the

necessary rules is REGRESSIVE VOICING ASSIMILATION, VOWEL SHORTENING, CONSONANT DELETION.

/ø:/

Pair (4) illustrates the long/short alternation when the vowel in question is /ø:/:

(4) døbe/døbt 'baptize' (infinitive and past participle) [tö:pə~töpt]

/u:/

The following pair illustrates the alternation of long and short [u] in this context:

(5) bruge/brugt 'use' (infinitive and past participle) [pRu:(χ)ə~pRukt] (for discussion of [χ] see section 3.5)

/o:/

The following pair illustrates the effect of the process on long /o:/:

(6) god/godt 'good' (common and neuter genders) [ko:ʔð~kAt]

The vowel represented by [ʌ] occurs only short and generally in the environment of a following consonant cluster, as the following examples illustrate: stolt 'proud' [stʌʔlt]; most 'juice' [mʌst]; loft 'ceiling' [lʌft]. Pair (6) may be assumed to have the underlying form /go:d, go:d+t/.

The rule of shortening is required when /t/ (the neuter suffix) is added, and since the shortened vowel is also lax and unrounded, a further rule is required to derive [ʌ] from (derived) [o]. This rule can be formulated as

(2.3) o-LAXING

$$\left[\begin{array}{l} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ +\text{bk} \\ +\text{rnd} \\ +\text{tns} \\ -\text{lng} \end{array} \right] \rightarrow \left[\begin{array}{l} -\text{rnd} \\ -\text{tns} \end{array} \right] / __\text{[+cons] [+cons]} \quad ([o] \rightarrow [\text{ʌ}] / __\text{CC})$$

The same order of application of rules applies to the form [kat] (from underlying /go:d+t/ as to [vit], with the addition of the laxing rule just formulated, which applies after the shortening rule.

It was stated above that the vowel segment [ʌ] occurs only short and generally in the environment of a following consonant cluster. There are, however, instances in which the surface environment is a following single consonant, as illustrated by these forms: lomme 'pocket' [lʌmɐ] and hoppe 'hop' [hʌpɐ]. It was also stated that a rule of consonant deletion is required to account for the surface form [kat], which is known to be derived from an underlying form in which there occur two consonants, not just one (i.e., /go:d+t/). Underlying geminates may be posited as the result of the assimilation of a stem-final consonant to a suffixed consonant, as in

/go:d+t/ → gʌdt → gʌtt → gʌt (→ [kʌt] -- see section 3.5.7 for discussion of obstruent devoicing and formulation of rule (3.18), OBSTRUENT DEVOICING). Since this is the case, and since it is in fact the environment of a following consonant cluster which triggers the laxing and unrounding rule of (derived) [ɔ], it is plausible to analyze the occurrences of [ʌ] before a single (surface) consonant as being derived from underlying /o:/ followed by underlying geminates. Thus [lʌmɐ] would derive from underlying /lo:mme/ and [hʌpɐ] from underlying /ho:ppɐ/ (/e/ being the infinitival suffix -- see section 4.3).

/ɔ:/

The following pair illustrates the effect of shortening on long /ɔ:/:

(7) koge/kogt 'boil' (infinitive and past participle) [k^hɔ:γə ~ k^hɔkt]

/a:/

The facts concerning this vowel are complex, and discussion is postponed to the end of section 2.4.

It is apparent that the process of shortening of long vowels in the environment of a following voiceless stop plus consonant is operative throughout the system, excluding /a:/. Since /a:/ must be treated separately, as noted, the rule formulated as (2.2) must be emended as follows:

(2.4) VOWEL SHORTENING

$$\begin{bmatrix} +\text{syll} \\ -\text{lo} \end{bmatrix} \rightarrow [-\text{long}] / \text{---} \begin{bmatrix} -\text{cont} \\ -\text{voi} \end{bmatrix} [+ \text{cons}]$$

2.4.1.2 The Effect of /R/ on Long /a:, ɔ:, ɛ:, ü:, ö:/

/a:/

As indicated above, underlying /a:/ is treated further on. It is necessary to note here, however, that [a:] never occurs in the vicinity of /R/ (i.e., before or after /R/), while [ɔ:] occurs only in the vicinity of /R/, as in the following examples: bare 'only' [pʰa:Rə]; klare 'clear' [kʰl̥a:Rə]. (See section 3.4.1.3 for discussion of /R/ and motivation for its characterization as [-son].) Thus [a:] is in this analysis considered to be a reflex of /a:/, derived by a rule of backing which, stated informally, is /a:/ → [a:] / /R/. This rule is formalized below as rule (2.13).

/ɔ:/

The segment [ɔ:] never occurs in the vicinity of /R/. As indicated in Table 2.1, there occurs the very low, very retracted segment [ɒ:]; this segment occurs only in the vicinity of /R/, as in tårer 'tears' [tʰɒ:R]. (See section 3.4.1.3 for motivation and formulation of R-VOCALIZATION rule.) There is a tendency in Danish for vowels to be affected by an adjacent /R/ by being

lowered, laxed and/or backed, as will be discussed further on with respect to /ɛ:/, /ø:/ and /a:/. Since the main manifestation of /R/ is as the very retracted uvular fricative [R] (see section 3.4.1.3), this tendency is a natural one. It is thus quite plausible to interpret the phones [ɔ:] and [ɒ:], which are in complementary distribution ([ɒ:] occurring, as noted, only in the vicinity of /R/), as reflexes of the same underlying segment. Since [ɒ:] occurs in one environment only, the underlying form is posited as /ɔ:/, and the rule deriving [ɒ:] from it can be formulated as

(2.5) ɔ:-LOWERING

$$\begin{bmatrix} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ +\text{bk} \\ +\text{rnd} \\ +\text{tns} \\ +\text{lng} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{tns} \\ +\text{lo} \end{bmatrix} \quad / \quad \begin{bmatrix} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{bmatrix} \quad (/ɔ:/ \rightarrow [ɒ:] / \left\{ \begin{array}{c} \text{R} \\ \text{---} \\ \text{R} \end{array} \right\})$$

/ɛ:/

As will be discussed later on with respect to /a:/, the simplest account is achieved by regarding certain instances of [æ:] as reflexes of /ɛ:/ --namely those occurring after /R/. Since there is no morphophonemic alternation in Danish dependent upon the affixation of a morpheme containing /R/ in the crucial environment, a pair demonstrating the alternation of [ɛ:] and [æ:] in the environment of /R/ is not available. However,

the fact that a form such as stræbe 'exert oneself' [stRæ:pə] occurs with [æ:] indicates an underlying /ɛ:/, since if the [æ:] were taken to be a reflex of underlying /a:/, it would be expected to surface as [a:] in the vicinity of /R/ (see section 2.4.4 below for the analysis of underlying /a:/).¹ Inasmuch as the actual realization here in the vicinity of /R/ is [æ:], this segment cannot be identified with underlying /a:/. Hence its identification with underlying /ɛ:] is justified, and the appropriate rule relating [ɛ:] and [æ:] can be formulated as

(2.6) ɛ:-LOWERING

$$\left[\begin{array}{l} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ -\text{bk} \\ -\text{tns} \\ +\text{lng} \end{array} \right] \rightarrow [+lo] / \left[\begin{array}{l} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{array} \right] \quad (/ɛ:/ \rightarrow [æ:] / R_)$$

/ü:, ö:/

Most accounts of the Danish vowel pattern include, in addition to the two front rounded vowels posited here, /ü:/ and /ö:/, a third, /æ:/, which is lower than /ö:/. The reason for this is the occurrence of forms such as høne 'hen' [hœ:nə], with a long vowel, and bønne 'bean' [bœnə], with a short vowel. However, a three-way distinction of [ü:] vs. [ö:] vs. [æ:] is found only before /R/. Examples, drawn from Rischel (1969:183), are

styre 'steer' (infinitive) [stü:Rɔ] or normally [stü:ɔ] ([ɔ] being derived from /R+e/ -- see section 4.3.1), vs. køre 'drive' [k^hö:Rɔ] or normally [k^hö:ɔ]; vs. gøre 'do' [kœ:Rɔ] or normally [kœ:ɔ]. Otherwise only two vowels are distinguished, [ü:] and [ö:], with, according to Rischel, [æ:] occurring before /n/ (and possibly /R/). (Rischel also cites the following series, with stød, which is more problematic because the vowel is often pronounced short: dyr 'deer' [tüʔɔ] or [tüɔ] ([ɔ] being Rischel's symbol for the non-vocalic reflex of /R/) vs. dør 'dies' [töʔɔ], or [töɔ] vs. dør 'door' [tæʔɔ] or [tæɔ]).

Since this is the case, it is preferable to posit only two underlying long vowels in this series, /ü:/ and /ö:/. Rischel does not cite any other examples, nor is it clear that there are indeed other such examples. The second series cited of the three-way distinction is problematic, as noted, because the vowel is often pronounced short, and Rischel also states that the distributional relationships are quite complex, with regard to both stød and vowel length, many speakers of Standard Danish not having long vowels in all of the forms. If the only data causing difficulty for this analysis (namely the positing of two underlying vowels in the front rounded series instead of three) do not constitute a clear counter-example, an argument in support of three underlying front rounded vowels based on these data is not a strong argument.

With respect to the first series cited above, it is possible to consider the form [kæ :p] 'do' as an exception, since it is a word in extremely frequent use, of the sort that sometimes, in a given language, does not conform to the general pattern. If it is indeed the only such example, it does not in any case constitute a convincing argument in favor of the three-way underlying distinction.

Under the present analysis, the rule necessary to relate the only clearly systematic occurrence of [æ:] to underlying /o:/ can be formulated as

(2.7) ö-LAXING

$$\begin{bmatrix} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ -\text{bk} \\ +\text{tns} \\ +\text{rnd} \end{bmatrix} \rightarrow [-\text{tns}] / \text{---} \begin{bmatrix} +\text{nas} \\ +\text{cor} \end{bmatrix} \quad (/ \text{ö}:/ \rightarrow [\text{æ}:] / \text{---} \text{n})$$

(There does not seem to be any evidence that this rule applies to /u:/.)

2.4.1.3 Summary

In section 2.4.1 the long vowels and their variants have been considered; the effects of a following consonant cluster and of adjacent /R/ have been described; and the rules relating the variants to the proposed underlying forms have been formulated. Table 2.4 provides a summary of the analysis.

/i:/	has the variants	[i:]	and	[i]
/e:/	has the variants	[e:]	and	[e]
/ɛ:/	has the variants	[ɛ:], [ɛ]	and	[æ:]
/ü:/	has the variants	[ü:]	and	[ü]
/ö:/	has the variants	[ö:], [ö]	and	[œ:]
/u:/	has the variants	[u:]	and	[u]
/o:/	has the variants	[o:]	and	[ʌ]
/ɔ:/	has the variants	[ɔ:], [ɒ]	and	[ɒ:]
/a:/	has the variants	[ɑ:]	and	[æ:]

Table 2.4: The underlying long vowels and their phonetic realizations

2.4.2 The Short Vowels

/i/

The occurrence of short [i] has been analyzed above as a reflex of underlying long /i:/ in the environment of a following consonant cluster. The following pair illustrates the behavior of underlying short /i/ in this environment:

(8) vist 'know' (past participle) [vi:ʔst] vs. vist 'certainly' [vɪst]

In the environment of a following consonant cluster, then, short /i/ surfaces as [ɪ]. The segment [ɪ] does not occur except in the environment of a following consonant cluster, (except as discussed below). Based on these facts, a rule expressing the relation between /i/ and [ɪ] can be formulated as

(2.8) i-LAXING

$$\begin{bmatrix} +\text{syll} \\ +\text{hi} \\ -\text{bk} \\ -\text{rnd} \\ -\text{lng} \end{bmatrix} \rightarrow [-\text{tns}] / ___\text{[+cons] [+cons]} \quad (/i/ \rightarrow [I] / ___\text{CC})$$

This rule describes the same laxing process that is expressed in (2.3) o-LAXING. Rules (2.3) and (2.8) can be collapsed into a rule of laxing formulated as

(2.9) LAXING

$$\begin{bmatrix} +\text{syll} \\ -\text{lo} \\ +\text{tns} \\ -\text{lng} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{rnd} \\ -\text{tns} \end{bmatrix} / ___\text{[+cons] [+cons]} \quad (i, o \rightarrow [I, \Lambda] / ___\text{CC})$$

There is, however, a set of apparent counter-examples to this analysis, containing forms such as ting 'thing' [t^hIn]; til 'to, at' [t^hIl]; ikke 'not' [Ikə]. The form [t^hIn] is, in fact, under the analysis of [ŋ] as underlying /ng/ (see section 3.4.4), not a counter-example, since it contains an underlying consonant cluster. The forms [t^hIl] and [Ikə] can be regarded as being, in their capacity as some of the most frequently used small words of Danish, simply exceptions.

/e/

That short /e/ is indeed underlying in Danish is attested by the fact that there are forms which surface in final short [e] without stød, and similar forms which surface with stød; the latter are indicative of an underlying long

vowel. The following pair illustrates this fact.

(9) sne 'snow' [sne:ʔ] vs. det 'the' [te]

Under conditions of stress short /e/ has one surface realization: [e]. That short /e/ has the variant [ə] under conditions of no stress is discussed below in section 2.6.

/ɛ/

The forms men 'but' [mɛn] and hest 'horse' [hest] illustrate that the surface realization of short /ɛ/ in the environments of both a following single consonant and a following consonant cluster is /ɛ/. That short /ɛ/ has the variant [æ] in the vicinity of /R/ is discussed below in section 2.4.4.2. Short /ɛ/ is analyzed as having the third variant [ə] in section 2.6.

/u/

Pair (10) illustrates the behavior of short /u/ in the environment of a following single consonant and a following consonant cluster:

(10) hulde/huldt 'gracious' (plural and neuter)
[hulə, huʔlt].

Thus short /u/ has the one surface realization [u].

/o, ɔ/

According to Rischel (1969:180), short [o] has a highly limited distribution, occurring in pretonic

and posttonic syllables and in a few cases where it is the stressed vowel, for example fóto 'photo' [foto], which can be considered [+foreign], and sort 'black' [sopt], which cannot. Rischel also states that short [o] has been widely replaced by [ɔ] (quite commonly in the younger generation), so that the pronunciation of, for example, hul 'hole' is no longer commonly [hol], but rather [hɔl]. Thus, in Rischel's view, the main allophones of /o, ɔ/ are probably [ɔ, ɒ], respectively.

Thus if short /o/ is posited as underlying, it is going to surface most of the time as [ɔ], as in kop 'cup' [k^hɔp] and krop 'body' [k^hɒp]. If short /ɔ/ is posited as underlying it will surface most of the time as [ɒ], as in habe 'hope' [hɒpə]. The two possible analyses are (1) that there is a common lowering rule for short /o/ and /ɔ/, and (2) that there has in fact been a phonemic shift, so that current /ɔ/ represents old /o/, and there is a new underlying vowel [ɒ]. This is a plausible analysis, but it fails to account for the occurrences of short [o], as in the examples given above. If some of the occurrences, like [sopt], are a part of the native vocabulary, it is difficult to explain them away as exceptions.

The phonetic situation among the occurring back vowels can be summarized thus:

<u>long</u>	<u>short</u>
u:	u
o:	o
ɔ:	ɔ
	ɒ

Table 2.5: The phonetically occurring back vowels

Rather than positing four back vowels, one of which occurs only long (/o:/) and another only short (/ɒ/), it seems reasonable to posit three back round vowels, and add a rule which lowers the bottom two by one degree when short. This analysis has the advantages of (1) preserving the symmetry of the vowel pattern, front and back, and (2) accounting for the forms in [o]. There is a difficulty, however, when it comes to formulating the rules in this case. The process appears to be, as stated, best expressed by a common lowering rule; the difficulty is that there is in the feature system employed, which is essentially that of Chomsky and Halle (1968), no provision for stating a rule which further lowers a vowel which is already [+lo]. It is possible to uniquely specify the vowels of each of the four vowel heights of Danish (as analyzed here) in terms of the features [hi], [lo] and [tns], with the exception of schwa. Since there is this exception, it would seem advisable to make use of a more adequate feature system, one in which not only would schwa be uniquely specified as well, but also the process described here as lowering would be captured in one rule, a rule of lowering. The nature

of such a feature system is still unresolved. Therefore, the rules for arriving at the correct output in this case are here formulated as

(2.10) o-LAXING

$$\begin{bmatrix} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ +\text{bk} \\ +\text{tns} \\ -\text{lng} \end{bmatrix} \rightarrow [-\text{tns}] \quad (/o/ \rightarrow [\text{o}])$$

(2.11) o-LOWERING

$$\begin{bmatrix} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ +\text{bk} \\ -\text{tns} \\ -\text{lng} \end{bmatrix} \rightarrow [+lo] \quad (/o/ \rightarrow [\text{ɒ}])$$

Rules (2.10) and (2.11) must be ordered so that (2.11) precedes (2.10), to avoid having all instances of /o/ lower to [ɒ] and subsequently be lowered to [ɒ], thus eliminating [ɒ] altogether.

/ü ö/

As mentioned with respect to long /ü: ö:/, the system which is most frequently given for Danish by researchers is one in which the three vowels [ü ö æ] figure as underlying, both long and short. This allows a completely symmetrical pattern, with three degrees of height in front unrounded, back rounded, and front rounded, with an additional single unrounded low vowel. (With respect to

symmetry, the preservation of the front unrounded three heights as underlying is not as much a necessary part of the picture as is the front unrounded/back rounded pair of sets, since there is no back unrounded set to parallel the front rounded set.)

The data, drawn from Rischel (1969: 182-183), concern the distribution of these vowels before nasals and /R/, and are as follows: ([i] and) [ü] occur only sporadically before nasals, in words like (pinje 'stone pine' [p^hinyə] and) hymne "hymn" [hümnə], and it appears that this class of forms can in fact be considered as [+foreign], whereas the opposition between [ö] and [œ] is largely confined to this position, as in the forms dyppe 'dip' [töpə] vs. bønne 'bean' [pœnə]. Thus it is possible to consider the short rounded series as consisting of two underlying vowels, /ü/ and /ö/, which become [ö] and [œ] respectively before nasals by rules which can be formulated as

(2.12) ü-LOWERING

$$\left[\begin{array}{l} +\text{syll} \\ +\text{hi} \\ -\text{bk} \\ +\text{rnd} \end{array} \right] \rightarrow [-\text{hi}] / ___ [+nas] \quad (/ü/ \rightarrow [\text{ö}] / ___ N)$$

(2.13) ö-LAXING

$$\left[\begin{array}{l} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ -\text{bk} \\ +\text{rnd} \end{array} \right] \rightarrow [-\text{tns}] / ___ \left\{ \begin{array}{l} [+nas] \\ +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{array} \right\} (/ö/ \rightarrow [œ] / ___ \left\{ \begin{array}{l} N \\ R \end{array} \right\})$$

Such an analysis seems preferable to positing a third underlying segment when the data are predictable given only two. It should be noted here that the discussion with respect to the process of lowering in the case of /o/ and /ɔ/ applies equally here. Rules (2.12) and (2.13) have been formulated as a rule of lowering and a rule of laxing, respectively, because the feature system does not allow for a distinction in terms of the lowness between [o] and [œ]. Thus what seems in fact to be a single process of lowering is not captured by these rules.

Again, it should be noted that (2.13) must be ordered before (2.12), in order to preserve derived [ö] before N.

2.4.3 Summary

Section 2.4.2 has dealt with the short vowels and their variants. Rules relating the variants to the proposed underlying forms have been formulated. The situation involving the back vowels as a whole (both short and long) has been examined, since there has not been up to now a conclusive argument with respect to which underlying vowels the various phonetically occurring back vowels should be analyzed as reflecting. For the four occurring vowel qualities, it is proposed here that the best account is that which posits three underlying vowels and a common rule of lowering. It has been noted that the feature system currently in use does not provide an adequate

mechanism for capturing this generalization. Table 2.6 provides a summary of the analysis.

/i/	has the variants	[i] and [I]
/e/	has the variants	[e] and [ə]
/ɛ/	has the variants	[ɛ], [æ] and [ə]
/u/	has the surface realization	[u]
/o/	has the surface realization	[ɔ]
/ɔ/	has the surface realization	[ɒ]
/ü/	has the variants	[ü] and [ö]
/ö/	has the variants	[ö] and [œ]
/a/	has the variants	[a], [æ], [ɑ] and [ɛ:]

Table 2.6: The underlying short vowels and their phonetic realizations

2.4.4 /a(:)/

As stated earlier, discussion of the segment which represents the lowest degree of height in the underlying vowel system has been postponed. This segment is taken up in this section.

Based on considerations of naturalness, the central vowel /a(:)/ is the most likely candidate for the underlying low vowel of Danish. With this as the point of departure, the facts of distribution of the various low surface vowels will be presented and the necessary rules of allophonic distribution will be formulated.

The situation is as follows. There occur phonetically in Danish, as indicated in Table 2.1, a number of non-round low vowels of varying backness. Most researchers assign the set of non-round low vowels to a single underlying segment, usually assumed to be a central or back vowel and usually represented by /a/. The multiplicity of symbols used by various researchers to characterize the members of the set, as well as

an apparent discrepancy with respect to the facts themselves (see below), present a confusing picture.

Nevertheless, it is clear that in Standard Danish at least these three may be distinguished: [æ], a front vowel occurring both short and long; [a], a central vowel somewhat lower than [æ], occurring only short; and [ɑ], a back vowel, lower still, occurring both short and long. (Further distinctions have been noted, but since they are not as widespread among speakers as these, they are omitted from this discussion.)

With the exception of [æ], the distribution of these sounds is clear. As described by most researchers (e.g. Hansen, Austin, Basbøll, Rischel), long [æ:] occurs everywhere but in the vicinity of /R/ (i.e., before or after /R/), whereas the distribution of short [æ] is very limited: it is variously described as occurring before dentals and palatals (Hansen), before dentals and in word-final position (Basbøll), and only in the vicinity of /R/ (Austin). This discrepancy will be treated below.

The distribution of short and long [æ] is irregular compared with that of the other vowels, of which, generally speaking, long and short occur in the same environments. Although examples can be given of minimal pairs containing this vowel and distinguished by length alone (such as mase 'mash' [mæ:sə] vs. masse 'mass' [mæsə]), not all occurrences of short [æ] can be interpreted as variants of the same underlying sound. Therefore this segment has

been omitted from the list of long/short oppositions given above in Table 2.2.

2.4.4.1 Long /a:/

As noted (barring the discrepancy noted above), [æ:] occurs everywhere but in the vicinity of /R/. The segment [a:] occurs only in the vicinity of /R/, and is the only member of the set of low vowels which does. Since [æ:] and [a:] are in complementary distribution, with [a:] occurring in one environment only, [a:] may be considered the reflex of the low vowel in the environment of /R/. Examples of long [a:] are: bare 'only' [pa:Rə], rar 'nice' [Ra:ʔR], grad 'degree' [kRa:ʔʔ] (Hansen 1956:28). The appropriate rule relating [a:] to underlying /a:/, then, is

(2.14) a:-BACKING

$$\left[\begin{array}{l} +\text{syll} \\ +\text{lo} \\ +\text{lng} \end{array} \right] \rightarrow [+bk] / \left[\begin{array}{l} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{array} \right] \quad (/a:/ \rightarrow [a:] / \left\{ \overline{\text{R}}^{\text{R}} \right\})$$

Following this rule is a context-free rule formulated as

(2.15) a:-FRONTING

$$\left[\begin{array}{l} +\text{syll} \\ +\text{lo} \\ +\text{lng} \end{array} \right] \rightarrow [-bk] \quad (/a:/ \rightarrow [æ:])$$

2.4.4.2 Short /a/

With respect to the variant short [æ] the picture is not so clear. A discrepancy in the description of the dis-

tribution of [æ] has already been mentioned. Most researchers describe [æ] as having a limited distribution, occurring--to combine their various observations--before dentals, palatals, and in word-final position. As noted, Basbøll limits the environments in which [æ] occurs to before dentals and word finally. It is thus apparently the case that in the variety of Danish currently under examination the environment which conditions the occurrence of [æ] is in fact a following [+cor]. Hansen, in including palatals, is describing a somewhat earlier form of Danish. Examples (mostly drawn from Hansen) are glad 'happy' [klæð]; glas 'glass' [klæs]; stald 'stable' [stæl?]; stand 'state' [stæn?]; da 'then' [tæ].

Austin, however, while also describing [æ] as having a limited distribution, states that it occurs only in the environment of /R/, as in for example redde 'save' [Ræðə] and værre 'worse' [væp]. Noting correctly that [ɛ] never occurs in the environment of /R/, Austin assigns [æ] to the underlying segment /ɛ/, in accordance with the general tendency toward the lowering of Danish vowels in the environment of /R/. Austin is in fact focussing on /ɛ/ when he observes [æ]. On the other hand, the other researchers, focussing on /a/, assign [æ] to this underlying segment, specifically not in the environment of /R/, apparently not connecting it with the [æ] they interpret as a reflex of underlying /ɛ/.

The two positions can be explained, then, by viewing [æ],

which occurs in both of the environments described, as a reflex of /ε/ when it occurs in the environment of /R/ (actually, in this case after /R/, not both before and after as in the other vowels affected by /R/), and as a reflex of /a/ when it occurs in the environment of a following dental consonant or word boundary. The rule-relating [æ] to /ε/ is given here as

(2.16) ε-LOWERING

$$\left[\begin{array}{l} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ -\text{bk} \\ -\text{tns} \\ -\text{rnd} \\ -\text{lng} \end{array} \right] \rightarrow [+10] / \left[\begin{array}{l} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{array} \right] \text{ ___ } (/ε/ \rightarrow [æ] /R___)$$

This rule can be collapsed with the rule of ε:-Lowering given earlier as (2.6):

(2.17) ε(:)-LOWERING

$$\left[\begin{array}{l} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ -\text{bk} \\ -\text{tns} \end{array} \right] \rightarrow [+10] / \left[\begin{array}{l} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{array} \right] \text{ ___ } (/ε(:)/ \rightarrow [æ(:)] /R___)$$

If certain occurrences of [æ], namely those before a [+cor] segment or a word boundary, are to be assigned to the underlying short non-round low vowel (as opposed to /ε/, then it must be decided which low vowel is to be taken as underlying. It has been assumed that the underlying short and long low vowels have the same quality, namely that of the central vowel [a]. The facts of dis-

tribution of the short set lend support to this hypothesis. Of the three, [a] occurs only in the environment of /R/, while none of the others occurs here, so that the simplest analysis is to consider [a] not as underlying but as derived. Since the front variant [æ] occurs predictably only in the environments (i) before coronal consonants and (ii) word-finally, and none of the others occurs here, the simplest analysis is that which considers [æ] not as underlying but as derived. Since the simple statement can be made that the central variant [a] occurs elsewhere, it is consistent with the analysis which takes [a] and [æ] as derived that the central variant [a] be posited as underlying.

The rules of allophonic variation which relate these three variants to underlying /a/ can be formulated as

(2.18) a-FRONTING

$$\begin{bmatrix} +\text{syll} \\ +\text{lo} \\ -\text{lng} \end{bmatrix} \rightarrow [-\text{bk}] / __ \begin{bmatrix} +\text{cons} \\ +\text{cor} \end{bmatrix} \quad (/a/ \rightarrow [\text{æ}] / __ [\text{t}, \text{ʃ}, \text{d}, \text{l}, \text{n}, \text{s}])$$

(2.19) a-BACKING

$$\begin{bmatrix} +\text{syll} \\ +\text{lo} \\ -\text{lng} \end{bmatrix} \rightarrow [+ \text{bk}] / \begin{bmatrix} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{bmatrix} \quad (/a/ \rightarrow [\text{a}] / \left\{ \overline{\text{R}}^{\text{R}} \right\})$$

This rule of backing can be collapsed with rule (2.14),
a:-backing:

(2.20) a(:)-BACKING

$$\left[\begin{array}{l} +\text{syll} \\ +\text{lo} \end{array} \right] \rightarrow [+bk] / \left[\begin{array}{l} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{array} \right] \left(/a(:) / \rightarrow [a(:)] / \left\{ \overline{R}^R \right\} \right)$$

Thus a quite simple set of rules accounts for the variants of the lowest vowel of Danish. Under this analysis a vowel of the quality posited as underlying for both long and short low vowels surfaces only in the short form. Nevertheless, considerations of symmetry and naturalness support the hypothesis that the underlying long low vowel is /a:/.

2.4.4.3 Rischel's Argument For an Underlying Short Low Back Vowel

An argument has been put forth by Rischel (1969: 191-192) in support of an underlying short non-round low back vowel. The argument is based on the following data. To quote Rischel:

There is in Danish a dorsal fricative or rather frictionless continuant which appears after long vowels as more or less palatal or velar depending on the quality of the vowel, cp. [e:χən] or [e:χ̥ən] [the symbol χ̥ under the i indicating non-syllabicity] 'own' (slightly old-fashioned pronunciation, except in certain compounds), [rö:χə] or [rö:χ̥ə] 'smoke (meat or fish)', [dæχ] or [dæχ̥] 'day', [töχ] or [töχ̥] 'train'. After short vowels it appears as the second part of a diphthong: [aiən] 'own' (more common pronunciation), [röi] 'smoke', [dæχli] or [dæχ̥li] 'daily'. The diphthongs given as "ai, öi" vary much in quality: in general Standard Danish the first component is central or rather front in the former and centralized back in the latter, but the latter may also be heard with a more front first component [œi]. In the Copenhagen dialect the first component of both diphthongs may be quite back: [ɑi öi].²

Rischel points out that the postvocalic consonant becomes [i̥] after those short vowels which alternate with, e.g., [e:] ([e:χən/e:i̥ən]) and [ö:] ([rö:χə/rö:i̥ə]), the non-low ones, but not after those short vowels which alternate with, e.g., [æ:] (dæ?χ/dæ?i̥) and [ɔ:] ([tɔ?χ/tɔ?u]), the low ones. (The stød occurs on an underlyingly long vowel (see section 2.7.4.) Thus in [ai̥ən] and [rɔi̥?] we get [i̥] but in [dauli] we get [u]. He also points out that the Copenhagen dialect example shows that the surface quality of the first component may be back and yet still produce [i̥]; [ḁi̥ ɔ̥i̥], as in [ḁi̥(ə)n] vs. [dauli].

Thus it must be the underlying vowel (first component) which is distinguished as [+bk] or [-bk] and which determines whether the continuant will be diphthongized to [i̥] or [u] in its second component.

Rischel then argues that the underlying vowel in [dauli] must be [+bk], and therefore the underlying vowel is properly seen in the set of short vowels as [+bk]. According to Rischel, "this implies that the long vowel must be fronted and somewhat raised

$$a: \rightarrow [æ:]^3$$

by a later rule, which nevertheless is early enough to make fricative [χ] front after this vowel if it remains long." Rischel is thus positing a [+bk] underlying long vowel as well, which is realized as [æ:], as in [dæ?χ/dæ?i̥].

In the presentation of the data, it is quite clear

that there is much variation in the pronunciation of these diphthongs. To repeat a portion of the citation: "...The diphthongs given as "a_i, v_i" vary much in quality: in general Standard Danish the first component is central or rather front in the former and centralized back in the latter, but the latter may also be heard with a more front first component [œi]. In the Copenhagen dialect the first component may be quite back: [a_i v_i]." (Underlining mine.) It appears from this that the only hypothesis which is clearly supported by the data constituted by these diphthongs is that the underlying vowel is not front, not that it is back. And in that case, the data, especially in view of the centralized quality of the first element in the diphthongs in the speech of many and the variation in its backness in the Copenhagen dialect, are consistent with the analysis presented above, namely that the underlying segment is the central vowel /a(:)/.

2.4.5 Summary

In section 2.4.4 another of the major issues with respect to the Danish vowel system has been examined, namely the analysis of the lowest, non-round, vowel. Distributional data concerning the variants of this vowel have been described, and a confusion arising from a discrepancy in the literature with regard to short [æ] has been explained. The underlying vowel has been assumed to

be a central one, /a(:)/, on both naturalness and rule-related grounds, the rules predicting the occurrence of the front and back variants from this underlying form being the most simply formulated; and these rules have been formulated. An argument presented by Rischel in support of an underlying short low back vowel has been discussed and argued against.

2.5 Underlying Vowel Length

Examples of long and short vowels have been given earlier (see Table 2.2). The distribution of long and short vowels in Danish is as follows: before a single consonant there occur both long and short vowels; before a (syllable-final) consonant cluster there occur only short vowels.

That rules of shortening and/or lengthening are needed is indicated by the following alternations:

(11) slæbe 'drag' (infinitive) [slɛ:pə] vs.
slæbt (past part.) [slɛpt]

(12) god 'good' (common gender) [ko:ʔð] vs.
godt 'good' (neuter) [kat]

(13) bad 'bath' [pæð] vs. bade 'bathe' [pɛ:ðə]

Since both long and short vowels occur before a single consonant (plus vowel), the analysis of pair (11) cannot be that an underlying short vowel lengthens in this environment. Pair (11), then, clearly illustrates the application of a vowel shortening rule (formulated above as

2.4), in which the underlying long /ɛ:/ shortens when the past tense suffix /t/ is added to the stem /slɛ:b/ (see section 3.5.7 for discussion of the behavior of /b/).

Pair (12) also illustrates this process, since stød is taken as an indication of an underlying long vowel, and the usually deleted final [ð̥] (a reflex of underlying /d/-- see section 3.5.7) also deletes in the inflected form after the consonant cluster has triggered the vowel shortening and laxing rules (see section 2.4.1).

The fact that vowel shortening before a consonant cluster is a very common process in language, combined with the fact that both long and short vowels occur in Danish in the environment of a following consonant (plus vowel), constitutes a strong case for the analysis in which an underlying long vowel is posited in pairs such as (11) and (12).

Pair (13), on the other hand, does not present such a clear case. Since the forms are closely related, it is tempting to posit a single underlying vowel in both cases, and this analysis will be supported below. The fact that there is no stød in [pæð̥] indicates that the vowel is underlyingly short. It is of course possible to analyze the vowels as being of different underlying length in view of the fact that they occur in forms belonging to different syntactic categories (i.e., noun and verb). For the moment, it is important only to make the point that it is necessary, for some forms at least, to posit

a single underlying vowel and to posit rules which alter its length in certain contexts.

2.5.1 The Single Underlying Vowel Length Hypothesis

Although the analysis put forth here includes two underlying vowel lengths, which is plausible at the outset in view of the fact that long and short vowels occur contrastively in Danish (see Table 2.2), it is not immediately clear that it is the best analysis. In this section the hypothesis that there exists in Danish one set of underlying vowels will be examined. Within this hypothesis there are of course two possibilities: that the set is long or that it is short. Under such a hypothesis only one type of length-related rule would be required, either a rule of shortening or one of lengthening. If such a solution, with only one underlying vowel length and one type of length-related rule, could be supported, it would be preferable to a solution which includes two underlying vowel lengths and two types of length-related rules. It appears, however, that such a solution is untenable, as will be argued below.

2.5.1.1 The Shortening Analysis

Since it is the case that long vowels do not occur before a consonant cluster, under this hypothesis there will have to be a rule shortening the underlying long vowels in this environment. As noted, this is a common process,

and in principle presents no difficulty for the facts of Danish; such a rule will also be required under the hypothesis that both long and short vowels are underlying. However, since there occur both long and short vowels before a single consonant, some kind of rule will have to be posited to shorten long vowels in certain single-consonant environments. It is necessary to determine, if possible, which these environments are. An argument can be constructed as follows:

(a) Vowel shortening does occur in certain clear-cut cases, such as in pair (7) [k^hɔ:ʎə ~ k^hɔkt], when /t/ (in this case the past tense suffix) is added to the stem. Rule 2.4 applies here, and the vowel is shortened.

(b) Vowel shortening also occurs in cases in which a suffix is added and a homorganic stem-consonant is subsequently deleted, so that only one consonant occurs on the surface, as discussed earlier (section 2.4.1.1), as in the pair [ko:ʔɾ ~ kat]. In this instance there is a single surface consonant following the vowel in question, but an underlying cluster can be demonstrated.

(c) The claim can now be made that all cases of the sequence VC derive from an underlying consonant cluster, made up of either two different consonants or (derived) geminates.

Now consider the following pairs:

(14) verbs: bade 'bathe' [pæ:ðə]; spille 'play' [spelə]

(15) nouns: bad 'bath' [pæð̃]; spil 'play' [spel]

By the above argument, we may posit underlying /ɪl/ in spil/spille to account for the short vowel. However, the case of bad/bade presents a difficulty for this line of reasoning. If we posit /dd/ in bad, the derivation is as follows:

UNDERLYING FORM	/ba:dd+e/ (/e/ being the infinitival suffix)
VOWEL SHORTENING	badde
CONSONANT DELETION	bade
e-REDUCTION	bade
SPIRANTIZATION	bað̃e
OBSTRUENT DEVOICING ₂	pað̃e
a-FRONTING	pæð̃e
SURFACE FORM	*[pæð̃e]

yielding an incorrect surface form.

(The rules are, respectively, (2.4), (3.16), (2.23), (3.7), (3.18), (2.18).)

This difficulty may be met by positing underlying /dd/ in only the noun, leaving underlying /d/ in the verb, which then retains its underlying long vowel; but all that this accomplishes is to shift the explanation for the behavior of the vowel from an underlying short vowel to an underlying long consonant. Since this analysis provides no better explanation for the data than positing two sets of underlying vowels, and since there is apparently no independent evidence to be put forward in its support, this account is rejected.

2.5.1.2 The Lengthening Analysis

The hypothesis that there is only one set of under-

lying vowels in Danish, a short set, has been advanced by Erteschik (1971). She states the following (page 1), a propos of her analysis of Danish stress, in which she finds the stress rules independent of vowel length: "It is therefore possible to posit only short vowels underlyingly in Danish and to derive all long vowels by a rule which follows the stress rules that lengthens stressed short vowels in open syllables."

With respect to the distribution of long and short vowels, she states (p. 2) "The short vowels in either position [before a single consonant or a consonant cluster] can be either stressed or not, but the long vowels are always stressed. All long vowels can therefore be derived from short underlying vowels when the latter are stressed and followed by only one consonant." A rough approximation of the rule is given as:

$$V \rightarrow [+long] / \text{---} \overset{1}{C}_0 \quad (V \text{ must actually be specified } [+stress].)$$

However, the difficulty exists that such a rule must be prevented from applying to forms such as ven 'friend' [ven], tak 'thanks' [t^hak], and bad 'bath' [pæð], to mention only a few of the many forms in a stressed short vowel followed by a single consonant.

It is possible that the environment of the rule is intended to be "open syllable", as is earlier stated in the paper. However, there is no provision in it for the vowel which presumably follows the single consonant (if one

occurs) following the vowel which is to be lengthened. But in one case or the other two problems must be considered: (1) that in forms such as [koʒ(ɔ̃)] the long vowel occurs before a single consonant, but then so does the short vowel in forms such as [pæð]; and (2) if the environment is being considered as that of open syllable, and with respect to this environment forms such as [pɛ:ðə] are cited, the characterization of the first syllable as "open" is probably incorrect, since the facts of Danish lead to the analysis of ə as a syllable unto itself (see section 3.5.2). The consonant in the forms in question is thus syllable-final, and the notion of open syllable is inapplicable here.

This hypothesis, then, appears not to be supported, and two sets of underlying vowels, one short and one long, must be posited to account for the data.

2.5.2 Vowel Lengthening

Returning to the question raised by pair (13) [pæð, pɛ:ðə], the first a noun and the second a verb, the difference in the vowel length must be accounted for. As stated in section 2.5, though it is not essential to assign to such related forms the same underlying stem vowel, on the grounds that they belong to different syntactic categories, it would be desirable if possible to do so and to account for the alternation in length by phonological rules, preferably rules of some generality,

such that they will account not only for this type of pair but also for any pair of related forms of the same or differing syntactic category which demonstrate alternations in vowel length.

Two possibilities present themselves in these cases: (1) that the underlying form of the vowel is long (as it happens, the plural form of the noun, [pɛ:ðə], is phonetically identical to the infinitive of the verb given in (13), and to that in every other form of the verb except the imperative (which, like the singular of the noun, ends in [ð̌] --see chapter 4 for discussion of verbs) and is shortened in the singular form of the noun; and (2) that the vowel is underlyingly short, and is lengthened elsewhere.

We have seen (section 2.5) that the length of a vowel occurring before a single consonant is unpredictable. The rule of stød-placement (see section 2.7.5) will assign stød to a long vowel in this environment; therefore a vowel which surfaces as short and without stød here must be considered as underlyingly short. In the plural form of the noun (as in [pɛ:ðə], 'baths'), if the same underlying vowel is assumed, the long vowel must be accounted for by means of a lengthening rule.

It is the case that not all vowels which occur as short and without stød in the singular are lengthened in the

plural. For example, the forms of pair (16) evidence neither stød in the singular nor lengthening in the plural:

(16) kat/katte 'cat' (singular and plural)
[k^hæt, k^hætə].

There is no reason to suppose the vowel is not underlyingly short; the question arises, however, as to why it fails to lengthen in the plural. The difference in the environment (following the stem vowel) between [pæð] and [k^hæt] lies only in the voicing of the following consonant ([ð] reflecting underlying /d/ and [t] reflecting underlying /t/--see section 3.5.7). This difference apparently has no effect on the vowel length in the singular forms, but only in the plural forms.

Assuming, as we apparently must, that the vowels here are short, their lengthened alternants must be explained. The explanation cannot lie in the syllable structure of the forms they occur in, as suggested by Erteschik (1971) and Basbøll (1970), since under the present analysis (and according to subsequent research of Basbøll as well (1972:188), the syllable boundary occurs between the schwa and the preceding consonant (see section 3.5.2). It must therefore lie in the feature specification of the consonant which follows the vowel. Since the vowel lengthens before [ð] (/d/) and not before [t] (/t/), it is the consonant feature value [+voice] which causes the preceding vowel to lengthen. Since it lengthens only

vironment of a following voiced consonant plus ə (e.g., [pɛ:ðə]), which is rule (2.21) just formulated; and a rule lowering /ɛ/ to [ə] when followed by the voiced consonant plus word boundary. But rule (2.18), a-FRONTING, has already been formulated (section 2.4.4.2) to derive [ə] in this environment, namely before a segment specified as [+coronal]. Thus if the underlying vowel in these forms is taken to be /a/, the occurrence of [ə] is predicted by rule (2.18), required elsewhere in the grammar, and the only rule required in addition to the lengthening rule is a low-level rule raising the [ə] reflex of /a/ which occurs before a coronal segment to [ɛ:] when lengthened. This rule follows rule (2.21), VOWEL LENGTHENING, and may be formulated as

(2.22) ə:-RAISING

$$\left[\begin{array}{l} +\text{syll} \\ -\text{bk} \\ +\text{lo} \\ -\text{tns} \\ -\text{rnd} \\ +\text{lng} \end{array} \right] \rightarrow \left[\begin{array}{l} -\text{hi} \\ -\text{lo} \end{array} \right] \quad / \text{---} \quad \left[\begin{array}{l} -\text{syll} \\ +\text{cons} \\ +\text{voi} \end{array} \right] \quad \text{ə}$$

The analysis which assumes an underlying /a/ in these forms rests on an independently motivated rule; therefore it is the one adopted here.

2.5.3 Summary

In this section it has been proposed that two underlying vowel lengths are required to account for the data. Arguments for single underlying vowel length, either

long or short, have been examined and found untenable. Since two vowel lengths are assumed to be underlying, and the required vowel shortening rule is formulated earlier, as (2.4) (section 2.4.1), the question of vowel lengthening is returned to in this section. The relevant data are examined and the necessary rule is formulated. Certain of the forms presented as data contain the alternation [ə ~ ε:], which involves a difference in quality as well as in quantity. The underlying vowel /a/ is argued for here as allowing the simplest account, which is based partly on a rule already motivated as being required elsewhere in the grammar.

2.6 The Schwa

The schwa in Danish has a limited distribution: it occurs only short and only in unstressed syllables. Because of this limited distribution, it is plausible to consider Danish schwa a derived vowel, and the question of what it is derived from has been discussed by a number of researchers (e.g., Hansen (1956), Hjelmslev (1951)). On the other hand, schwa is often tacitly or tentatively considered, or in at least two cases (i.e., Austin (1971), Erteschik (1971)) argued for, as underlying. However, convincing arguments with regard to the status of schwa have yet to be advanced. In this section arguments given by various researchers will be examined, and it will be proposed that schwa in Danish is best considered as

a derived vowel.

A great proportion of the occurrences of schwa are in the final syllable of bisyllabic words. The form in question is very often either the infinitive of a verb or the plural of a noun, as, for example, tale 'speak' [t^hæ:lə] and senge 'beds' [sɛŋə], though there are many examples of other types, such as pige 'girl' [p^hi:yə], hoved 'head' [ho:wəð] and håret 'hairy' [hɔRəð]. There are also forms of more than two syllables in which schwa occurs in the final syllable, such as kærlighed 'love' [k^hɛɔlihəð].

There exist alternations in which it is clear which underlying segment (surface) [ə] is derived from, such as kærlighed/kærlighedén 'love' (definite and indefinite). In this pair the vowel in the third syllable surfaces as [e] under stress: [k^hɛɔlihéðən].

A different alternation occurs in other cases, with a change in stress, as in the form dem 'them', which occurs as [tɛm] under stress and as [təm] in enclitic position, i.e. where the stress is reduced, as in the expression få dem ind 'get them in!' [fɔdəm én?] (examples drawn from Rischel 1969:200). Thus there are cases of [e/ə] and [ɛ/ə] alternations. However, it is not clear what the status of [ə] is in the case of forms where there are no such alternations (as in [p^hi:yə] or where the schwa occurs in an infinitive or plural suffix.

2.6.1 Erteschik's Argument for Underlying /ə/

As discussed above, Erteschik posits only short vowels underlyingly in Danish, and derives all long vowels by a rule which lengthens stressed short vowels in open syllables. Since the only occurrences of schwa in Danish are short, it is plausible under this analysis to posit underlying /ə/ and at least partially to account for its non-occurrence as long by the fact that since it does not occur in stressed syllables it will never be lengthened. Of course the very fact of this non-occurrence, viewed as an accident, is a bit odd. Under this analysis, it is the only underlying vowel in Danish whose distribution is limited in this way, and this fact calls the analysis into question. In addition, in discussing certain occurrences of [ə], namely those which are word-final (ballade, sabotage, materiale--all foreign words, by the way) and those contained in inflectional suffixes (kongen 'the king', manererne 'the manners'), Erteschik states that "the ə's never alternate with any non-lax vowels, and hence there does not seem to be any reason to derive them from one. I would therefore like to posit them as being ə's underlyingly." These particular occurrences of [ə], it is true, do not alternate with any non-lax vowel; I am not aware that they alternate with any vowel. However, the suggestion appears to be that there are two possible sources of schwa: derived and underlying, though this is not in fact stated. Given the facts of the

distribution of schwa in Danish and the lack of other, independent, evidence for underlying schwa, the argument for underlying /ə/ is weak.

2.6.2 Austin's Argument for Underlying /ə/

Austin (1971: 63-65) posits underlying /ə/ and argues for this analysis on several grounds. First he argues against derived [ə] on the grounds that in native Danish words [ə] contrasts only with [i] in unstressed syllables of simple words: fatte 'comprehend' [fætə] vs. fattig 'poor' [fæti]. Though Martinet (1937:22) interprets [ə] as "la neutralisation...de tous les phonèmes vocaliques brefs, à l'exception des voyelles de la série la plus fermée i, y, et u," Austin (1971:63) claims that there is actually very little reduction of this sort in Danish. As has been indicated above, there is indeed this sort of reduction, but it is fairly restricted to /e/ and /ɛ/. Thus while it may not be the best account to say that [ə] is the neutralization of all short vowels in Danish (with the noted exceptions), it is quite plausible to regard it as reduced /e/ or /ɛ/. And this is precisely how Hjelmslev (1951:19) deals with it: [ə] is derived from /e/ in pretonic position and from /ɛ/ in posttonic position (as in betale 'pay' [pæt^hæ:lə]).

According to Austin, the main argument against deriving [ə] from either /e/ or /ɛ/ or, as Hjelmslev does, from both, is that there seems to be no good reason for

choosing one underlying representation over the other, so that an arbitrary choice must apparently be made. This is of course not so for the cases in which alternations make it clear which segment [ə] is derived from. It seems quite plausible that [ə] should be considered, in those cases in which alternations do not exist, to derive from /e/, since that is the case in the majority of alternations of [ə] with another vowel. Thus the underlying form of the plural suffix, for instance, would be assumed to be /e/.

Austin's final argument for considering schwa to be underlying is that the statement of many rules can thereby be simplified, and the example he cites is the following, based on the pair Helge (boy's name) [hɛlɣə] and Helga (girl's name) [hɛlkə]. Austin argues that if we assume that both words have an underlying /g/, which according to him is most likely true, then the different surface manifestations can be accounted for in relation to the following vowel. That is, when occurring before /ə/, /g/ undergoes consonant gradation, but when occurring before /a/ it does not. (For discussion see section 3.5.2.) According to his analysis, a /g/ in this position (i.e. a non-initial /g/ followed by a vowel) will become [+cont]. However, this formulation misses the generalization that it is in syllable-final position that /g/ undergoes consonant gradation. In the case of [hɛlɣə], the syllabification is [hɛlɣ\$ə] (after the rule of e-reduction has applied),

whereas in the case of [hɛl~~k~~ə] it is [hɛl\$~~k~~ə]. The /g/ in the first case is syllable-final; therefore it becomes [+cont]. The /g/ in the second case is syllable-initial; hence it is not subject to consonant gradation rules and does not become [+cont].

The argument presented by Austin for positing underlying /ə/ thus does not hold up, given what appears to be the necessary interpretation of the behavior of schwa.

2.6.3 Arguments for derived [ə]

Certain clear cases of derived [ə] have been cited above. Rischel's (1969: 196ff) presentation with respect to the sources of posttonic [ɒ] show that this vowel may be taken as equivalent to [ə] + [ɒ]. Since he demonstrates [ɒ] to be generated from /R/, unstressed [ɒ] can be generated from schwa plus /R/: [əR] → [əɒ] → [ɒ]. Whether the schwa in question is underlying is not clear. But Rischel has shown that in words with alternating stress placement, posttonic [ɒ] alternates with stressed [e?R, e:R] and [o?R, o:R]. And he states that this is probably best accounted for if one posits underlying /eR/ and /oR/. His examples are:

(1) [é?tɒ] 'ether' and [sté?Rɪsk] or [stéɒ?ɪsk]
'ethereal'

(2) [fáktɒ] 'factor'--[fakto:Rɒ] or [fakto:ɒ]
'factors' and [faktoRé?ɒ] 'factorize'

(It is not immediately evident whether posttonic /eR, oR/

become [ə] via a reduced common form or by lowering and retraction rules.)

Since there are cases in which [ə] is clearly derived from /e/, and since there are other cases in which [ɒ], which can be shown to derive from [ə] plus /R/, alternates with stressed [eʔR, e:R] and [oʔR, o:R], it is plausible to analyze schwa as a derived vowel. In the large number of cases of non-alternating schwa, the schwa functions as a suffix. Evidence exists that certain suffixes are inherently stressless (Rischel, 1970a: 131-132) and the suffixes just discussed are among them. It is reasonable to posit something else as underlying where these [ə]'s occur, and on the grounds of symmetry it appears to be a good idea. In the absence of convincing arguments for underlying /ə/, as demonstrated in the above discussion, and in view of the clear and the indirect cases of derived [ə], and since those cases are in inherently stressless syllables, and since [ə] never occurs stressed, it appears best to consider schwa in Danish as always derived. Nothing is gained by positing underlying /ə/, and the arguments given in support of it are based on an apparently incorrect interpretation of the functioning of schwa with respect to syllabification.

As further support for this position, it is the case that in colloquial, particularly "non-educated" speech, other vowels besides /e/ and /ɛ/ alternate with schwa (or vacillate) in non-initial pretonic syllables (in

connection with a general assimilation of the word to a native pattern). This is typically found with /a/ when followed by /R/, as for example apparat 'device' [apɔRɔ́t] → [apəRɔ́t] (or [apRɔ́t]). (These data are drawn from Rischel (1969: 200-201.) This is further evidence of the derived nature of some schwas. In Danish there seems to be a tendency, at least, for vowels to reduce to [ə] under conditions of no stress.⁴

The position is taken here, then, that all occurrences of [ə] are derived. Certain of these occurrences alternate with and hence can be related to /a, o, ε/ and most often /e/. It remains to hypothesize an underlying segment for those occurrences of [ə] which do not alternate with another segment. Inasmuch as, in the greatest number of instances of [ə] which do alternate with another segment, that segment is [e], and in view of the phonetic similarity of the two vowels, underlying /e/ may be posited for those instances of non-alternating schwa. The rule relating [ə] to underlying /e/ can be formulated as:

(2.23) e-REDUCTION

$$\left[\begin{array}{l} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ -\text{bk} \\ -\text{rnd} \\ +\text{tns} \end{array} \right] \rightarrow [\text{ə}] / \left[\overline{-\text{str}} \right]$$

2.6.4 Summary

In this section the facts of the distribution of schwa in Danish have been described. Arguments which have been put forward for positing underlying schwa have been reviewed and criticized. Arguments for derived schwa have been presented, and the analysis that schwa is always derived in Danish has been adopted. Where there is an alternation with another vowel, this vowel has been assumed to underlie the segment surfacing as schwa; where there is no such alternation, schwa is held to derive from underlying /e/, primarily on grounds of frequency of occurrence of this particular alternation, and phonetic similarity of the two segments. Finally, the necessary rule of e-REDUCTION has been formulated.

2.7 The Stød: its Relation to Vowel Length and to the Syllable

The stød in Danish is a topic which has generated a good deal of literature. It is not the purpose of this section to present anything like an exhaustive account of this phonological phenomenon of Danish; rather, it is discussed here because of its bearing on the various subjects covered in this work. It is necessary to make reference to it at various stages in the analysis being presented because certain arguments are motivated by its occurrence or non-occurrence in a given set of forms.

In section 2.7 certain necessary facts pertaining to the stød will be presented: its articulation, its status as a sound occurring in Danish, its distribution. The most recent work, done within the generative framework, will be discussed briefly, and a rule of stød-placement will be proposed which will predict its occurrence in the forms under consideration; this will be the rule referred to in arguments in which the presence of stød must be accounted for in the analysis of subsequent chapters. Finally, the theoretical implications of the analysis of stød in Danish with respect to the inclusion in the grammar of the notion of the syllable will be discussed.

2.7.1 Articulation of the Stød

"Stød" in Danish means a 'push' or 'thrust'. The phonetic articulation this term refers to has the effect of interrupting certain segments, an interruption which lends to the flow of that dialect of spoken Danish under consideration the quality which is sometimes characterized as a "machine gun" effect. "Stød" is often translated as 'glottal stop'; however, it is more accurately described not as a full glottal stop, but rather as a catch or constriction which reduces the vibration of the vocal cords briefly.

As noted by Lehiste (1970), there are some dialects of Danish in which stød contrasts with a glottal stop; therefore the glottal modification constituting the stød

cannot be analyzed as a glottal stop. Moreover, since it is in fact a constriction which briefly reduces the vibration of the vocal cords, it follows that it occurs only in voiced sounds.

2.7.2 Status of the Stød

The stød does not represent one of the underlying segments of Danish. Though the historical development of certain forms causes it in some instances to be the only sound which distinguishes the meaning of a pair of otherwise phonetically identical forms, it does not function systematically to distinguish meaning. The generally accepted view of the Danish stød is that it is a suprasegmental, a type of accent, whose occurrence is quite predictable;⁵ the assumption, for instance, that the occurrence of stød is an indication of an underlying long vowel in certain environments has been referred to a number of times earlier in this chapter. As mentioned above, the Danish stød has been the subject of much attention. However, few attempts have been made within the generative framework to formulate rules which predict its occurrence. The discussion here will be limited to Basbøll's account and his formulation of the rule for the context of monosyllabic forms.

2.7.3 Distribution of the Stød

The stød occurs in conjunction with voiced sounds

in stressed syllables only (i.e., those syllables with primary or secondary stress). It is generally described in the literature as occurring either "on" a vowel or "on" a consonant. That is, when the syllable is of a certain structure, to be described below, the stød "falls" on the vowel, interrupting it briefly. When the syllable structure is of a different sort, the stød falls on the (voiced) consonant immediately following the vowel, occurring either just before or just after the consonant.

It is implicit in the description of the occurrence of stød that it is a phenomenon which has reference to the syllable; as such, it is, like stress, a suprasegmental. The indications that this is so are (1) the fact that it falls on the vocalic portion of a sequence of sounds or on an immediately following voiced consonant, and not on a specific sound or in a specific place in the form; (2) the fact that a word never has more than one occurrence of stød; and (3) the fact that stød is not a member of the underlying set of sounds of Danish. This subject will be returned to in section 2.6.6.

The actual facts of distribution are the following. Stød may occur (a) on a vowel followed by a word boundary (e.g., sne 'snow' [sne:ʔ]); (b) on a vowel followed by a consonant which is not a voiceless stop plus word boundary (e.g., fin 'fine' [fi:ʔn]; tid 'time' [t^hi:ʔð]; hus 'house' [hu:ʔs]); (c) on a vowel which is followed by a consonant which is not a voiceless stop, followed

by another consonant plus word boundary (e.g., bæst 'beast' [pɛ:ʔst]; fint 'fine' (neuter) [fi:ʔnt]); (d) on a voiced consonant immediately preceded by a short vowel and immediately followed by a consonant plus word boundary (e.g., stemt 'voiced' [stɛʔmt]); (e) on a voiced consonant followed by a word boundary (e.g., mand 'man' [mænʔ]).

2.7.4 Basbøll's Discussion of the Stød

In a paper dealing with Danish stød Basbøll (1970) distinguishes two sorts of "stød-bases", i.e., environments in which stød predictably occurs. The first of these he calls "phonetic stød-basis," and he defines it under the heading "Danish imperatives from a taxonomic point of view" (1970:18) in the following manner:

Syllables with a long vowel always have phonetic stød basis (if stød occurs it falls in the vowel). Syllables with a short vowel have phonetic stød-basis only if the vowel is immediately followed by a voiced consonant (which may or may not be followed by additional voiced or voiceless consonants), i.e. by [ɖ ɣ ʁ l m n ŋ] (if stød occurs it falls in this consonant).

(The [ʁ] corresponds to the symbol [R] used in the present work.)

Basbøll's second definition of "stød-basis" (1970: 25-26) is defined under the heading "Danish imperatives from a generative point of view", thus:

...stød occurs automatically in stressed monosyllables with underlying short vowel plus a consonant cluster (including geminates) whose first member is one of the voiced consonants mentioned above, i.e. l, n, m, ɖ, ɣ, j, v, r..., the clusters rp, rt, rk, rf, rs are exceptions to the rule). Furthermore, the stød occurs automatically

in stressed monosyllables with an underlying long vowel...these two types of syllables are said to have phonological stød-basis.

Basbøll further states (1970:26) that though he does not "a priori exclude the possibility that the stød may be introduced at various stages of the derivation," his discussion presupposes that "the stød is predictable from the underlying form, i.e. only syllables with phonological stød-basis have stød."

Under the first definition of stød-basis, the notion of underlying form of the vowels in question is of course not appealed to. Thus it may be taken that "long" and "short" vowels are simply those vowels which occur as long and short in an utterance, whereas according to the second definition, which makes use of the underlying/surface distinction in accordance with generative theory, the occurrence of stød is predictable from the underlying form, and it is left to the phonological rules to untangle which occurrence of short vowel followed by a consonant cluster is underlyingly short and which is underlyingly long.

In other words, under the generative view, stød will occur in a syllable in which an underlyingly short vowel is followed by a voiced consonant plus consonant. Therefore, since it is to apply to all vowels in this context, the rule of stød-placement must follow the rule of vowel shortening. And if this is the case, it must also be operant when the following consonants which constitute the cluster are not

both part of the morpheme--i.e., when the second one is a suffix (as in stemme/stent 'voice, voiced' [steme, steʔmt]). This unfortunately is contrary to Basbøll's conclusion (1970:25), which is that "the domain of this stød-basis rule does not exceed morpheme boundaries, cf. tals [t^hæls], genitive of tal [t^hæl] 'number' as against hals [hæʔls] 'neck' (this difference may be explained by some sort of juncture in the former case.)"

If, as is argued here, the stød-placement rule applies in forms such as [steʔmt], in which the second consonant is a suffix, the rule cannot be considered as applying only within morpheme boundaries, and the explanation for the [t^hæls/hæʔls] phenomenon must lie elsewhere. This topic requires further investigation.

In a later paper Basbøll (1975) deals again with monosyllables, distinguishing, on the surface, the following word types. (Basbøll's table is reproduced here for ease of explanation, (with the phonetic representations and glosses added).

(1) $C_0 \check{V} \left[\begin{smallmatrix} C \\ -son \end{smallmatrix} \right]$	(2) $C_0 \check{V}$	(3) $C_0 \check{V} \left[\begin{smallmatrix} C \\ +son \end{smallmatrix} \right]$	
kat [k ^h æt] 'cat'	vi [vi] 'we'	3a øl [öl] 'beer'	3b hal [hæ?l] 'hall'
hest [hest] 'horse'	nu [nu] 'now'		
hof [hɒf] 'court'	det [te] 'the'	bær [pæɹ] 'berry'	mand [mæn?] 'man'
(all without <u>støð</u>)	(all without <u>støð</u>)	han [hæn] 'he'	lang [lan?] 'long'
		(without <u>støð</u>)	(with <u>støð</u>)

Basbøll states that only group (3) has unpredictable stød-conditions according to their surface form. He further states (1975:9) that it has been proposed that the stød should be predictable in all monomorphemic monosyllables by the rule

$$[] \rightarrow [+stød] / \left\{ \begin{array}{l} \left[\begin{array}{c} \overline{v} \\ +long \end{array} \right] \\ \left[\begin{array}{c} v \\ -long \end{array} \right] \left[\begin{array}{c} \overline{c} \\ +son \end{array} \right] c \end{array} \right\} c_0 \#$$

and that according to this analysis, group (3b) must be analyzed as having the underlying structure

$$c_0 \check{v} \left[\begin{array}{c} c \\ +son \end{array} \right] c_1 .$$

Several points must be raised with respect to this analysis. First, there is the question of why the form [hæʔl] is in this group. Since it occurs with stød, according to the above rule of stød-placement, the simplest explanation is that the vowel is underlyingly long and therefore the form belongs in group (5).

A second point to be raised concerns the specification of the consonant following the vowel in the second line of the rule as [+son]. If the facts are as Basbøll states earlier, then this consonant should be specified as [+voi].

The third issue arising out of Basbøll's discussion concerns the fact that among the forms in non-sonorant single consonants (none of which occur with stød) there is no example of a following voiced obstruent. The

fact is that there occur forms in final voiced obstruents which take stød, like [hæʔl], above, others which do not. The simplest explanation for this fact is that the ones that take stød have an underlying long vowel and those that occur without stød have an underlyingly short vowel (e.g., bad 'bath' [pæð̥] vs. tid 'time' [t^hiʔð̥]).

Finally, with respect to the domain of the rule of stød-placement, it should be emphasized that, as discussed above, the application of this rule is not restricted to monomorphemic monosyllabic forms, but affects forms which contain affixed endings as well.

2.7.5 The Stød-Placement Rule

The existence of pairs such as [t^hi:ʔð̥]/[pæð̥] demonstrates that though the environment (a following [ð̥] plus word boundary) is the same in both, stød does not occur in both forms. As mentioned earlier, the simplest explanation--which is based on two underlying vowel lengths, motivated elsewhere in the grammar (section 2.5)--is that stød occurs on those stressed vowels which are underlyingly long. A rule, such as the one formulated by Basbøll and cited in the preceding section, must be formulated to account for the various occurrences of stød. At what point in the derivation of a form this rule is assumed to apply is an important question. As we have seen (section 2.5), under the present analysis rules

of vowel lengthening and shortening are posited to account for the behavior, respectively, of underlying short vowels which are realized as long and underlying long vowels which are realized as short. Since, as Basbøll states, syllables containing the sequence (underlying) short vowel plus voiced consonant, voiceless consonant, word boundary will receive stød, the rules which effect stød-placement and vowel shortening must be so ordered that underlyingly long vowels which shorten in a given environment do not constitute input to the rule of stød-placement.

The rule may be formulated as follows:

(2.24) STØD-PLACEMENT

$$\emptyset \rightarrow [+st\text{ød}] / \left\{ \begin{array}{l} \left[\begin{array}{l} +syll \\ -cons \\ +long \end{array} \right] \\ \left(\left[\begin{array}{l} +syll \\ -cons \\ -long \end{array} \right] \left[\begin{array}{l} -syll \\ +cons \\ +voi \end{array} \right] \left[\begin{array}{l} -syll \\ +cons \end{array} \right] \left(\left[\begin{array}{l} -syll \\ +cons \end{array} \right] \right) \# \end{array} \right. \right\}$$

This rule requires some discussion. First, as Basbøll correctly points out (1975:9), the rule is inadequately formulated, since it fails to take account of the fact that the occurrence of stød depends upon syllable structure. It is necessarily formulated within the restrictions of current theory; thus the notion of the syllable is not directly statable in the rule. The generalization with respect to the relation of stød to syllable structure is therefore not captured by rules of this type, and this fact is important. Under a formulation which captures

this generalization, the prediction would not be that stød occurs on a particular (voiced) segment (i.e., $\emptyset \rightarrow [+stød]$ / $\left\{ \begin{array}{c} \bar{v}: \\ \left[\begin{array}{c} \bar{c} \\ +voi \end{array} \right] \end{array} \right\}$) for no apparent

reason, but rather that [syllable] $\rightarrow [+stød]$.

A low-level adjustment rule would then assign the stød to the appropriate segment: the vowel in the case of underlying long vowels and the following consonant in the case of underlying short vowels.

If it is assumed that this rule of STØD-PLACEMENT applies early in the grammar, then all long-vowel syllables will early be assigned stød. (Short-vowel syllables will be assigned stød in only the one environment specified.)

As noted earlier, there are instances of phonetically long vowels, which are demonstrably underlyingly long (i.e., they alternate with forms in which the vowel occurs with stød, e.g., [fi:ʔn, fi:nə]), which do not occur with stød. In all such cases, the form contains a vowel followed by a single consonant (with the exception of voiceless stops) plus schwa. Further, there is a set of forms, also containing a vowel which is demonstrably underlyingly long, followed by a voiceless stop (with or without a following consonant), which does not occur with stød (e.g., hvid/hvidt/hvide 'white' (common gender, neuter, plural) [vi:ʔð̥, vit, vi:ð̥ə]). Thus a rule must be formulated to apply after the early rule of STØD-PLACEMENT, to delete the stød in these environments. This

rule may be formulated as

(2.25) STØD-DELETION

$$[støð] \rightarrow \emptyset / \left[\begin{array}{c} +syll \\ -cons \\ +long \end{array} \right] \left[\begin{array}{c} -syll \\ +cons \\ -cont \end{array} \right] \left\{ \begin{array}{c} [-syll] \\ [+cons] \\ \emptyset \end{array} \right\} \#$$

2.7.6 Theoretical Implications of the STØD-PLACEMENT Rule

As mentioned in the preceding section, the facts of occurrence of the stød in Danish appear to be best captured by a rule which describes the environments in which it occurs in terms of syllable structure. If the rule of STØD-PLACEMENT is formulated, as it is both by Basbøll and here, as $\emptyset \rightarrow [støð]$ in a particular set of environments, the fact that the environments comprise only voiced segments, that the environments range over vowel and consonant, that stød can occur only once in a form, are seen as accidental, and a linguistically significant generalization is missed. That these "accidents" are related, and that the generalization is captured if stød, like stress, is considered a suprasegmental whose domain is the syllable, argues for the inclusion of the notion of the syllable in the grammar. The rule would then be formulated, as suggested above, in terms of the syllable receiving stød, much as it receives stress, if it is of a certain structure, namely if it contains either an underlyingly long stressed

vowel or an underlyingly short stressed vowel followed by the sequence voiced consonant, consonant, word boundary. Adjustment rules, like those which readjust syllable boundaries when, for example, affixes are added, would place the stød either on the vowel, in the first case, or on the consonant, in the second.

2.7.7 Summary

In this section the stød, an important issue in Danish phonology, has been discussed. Since an exhaustive account of this topic is outside the realm of the present work, it has been treated only to the extent necessary for the analysis of the topics in succeeding chapters. To this end its articulation and its status as a suprasegmental have been characterized, and the facts of its distribution have been presented. The most important recent work, generative in nature, has been discussed, namely that of Basbøll, and his rule of stød-placement has been cited. A somewhat altered version of the rule, based on conclusions arising from this discussion, among other reasons, has been formulated.

A rule of STØD-DELETION has been formulated to account for those classes of forms in which stød, predicted on the assumption that STØD-PLACEMENT is an early rule applying to all long stressed vowels, fails to occur. Finally, the implications of the formulation of the STØD-PLACEMENT rule are discussed, and it is concluded that unless the

rule is stated in terms of syllable structure--necessitating the inclusion of the notion of the syllable into the grammar--a significant generalization is missed.

2.8 Conclusion

In this chapter it is proposed that two sets of vowels, one long and one short, underlie all of the phonetically occurring vowels of Danish. The subject of underlying vowel length has been explored and evidence presented in support of the two posited underlying lengths. Rules of shortening and lengthening are formulated, as well as the low-level rules which relate the underlying sets of vowels to their surface manifestations.

Evidence has also been presented in support of the assumption of schwa in Danish as derived in every instance, and in cases in which the underlying vowel is never realized, it is argued that schwa derives from underlying /e/.

The Danish stød, or glottal catch, has been discussed; the stød is here assumed to be a suprasegmental, and it is proposed that it is assigned at an early stage in the derivation to all long vowels, and to short vowels in one phonetic context. A rule of STØD-PLACEMENT is formulated, and a subsequent rule of STØD-DELETION as well, which deletes the stød from long vowels in certain environments.

It has been shown that since stød is, like stress, an early-assigned suprasegmental, and since it does not fall necessarily on one type of segment or the other--i.e., consonant or vowel--but rather simply on a voiced segment, it is most plausibly considered an element of the syllable and not the segment. Therefore, it is argued that unless the account of the stød makes reference to the syllable, a linguistically significant generalization is missed.

FOOTNOTES TO CHAPTER II

1. Evidence from ældre ny dansk (older modern Danish--1500-1700), in which stræbe occurs as strebe, and from German (cf. streben 'strive'), supports this analysis.
2. In the notation being used here, instances of [r] would be rendered as [R], word-initial [t] would be rendered as [t^h], and what is given in this passage as [d] would be represented by [t].
3. In the present notation /a:/ → [ə].
4. As an interesting historical aside, it is worth noting that in the development of Danish, going back to Common Scandinavian (AD 550-1050), the weak preterites fall into three classes, depending on the vowel that links the -n of the infinitive and the dental of the preterite to the root:

(1)	-ja-	(PSc <u>lagjan</u>	CSc <u>leggja</u> 'lay')
(2)	-ō-	(PSc <u>kallōn</u>	CSc <u>kalla</u> 'call')
(3)	-e-	(PSc <u>wakēn</u>	CSc <u>waka</u> 'wake')

as described by Haugen (1976:158). (CSc=Common Scandinavian; PSc=Proto-Scandinavian, 200-500 A.D.?) Thus there were three different root vowels in PSc, which all fell together as -a, which is yet retained in modern Scandinavian languages other than Danish. In Danish this -a, under conditions of no stress, reduces to [ə]. It is interesting to note that the vowels which reduce to schwa in alternations in Modern Danish are just these: a, o, and e (and sometimes ε).

5. Danish stød is associated with the tones of Norwegian and Swedish, which are related to sentence intonation and classed as Accent 1, with a typically rising or falling intonation, and Accent 2, the peculiarly Scandinavian accent limited to polysyllables. The distribution of Danish stød roughly corresponds to that of Accent 1, and dates at least to the sixteenth century, and it has been suggested that it developed as a device to maintain the distinction of accent when the weakening of Danish unstressed vowels was leading to loss of tone. For a fuller discussion, see Haugen (1976:281-285).

CHAPTER III

THE CONSONANT SYSTEM

3.1 Introduction

In this chapter the consonant system of Danish will be examined. In Table 3.1 the Danish consonant phones are presented; they are described in section 3.2. (Data are largely drawn from Basbøll (1974b).) In section 3.3 a set of underlying consonants is proposed, and in section 3.4 rules of allophonic variation are formulated which relate them to the phones listed in Table 3.1, with the exception of the stops. Certain of the proposed underlying segments permit of a quite simple and straightforward analysis. Others present greater difficulty and are accorded fuller discussion. Where appropriate, previous analyses are reviewed, notably those of Basbøll, Rischel and Austin. In section 3.4.4 the segment [ŋ] is examined, leading to a discussion of voicing assimilation in Danish. Basbøll's analysis is discussed and a more general rule of voicing assimilation is formulated, based on data previously unaccounted for. In section 3.5 the analysis of the Danish stop system is undertaken; the topic of consonant gradation, one of the basic issues in Danish phonology, is discussed at length. Previous analyses are reviewed and the various phonological solutions that have been proposed are discussed. The conclusion is reached that solutions of this type are unsatisfactory;

therefore a morphological solution is adopted.

In addition, in section 3.5.2 the subject of the syllable is discussed, since it is relevant to the statement of the environments in which consonant gradation occurs. The traditional view of this environment with respect to this topic is examined and motivated, and it is argued here that the notion of the syllable must be incorporated into the grammar if the relevant significant generalizations of Danish phonology are to be captured.

	<u>bilabial</u>	<u>labiodental</u>	<u>alveolar</u>	<u>alveopalatal</u>	<u>palatal</u>	<u>velar</u>	<u>glottal</u>	<u>uvular</u>
<u>stops</u>								
asp	p ^h		t ^h			k ^h		
unasp	p		t			k		
<u>fricatives</u>								
vl		f	s	ʃ			h	ʀ
vd		v	ð			ɣ		ʀ
<u>nasals</u>								
vl	ṃ		ṇ					
vd	m		n			ŋ		
<u>laterals</u>								
vl			ḷ					
vd			l					
<u>glides</u>								
					y	w		

Table 3.1: The consonant phones

In addition to these, there occurs sporadically in Standard Danish the voiced bilabial (non-strident) fricative [β]. Its presence is taken to be the result of borrowing, occurring as it does essentially in only two forms.¹ Therefore it is not included either in the set of phones listed in Table 3.1 or in the discussion of consonant gradation (section 3.3).

The stød, discussed in section 2.7 of the preceding chapter, is also omitted from Table 3.1, since according to the analysis there presented, it is not properly speaking a Danish phone, but rather a suprasegmental, which has the effect of interrupting a voiced sound under certain predictable conditions.

3.2 Description of the Consonant Phones

While some of the phones listed in Table 3.1 are easily captured by the IPA symbols used, others require further description. In this section the articulation of the stops, fricatives, nasals, laterals and glides will be discussed.

3.2.1 The Stops

As can be seen from Table 3.1, Danish has two voiceless surface series of stops, and no voiced series. The symbols [p t k] quite adequately represent the unaspirated series. With respect to the second series, it should

be noted that [p^h] and [k^h] are quite heavily aspirated, and [t^h] is extremely heavily aspirated, so that at times it may even sound somewhat affricated.

3.2.2 The Fricatives

Listed in Table 3.1 are two sets of fricatives, a voiceless set and a voiced one. Of the voiceless phones, [f], [s] and [h] require no description in addition to their placement in the table. The articulation of [ʃ^V] is farther back than the sound represented by this symbol for English. [ʀ] is a uvular fricative, articulated quite far back, as a tap rather than a trill.

Turning to the voiced fricatives, it should be stated that [v] represents a non-strident labiodental sound; [ð] represents a non-strident alveolar sound articulated with the blade of the tongue brought close to, but not quite touching, the alveolar ridge; and [ɣ] is a non-strident velar fricative, according to Basbøll (1976b:3) almost completely lost among the younger generations. [ʀ] is the voiced counterpart of [ʀ], also articulated quite far back, resembling the French [ʀ], except that, as noted with respect to [ʀ], it is not trilled but tapped.

3.2.3 The Nasals, Laterals and Glides

The articulation of all of the sounds in these groups which appear in Table 3.1 is sufficiently described by their placement in the table.

3.3 Underlying Consonants

The set of consonants posited to account for the consonant sounds listed in Table 3.1 is listed in the following table:

p	t	k		
b	d	g		
f	s	h	R	
m	n			
	l			
	y	w		

Table 3.2: The proposed underlying consonants

3.4 Rules of Allophonic Variation

In this section the voiceless fricatives will be discussed first. The voiced fricatives, all except /R/ considered in the present analysis to be derived, will be discussed when those segments from which they derive are treated. Next the liquids will be discussed, then the nasals, the glides, and finally the stops.

3.4.1 The Fricatives

The fricatives posited as underlying are /f/, /s/, /R/ and /h/. Under this analysis, [^Vs] and [R] are considered to be derived. The source of [^Vs] is discussed in section 3.4.1.2, pertaining to /s/; the source of [R] is discussed in section 3.4.1.3 below.

3.4.1.1 /f/

That the segment /f/ is distinctive in Danish is clear from minimal pairs such as fil 'file' [fiʔl] vs. bil 'car' [piʔl]. Underlying /f/ is realized in all environments as the voiceless labiodental strident [f] (e.g., [fiʔl]; stof/stoffer 'matter' (singular and plural) [stʌf, stʌfɒ]; kraft 'strength' [k^hʀaft]).

3.4.1.2 /s/

That /s/ is an underlying segment of Danish is evident from minimal pairs such as sat 'placed' [sæt] vs. kat 'cat' [k^hæt]. The segment [s] occurs initially, medially and finally (e.g., [sæt]; fest 'celebration' [fɛst]; spise 'eat' [spi:sə]). The usual realization of /s/, then, is [s]. It will be argued here that /s/ has one other realization: [s̺].

As already mentioned, the articulation in Danish of the sound here represented by [s̺] is farther back than the similar English sound. Its pronunciation in certain regional dialects as [s] followed by devoiced [y], as well as its spelling (sj), suggests the possibility that it is best accounted for as a sequence of two underlying segments /s/ and /y/. The following facts lend support to this hypothesis (data from Basbøll (1974b:6)).

The segment [s̺] occurs only syllable-initially, as in the examples sjov 'fun' [s̺owʔ] and sjælen 'rare' [s̺ɛlɐʔn]. If viewed as a single underlying segment,

it is the only such segment of Danish (except for [h]-- see section 3.4.1.3) whose distribution is limited in this way.

In addition, in the case of the juxtaposition of a morpheme ending in [s] with a morpheme beginning with [y], resulting in the string [s+y], it is a fact that there is an optional assimilation of these sounds across the word boundary, as in, for example, hushjørne 'house corner' [husyœp̥nə/hu^Vsœp̥nə] and hos Jens 'with Jens' [hɔsyens/hɔ^Vsens]. Since [s̥^V] in these cases is indisputably a reflex of underlying /sy/, this assimilation is clearly possible in Danish.

It is also the case that /y/ in Danish is one of the permissible second members of an initial consonant cluster of which /s/ is the first member. As will be demonstrated below (see sections 3.4.1.3 and 3.4.2.1), when a voiced non-vocalic segment (with the possible exception of the nasals) is preceded in such a cluster by an underlyingly voiceless consonant, the voiced segment devoices. The segment /y/ is subject to this process--and it does indeed devoice in those regional dialects referred to above in which the sequence /sy/ is realized [sy]. The further assimilation to [s̥^V] is a quite natural and commonly occurring one in language.

The interpretation of initial [s̥^V] as underlying /sy/ immediately explains its unusual distribution. This fact,

taken together with the preceding discussion, provides a convincing argument for such an interpretation, and, in the absence of any counter-evidence, is the one adopted here.

The rules relating [s] and [^Vs̥] can be formulated as follows, with the stipulation that (3.1) be ordered to precede the rule of OBSTRUENT DEVOICING formulated as (3.18) in section 3.5.7 below, so that underlying /b d g/, devoiced in initial position (see section 3.5.7), will not trigger the application of (3.1), DEVOICING. (As noted, the devoicing process operating here is part of a more general process, which will be discussed further on.)

(3.1) DEVOICING

$$\begin{bmatrix} -\text{syll} \\ -\text{cons} \\ -\text{back} \end{bmatrix} \rightarrow [-\text{voi}] / \begin{bmatrix} -\text{syll} \\ +\text{cons} \\ -\text{voi} \end{bmatrix} \text{ — } (y \rightarrow [\dot{y}] / \begin{bmatrix} \text{C} \\ -\text{voi} \end{bmatrix} \text{ —})$$

(3.2) s-BACKING

$$\begin{bmatrix} +\text{stri} \\ +\text{cor} \end{bmatrix} \rightarrow [-\text{ant}] / \text{ — } \begin{bmatrix} -\text{syll} \\ -\text{cons} \\ -\text{back} \\ -\text{voi} \end{bmatrix} (s \rightarrow [\dot{s}] / \text{ — } [\dot{y}])$$

(3.3) y-DELETION

$$\begin{bmatrix} -\text{syll} \\ -\text{cons} \\ -\text{back} \\ -\text{voi} \end{bmatrix} \rightarrow \emptyset / \begin{bmatrix} +\text{stri} \\ +\text{cor} \\ -\text{ant} \end{bmatrix} \text{ — } (y \rightarrow \emptyset / [\dot{s}] \text{ —})$$

3.4.1.3 /R/

The analysis of /R/ constitutes, especially with respect to its relation to the phone [ɐ], one of the interesting issues in Danish phonology. There is evidence that the segment /R/ does not behave like the sonorant consonants of Danish (namely with respect to the preterite suffix taken by one of the classes of weak verbs--see section 4.5.1). Since there exists evidence that it does not class with sonorant consonants, and since it surfaces in most environments as a uvular fricative (voiced or voiceless), and in only one environment as another type of segment (i.e., [ɐ]--see below for analysis), its classification here as [-son] is motivated.

The distribution of /R/ is as follows. It is realized initially and immediately following an underlyingly voiced obstruent as [R], as in the following examples: række 'hand (vb.)' [Rækə]; brede 'broaden' [pRæ:ðə]; drikke 'drink' [tRIkə]; grøn 'green' [kRøʔn]. In the environment immediately preceding or following a voiceless obstruent it is realized as voiceless [R̥], as in the following examples: pris 'price' [p^hRis]; trine 'step' [t^hRi:nə]; krop 'body' [k^hRɔp]; frost 'frost' [fRɔst]. (Initial /sR/ does not occur in Danish.) The devoicing rule given above as (3.1) can therefore be explained to include /R/. This more general rule will be formulated further on, when additional segments to which

it must apply have been discussed.

The segment [ɒ], as noted, constitutes an interesting problem in Danish phonology. Generally in the literature this segment is, in certain environments, assumed to be a reflex of /R/.² However, evidence to support this assumption is not abundant. In certain inflected forms of nouns and verbs there is a suffix -er [ɒ] added to indicate plurality and person, respectively, as in the examples stoffer 'matter' [stɒffɒ] (plural) and mener 'thinks' [me:nɒ]. This suffix is often considered to contain an underlying /R/, but since the suffix does not alternate with another form in which the presumed /R/ is realized otherwise, evidence for this underlying form cannot really be adduced from the suffix. However, in foreign words there may occur an alternating stress pattern which causes the two sounds to alternate, and from such cases evidence for the identification of [ɒ] with /R/ can be found. For example, the pair klor 'chlorine' [k^hlɒb?]/klorid 'chloride' [k^hlɒRi?ɔ̃] clearly illustrate the [ɒ/R] alternation (example from Rischel (1969:193)).

The rule required to produce the correct phonetic output, based on this interpretation, can be formulated as

(3.4) R-VOCALIZATION

$$\left[\begin{array}{l} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{array} \right] \rightarrow \left[\begin{array}{l} -\text{cons} \\ +\text{low} \end{array} \right] / [+syll] __ (R \rightarrow [\text{ɒ}]/V__).$$

3.4.1.4 /h/

This segment has been included in Table 3.2 although, as noted by Basbøll (1974c:67), it does not enter into any phonological processes of Danish, and therefore is not included in the structural description or structural change of any phonological rules of Danish. The distribution of the phone [h] in Danish is limited to syllable-initial position, as in the examples hoppe 'hop' [hʌpə]; -hed (nominal suffix) [həd̥]. Motivation for including /h/ among the underlying segments rests on the occurrence of minimal pairs such as henne/denne 'there', 'this' [henə, tsnə] and høre/køre 'hear', 'drive' [hæ:ɒ, k^hæ:ɒ].

Since /h/ plays no role in the phonological processes of Danish it will not be discussed further here, but since it is clearly distinctive it is included in the system of underlying consonants presented here.

3.4.2 The Liquids: /l/

The segment /l/ is assumed here to be a member of the underlying consonant system of Danish. The interpretation of the voiceless phone [l̥], which is listed in Table 3.1, as a variant of /l/, is quite straightforward and is discussed below.

That /l/ is distinctive in Danish is shown by minimal pairs such as fil/fin 'file, fine' [fi:ʔl, fi:ʔn].

The interpretation of voiceless [l̥] as a reflex of /l/

is motivated by the fact that [l] occurs in all contexts except when immediately preceded or followed by an underlyingly voiceless obstruent, as illustrated by the following examples: lade 'allow' [lɛ:ðə]; hvile 'rest' [vi:lə]; til 'to' [t^hɪl]; held/heldig 'luck, lucky' [hɛʔl, hɛltɪ]; blæse 'blow' [plɛ:sə]; glimt 'glint' [klɪʔmt]; vælg/vælge 'choose' (imperative, infinitive) [væʔl, vɛlɣə]. (Initial /tɪ, dɪ/ do not occur in Danish.) These examples of [l] in various environments are in complementary distribution with [ɫ] in the next examples, where the environment is a following or a preceding voiceless obstruent: plads 'place' [p^hlæs]; klasse 'class' [k^hlæsə]; flere 'more' [flɛ:ɐ]; slå 'hit' [slɔ:ʔ]; hvalp 'puppy' [væʔlp]; salt 'salt' [sæʔlt]; tolk 'interpret' [t^hɔʔlk]; hils 'greet' [hi:ʔls].

/l/ is thus taken to be underlying, and the devoicing rule given above as (3.1) can be expanded to include this segment as well, relating it to [ɫ]:

Since the devoicing process occurs in the case of /R/ and /l/ in the environment of a preceding or a following voiceless consonant, the rule of DEVOICING can be formulated as a mirror-image rule. In its application to /y/ this formulation presents no difficulties, since [y]--and [v] as well (see section 3.4.5.2)--occurs only as the second member of such a consonant cluster, never as the first. As will be discussed in section 3.4.4, the rule of DEVOICING is more general still, applying in the

case of the nasals as well.

In order to prevent the DEVOICING rule from applying in the case of a consonant cluster whose first member is a derived voiceless stop (i.e., underlying /b d g/-- see section 3.5.7), it must be ordered before the rule of OBSTRUENT DEVOICING, formulated as (3.18) in section 3.5.7. below.

3.4.3 Summary

In the preceding portion of section 3.4 the fricatives and the liquids have been discussed. It has been proposed that since the voiceless fricatives [f] and [h] do not alternate with any other segments they are the only realizations of underlying /f/ and /h/, respectively. It has been noted that /h/ must be included in the inventory of underlying segments despite its limited distribution, because it does serve to distinguish meaning. The voiceless segment [^Vʃ] also has a limited distribution, occurring only syllable-initially before [y]. Evidence has been presented in support of the hypothesis that [^Vʃ] is best interpreted as the realization of underlying /s/ when followed by /y/.

The analysis of /R/ as a fricative rather than as the sonorant /r/ has been motivated; and it has been argued that [R] and [ɹ] are best accounted for if interpreted as alternants of /R/, [R] being the surface form in the

environment of a preceding or a following voiceless consonant, and [ɸ] the surface manifestation in the environment of a preceding vowel. Finally, rules relating the surface variants of the fricatives and the liquids to their respective proposed underlying forms have been formulated.

3.4.4 The Nasals

Of the nasal phones listed in Table 3.1, [m] and [n] are assumed to have underlying status. The segment [ŋ] is interpreted as derived. In this section this analysis is motivated.

3.4.4.1 /m/ and /n/

That /m/ is distinctive in Danish is clear from minimal pairs such as ment 'think' (past participle) [me:ʔnt] vs. sent 'late' [se:ʔnt]. The phone [m] occurs initially, medially and finally (e.g., [me:ʔnt]; samme 'same' [same]; søm 'seam' [søʔm]).

Voiceless [m̥] occurs in the same environment as the voiceless consonants just discussed, namely in the vicinity of a voiceless consonant (e.g., smile 'smile' [smi:lə]; glimt 'glimpse' [kliʔmt]). Thus it can be interpreted as an alternant of underlying /m/ and included in the general devoicing rule formulated below as (3.5).

Elsewhere /m/ is realized as [m].

The segment [n] occurs initially, medially and finally (e.g., nat 'night' [næt]; fine 'fine' (plural) [fi:nə]; fin 'fine' (common gender) [fi:ʔn]). Thus /n/ is assumed to underlie this segment and to surface in most contexts as [n]. The segment [n̥] occurs in the same environment as [m̥], namely in the vicinity of a voiceless consonant. (e.g., [se:ʔnt]; sne 'snow' [sne:ʔ]). It is therefore interpreted as an alternant of underlying /n/ and included in the general devoicing rule now formulated as (3.5). (The formulation of (3.5) as a mirror-image rule presents no problem for this analysis, since there occur no sequences of the type voiceless stop plus nasal in monosyllabic words.)

(3.5) DEVOICING

$$[-\text{syll}] \rightarrow [-\text{voi}] / \begin{bmatrix} +\text{cons} \\ -\text{voi} \end{bmatrix}$$

There are certain other contexts in which [n] fails to occur, primarily before /g/ (see section 3.4.5 for analysis of Danish stops). It is proposed here that in this environment /n/ is realized as [n̥]. In the following discussion support is adduced for this hypothesis, and the process of assimilation is discussed at length for this and related contexts, resulting in the formulation of an optional mirror-image rule of progressive/regressive assimilation and an obligatory rule of regressive assimilation.

The distribution of [ŋ] is limited, like that of [h] and [ʃ], but in contrast with these it never occurs initially, only syllable-finally, as the following examples illustrate: klang 'sound, ring' [k^hlaʔŋ]; seng 'bed' [sɛʔŋ]; bringe 'to bring' [pRɛŋə]; Inka 'Inca' [ɛŋk^hə]; Inga (girl's name) [ɛŋkə]. *[ɛŋə] is phonetically impossible in Danish. (The data for this discussion are largely drawn from Basbøll 1974c.)

In accord with the principles of syllabification discussed below in section 3.4 on consonant gradation, if the form *[ɛŋə] were syllabified [ɛŋ\$ə], it would violate the principle that consonants are "attracted" to following full or stressed vowels. If the syllabification were taken to be [e\$ŋə], then the principle that syllable-initial consonants (or clusters) should be consistent with possible word-initial consonants (or clusters) would be violated, since [ŋ] is excluded from word-initial position. As seen in the above examples, there occur [ɛŋkə] and [ɛŋk^hə], which permit of the allowable syllabification [ɛnk\$ə] and [ɛŋ\$k^hə] respectively, where [ŋ] occurs in the permissible syllable-final position. Thus the proposed principles of syllabification provide an explanation for the non-occurrence of forms such as *[ɛŋə]. (Motivation for the syllabification of forms like [pRɛŋə] as [pRɛŋ\$ə] rests on the analysis of [ə] as a syllable unto itself (see

section 3.5.2).

Now if the distribution of [ŋ] is thus limited to syllable-final position, the question arises as to whether [ŋ] is to be interpreted as an underlying consonant of Danish or whether it is better interpreted as the underlying sequence /ng/. (That it is not interpretable as the underlying sequence /nk/ follows from the facts of consonant gradation--see section 3.5.8--namely that underlying /g/ but not /k/ will delete in this context.) There are arguments (Basbøll 1974c) for assuming underlying /ng/ for phonetic [ŋ] which, taken together, are convincing. These are as follows:

i) Alternations such as diftong/diftongere 'diphthong, diphthongize' [diftʰŋ, diftʰŋgʲɐ], clearly show the presence of underlying /g/, since it surfaces in the second member of the pair, and there is no derivational suffix -gere in Danish.

ii) The fact that forms like [ɛŋkæ/ɛŋkʰæ] form minimal pairs, whereas forms such as *[ɛŋæ] are ruled out, indicates the presence of two different underlying consonants, /g/ and /k/. In addition, klunge 'to ring' [kʰlɛŋə] and klinke 'to touch glasses with' [kʰlɛŋkʰə/kʰlɛŋkə] form a minimal pair. The explanation for this fact is as follows: in [kʰlɛŋkʰə/kʰlɛŋkə] the [ŋ] is on the surface adjacent to a velar consonant, and is assumed to be the reflex of /n/ assimilated in point of articu-

lation to this consonant (the following [ə] being, as noted, a syllable unto itself). Thus the underlying /ng/, surfacing as [ŋk] (or sometimes as [ŋk^h], form a syllable-final consonant cluster (motivation for the velar as underlying /g/ will not be discussed here, since the point is made regardless of which velar is assumed as underlying). On the other hand, in the case of [k^hlenə], there occurs only the syllable-final [ŋ], not followed by a velar consonant. This [ŋ], according to Basbøll, is most easily accounted for by deriving it from a "nasal plus γ or /g/," and having γ delete after a nasal. Thus /klenge/ $\rightarrow$ klenge $\rightarrow$ klenge $\rightarrow$ klen γ ə (by the rules of consonant gradation) $\rightarrow$ klenə ($\rightarrow$ [k^hlenə]).

The rules necessary for this process have not been specifically formulated by Basbøll, except for the assimilation rule discussed below. They are formulated in this section, with the exception of the rule of e-REDUCTION, which has been formulated in the preceding chapter, section 2.6.3. For the present, the following derivation will suffice to illustrate the processes involved here:

UNDERLYING FORM	/klenge/
(SYLLABIFICATION	klen\$ge)
e-REDUCTION	klen\$gə
SYLL. READJUSTMENT	klen\$ə
ASSIMILATION	klen\$ə
SPIRANTIZATION	klen γ \$ə
CONSONANT DELETION	klen\$ə
ASPIRATION	k ^h len\$ə
DEVOICING	k ^h len\$ə
SURFACE FORM	[k ^h lenə]

If the form has been initially syllabified klen\$ge,

after the application of the rule of e-REDUCTION a readjustment of the syllabification occurs, since [ə] is a syllable unto itself. It is necessary for the rule of e-REDUCTION to apply early in order to ensure that the consonant cluster will be syllable-final, so that the consonant gradation rules may apply. Basbøll compares the process involved here to that in the pair Helga/Helge (feminine and masculine names) [hɛlkə, hɛljə], "where /g/ is manifested as a stop before a full vowel but as a fricative before [ə]"--which as we have seen is explained more adequately on the basis of syllabification. He cites other examples to illustrate the generality of this process: manko/mango 'mango' [mɔŋko, mɔŋk^ho, mɔŋko, *mɔŋo] vs. manke/mange 'mane', 'many' [mɔŋk^hə/mɔŋkə, mɔŋə].

iii) There is what seems to be a general redundancy rule, namely that there occurs only one underlying short round front vowel before nasals (see section 2.4.2), manifested as [ö] (except after /R/, when it is manifested as [œ]) before nasal plus oral consonant, and as [œ] before nasals.

Before the single nasals [n] and [m] only [œ] occurs: søn 'son' [sœn], bønne 'bean' [pœnə], svømme 'swim' [svœmə] (except when preceded by /R/, when the vowel is realized as slightly lower, in conformity with a general tendency in Danish--see section 2.4.1.2). On the other hand, before [ŋ] the only reflex of this vowel is [ö], never [œ]. An explanation for this fact is available if

[ŋ] is interpreted as underlying nasal plus underlying oral consonant.

iv) Monosyllabic words ending in a consonant cluster whose first member is voiced have støð (for example, kant 'edge' [k^hæʔnt]; damp 'steam' [tæʔmp]--see section 2.7.3). All native Danish monosyllabic words in [ŋ] have støð. This fact is immediately accounted for under the assumption that [ŋ] is underlyingly such a cluster.

v) The final argument put forth by Basbøll in support of the analysis of [ŋ] as underlying [+nas] $\begin{bmatrix} +\text{cons} \\ -\text{nas} \end{bmatrix}$ when not followed by a velar consonant (in which case it is assumed to be /n/, assimilated in point of articulation to the velar), is that there are a number of combinatorial restrictions for [ŋ] which are the same as those which exist for clusters of this sort.

Taken in total, these arguments do constitute strong evidence in support of the analysis of [ŋ], as qualified above, as underlying [+nas] $\begin{bmatrix} +\text{cons} \\ -\text{nas} \end{bmatrix}$. The nasal in question has been taken to be /n/, as discussed above, and the following consonant to be /g/. That /k/ is not the underlying consonant is motivated by the rules of consonant gradation, since it is only the voiced obstruent which weakens and deletes. The rules required to derive final [ŋ] are here formulated as:

(3.6) REGRESSIVE ASSIMILATION

$$\begin{bmatrix} +nas \\ +cor \end{bmatrix} \rightarrow [-ant] / ___ \begin{bmatrix} -cont \\ -ant \end{bmatrix} \quad (n \rightarrow [n] / ___ \{g, k\})$$

(3.7) SPIRANTIZATION

$$\begin{bmatrix} -cont \\ -ant \\ +voi \end{bmatrix} \rightarrow [+cont] / ___ \$ \quad (g \rightarrow [\gamma] / ___ \$)$$

(This is a special case of a more general rule of spirantization formulated below as (3.20).)

(3.8) CONSONANT DELETION

$$\begin{bmatrix} +cons \\ -son \\ +cont \\ -ant \end{bmatrix} \rightarrow \emptyset / \begin{bmatrix} +nas \\ -ant \end{bmatrix} ___ \$ \quad (\gamma \rightarrow \emptyset / [n] ___ \$)$$

3.4.4.2 Summary

In the preceding section, the segments /m/ and /n/ have been motivated as underlying in Danish. The segment [ŋ] has been analyzed as a reflex of the underlying sequence /ng/. Support for this analysis has been adduced from the facts of its distribution, namely that it is limited to syllable-final position. This distribution, it is argued here, is accounted for on the basis of principles of syllabification discussed in section 3.4 below. A number of arguments put forth by Basbøll have been cited as additional support for this hypothesis.

Finally, the rules necessary to derive final [ŋ] have been formulated.

3.4.4.3 Basbøll's Regressive Assimilation Rule

The process of regressive assimilation which is involved in the derivation of [ŋ] occurs elsewhere as well (see consonant gradation, section 3.4.), but as Basbøll points out, it does not occur where the nasal in question is followed by a non-dental obstruent, as in vams 'doublet' [vaʔms] and gængs 'common' [kɛʔŋs]. (Forms like *[aʔŋb, ʌʔmg] are structurally excluded.) Basbøll formulates the rule of regressive assimilation as

$$(a) \quad [+nas] \rightarrow [\alpha art] / \text{---} \begin{bmatrix} -son \\ -cor \\ \alpha art \end{bmatrix}^3$$

This rule, he states, does not apply across phonologically marked boundaries, except optionally according to tempo and style of speech. The rule as formulated is too powerful, since it predicts that, for instance, tamgæs 'tame goose' [tʰámkəs] and sangbog 'song book' [sánpɒu] will be realized as *[tʰánkəs, s mpɒu] ([u] being Basbøll's symbol for what is here represented as [w]), which generally is not the case for forms such as these, although there are forms in which the generalization does not hold. In cases where the assimilation does not occur, there is a morpheme boundary between the two elements in the words and it is necessary to account for the general non-occurrence of assimilation across such a boundary, along with its occasional occurrence in this environment. Therefore Basbøll formulates a rule for optional assimilation across a boundary as

$$(a') \quad [+nas] \rightarrow [\alpha_{art}] / \text{---} \left[\begin{array}{c} -syll \\ \alpha_{art} \end{array} \right] \text{OPT}$$

The situation with respect to $[\alpha_{art}]$ is that it ranges across bilabial, labiodental, palatal and velar points of articulation (when the point of articulation is farther back than velar, assimilation does not occur). Thus, assuming $[+nas]$ to represent $/n/$, $/n/$ becomes through the process of assimilation $[m, \text{m̥}, \text{ɲ}, \text{n}]$ respectively. That $[+nas]$ will always turn out to be $/n/$ is stated but not explained. In fact, data show that $/m/$ does not assimilate to, for example, $/t/$, but occurs contrastively with $/n/$ before $/t/$ (in the same syllable, as the following pair shows: glemte 'forgot' $[k\text{ɛ}m\text{t}\text{ə}]$ vs. glente 'kite' $[k\text{ɛ}n\text{t}\text{ə}]$ (bearing in mind that the syllable boundary occurs between the $[t]$ and the final $[\text{ə}]$)).

If $/m/$ does not assimilate to a following consonant, and if $/m/$ and $/n/$ are the only two underlying nasals in the system, then it follows that the nasal involved in the rule is in fact $/n/$. Thus the rule of assimilation must be formulated to apply only to $/n/$, thereby excluding unwanted forms such as the abovementioned $*[t\text{a}n\text{k}\text{es}, \text{s}\text{a}m\text{p}\text{u}]$.

Basbøll points out that rules (a) and (a') seem to reflect the same process. He terms (a) a morpheme structure rule, and reformulates it as (a''), to indicate its relationship to (a'):

$$(a'') n \rightarrow [\alpha \text{art}] / \text{---}(\#) \left[\begin{array}{c} +\text{cons} \\ \alpha \text{art} \end{array} \right]^4$$

Condition: the rule is optional if # occurs; otherwise it is obligatory.

Some discussion of Basbøll's account is warranted.

With respect to rule (a) and its classification as a morpheme structure rule, it should be pointed out that classing it as such, and then collapsing it with (a'), is a matter of some confusion. Morpheme structure rules were posited to supplement the phonological rules, which describe alternations. Their function was to fill in the predictable, or redundant, features in representations. Basbøll's rule can be compared with Anderson's example (1974:283):

$$(1) \quad [+obstruent] \quad \left[\begin{array}{c} -\text{voice} \\ +\text{cor} \\ +\text{dist} \\ +\text{ant} \\ \vdots \\ \vdots \\ \vdots \end{array} \right] / \# \text{---} [+obstruent]$$

This rule expresses the fact that the first member of an initial obstruent cluster in English must be s. However, this does not account for any alternations in English, i.e. "There is no element, that is, which appears as s under the conditions of the structural description of (1), but as something else elsewhere. We have no motivation for positing (1) as a rule of English except an inductively arrived at generalization about the internal structure of each individual form in the language. There is, furthermore, no

basis for the implication carried by rule (1) that the s in spit, for example, is basically something else, and only becomes s by the operation of (1)." (Anderson 1974:283)

Basbøll's (a) is a very similar rule: there is no element which appears as n under the condition of the structural description of (a), but as something else elsewhere. If looked at as a morpheme structure rule, it does indeed fill in the predictable features in representations. But according to Anderson (1974:284) there are formal difficulties inherent in the notion of morpheme structure rules, and the notion of morpheme structure conditions is called into play, such that a specification is provided

...for any given language, of the range of possible segments and morphemes, including dependencies that may exist between feature values. Since these constraints all apply to the same units (the underlying representation) they are simultaneous, rather than sequential (as morpheme structure rules were presumed to be), and do not have the effect of changing any feature specifications. Rather, they simply state what is and what is not a permissible feature combination. (Anderson 1974:286)

It seems then that rule (a) is properly a phonological rule, and as such is better stated, as it is in (a'), as involving the behavior specifically of the only segment it does involve, namely /n/.

Next we must consider the rule (a'), which is Basbøll's optional rule for assimilating a nasal to a following consonant, in point of articulation. In

this formulation, the environment for the assimilation is specified as [-syll], which admits of any consonant at all. Now it has already been noted that in fact it is /n/ which is meant by [+nas]. Thus the rule predicts that /n/ will assimilate to any consonant. In fact, the formulation of (a), which specified [-cor], is no longer necessary, since the nasal in question is only /n/; and therefore the assimilation rule simply applies vacuously in those cases in which the consonant to which it assimilates is [+cor].

Basbøll explains that he uses [-syll] in the environment of (a') because the assimilation occurs also when the segment which follows the /n/ is the glide /y/ (as in the example hanjaguar 'male jaguar' [hæ̃nyakubʔ]); the environment [+cons] would exclude this possibility. The rule is specified as optional, but as it stands it seems to imply that its application is optional even when, as in fact it is formulated, there is no intervening boundary. This is of course not the case, since (a) has been formulated to cause the assimilation to occur where there is no intervening boundary.

Turning to (a''), we see Basbøll's collapsing of these two rules, adding the condition that only if # (i.e. morpheme boundary) occurs is the rule optional. This condition is a complication which seems a bit odd. In considering forms such as genbrug 're-use' [kɛn+pRo], in which a morpheme boundary intervenes between the nasal

and the stop (and here the two sounds are not tautosyllabic, since the cluster they form is not permissible either word-initially or word-finally), it is not the case that such forms can be optionally rendered by all speakers as *[kempRo]. And in forms such as en kending 'an acquaintance' [enk^hénIn], in which a word boundary intervenes, the assimilation cannot occur either. In a form such as enkelt 'simple' [énkelt], where the sounds in question may not be tautosyllabic either, nevertheless the rule applies. In any case, the notion of optionality here does not imply that sometimes the rule applies and sometimes it does not, but rather that there are some words for which it is optional and some for which it is not. This fact is not captured by the formulation of (a''). It may of course be the case that it is optional but that certain words must be marked as not undergoing it. Formulation of rules to account for the assimilation process under consideration will be discussed below.

3.4.4.4 Summary

In the preceding section Basbøll's regressive assimilation rule has been discussed. Its formulation, which includes a condition concerning its optionality only if a morpheme boundary occurs in the environment in which it applies, is questioned on the grounds that it

does not capture the fact that the optionality refers to forms--that it is optional for some but obligatory for others--and not to its application in general.

3.4.4.5 Progressive Assimilation

The following data indicate that a similar process to that of regressive assimilation--namely, progressive assimilation--may occur when the order of the consonants is the reverse, that is, when the nasal follows a consonant which assimilates to it, rather than preceding a consonant to which it assimilates:

- (1) København 'Copenhagen' [k^høpmhaʔwn/k^høpənhaʔwn]
- (2) Klampenborg (place name) [k^hlampmpɔɔ/k^hlampənɔɔ]
- (3) køkken(et) '(the) kitchen' [k^høkŋəð/k^høkənəð]
- (4) koppen 'the cup' [k^hʌpm/k^hʌpən]
- (5) trappen 'the stair' [t^hRapm/t^hRapən]
- (6) nakken 'the neck' [nakŋ/nakən]
- (7) drikken 'the drink' [tRIkŋ/tRIkən]

Examples (1) - (3) illustrate the assimilation within a morpheme, (1) and (2) involving the assimilation of [n] to a bilabial stop and (3) involving the assimilation of [n] to a velar stop. Examples (4) - (7) illustrate the assimilation across morpheme boundaries (-en [ən] being the definite article--see section 5.5.1), (4) and (5) involving a bilabial stop and (6) and (7) involving a velar stop. Inasmuch as the application of the rule depends upon the rate or style of speech, it must be formulated as

optional. The rule expressing this process can be formulated as

(3.9) PROGRESSIVE ASSIMILATION

$$\begin{bmatrix} +nas \\ +cor \end{bmatrix} \rightarrow [\alpha ant] / \begin{bmatrix} +cons \\ -son \\ -cont \\ \alpha ant \end{bmatrix} \text{--- (OPT) } (n \rightarrow [m, \eta] / \{p, k\} \text{---})$$

It should be pointed out here that in order for the stop in question to immediately precede [n] in these cases, another rule will have had to apply before the rule of assimilation, namely a rule of e-DELETION, formulated as

(3.10) e-DELETION

$$[e] \rightarrow \emptyset / \text{---} \begin{bmatrix} +nas \\ +cor \end{bmatrix} \text{ (OPT) } (e \rightarrow \emptyset / \text{---} n)$$

This of course is a quite natural rule, the process it captures being analogous to the process in English whereby forms such as button are rendered as [bʌtn]. The rule is probably of greater generality than expressed here, since Danish e does delete in other circumstances (being, as it is, unstressed), but this formulation will suffice here. (The rule of e-DELETION presupposes a rule of e-REDUCTION, formulated in section 2.6.3 above.)

The following examples indicate that the rule of PROGRESSIVE ASSIMILATION is more general than is implied in the formulation just given:

(8) sammen 'together' [samm/samən]

(9) drengen 'the boy' [tRæŋŋ/tRæŋən]

In fact, the process of progressive assimilation applies in cases in which the consonant preceding the [n] is a nasal as well as in those in which it is an oral stop. Example (9) indicates that the rule of REGRESSIVE ASSIMILATION applies before the rule of PROGRESSIVE ASSIMILATION, as the following derivation illustrates:

UNDERLYING FORM	/dRengren/
REGRESSIVE ASSIMILATION	dRengen
SPIRANTIZATION	dRɛŋɛn
OBSTRUENT-DELETION	dRɛŋɛn
e-REDUCTION	dRɛŋən
ə-DELETION	dRɛŋn
PROGRESSIVE ASSIMILATION	dRɛŋŋ
OBSTRUENT DEVOICING	tRɛŋŋ
ɛ-LOWERING	tRæŋŋ
SURFACE FORM	[tRæŋŋ]

(The rules of SPIRANTIZATION, CONSONANT DELETION, OBSTRUENT DEVOICING and ɛ-LOWERING are formulated in sections 3.5.7, 3.4.4.1, 3.5.7, and 2.4.1.2, respectively.)

To predict the phonetic forms exemplified by forms (8) and (9), rule (3.9) must be reformulated in a more general fashion, as

(3.11) PROGRESSIVE ASSIMILATION

$$\left[\begin{array}{l} +nas \\ +cor \end{array} \right] \rightarrow [\alpha ant] / \left[\begin{array}{l} +cons \\ -cont \\ \alpha ant \end{array} \right] \text{--- (OPT) } (n \rightarrow [m, \eta] / [p, m, k, \eta] \text{---})$$

Returning now to Basbøll's formulation of the regressive assimilation rule, (a'') is repeated here for convenience:

$$(a'') \quad n \rightarrow [\alpha \text{art}] / \text{---}(\#) \begin{bmatrix} +\text{cons} \\ \alpha \text{art} \end{bmatrix}$$

Condition: The rule is optional if # occurs, otherwise it is obligatory.

The similarity of this rule to rule (3.9) above is clear. Except for the condition placed on (a''), (a'') and (3.9) form a mirror-image rule. Basbøll has placed the condition on (a'') in order that the rule may be seen to reflect a similar process in two different types of cases, namely regressive assimilation within a morpheme and across morpheme boundaries. The condition enables this similarity to be expressed in one rule, but it does create an undesirable complication. It is clear that there is a process here which is operative in two cases; taking into account the rule of progressive assimilation just proposed, the process is seen to be operative in three cases: within morphemes, across morpheme boundaries, and in either direction. Two different types of facts must be expressed: (i) the fact of the assimilation process itself and (ii) the fact of its occurrence optionally across morpheme boundaries or obligatorily within morphemes. The most logical way to capture these facts formally is to express the optional cases by means of (1) an optional mirror-image rule which includes the possibility of the occurrence of a morpheme boundary, and (2) an obligatory rule of regressive assimilation within morphemes. These rules may be formulated as:

(3.12) MIRROR-IMAGE ASSIMILATION

$$\begin{bmatrix} +nas \\ +cor \end{bmatrix} \rightarrow [\alpha ant] \text{ */ } \begin{bmatrix} +cons \\ -cont \\ \alpha ant \end{bmatrix} (OPT) (n \rightarrow [m, \eta] / \left\{ \begin{array}{l} \{p, m, \eta, g, k\} \\ \text{---} \{p, m, \eta, g, k\} \end{array} \right\})$$

and

(3.13) REGRESSIVE ASSIMILATION

$$\begin{bmatrix} +nas \\ +cor \end{bmatrix} \rightarrow [\alpha ant] / \text{---} \begin{bmatrix} +cons \\ \alpha ant \end{bmatrix} (n \rightarrow [m, \eta] / \text{---} \{p, m, k, g, \eta\})$$

A difficulty is raised by Basbøll in the course of his analysis, as follows. Consider the following two forms:

(10) vang 'field' [vaʔŋ]

(11) vandkande 'ewer' [vaŋkæne]

Number (10) is assumed to be underlyingly /vang/, which satisfies the structural description of the rule of regressive assimilation, as Basbøll points out, only before the velar obstruent is deleted. On the other hand, number (11), which is assumed to be underlyingly /vand+kane/ (under the analysis presented here), satisfies the structural description of the assimilation rule only after the dental obstruent is deleted. Basbøll points out that if the deletion of the /d/ in /vand/ and the /g/ in /vang/ is the same process, then there is a "reverse order paradox".

This apparent paradox can be explained, however, if the two deletions are not viewed as part of the same process. It is a fact that syllable-final /d/ deletes in all cases where it is preceded by /n/ or /l/, as illustrated

by the following pairs:

(12) mand/mandig 'man', 'manly' [mæʔn, mænti]

(13) held/heldig 'luck', 'lucky' [hɛʔl, hɛlti]

(The second form in each pair contains the surface manifestation of the underlying /d/, so that it is indeed seen to be there.) The explanation for this deletion lies in the fact that the two consonants in the syllable-final cluster are homorganic. The rule expressing this generalization can be formulated as

(3.14) CONSONANT DELETION₂

$$\left[\begin{array}{l} -\text{cont} \\ +\text{cor} \\ +\text{voi} \end{array} \right] \rightarrow \emptyset / \left[\begin{array}{l} +\text{son} \\ +\text{cor} \\ +\text{voi} \end{array} \right] __\$. \quad (/d/ \rightarrow \emptyset / \left\{ \begin{array}{l} n \\ 1 \end{array} \right\} __\$)$$

(This is in line with a general tendency for /d/ to delete when adjacent to another coronal obstruent-- see rule (3.16) below.)

This rule applies before the rule of REGRESSIVE ASSIMILATION, so that the /n/ and the /k/ of /vand+kane/ are brought into juxtaposition, thus satisfying the structural description of the REGRESSIVE ASSIMILATION rule. In the case of /vang/, on the other hand, the nasal and the stop are already adjacent to each other, and the rule of REGRESSIVE ASSIMILATION may apply.

The only other attempt I know of to formulate the rules involved in the derivation of [ŋ] is that of Austin (1971:55), which is discussed in section 3.4.4.6 below.

3.4.4.6 Austin's Analysis of [ŋ]

Under this brief analysis, on the basis of its distribution, [ŋ] is also assumed to reflect underlying /ng/. Austin's rules are as follows:

$$(1.8) \begin{bmatrix} -\text{voc} \\ +\text{cons} \\ +\text{son} \\ +\text{ant} \\ +\text{cor} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{ant} \\ -\text{cor} \end{bmatrix} / \text{---} \begin{bmatrix} -\text{cont} \\ -\text{ant} \\ -\text{cor} \end{bmatrix} \quad (n \rightarrow \eta / \text{---}g, k)$$

$$(1.9) \begin{bmatrix} -\text{cont} \\ -\text{ant} \\ -\text{cor} \\ +\text{gl con} \end{bmatrix} \rightarrow \emptyset / \begin{bmatrix} -\text{voc} \\ +\text{cons} \\ +\text{son} \end{bmatrix} \text{---} \quad (g \rightarrow \emptyset / N \text{---})$$

Rule (1.8) is equivalent to rule (3.6) in this analysis, though it is somewhat incorrectly formulated, including all coronal sonorants in the feature specification to the left of the arrow. (Rule (1.9) is not quite correct either, since it predicts the deletion of /g/ after a nasal, when in fact it is only syllable-final /g/ which thus deletes, as the form diftongere 'diphthongize' [tɪftʰŋkɛʔ^hɒ] illustrates.

The most careful examination of the subject to date has been that of Basbøll, whose account has been discussed at length here, and in light of which the present one has been undertaken.

3.4.4.7 Summary

In the preceding sections data were presented which indicate that a process of progressive assimilation--i.e.,

the assimilation of a consonant to a following nasal in point of articulation--occurs in Danish, as well as one of regressive assimilation. Further, this process applies not only in cases in which the consonant preceding the nasal is a nasal, but also in those in which it is a stop. It is necessary to capture the generalizations that (a) the process occurs within morphemes, across morpheme boundaries, and in either direction; and (b) that it occurs optionally across morpheme boundaries and obligatorily within morphemes. These generalizations have been captured here by positing two rules, one an optional mirror-image rule of assimilation to apply within or across morpheme boundaries, and the other an obligatory rule of regressive assimilation.

A rule of CONSONANT DELETION, which accords with a general tendency of Danish to delete /d/ when adjacent to another coronal obstruent has been proposed to account for an apparent "reverse order paradox" raised by Basbøll. Two forms which he cites as apparently requiring reverse rule orderings have been analyzed here as not undergoing the same process of consonant deletion, but rather that one undergoes consonant deletion after the application of REGRESSIVE ASSIMILATION, as expected, and the other undergoes a preceding, independently motivated rule of consonant (/d/) deletion.

The rules required to account for the analyses presented here have been formulated, and the necessary order-

ing relations have been stated.

Finally, Austin's account has been briefly examined and found generally to accord with the other analyses presented; however, discussion of the major way in which Austin's account differs from others, his use of the feature [glottal constriction], has been deferred to the section on consonant gradation.

3.4.5 The Glides

Listed in Table 3.1 are the phones [y] and [w]. Table 3.2, the proposed set of underlying consonants of Danish, includes them as well. In this section their inclusion in this set will be motivated, and, in the case of /w/, the rules which relate its surface manifestations to this proposed underlying form will be formulated.⁵

3.4.5.1 /y/

That /y/ is distinctive in Danish is evident from minimal pairs such as the following: jakke 'jacket' [yakə] vs. takke 'thank' [t^hakə] and ja 'yes' [jæ] vs. da 'when' [tæ]. The segment [y] does not alternate with any other sound; hence it is assumed here to reflect underlying /y/.

3.4.5.2 /w/

The status of the segment [w] in Danish is not

as clear as that of [y]. As the pair liv/livet 'life', 'the life' [liw?~li:vəð] illustrates, [w] alternates with [v]. The facts of distribution are as follows: [v] occurs syllable-initially before sonorants (except nasals), as in ven 'friend' [ven]. In the context of a preceding voiceless consonant [v] occurs, as in svar 'answer' [svɔ:ʔ] and tvivle 'doubt' [t^hvivlə]. Danish voiceless [v] is distinct from [f] in that it is [-strident], Danish /v/ being specified as non-strident.⁶ [v] does not occur syllable-finally. In syllable-final position and before nasals [w] occurs, as in blev 'become' (preterite) [plew?]; these are the only contexts in which [w] occurs. Thus [v], [v] and [w] are in complementary distribution. The environment in which [v] occurs may be more succinctly expressed as before sonorants, except nasals, which is precisely where [w] does not occur. It is argued here that the simplest account is the one which assumes underlying /w/.⁷

Evidence for underlying /w/ may be adduced from the behavior of a certain class of Danish verbs. It is noted in section 4.1.3 that, according to Diderichsen (1972:51) with respect to one of the classes of weak verbs (weak verbs being those that take a dental preterite), namely that class which takes the preterite and past participle endings -te, -t, respectively, that this class is virtually restricted to stems

ending in (a) short vowel plus [l, m, n, ŋ] and (b) long vowel plus single consonant except v. Weak verbs of all other types, including those with stems ending in a vowel, diphthong, or a vowel plus v, take a different preterite and past participle ending, namely -ede and -et, respectively. The reason Diderichsen refers to the consonant as v (besides its being spelled v) is that once the ending is attached and it is now occurring before a sonorant, it is pronounced as the voiced labiodental fricative [v] (e.g., lavet 'made' [lɛ:vəð], skrevet 'written' [skRe:vəð]).

In other words, with respect to these verbs, vowel plus v behaves like a diphthong, or vowel plus w. The reason for its taking the -ede ending, as a diphthong does, cannot be simply that in word-final position it is articulated as vowel plus glide; because once the ending is affixed it is no longer articulated this way--as a diphthong continues to be after the ending is affixed (e.g., leget 'played' [layəð])--but is realized as the [v] alternant. Therefore, the motivation for its taking the -ede ending is that underlyingly it resembles a diphthong in that it is a vowel followed by a glide.

This evidence, then, supports the assumption of /w/ as an underlying segment of Danish.⁸ Examples such as those cited by Basbøll (stive/stift, grove/groft) indicate that /w/ has a fourth alternant, namely [f],

which differs from [v] in that it is [+stri], while [v] is [-stri]. (Another way of describing this distinction is in terms of tenseness: [f] is [+tns] and [v] is [-tns].) This alternant occurs in the environment of a following /t/ and a following /s/ as well, as the example lives 'life's' [lifs] illustrates. Under this analysis the rules relating underlying /w/ to the surface realizations [w], [v], [v̥] and [f] are as follows:

(3.15) SPIRANTIZATION₁

$$\begin{bmatrix} -\text{syll} \\ -\text{cons} \\ +\text{back} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cons} \\ +\text{cont} \\ +\text{ant} \\ -\text{cor} \\ \text{a} \text{voi} \end{bmatrix} / \text{---} \begin{bmatrix} \text{a} \text{voi} \\ -\text{nas} \end{bmatrix} \quad (w \rightarrow [f, v] / \text{---} \begin{bmatrix} \text{a} \text{voi} \\ -\text{nas} \end{bmatrix})$$

The other necessary rule in this context has already been formulated as (3.5), the quite general rule of DEVOICING.

The fact that the important generalizations about /w/ can be captured in the fairly simple rule (3.15), SPIRANTIZATION, is a positive factor here, and the fact that the other necessary rule of DEVOICING is required elsewhere in the grammar strengthens the analysis.

3.4.5.3 Summary

In section 3.4.5 /y/ has been motivated as an underlying segment of Danish, which, since it does not alternate with any other sound, requires no further dis-

cussion.

The segment [w] has been related to the phones [v], [v̥] and [f]; /w/ has been posited as underlying. Evidence for this analysis is adduced from the behavior of the segment in question in a particular class of weak verbs, in which it functions with respect to a set of suffixes in the manner of a glide. That is, the suffixes occurring with stems in final vowel plus v are those which occur with stems in a final diphthong.

Though at first glance it appears that the number of environments in which [v] occurs would lead to the positing of /v/ as underlying, the formulation of the necessary rule of SPIRANTIZATION shows that the major generalizations are capable of being captured in one rather simple rule. The other rule which is required, DEVOICING, is a low-level rule which is indicative of the general tendency of Danish to devoice voiced consonants in the environment of a voiceless aspirated consonant.

Of the proposed underlying consonants listed in Table 3.2, the voiceless fricatives, the liquids, the nasals and the glides have been analyzed in the preceding sections. In section 3.5 an analysis of the stop system of Danish will be undertaken; this constitutes one of the major issues of Danish phonology, about which a good deal of research has been done, the most recent of which will be reviewed in the following sections.

3.5 The Stop System

In Table 3.1 are listed two sets of phones characterized as voiceless stops, one set aspirated and the other unaspirated ($[p^h t^h k^h, p t k]$). Danish has no phonetically voiced stops. Table 3.2 lists as the hypothesized underlying stop series one set of voiceless unaspirated stops and one set of voiced stops ($/p t k b d g/$). In section 3.5.1 below the facts of distribution of the segments involved in the analysis of the stop system are presented. Section 3.5.2 motivates the environments for the occurrence and non-occurrence of the relevant phenomena as syllable-initial and syllable-final. In section 3.5.3 the various categories of solutions to the problem are defined, and Rischel's, Austin's and Basbøll's analyses are reviewed in sections 3.5.4, 3.5.5 and 3.5.6, respectively. Since the proposed phonological solutions put forth in these analyses appear not to have any advantage over the morphological one of marking the stems under consideration, in section 3.5.7 it is argued that this analysis provides the simplest account, and the necessary rules are formulated.

During the course of the discussion the theoretical issue of the notion of the syllable is raised, and it is argued that in order to capture the significant generalizations about the behavior of stops in Danish, it is necessary to include the entity [syllable] in the grammar.

3.5.1 Facts of Distribution

Table 3.3 lists those phonetically occurring stops and fricatives of Danish which have not until this point been analyzed as reflexes of another underlying segment (excluding [h], which though posited as underlying (see section 3.4.1.3), participates in no phonological processes of Danish). That is, [ʃ], which has been analyzed as underlying /sy/ (see section 3.4.1.2), and [v], which has been analyzed as underlying /w/ (see section 3.4.5.2), are not included.

	p ^h	t ^h	k ^h	p	t	k	ð	ɣ	f	s	R
syll	-	-	-	-	-	-	-	-	-	-	-
cons	+	+	+	+	+	+	+	+	+	+	+
son	-	-	-	-	-	-	-	-	-	-	-
cont	-	-	-	-	-	-	+	+	+	+	+
cor	-	+	-	-	+	-	+	-	-	+	-
ant	+	+	-	+	+	-	+	-	+	+	-
stri	-	-	-	-	-	-	-	-	+	+	-
voi	-	-	-	-	-	-	+	+	-	-	+
asp	+	+	+	-	-	-	-	-	-	-	-

Table 3.3: Feature specification of stops and fricatives

The only distinction between the two stop series is that of aspiration. This distinction is manifested only in syllable-initial position: elsewhere aspiration does not occur contrastively but in free variation. Only the stop series [p t k] and the voiced fricatives [ð ɣ] occur in other contexts, as illustrated by the forms in Table 3.4. These forms represent examples of the process of lenition undergone by some of the Danish stops in cer-

tain contexts, a process generally referred to in the literature as "consonant gradation."

A. Initial position

<u>pakke</u> 'parcel'	[p ^h akə]	<u>bakke</u> 'hill'	[pakə]
<u>takke</u> 'thank'	[t ^h akə]	<u>dække</u> 'cover'	[tskə]
<u>katte</u> 'cats'	[k ^h ætə]	<u>gætte</u> 'guess'(vb)	[kætə]

B. Medial position

<u>hoppe</u> 'hop'	[hɒpə]		
<u>gætte</u> 'guess'	[kætə]	<u>gade</u> 'street'	[kɛ:ðə]
<u>dække</u> 'cover'	[tskə]	<u>koge</u> 'boil'(vb)	[k ^h ɔ:ɣə]

C. Final position

<u>hop</u> 'hop'(imper.)	[hɒp]		
<u>kat</u> 'cat'	[k ^h æt]	<u>god</u> 'good'	[ko:ʔð]
<u>tak</u> 'thanks'	[t ^h ak]	<u>tog</u> 'train'(n.)	[t ^h ɔ:ʔɣ]

Table 3.4: The distribution of [p t k ð ɣ]

A gap in the pattern is observed in the system: there is no bilabial stop occurring where considerations of symmetry would lead one to expect it, and, correspondingly, no bilabial fricative. As noted, this sound does not occur systematically in Danish; the following discussion will thus be restricted to dentals and velars.

Accounts of the data involved in consonant gradation are based upon the observation that the above-mentioned

voiced fricatives alternate with their voiceless
homorganic stops in alternating forms of morphemes
belonging to various syntactic categories, as,
for example,

<u>gode/godt</u>	'good'	[ko:ð̥əkʌt] (adjective, plural and neuter singular)
<u>bage/bagt</u>	'bake, baked'	[pɛ:ɣ̥ənpakt] (verb stem plus suffix)
<u>møde/mødt</u>	'meet, met'	[mø:ð̥ənmöt] (verb stem plus suffix)
<u>jage/jagt</u>	'hunt' (vb/n)	[ɣɛ:ɣ̥ənyakt] (verb and derived noun)
<u>klog/kløgt</u>	'clever/ness'	[k ^h lɔ:ʔɣ̥~k ^h lökʈ] (adj. and derived noun)

(A medial or final [p] does not alter in alternating forms of a morpheme, as the following examples indicate:
tabe/tabt 'lose/lost' [t^hɛ:pə t^hapt]; råbe/råbt 'shout/ed' [Rɔ:pə~Rɔpt].)

The issue is complicated by the existence of forms which do not exhibit the expected alternations, and these constitute a central problem with respect to consonant gradation. The problem can be elucidated by means of the following pairs of alternating forms (concentrating for the moment on forms involving velars):

- (1) klog/klogt 'clever' [k^hlɔ:ʔɣ̥~k^hlɔ:ʔɣt]
- (2) koge/kogt 'boil/ed' [k^hɔ:ɣ̥ə~k^hɔkt]
- (3) række/rakt 'hand/ed' [Rækə~Rakt]

Pair (1) consists of an uninflected and an inflected form of an adjective, (t] being the neuter

suffix. The remaining pairs consist of the infinitive and the past participle of verbs, the [ə] constituting the infinitive suffix and the [t] the participial suffix.

It will be noticed that in these pairs, as well as in those cited above as illustrative of the alternations of stops and fricatives in alternating forms of morphemes (such as verb and derived noun, and adjective and derived noun), there is associated with the alternation in obstruents an alternation in vowel quantity, and in some an alternation in vowel quality as well. The task, then, is to account for the alternations in obstruents and the concomitant alternations in vowels. It must be noted here that there occur in Danish both strong and weak verbs, and some of the alternations in vowel quality are to be ascribed to ablaut, as in, for example, pair (3).

With respect to the pairs cited above, we observe the following situation: there is a stem-final [ɣ] which does not alter when followed by [t], there is a stem-final [χ] which alternates with [k] when followed by [t], and there is a stem-final [k] which does not alter when followed by [t]. Analogous alternations occur among pairs in stem-final dentals (with the complication of an additional rule of consonant deletion, to be discussed below), as illustrated by the following pairs of alternating forms:

- (4) klæde/klædt 'dress/ed' [k^hlɛ:ð̥k^hlɛ:ʔt]
 (5) møde/mødt 'meet/met' [mö:ð̥möt]
 (6) sætte/sat 'place/d' [sɛtəʷsæt]

The first form in each of these pairs is the infinitive of the verb, and the second form is the past participle. As before, the [ə] constitutes the infinitive suffix and the [t] the participial suffix. It is evident from pairs (4) and (5) that an additional rule is necessary to account (a) for the fact that in (4) the stem-final fricative does not surface when followed by the suffixed [t], and (b) for the fact that in (5) there is a single stop [t], whereas in pair (2), in the example given of the alternation in velars (koge/kogt [k^hɔ:ɣ̥k^hɔkt]), the stem-final stop ([k]) does occur before the [t]. Such a rule (assuming the prior application of REGRESSIVE VOICING ASSIMILATION--rule (3.19) below--to those forms which are not exempt from it) may be formulated as

(3.16) CONSONANT DELETION₃

$$\begin{bmatrix} +\text{cons} \\ -\text{son} \\ +\text{cor} \\ -\text{stri} \end{bmatrix} \rightarrow \emptyset / __ \begin{bmatrix} -\text{cont} \\ +\text{cor} \end{bmatrix} \quad (\{\text{ð}, \text{d}, \text{t}\} \rightarrow \emptyset / __ [\text{d}, \text{t}])$$

With respect to the vowels in these examples, it will be observed that, except for those pairs in stem-final fricatives, there is an alternation in quantity (e.g., [mö:ð̥möt]), and an alternation in quality (e.g.,

[sɛtə~sæt]) or both (e.g., [ko:ð̥əkʌt]). The alternation in vowel quantity has been assumed in the literature (Rischel 1970b:477) to reflect an underlying long vowel, on grounds of ease of the formulation of rules, and the important question has been considered to be that of the relation between vowel shortening and the process of consonant gradation.

Rischel (1970b:473) assumes that vowel shortening occurs before underlying stop plus stop, but not before underlying fricative plus stop, since it is the pairs in stem-final fricatives which show no alternation in vowel quantity (e.g., [k^hlɔ:ʔγ~k^hlɔ:ʔt; k^hlɛ:ð̥ək^hlɛ:ʔt]). It is also the case that in these pairs there is no alternation in vowel quality. Thus alternations in vowel quality occur only before stop plus stop but not always before stop plus stop, as seen in the pair [mø:ð̥ə~möt] (always under the assumption that the behavior of this pair is analogous to that of pair (2)). There are two possible reasons for the alternation in vowel quality: a phonological one, in which certain vowels undergo predictable changes in quality in certain phonetic contexts, and a syntactic one, namely that Danish has a set of strong verbs, as previously noted, of which pairs (3) and (6) are examples. Thus the vowel alternations in these pairs are explained as ablaut and as such need not be treated in conjunc-

tion with the process of consonant gradation. The alternation in pair (2) is representative of a large number of such pairs, and it occurs not only in verbs, but elsewhere as well, as for example in the adjectival pair god/godt 'good' (common and neuter genders) [ko:ʔðwkat]. These are examples of the alternations in vowel quality that accompany alternations in vowel quantity; it is only this last which is of direct interest here. Qualitative vowel changes occurring in conjunction with quantitative vowel changes will, along with ablaut, be assumed in the following discussion.

Certain long vowels are seen to shorten with the addition of a suffix [t] to the form in which they occur. If they fail to shorten in certain cases, and if those cases are just the ones which involve the non-alternation of a stem-final fricative, it may be assumed that the two phenomena are related. Furthermore, where vowel shortening fails to occur when expected (i.e. with the addition of a suffix [t]), a stem-final fricative may be assumed, though phonetic context may have triggered its deletion, as in pair (4) above.

In this section the data involved in the process of consonant gradation have been presented. The relevant distributional facts have been stated and illustrated: namely, that the aspirated series [p^h t^h k^h] occurs only in syllable-initial position, and that the

unaspirated series [p t k] and the voiced set [ɖ ɣ] never occur in syllable-initial position. The voiced fricatives are seen to alternate with their voiceless homorganic stops, but a straightforward analysis of one set as being derived from the other is complicated by the occurrence of forms in which the expected alternations do not occur. It is in precisely this class of forms that underlyingly long vowels fail to shorten, when vowel shortening is expected. These two phenomena, then, are interpreted as being related, and the explanation for one would be expected to account for the other as well.

Before embarking on a review of the various analyses which have been proposed to account for the data presented here, it is necessary to motivate the definition of the positions in which the phenomena of consonant gradation occur. It has been stated that the distinction between the sets of aspirated and non-aspirated stops is clear only in syllable-initial position; in other words, it is in this environment that lenition does not occur. It will be argued that it is in syllable-final position that it does occur. Traditional notions of "strong" and "weak" position, which are implicitly based on the notion of syllable boundary, must be discussed, and if the notion of the syllable is to be resorted to it must be clearly motivated. This topic will

be treated in the following section.

3.5.2 The Syllable: Its Relation to Danish Phonology

Traditionally, research in the area of consonant gradation in Danish has made use of the notion of strong and weak position: that is, that "two positions are discernible in the Danish word -- strong and weak. In monosyllabic words the strong position for a consonant is at the beginning of the syllable and the weak position at its end." (Jakobson, Fant and Halle 1952:5.) This definition has been expanded by Rischel (1970b:462) to include polysyllabic words:

A consonant is in strong position if it fulfills the following two requirements: (1) it is preceded by juncture (morpheme border) or by a segment that is (phonetically) voiced; (2) it is followed by a full vowel (i.e. not schwa) with or without an intervening voiced consonant but without an intervening juncture.....Otherwise a consonant is in weak position.

Examples of consonants in strong position given by Rischel are [k] in [kli:ðə] 'glide', [p, k] in [lompæ:ko] 'lumbago'. Rischel (1970b:462) states that these positions are to be taken as "essentially synonymous with (syllable-) initial and (syllable-) final position". Rischel's strong position can be expressed formally as

$$\left\{ \begin{array}{c} + \\ [+voi] \end{array} \right\} \text{ --- } \left(\left[\begin{array}{c} C \\ [+voi] \end{array} \right] \right) V \text{ (where } V \neq [ə] \text{)}.$$

$$\left\{ \begin{array}{c} + \\ [+voi] \end{array} \right\} \text{ --- } \left(\left[\begin{array}{c} C \\ [+voi] \end{array} \right] \right) V$$

Thus formulated, the classes of conditioning factors for strong position have no features in common, and thus appear somewhat ad hoc. Furthermore, examination of intervocalic consonant clusters reveals that there is a problem with the environments as stated. For example, in the word adoptering 'adoption' [ætʌpt^héʔRIŋ], the intuition concerning the syllable structure of this word is that there is a syllable-boundary between the [p] and the [t]. The fact that the [t] is aspirated is consistent with this intuition. Rischel's formulation places this [t] in weak position, since it is preceded neither by a morpheme boundary nor by an underlyingly voiced segment. If strong position is to be taken as "essentially synonymous with (syllable-) initial position", then this [t] cannot be syllable-initial, and the consonant cluster [pt] must be considered syllable-initial. However, this account violates the principle proposed by various researchers⁹ that syllable-initial consonant clusters be consistent with possible word-initial consonant clusters. Adoptering is preferably syllabified as [ætʌp\$t^héʔ\$RIŋ], but this is not the syllabification entailed by the above formulation of strong position.

Another account is apparently called for to capture a generalization of Danish. Such an account would hold that the position in question is indeed syllable-initial position, and for this another approach to syllabifica-

tion is required. Such an approach has been proposed in various treatments of the syllable (e.g., Basbøll 1972; Hoard 1971; Hooper 1972). Before continuing the analysis of the adoptering example, it is necessary to discuss the theoretical basis for it and for the analysis of consonant gradation presented below. The theoretical position adopted here is based on Hooper's discussion (1972:533) in which the following statement is made:

We have seen that in most cases, if we are clever enough, we can avoid mention of the syllable or syllable-boundary. But the resulting analyses are more complex, and obscure rather than illuminate the phonological facts. In each example presented above, the preferred analysis is dependent upon the syllable as a phonological unit. These preferred analyses cannot be judged as more natural (simple, plausible) unless the metatheory provides a definition of the syllable. That is, unless the rules for syllable-boundary insertion in each language are largely universal, no reasonable evaluation metric would give higher value to the rules that refer to syllable-boundaries. Therefore, the metatheory must be revised to include a definition of the syllable.

Once the notion of the universal definition of the syllable is accepted (its specific formulation is not at issue here), we note that there must be certain language-specific adjustment rules, of greater or lesser universality, which re-assign the syllable-boundaries, if necessary, after the application of certain phonological rules has changed the make-up of a form.¹⁰ For example, under the analysis presented in section 2.6.3, the rule of e-REDUCTION in Danish derives [ə] from /e/;

[ə] is seen to function alone as a syllable (that is, the behavior of a number of other segments when in the environment of a following [ə] is consistent with their behavior when incontestably syllable-final (i.e., word-final). If the syllable is defined "in terms of a rule that inserts syllable-boundaries at certain places in the sequences of segments" (Hooper 1972:534), and if syllable adjustment rules are posited, then the heuristic approach outlined below follows this line of reasoning, and the generalizations about consonant gradation in Danish are seen to be accurately captured.

The approach referred to is that in which consonants are counted to the left of each vowel which constitutes a syllable peak, making use of the principle that consonants are "attracted" to following full or stressed vowels. Thus syllable-initial clusters consist of all those consonants to the left of the vowel such that they do not violate the principle that they be possible word-initial clusters. Having paired off the syllable-initial clusters, we then look to the right of vowels which are syllable peaks and determine whether the consonant clusters, if any, that close its syllable are consistent with the principle that syllable-final clusters be possible word-final clusters. Such an approach in Danish does indeed seem to yield the desired results, as illustrated by the adoptering ex-

ample.

The discussion so far has centered on syllable-initial position. It is also necessary to motivate syllable-final position as that position where consonant gradation does occur. Using the form kog 'boil' (imperative) [k^hɔ:ʔɣ] as an example, where the underlying form of the final consonant is assumed to be a stop, the rule of spirantization is seen to apply word-finally (hence of course syllable-finally). In the form koge 'boil' (infinitive) [k^hɔ:ɣə], according to the approach which counts consonants to the left of vowels, the expected syllable boundary assignment would be [k^hɔ:\$ɣə]. However, the special nature of schwa in Danish must be noted, as mentioned. It is accepted by researchers in Danish phonology that, as Basbøll (1974a:91) puts it, "there is overwhelming evidence that a single intervocalic consonant before a schwa belongs to the preceding syllable" (e.g., bade, koge [pæ:ðə, k^hɔ:ɣə]). Thus the correct syllabification of koge is [k^hɔ:ɣ\$ə]. Inasmuch as the contexts where consonant gradation occurs are just these (word finally and before schwa), the position can be expressed as syllable-final. Thus if the notion of the syllable boundary is incorporated into the grammar a generalization about Danish phonology can be captured which is otherwise missed. Since this is the case, the facts of Danish lend support to a grammar which incorporates the notion of the syllable.

In this section the traditional view of the environments in which consonant gradation phenomena do and do not occur has been examined. Implicit in this view is the notion of the syllable boundary; it has been argued here that, under a particular approach to syllabification, incorporating the notion of the syllable into the grammar allows generalizations about the environment of consonant gradation phenomena to be captured, generalizations which are otherwise missed.

In the next section the different categories of solutions to the problem of consonant gradation are presented. Rischel's analysis--and Basbøll's discussion of it--are reviewed. In the succeeding section, Austin's analysis and Basbøll's analysis are reviewed and discussed.

3.5.3 Categories of Solutions to the Problem of Consonant Gradation

There are three categories of solutions that have been posited to account for the varying behavior of the stem-final consonants under consideration:

(A) differences in the underlying stem-final consonants

(B) differences in the underlying form of the suffixed consonants

(C) differences in the boundaries between stems and

suffixes

3.5.4 Rischel's Analysis

Rischel (1970b:462-463) assumes a classificatory distinction [+voice] vs. [-voice] in the underlying form of the segments under consideration. His account is based on the pairs of alternating forms (1), (2) and (3) cited above. Within this account there are two possible analyses:

(1) these pairs contain three different underlying stem-final consonants

(2) these pairs contain two different underlying stem-final consonants, /G/ and /K/, unspecified as to whether they are stops or fricatives.

Within each of these two proposals are two possible descriptions:

(1a) the difference between the underlying final consonants in [k^hɔ:ɣə] and [Rækə] is between a short and a long stop

(1b) the difference is between a voiced and a voiceless stop

(2a) /G/ is an underlying voiced fricative

(2b) /G/ is an underlying voiced stop

Basbøll (1974c:48) has summarized these four possibilities as follows:

(1a) klog ends in /ɣ/, kog in /k/ and ræk in /kk/

(1b) klog ends in /ɣ/, kog in /g/ and ræk in /k/

(2a) klog and kog both end in /ɣ/ and ræk in /k/

(2b) klog and kog both end in /g/ and ræk in /k/

Solutions (1a) and (1b) constitute category (A), in which the difference lies in the underlying stem-final consonants. Solutions (2a) and (2b) constitute category (B), in which the difference lies in the underlying form of the suffixed consonants.

Category (A)

Solution (1a): This analysis requires a rule of spirantization to derive [ɣ] from /k/ when not followed by [t], as in [k^hɔ:ɣæwk^hɔkt]. The underlying fricative /ɣ/ exhibits no alternation before [t], as in [k^hɔ:ʔɣt], and the underlying /kk/ reduces to [k], as in [Rakt]. Two problems are inherent in this analysis: first, with respect to the underlying fricative /ɣ/, which according to this analysis is the stem-final consonant in [k^hɔ:ʔɣt], the difficulty arises of accounting for the alternation klogt/kløgt [k^hɔ:ʔɣtæk^hlœkt] in the pair cited earlier, which consists of the adjective 'clever' (in the neuter form) and the derived noun 'cleverness'. Under solution (1a), the two varying behaviors of this underlying fricative in the identical context (i.e. before [t]) remain unaccounted for. It must be pointed out, however, that inasmuch as the two forms in question represent different classes of words, namely adjective and

noun, there is no a priori reason why they should necessarily behave in the same fashion.

The second difficulty arises with respect to the underlying long stop /kk/. Rischel (1970b:472) points out that this analysis entails an underlying syllable type /V:C:/,¹¹ which he states is unknown in Danish, and on this point he rejects (1a).

Only those forms ending in stem-final velars have been considered so far. For the sake of completeness there now follows the analogous case of forms in stem-final dentals. The possible accounts of the data concerning stem-final dentals may be summarized thus:

- (1a) klæd ends in /ð/, mød in /t/ and sætt in /tt/
- (1b) klæd ends in /ð/, mød in /d/ and sætt in /t/
- (2a) klæd and mød both end in /ð/ and sætt in /t/
- (2b) klæd and mød both end in /d/ and sætt in /t/

The same problems arise with respect to these data which were noted in the klogt/kløgt example. The following pairs illustrate this fact:

- (7) brede/bredt 'broaden/ed' [pRɛ:ðəw pRɛ:ʔt]
- (8) bred/bredt 'wide' (common and neuter genders)
[pRɛ:ʔðw pRɛt]

Under analysis (1a) the problem exists of the underlying syllable type /V:C:/, and in (1a) (and (1b)) we are again faced with the failure to account for the differing behavior of the stem-final fricative in

identical contexts. Here again the two sets of pairs are clearly related, yet, in the case of (7), taking the rule of dental deletion into account, the underlying /ð/ undergoes no alternation (as the non-alternation of the vowel indicates). It is simply lost when [t] is suffixed. And in the case of (8), as the shortening of the vowel indicates, underlying /ð/ → [t] and is subsequently lost, in accordance with the dental deletion rule.

Returning to Rischel's analysis, the possibility of assuming an underlying distinction of tense vs. lax, or voiced vs. voiceless, is raised on the grounds that this distinction "must be used anyway to take care of [p, t, k, f] vs. [b, d, g, v] in strong position." (Rischel 1970b:472.)

The first distinction would avoid the problem of the unmotivated syllable type /V:C:/, but this possibility is not explored. The second distinction would result in solution (1b), the first of the three solutions based on the voiced/voiceless distinction.

These three solutions, (1b), (2a) and (2b), entail the positing of three ordered rules:

- (a) aspiration of voiceless stops in strong position (e.g. /kɔ:ge/ → [k^hɔ:χə])
- (b) devoicing of stops in strong position and before voiceless stops (e.g. /bɛ:ge/ → [pɛ:χə])
- (c) weakening of voiced stops to fricatives (e.g. /kɔge/ → [k^hɔ:χə])

Ordering (b) after (a) ensures that the underlying voiced stops will not be aspirated; ordering (b) before (c) ensures that voiced stops occurring initially and before voiceless stops will not become fricatives.

Solution (1b): Under this analysis the underlying forms of the stem-final consonants are /ɣ/, /g/ and /k/. As in (1a), /ɣ/ → [ɣ] everywhere, raising the same question as it does in (1a) with respect to the varying behavior of this underlying segment in two identical contexts, which, as noted, may be answered by an appeal to syntactic information concerning word classes. As previously indicated, this argument against (1b) does not seem adequate grounds for rejecting this analysis. However, a greater difficulty inherent in (1b) is that this analysis entails the positing of three sets of underlying consonants, one of which (/ɣ, ɣ/) is restricted as to the position in which it may occur. Such a distribution is suspect and seems adequate grounds for rejecting this analysis.

Turning now to an analysis which does not entail this difficulty, we consider Rischel's possibility (2), (a) and (b)--category (B).

Category (B)

The analyses of category (B) involve the positing of two different underlying stem-final consonants in

the pairs under consideration. This analysis, which does not depend on there being three sets one of which is restricted as to the position in which it can occur, is based on the desirability of assigning the same stem-final consonants to pairs which are as closely related as pairs (7) and (8). If it is assumed that both the verb stem and the adjective bred end in the same underlying consonant, then the difference in their behavior before suffixed [t] must have another explanation. Rischel suggests that this explanation lies in there being two different underlying suffixes [t]. The same underlying stem-final consonant can be posited for both klog and koge, and two rather than three underlying stem-final consonants can be posited, which surface as [d, ð] and [g, ɣ]. In Rischel's terms the two sets of underlying stem-final consonants are /t, D/ and /k, G/. This solution constitutes alternatives (2a) and (2b), under which /D, G/ are understood as neutral as to their eventual specification as stops or continuants, but there is an underlying difference of voicedness between /t, k/ and /D, G/. Thus the stems of møde, brede, and bred all end in /D/, and those of klog, and koge both end in /G/, while the verb suffixes may be either /D/ or /t/. Then, if verbs like møde take the suffix /t/ and verbs like brede take the suffix /D/, the following combinations occur:

/t/ + /t/ sat (past part. of sætte) [sæt] from /sat+t/

/D/ + /t/ bredt (neuter of adjective) [pRæt]
from /bRɛ:D+t/

/D/ + /D/ bredt (past part. of brede) [pRɛ:ʔt]
from /bRɛ:D+D/

All of these combinations surface as a single stop. And similarly for the velars, the following combinations occur:

/k/ + /t/ rakt (past part. of række) [Rakt]
from /Rak+t/

/G/ + /t/ kløgt (derived noun) [k^hlɔkt] from /klɔG+t/
køgt (past part. of køge) [k^hɔkt] from
/kɔ:G+t/

/G/ + /D/ klogt (neuter of adjective) [k^hlɔ:ʔt]
from /klɔ:G+D/

(Under this analysis it is the suffixed stop which conditions the vowel shortening. When /t/ is suffixed, shortening occurs; when /D/ is suffixed it does not.)

Under this analysis, the rules accounting for the alternations, according to Rischel, are as follows:

- (a) devoicing before /t/
- (b) devoicing of /D/ + /D/
- (c) shortening of geminates

The vowel shortness will be associated with devoicing before /t/ but not with devoicing of /D/ + /D/.

Now although rule (b) is a possible description of the process occurring in the forms in stem-final dentals, the parallel case involving velars shows it to be incorrect. In the inflected form of the adjective bredt [pRɛ:ʔt], presumably from /bRɛ:D+D/, the surface form does indeed end in a single stop, but in the analogous form klogt [k^hlɔ:ʔt] the stem-final [ɣ] is not devoiced.

The correct rule would be one of consonant deletion, whereby /brɛ:D+D/ ($\rightarrow$ brɛ:ðt) $\rightarrow$ [prɛ:ʔt], analogous to /kɭɔ:G+t/ $\rightarrow$ [k^hɭɔ:ɣt].

Taking possibilities (2a) and (2b) in turn, we note the following problems. Under analysis (2a), in which the voiced stops are derived from underlying fricatives, a rule is required converting all members of the series /B D G/ (/β ɣ γ/) to stops whenever they are devoiced. Rischel rejects this proposal on the following grounds. First, /β/ must in fact be converted to a stop in all environments, since it is never realized phonetically, and this Rischel regards as being counterintuitive. Second, the rule converting the series to stops must not apply to the fricatives /f v s/.¹² In order to block the application of the rule to this set, the set can be defined as [+strident] and the set /B D G/ as [-strident]. However, Danish [v] is not phonetically strident; therefore Rischel rejects this definition also on the grounds that it is counterintuitive. Solution (2a) is thus rejected.

Solution (2b), in which the set [ɣ γ] is derived from the corresponding set of voiced stops, does not entail the above difficulty. Basbøll (1974c:52) raises an objection to the assumption upon which solutions (2a) and (2b) both rest, i.e. that the difference lies in the underlying forms of the suffix. His objection

is that it leads to the positing of the sequence /D/ + /D/, which must then be devoiced. He suggests that this process is phonetically implausible, especially when the sequence occurs intervocalically, as it can be shown to do.

This objection has been met by the fact, as discussed above, that devoicing of this sequence is not involved in any case, the correct rule being one of consonant deletion.

To recapitulate, solution (1a) has been rejected by Basbøll on two grounds: (1) that it entails the positing of an underlying syllable type /V:C:/ which is apparently unknown in Danish, and (2) that positing underlying /ðʁ/ entails differing behavior of the underlying fricatives in phonetically identical contexts. This latter point, which arises with (1b) as well, has been argued against here. While finding solutions based on two sets of underlying consonants ((2a) and (2b)) more satisfactory than those based on three such sets, Basbøll does not argue against the latter type of solution on the grounds that it entails positing one set which is restricted in its distribution (i.e., /ðʁ/ do not occur in initial position). This, however, constitutes a significant problem for this analysis. On the other hand, Basbøll's above-mentioned criticism with respect to the different behavior of the consonants in identical contexts is perhaps not quite as significant. Since these cases involve different syntactic categories,

there is no a priori reason why they should behave in the same way. In view of the very suspect distribution of one of the posited underlying sets of consonants, the argument for solutions of this type is weak.

Solution (2a) is rejected by Basbøll on the grounds that it is counterintuitive, and he is therefore left with solution (2b) as the preferred one within this category. His own proposal falls under category (C), but before turning to it it is necessary to consider one other proposal that falls within (B), and, in addition, to discuss a major difficulty encountered by solutions of this type.

The other proposal within category (B) is that of Austin (1971), and it is to this proposal that we now turn our attention.

3.5.5 Austin's Analysis

This analysis is based on the assumption of underlying forms which correspond in general to Rischel's (2b), but instead of retaining the underlying distinction of voiced vs. voiceless segments, Austin proposes an underlying distinction based on the feature [glottal constriction]. This distinction immediately raises the following problems: first, while [p t k f] and [b d g v] (under Austin's analysis) constitute natural classes with regard to consonant gradation phenomena, according to Austin's feature

analysis [f] and [v] cannot be described as related to the others in these sets because they are distinguished by being [+strident] and [-strident] respectively, while both are specified [-glottal constriction]. And second, [p t k f s] have been shown (Frøkjær-Jensen, Ludvigsen and Rischel 1971:284) to have a laryngeal opening and closing gesture of the same type, contrary to the (weaker) one in [b d g v], so that these two sets cannot in fact be classed as having opposite values for the feature [glottal constriction].

Problems of this nature aside, it is necessary to devote some attention to Austin's proposal, which consists of seven ordered rules, listed on page 144 (after Basbøll 1974c:58).

Examination of Austin's system of rules reveals major problems. Briefly, it must be pointed out that rule (2), a rule of vowel shortening, predicts vowel shortening not only in the types of contexts he cites as examples, but also before /st/, and it is in fact that vowel shortening does not regularly occur in this context. (Basbøll 1974c:58). In addition, Austin is forced by his assumptions concerning the underlying forms of suffixes to limit application of this rule to contexts containing only fricatives which are [+anterior], which is also contrary to the facts. This limitation, as Basbøll points out (1974c:58), leads

to the unlikely occurrence of velars and dentals behaving in exactly opposite ways before the endings /d/ and /t/. Further, with respect to rule (3), the difference in stridency between /v/ and the derived [f] seems to depend in fact on the difference in voicing; there is no independent motivation for such a rule and it would be redundant if the underlying distinction were taken to be one of voicedness instead of glottal constriction.

The most serious problem is encountered when taking Austin's set of rules as a whole. It is evident that two of his rules are stated twice in order to yield the correct output. He has in fact two rules of continuant formation (rules (1) and (5)), performing the same operation in two different environments, and two rules of vowel shortening (rules (2) and (6)), one applying in a more general context than the other. By splitting these two rules he is able to arrive at the correct phonetic output, but he has not motivated this split on any theoretical grounds, and within the theoretical framework in which he appears to be working a system which fails to collapse rules performing the same function is clearly suspect.

- 1) $\begin{bmatrix} -\text{cont} \\ +\text{gl con} \\ \alpha\text{ant} \\ \alpha\text{cor} \end{bmatrix} \rightarrow [+cont] / \text{---} \begin{bmatrix} -\text{cont} \\ -\text{gl con} \\ +\text{cor} \end{bmatrix}$ e.g. $/\text{m}^{\text{ö}}\text{dt}/ \rightarrow \text{m}^{\text{ö}}:\text{t}$
 $/\text{k}^{\text{lo}}:\text{gt}/ \rightarrow \text{k}^{\text{lo}}:\text{t}$
 $/\text{br}^{\text{e}}:\text{dt}/(\text{adj.}) \rightarrow \text{br}^{\text{e}}:\text{t}$
- 2) $\begin{bmatrix} +\text{voc} \\ -\text{cons} \end{bmatrix} \rightarrow [-\text{long}] / \text{---} \begin{bmatrix} +\text{cont} \\ +\text{ant} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ +\text{cons} \\ -\text{son} \end{bmatrix}$ e.g. $\text{m}^{\text{ö}}\text{t} \rightarrow \text{m}^{\text{ö}}\text{t}$
 $\text{br}^{\text{e}}:\text{t}(\text{adj.}) \rightarrow \text{br}^{\text{e}}\text{t}$
- 3) $\begin{bmatrix} +\text{cont} \\ +\text{ant} \\ -\text{cor} \end{bmatrix} \rightarrow [+strid] / \text{---} [-\text{gl con}]$ e.g. $\text{stivt} \rightarrow \text{stift}$
- 4) $\begin{bmatrix} +\text{cor} \\ -\text{strid} \end{bmatrix} \rightarrow \emptyset / \text{---} [+cor]$ e.g. $\text{m}^{\text{ö}}\text{t} \rightarrow \text{m}^{\text{ö}}\text{t}$
 $\text{br}^{\text{e}}\text{t} \rightarrow \text{br}^{\text{e}}\text{t}$
 $/\text{br}^{\text{e}}:\text{dd}/(\text{vb}) \rightarrow \text{br}^{\text{e}}:\text{d}$
- 5) $\begin{bmatrix} -\text{cont} \\ +\text{gl con} \\ \alpha\text{cor} \\ \alpha\text{ant} \end{bmatrix} \rightarrow [+cont] / [+seg] \text{---} \begin{bmatrix} +\text{voc} \\ -\text{cons} \end{bmatrix}^*$ e.g. $/\text{m}^{\text{ö}}:\text{de}/ \rightarrow \text{m}^{\text{ö}}\text{de}$
 $/\text{k}^{\text{o}}:\text{ge}/ \rightarrow \text{k}^{\text{o}}:\text{ge}$
- 6) $\begin{bmatrix} +\text{voc} \\ -\text{cons} \end{bmatrix} \rightarrow [-\text{long}] / \text{---} [-\text{cont}] [-\text{cont}]$ e.g. $/\text{k}^{\text{o}}:\text{gd}/ \rightarrow \text{k}^{\text{a}}\text{gd}$
- 7) $\begin{bmatrix} -\text{cont} \\ -\text{gl con} \end{bmatrix} \rightarrow [+gl con] / [+seg] \text{---} \left(\begin{matrix} \text{opt. when} \\ \text{---} [-\text{seg}] \end{matrix} \right)$ e.g. $\text{m}^{\text{ö}}\text{t} \rightarrow \text{m}^{\text{ö}}\text{d}$
 $\text{k}^{\text{lo}}:\text{yt} \rightarrow \text{k}^{\text{lo}}:\text{yd}$
 $\text{br}^{\text{e}}\text{t} \rightarrow \text{br}^{\text{e}}\text{d}$

Table 3.5: Austin's rules of consonant gradation

*It seems to be an error that the consonant weakening in rule (5) is limited to the context "before a vowel". The correct formulation must be that of an earlier rendition of this rule, in which the right side is simply $/ [+seg] \text{---}$.

A happy solution to the problems involved in the analysis of consonant gradation is apparently not easily arrived at. Before turning to Basbøll's category (C) solution (in which the explanation for the varying behavior of the stem-final consonants under consideration is taken to lie in differences in the boundaries between stems and suffixes), a major difficulty encountered by solutions within category (B) (in which the explanation is based on differences in the suffixed consonants) must be pointed out.

As mentioned earlier, in addition to the specific criticisms discussed with respect to the solutions of category (B), there is a larger difficulty concerning the reasoning which underlies proposals of this type. It is evident that within these solutions each form which takes one of the proposed suffixes will have to be marked as to which it takes. The factor which determines the selection of the suffixed segment is inherent in the stem. Within (B) not only will there have to be two different sets of underlying suffixing consonants, but in addition each stem will have to be marked for which of these it takes, which is merely another way of saying that in fact all of these forms must be learned individually. Marking them in this way constitutes a use of diacritic features which has been argued against by Kiparsky (1968:5-56), who would limit their use to cases in which strictly phonological solutions cannot

be motivated. This appears to be such a case. The only possible phonological solution is to consider the non-alternating stem-final fricatives as underlying (category (A)), and this solution has been rejected on grounds of distribution. Having noted this difficulty, we turn now to category (C).

3.5.6 Basbøll's Analysis

This analysis (Basbøll 1974c:61-66) rests on the assumption of two different kinds of juncture as the trigger for the behavior of the consonants involved in consonant gradation. This solution is "based on the fact that there are (at least) two different word internal grammatical boundaries in the underlying forms which are input to the phonological component, namely + and #." (Basbøll 1974c:62.) Basbøll suggests that the underlying suffix is in all cases /t/, but that suffixes are separated from stems either by + or by #: /klo:g#t, ko:g+t, bRɛ:d#t (adj.), bRɛ:d+t (vb)/ with /#/ the "phonologically relevant boundary" and /+/ the "phonologically irrelevant boundary". That is, the presence or absence of /#/ can play a role in the application of phonological rules, whereas the phonological component ignores whether or where /+/ occurs. In other words, Basbøll defines /+/ as "a grammatical boundary without phonological effect" and he points out that this defini-

tion conflicts with the conventions laid out by Chomsky and Halle (1968:67) according to which phonological rules can depend on the presence, but not the absence, of /+/.¹³

According to Basbøll's suggested principle (Basbøll 1974c:63), the difference between, for example, the adjective klogt /klɔ:g#t/ ([k^hlɔ:ʔt]) and the substantive kløgt /klø:g+t/ ([k^hløk^ht]) consists in the stem of /klɔ:g#t/ being treated "just as when in isolation, whereas the form /klø:g+t/ is treated phonologically as if it were a morpheme." (Examples mine.) As far as the phonological effect of /#/ is concerned, Basbøll here limits himself to saying that "the most important phonological function of /#/ is to delimit the domain of a whole set of phonological rules, i.e. to determine the extent of the segment chain which is to be examined as to whether it satisfies a given rule's structural description. Thus a /#/ can block certain phonological rules...and the distinction between /#/ and /+/. is therefore an expression of the well-documented observation that some grammatical boundaries, but not all, are phonologically relevant." (Basbøll 1974c:63.)

The advantages of Basbøll's proposal are (a) that it avoids the problems inherent in the solutions discussed above, for example the problem of accounting for the different behavior of stem-final consonants in identical contexts; and (b) that it accounts for data

left unexplained by the other analyses, as, for example, the following. There occur in Danish adjectives in stem-final /d/, in which the /d/ does not always behave the same way. In one such group (data from Rischel 1970b:466) the stem does not undergo any modification before suffixed /t/, so that, for instance, ledt 'repulsive' (neuter) /le:dt/ is realized as [le:ʔðt]. On the other hand, most of the common adjectives in stem-final /d/ occur with both the short vowel and loss of [ð] in the inflected form. Under Rischel's analysis the first set is classified as exceptional, but since, according to Basbøll (1974c:64), it seems to be the only productive way of forming neuters of adjectives whose stems end in /d/, this classification is not very satisfactory. Basbøll's proposal accounts for the data by considering the adjective ledt as /le:d#t/, as opposed to the neuter form bredt, which he considers to be /bre:d+t/. The difference between these two forms stems from the formulation of ledt as neuter "by the simple addition of the ending /t/, while /bre:d+t/ is phonologically treated as a morphological unit." (Basbøll 1974c:64.)

The disadvantage of this analysis is that, similarly to Rischel's (2a) and (2b), stems which take the suffix /t/ would again have to be marked, in this case with respect to which boundary they take, since it is ap-

parently not the case that syntactic classes are subject to taking one boundary or the other, but rather members of the same syntactic class may occur with different boundaries.

Thus it appears that this analysis requires both a distinction in the boundary and a marking of the stem, just as the category (B) solutions require a distinction in the suffixing consonant and a marking of the stem. The same argument applies here as did with respect to the category (B) analyses: this analysis amounts to a morphological solution, and, as with grammatical gender, each form must be learned individually.

To recapitulate, analyses of consonant gradation phenomena which rest on the positing of three different sets of underlying stem-final consonants, i.e., category (A), are here rejected on the grounds that one of the sets is of limited distribution, unlike all of the other posited underlying consonants (with the exception of /h/--see section 3.4.1.3). And analyses which are based on the assumption of only two sets of underlying stem-final consonants, namely voiced and voiceless, and which involve positing two different underlying suffixing /t/'s--category (B)--or two different word-internal boundaries--category (C)--(neither of which sets, apparently, is strongly motivated) entail marking each stem for the /t/ or the boundary it takes. This

entailment, as pointed out above, is in fact equivalent to stating that each form must be learned individually anyway. It therefore appears that none of these phonological analyses is simpler or more advantageous than the morphological one, which involves only marking the stems for their behavior in this environment (before /t/), and not positing any additional distinctions.

3.5.7 The Morphological Analysis

Once it is accepted that (a) the solution in which three different stem-final consonants must be posited is not well-motivated, and (b) that an analysis which rests on underlying distinctions of either boundaries or suffixing consonants is in principle equivalent to and even more costly than one which marks stems in final voiced stops for their behavior in a particular environment, there is no strong justification for positing such solutions. In the absence of such justification, it is proposed here that this morphological solution provides the best account of the consonant gradation issue. Under this analysis, which assumes an underlying voiced/voiceless distinction in the stop system of Danish, the following underlying forms are posited for the data presented in section 3.5.1:¹⁴

- (1) klog/klogt /klo:g, klo:g+t/ [k^hlo:ʔʏnk^hlo:ʔʏt]
- (1) klog/klogt /klo:g, klo:g+t/ [k^hlo:ʔʏnk^hlo:ʔʏt]
- (2) koge/kogt /ko:g+e, ko:g+t/ [k^ho:ʏənk^ho:kt]

- (3) række/rakt /Rɛk+e, Rak+t/ [Rækə~Rakt]
 (4) klæde/kladt /klɛ:d+e, klɛ:d+t/ [k^hlɛ:ðək^hlɛ:ʔt]
 (5) møde/mødt /mø:d+e, mø:d+t/ [mø:ðə~möt]
 (6) sætte/sat /sɛt+e, sat+t/ [sɛtə~sæt]

The new rules which are required in order to arrive at the correct phonetic output are formulated below.

Table 3.6 contains derivations for forms (1) - (6).

The rule of VOWEL SHORTENING formulated as (2.4), section 2.4.1.1, applies in these derivations--those forms which are not susceptible to the rule of REGRESSIVE ASSIMILATION are also exempt from this one--and must apply before the rule of CONSONANT DELETION in order for its structural description to be satisfied.

(3.17) ASPIRATION

$$\begin{bmatrix} \text{-cont} \\ \text{-voi} \end{bmatrix} \rightarrow [+asp] / \$ ___ \quad (/p \ t \ k/ \rightarrow [p^h \ t^h \ k^h] / \$ ___)$$

Examples of the application of this rule are pakke 'parcel' [p^hakə]; takke 'thank' [t^hakə]; katte 'cats' [k^hætə], as opposed to the underlying voiced stops, which are not subject to this rule (e.g. bakke 'hill' [pakə]; dække 'cover' [təkə]; gætte 'guess' [kɛtə]).

This rule must be ordered before the one which devoices underlying voiced stops, so that they will not be subject to aspiration in initial position. Rischel's rule, cited above as (b), "devoicing of stops in strong position and before voiceless stops," should in fact

be divided into two parts, since the devoicing of voiceless stops "in strong position", i.e. syllable-initially, is one process, similar to that which aspirates voiceless stops in the same position. The devoicing of voiced stops before voiceless stops, on the other hand, is of course a rule of regressive voicing assimilation similar to the regressive assimilation rule which applies to /n/ (see section 3.4.4.1). The rule of initial devoicing can be formulated as

(3.18) OBSTRUENT DEVOICING

$$\begin{bmatrix} +\text{cons} \\ -\text{cont} \\ -\text{asp} \end{bmatrix} \rightarrow [-\text{voi}] / \$ ___ \quad (\{b \ d \ g\} \rightarrow [p \ t \ k] / \$ ___)$$

Examples of the application of this rule are those mentioned earlier: [pakə, tsəkə, ketə].

The rule of regressive voicing assimilation can be formulated as

(3.19) REGRESSIVE VOICING ASSIMILATION

$$\begin{bmatrix} +\text{cons} \\ -\text{cont} \end{bmatrix} \rightarrow [-\text{voi}] / ___ \begin{bmatrix} +\text{cons} \\ -\text{cont} \\ -\text{voi} \end{bmatrix} \quad (\{b \ d \ g\} \rightarrow [p \ t \ k] / ___ [p \ t \ k])$$

This rule applies vacuously to stops which are already voiceless. Examples of the application of this rule are kogt 'boiled' [k^hɔkt], mødt 'met' [möt], and klædt 'dressed' [k^hlɛ:ʔt] (derived from underlying /klɛ:d+t/).

The next rule necessary to arrive at the correct output of forms such as klædt (which has been analyzed

as analogous to klogt 'clever' (neuter) [$k^h l o : ? \gamma t$] with respect to the behavior of the stem-final consonant) is the rule of CONSONANT DELETION formulated as (3.16)--see section 3.5.1--which deletes the stem-final [δ] of forms such as [$k^h l \varepsilon : ? t$] and the stem-final [t] of forms like [$m \ddot{o} t$]. The following derivations illustrate the application of these rules.

UNDERLYING FORM	/m $\ddot{o}$:d+t/	/kl ε :d+t/*
ST $\ddot{O}$ D-PLACEMENT	m $\ddot{o}$:?dt	kl ε :?dt
REGRESSIVE VOICING	m $\ddot{o}$:?tt	----
ASSIMILATION		
VOWEL SHORTENING	m $\ddot{o}$?tt	----
ST $\ddot{O}$ D-DELETION	m $\ddot{o}$ tt	----
SPIRANTIZATION ₂	----	kl ε :? δ t
OBSTRUENT DELETION	m $\ddot{o}$ t	kl ε :?t
ASPIRATION	----	k ^{h} l ε :?t
DEVOICING	----	k ^{h} l ε :?t
SURFACE FORM	[m $\ddot{o}$ t]	[k ^{h} l ε :?t]

*This form must be marked [-rules (3.19) and (2.4)].

There remains the question of the weakening of underlying voiced stops to fricatives in syllable-final position. The rule which accounts for this process can be formulated as

(3.20) SPIRANTIZATION₂

$$\begin{bmatrix} -\text{cont} \\ +\text{voi} \end{bmatrix} \rightarrow [+cont] \text{ / } __\$ \quad (\{d \ g\} \rightarrow [\delta \ \gamma] / __\$)$$

This rule, which is a more general version of (3.7)--see section 3.4.4.1--accounts for forms such as koge 'boil' [$k^h o : \gamma \emptyset$] and møde 'meet' [$m \ddot{o} : \delta \emptyset$] (and for those forms which are exempt from REGRESSIVE VOICING ASSIMILATION and VOWEL SHORTENING, and in which SPIRANTIZATION

occurs before suffixed [t], as well, such as klogt 'clever' (neuter) [k^hlɔ:ʔɣt]).

3.5.8 The Underlying Stops and their Phonetic Alternants

The facts of consonant gradation having been presented, previous analyses of the subject discussed, and a conclusion arrived at with respect to the best account of the data, it remains only to state the relation of the proposed voiced and voiceless stops listed in Table 3.1 to the phones in Table 3.2.

3.5.8.1 The Voiceless Stops /p t k/

Of the posited underlying voiceless stops /p t k/, /p/ has the alternant [p^h]; /t/ has the alternant [t^h]; and /k/ has the alternant [k^h]. These alternants are related to the underlying forms by rule (3.17), ASPIRATION, which aspirates voiceless stops in syllable-initial position.

3.5.8.2 The Voiced Stops /b d g/

Of the posited underlying voiced stops /b d g/, /b/ has the alternant [p]; /d/ has the alternants [t] and [ð]; and /g/ has the alternants [k] and [ɣ]. The voiceless variants are related to the underlying forms by rule (3.18), OBSTRUENT DEVOICING, which devoices voiced stops in syllable-initial position. /d/ is related to [ð] and /g/ to [ɣ] by rule (3.20), SPIRANTIZATION, which derives

these continuants from the underlying stops in syllable-final position. (This rule also applies, as noted, to those forms which are exempt from rules (3.19) REGRESSIVE VOICING ASSIMILATION and (2.4) VOWEL SHORTENING even when /d/ and /g/ occur as the first member of the final consonant cluster formed by suffixing /t/.)

It must also be noted that of the alternants [ð] and [ɣ], [ɣ] has virtually disappeared from contemporary Danish speech. That is, there is a further low-level process of glide-formation which applies to derived [ɣ], and which gives /g/ two additional alternants: [y] and [w]. Examples of this process are sige/sagt (infinitive and past participle) [si:yəʷsakt] and koge/kogt 'boil' [k^ho:wə~k^hɔkt]. This process is captured in the rule formulated as

(3.21) GLIDE-FORMATION¹⁵

$$\left[\begin{array}{l} -\text{syll} \\ +\text{cons} \\ -\text{son} \\ +\text{cont} \\ +\text{back} \\ +\text{voi} \end{array} \right] \rightarrow \left[\begin{array}{l} -\text{cons} \\ +\text{syll} \\ \alpha\text{back} \end{array} \right] / \left[\begin{array}{l} +\text{syll} \\ \alpha\text{back} \end{array} \right] \text{ — } ([ɣ] \rightarrow \{y, w\} / \left[\begin{array}{l} \text{V} \\ \alpha\text{back} \end{array} \right] \text{ — })$$

Furthermore, the occurrence of forms such as brug 'use!' [pRu:ʔ] and sig 'say!' [si:ʔ] indicates that the glides [y] and [w] may be deleted word-finally. The following forms illustrate that the process occurs before [ə] (i.e., syllable-finally) as well (this is the tendency especially in the less conservative speech of the younger

generations): sige/sagde/sagt 'say' (infinitive, preterite, past participle) [si:ə, sɛ:ə, sakt]; bage/bagte/bakt 'bake' [pɛ:ə, paktə, pakt]; bruge/brugte/brugt 'use' [pRu:ə, pRuktə, pRukt]; koge/kogte/kogt 'boil' [k^hɔ:ə, k^hɔktə, k^hɔkt]. This process, which deletes /g/ and not /d/, is a natural one, in line with the notion of the greater or lesser strength of resistance to lenition of different consonants, on articulatory grounds. Moreover, it is an entirely general process in Danish, affecting forms of all syntactic categories (cf. klog/kloge/klogt 'clever' (common gender, plural, neuter) [k^hlɔ:?, k^hlɔ:ə, k^hlɔkt]).

The low-level rule required to capture these facts may be formulated, to apply after GLIDE-FORMATION, as

(3.22) GLIDE-DELETION

$$\left[\begin{array}{l} -\text{cons} \\ -\text{syll} \\ \alpha \text{back} \end{array} \right] \rightarrow \emptyset / \left[\begin{array}{l} +\text{syll} \\ \alpha \text{back} \end{array} \right] ___ \quad (\{y, w\} \rightarrow \emptyset / \left[\begin{array}{l} v \\ \alpha \text{back} \end{array} \right] ___)$$

3.5.9 Summary

In section 3.5 the stop system of Danish has been examined. The facts of distribution have been presented, and it has been noted (a) that the distinction between the aspirated and the non-aspirated stops is clear only in syllable-initial position; and (b) that in syllable-final position the voiced fricatives [ɖ ɣ]

alternate with their homorganic voiceless stops.

A straightforward analysis deriving one set from the other is complicated by the occurrence of forms in which the expected alternations do not occur, and the question of consonant gradation hinges on the differing behavior of these stem-final consonants in the identical phonetic context, namely before [t]. The traditional view of the environments for the occurrence of consonant gradation phenomena, namely syllable-initial and syllable final position, have been examined and motivated.

Three types of solution to the problem of consonant gradation which have been proposed in the literature have been examined: (A) that the difference arises from distinctions in the underlying stem-final consonants; (b) that it arises from distinctions in the underlying form of the suffixed consonants; and (C) that it arises from distinctions in the boundaries between the stems and suffixes. Proposals along these various lines, put forth by Rischel, Basbøll and Austin, have been reviewed. The proposal that the difference be accounted for by positing three different underlying stem-final consonants has been rejected on the grounds that it requires an underlying set, not otherwise motivated, which is peculiarly limited in its distribution. It is suggested here that, quite apart from any specific difficulties entailed by solutions which require positing either two different

underlying suffixed consonants or two different word-internal boundaries, there is a basic problem which they share: that they require not only positing additional boundaries or underlying suffixing consonants, but a further marking of each form for which suffix or which boundary it takes. Thus such solutions are more costly than one which simply marks the forms for which behavior the stem-final consonant engages in when followed by a suffixed [t].

This solution, then, is the one argued for here. An underlying voiced/voiceless distinction is posited between the two series of stops; the unaspirated one is assumed to be underlyingly voiced and the members of the set /d g/ are assumed to alternate in syllable-final position with the voiced fricatives [ð ɣ]. A further process is noted for contemporary speech, namely that derived [ɣ] has virtually disappeared, now being realized as [y] or [w], depending upon the phonetic context, and deleting in less conservative speech. Rules relating the phonetic output to the underlying forms are formulated: a rule of CONSONANT DELETION which deletes coronal stops and fricatives before coronal stops, to account for forms which surface in a single final consonant when there are underlyingly a stem-final consonant and a suffixed consonant; a rule of ASPIRATION which aspirates underlying voiceless stops in syllable-initial position; a rule of OBSTRUENT DEVOICING which

devoices underlying voiced stops in the same environment; a rule of REGRESSIVE VOICING ASSIMILATION which devoices underlying voiced stops before voiceless stops (except in those forms marked minus this rule); a rule of SPIRANTIZATION which derives voiced fricatives from underlying voiced stops in syllable-final position; a rule of GLIDE FORMATION which derives [y] and [w] from [ɣ] when preceded by front and back vowels respectively, and a rule of GLIDE-DELETION. The application of these rules to the forms cited as the data for this discussion is illustrated in the set of derivations found in the Appendix.

In addition to this review and analysis, the subject of the syllable has been discussed, both with respect to its role in the environment of the rules required by the analysis and with respect to the theoretical issue of whether it should be included in the grammar. It is argued here that significant generalizations of Danish phonology are captured if the notion of the syllable is incorporated into the grammar such that the syllable boundary is available to express environments in the formulation of rules--generalizations which are otherwise missed. The facts of consonant gradation, then, lend support to the hypothesis that the notion of the syllable should be included in the grammar.

3.6 Conclusion

This chapter has dealt with the consonant system of Danish. Rules of allophonic variation have been formulated to relate the proposed set of underlying consonants to their surface realizations.

The segment [ŋ] has been analyzed as the reflex of the underlying sequence /ng/. The occurrence of this segment is limited to syllable-final position; and it is argued that unless reference is made to the syllable, the rule which predicts the assimilation of /n/ to /g/ fails to capture a linguistically significant generalization.

The major subject of consonant gradation has been explored in the section which treats the stop system of Danish. Phonological solutions to the problem of consonant gradation have been demonstrated to be more costly than a morphological solution which marks certain forms as exempt from the rules pertaining to consonant gradation, which is the solution adopted here.

Again, the facts of consonant gradation support the hypothesis that linguistically significant generalizations are missed unless the notion of the syllable is incorporated into the grammar.

FOOTNOTES TO CHAPTER III

1. The forms are pibe 'pipe' [p^hi:βə] and peber 'pepper' [p^he:βp].
2. In Rischel 1969:179, r is stated to be "a somewhat fricative uvular occurring syllable-initially (the "vocalic r" is represented by the symbol "ɐ")"; though [R] is normally classified as a uvular-pharyngeal fricative, Basbøll (1974c:71) considers underlying /R/ a pharyngeal, because /R/, when preceded by a diphthong, becomes a pharyngeal "semi-vowel" [ɐ] (the symbol ^ indicating non-syllabicity).
3. Basbøll uses the feature [art] as a cover term for the features ranging from front to back.
4. For Basbøll's use of # to represent "phonologically relevant boundary" see section 3.5.6.
5. The role of [y] and [w] as members of diphthongs is not discussed here.
6. Cf. Austin 1971:38 and Basbøll 1973:109.
7. Basbøll (1974c:67-68) has assumed the segment /v/ to be underlying, and he notes that it devoices before /t/: stive/stift 'stiff' (plural and neuter) [sti:vəstift]; grove/groft 'coarse' (plural and neuter) [kRo:vəʔkRʌft].
8. For discussion of the historical development of w see Haugen 1976:204-205.
9. E.g., Basbøll 1974a, but see the discussion in Feinstein 1977:17.
10. "Ideally we want to formulate a syllable-boundary insertion rule that has universal applicability. As with every attempt at language universals, we find that a few conditions on the structure of syllables are truly universal, and many conditions are widely applicable but not strictly universal. Nevertheless, the theory should define the notion 'possible syllable' of a natural language." (Hooper 1972:534.) Hooper also proposes (1972:536) that "languages may or may not have additional late rules that define a language-specific, phonetic syllable." See also Vennemann (1972:16) re syllabification rules as persistent, or anywhere, rules.

11. From forms such as skæg/skægt 'funny' (common and neuter genders) [skɛ:ʔk, skɛ:ʔkt], in which the underlying vowel is long, and, under this analysis, the following consonant is also long.
12. Under the analysis presented in section 3.4.5.2, the segment [v] is not considered as underlying, but rather as derived from /w/.
13. It is important to avoid confusing Basbøll's use of + and # as two word-internal boundaries with the definition in SPE of + as a formative boundary and # as a word boundary.
14. Motivation for the underlying forms of the inflectional morphemes rests upon verb and adjective forms with stem-final vowel, e.g., ske/sket 'happen/ed' [ske~sket]; se/set 'see/n' [se~set].
15. That this is a tendency of Danish is borne out by historical evidence, e.g., earlier forms of vie 'consecrate' [vi:ə] derive from Old Danish wighia; grue 'dread' [kRu:ə] derives from Old Danish gruva (sig) (v = [w]).

ORTHOGRAPHY	klog	klogt	koge	kogt	række	rakt	klæde	klædt
UNDERLYING FORM	/klo:g/	/klo:g+t/	/ko:ge/	/ko:gt/	/Rekte/	/Rakt/	/kle:dte/	/kle:dt/
STRESS PLACEMENT*	klo:g	klo:gt	ko:ge	ko:gt	Réke	Rákt	klé:de	klé:dt
<u>STØD</u> -PLACEMENT	klo:ʔg	klo:ʔgt	ko:ʔge	ko:ʔgt	---	---	klé:ʔde	klé:ʔdt
<u>e</u> -REDUCTION	---	---	ko:ʔgə	---	Rékə	---	klé:ʔdə	---
SYLLABLE READJUSTMENT	---	---	ko:ʔgʔə	---	Rékʔə	---	klé:ʔdʔə	---
REGRESSIVE VOICING ASSIMILATION	---	---	---	ko:kt	---	---	---	---
VOWEL SHORTENING	---	---	---	koʔkt	---	---	---	---
<u>STØD</u> -DELETION	---	---	ko:gʔə	koʔkt	---	---	klé:dʔə	---
SPIRANTIZATION ₂	klo:ʔɣ	klo:ʔɣt	ko:ʔɣə	---	---	---	klé:ʔɣə	klé:ʔɣt
CONSONANT DELETION	---	---	---	---	---	---	---	klé:ʔt
ASPIRATION	k ^h lo:ʔɣ	k ^h lo:ʔɣt	k ^h ko:ʔɣə	k ^h koʔkt	---	---	k ^h klé:ʔɣə	k ^h klé:ʔt
DEVOICING	k ^h lo:ʔɣ	k ^h lo:ʔɣt	---	---	---	---	k ^h klé:ʔɣə	k ^h klé:ʔt
<u>ε</u> -LOWERING	---	---	---	---	Rækʔə	---	---	---
<u>a</u> -LOWERING	---	---	---	---	---	Rakt	---	---
SURFACE FORM	[k ^h lo:ʔɣ]	[k ^h lo:ʔɣt]	[k ^h ko:ʔɣə]	[k ^h koʔkt]	[Rækə]	[Rakt]	[k ^h klé:ʔɣə]	[k ^h klé:ʔt]

*An early rule of STRESS PLACEMENT is assumed.

Table 3.6: Derivations illustrating the phonological rules pertaining to consonants

ORTHOGRAPHY	møde	mødt	sætte	bakke	dække	gætte
UNDERLYING FORM	/mø:d+e/	/mø:d+t/	/sæt+e/	/bak+e/	/dæk+e/	/gæt+e/
STRESS PLACEMENT	mø:de	mø:dt	séte	báke	déke	géte
<u>STØD</u> -PLACEMENT	mø:ʔde	mø:ʔdt	---	---	---	---
<u>e</u> -REDUCTION	mø:ʔdə	---	sétə	bákə	dékə	gétə
SYLLABLE READJUSTMENT	mø:ʔd\$ə	---	sét\$ə	bák\$ə	dék\$ə	gét\$ə
REGRESSIVE VOICING ASSIMILATION	---	mø:ʔtt	---	---	---	---
VOWEL SHORTENING	---	møʔtt	---	---	---	---
<u>STØD</u> -DELETION	mø:d\$ə	mött	---	---	---	---
SPIRANTIZATION ₂	mø:ðə	---	---	---	---	---
CONSONANT DELETION	---	möt	---	---	---	---
ASPIRATION	---	---	---	---	---	---
OBSTRUENT DEVOICING	---	---	---	pák\$ə	ték\$ə	két\$ə
SURFACE FORM	[mø:ðə]	[möt]	[sétə]	[pákə]	[tékə]	[kétə]

Table 3.6, continued: Derivations illustrating the phonological rules pertaining to consonants

CHAPTER IV

THE SYSTEM OF VERBAL INFLECTIONS

4.1 Introduction

Danish verbs fall into two main classes, "strong" and "weak". This chapter begins with a brief discussion of these verb classes. It is noted that in the largest class of weak verbs all of the suffixes begin with [ə]. In section 4.2 this [ə] is analyzed as epenthetic. Section 4.3 deals with the infinitive, 4.4 with the present tense, 4.5 with the preterite, 4.6 with the past participle, 4.7 with the present participle, 4.8 with the passive, and 4.9 with the imperative. Underlying forms for all of the suffixes are posited, and rules are formulated when necessary to account for the morpho-phonemic variation. In section 4.10 those verb stems which surface in a final vowel are discussed, and an underlying stem-final vowel is proposed for them. In addition, a class of stems which surface without the infinitive suffix is discussed and phonological evidence is adduced to account for the deletion of the infinitive suffix (here taken to be /e/). In section 4.11 the second class of weak verbs is discussed and the underlying forms of the suffixes are posited.

4.1.1 The Strong Verbs

The so-called "strong" verbs are characterized by

a monosyllabic past tense, and in komme/kom/kommet 'come' (infinitive, preterite, past participle) [k^hɔmə, k^hɔm, k^hɔməð]. In this example, the stem vowel is invariant. Other strong verbs demonstrate two and three alternating stem vowels: sidde/sad/siddet 'sit' [sɪðə, sæð, seðet];¹ binde/bandt/bundet 'tie' [penə, pænt, punəð]. The suffixes which occur in the various forms of the verbs of this type are quite regular, and the infinitive, present, present participle, passive and imperative are formed in the same way as in the weak verbs, as illustrated in Table 4.1. The majority of strong verbs take the past participle suffix -et [əð], which is the same suffix found in the past participle of the verbs belonging to the productive weak class. Thus this and the abovementioned other suffixes are susceptible of the same analysis presented beginning in 4.4 below.

A smaller set of strong verbs takes the past participle suffix -t [t], as for example hænge/hang/hængt 'hang' [hɛnə, han, hænt]. This suffix is the same as that found in the smaller class of weak verbs analyzed below in section 4.11; thus that analysis applies to these forms as well.

The set of strong verbs is described above as having a monosyllabic preterite; this generalization is also expressed by positing a zero suffix for these forms. This zero suffix, and the alternating stem vowels,

when such occur, constitute the differences between the strong verbs and the weak verbs. The alternating stem vowels can be accounted for by positing different underlying vowels for the different forms; indeed, there seems to be no other convincing way of accounting for them.

Since this class of verbs is not productive in Danish, it will be discussed no further here.

4.1.2 The Weak Verbs

As mentioned above, there are two past participle suffixes occurring in the class of verbs generally known as "weak" verbs, namely the productive [əð], and [t]. There are in addition two preterite suffixes, -ede [əðə], which characterizes the productive forms and classes together with the past participle forms in the suffix [əð], and -te [tə], which occurs in the same class as those verbs taking the preterite suffix [t]. Examples of these two classes of weak verbs are (a) in preterite and past participle suffixes respectively, [əðə], [əð]: hoppe/hoppede/hoppet 'hop' [hʌpə, hʌpəðə, hʌpəð]; and (b) in preterite and past tense suffixes, respectively, [tə], [t]: mene/mente/ment 'think' [me:nə, mente, me?nt]. The first of these types comprises by far the largest number of Danish verbs, and the processes involved in these verb forms are, as noted, the pro-

ductive ones, being applied in the case of borrowings (and in the case of nonsense verbs as well). The major portion of the analysis presented below will therefore be concerned with this class of verbs. The formation of the second type of weak verbs will also be analyzed below, insofar as it differs from that of the larger class.

It should be noted that this second class of verbs is in general restricted to two stem types: (a) stems ending in a long vowel plus consonant other than [v], for example the abovementioned [me:nə, mente, meʔnt];² and (b) stems ending in short vowel plus [l, m, n, ŋ] (written ll, mm, nd, ng), for example skille/skilte/skilt 'separate' [skIlə, skIlte, skIʔlt]; brænde/brændte/brændt 'burn' [pRæne, pRænte, pRæʔnt]. Verbs of class 1, the larger class (those in preterite [əð̥ə] and past participle [əð̥]), on the other hand, contain instances of all stem types but (b) above. All of the occurring stem types in Class 1 are illustrated in Table 4.1, which presents the infinitive, present, preterite, past participle, present participle, passive, and imperative forms of verbs taking the preterite and past participle suffixes [əð̥ə] and [əð̥], respectively. Numbers (1) - (6) of Table 4.1 are vowel-final stems; (7) - (10) are sonorant-final stems, (11) - (16) are obstruent-final stems, and (17) - (20) are consonant-cluster final stems.

It will be noted that in Table 4.1 a single form

is cited for the present tense of each verb; Danish verbs are not declined for person, the regular present tense suffix for all persons being -er [ɐ].

Examination of the forms listed in Table 4.1 reveals that in the great majority of verbs there is complete regularity; that is, the infinitive of nearly all of the verbs ends in [ə], the present in [ɐ], the preterite in [əðə], the past participle in [əð], the present participle in [ənə], and the passive in [əs]. And in every case the imperative occurs without a regular ending. It is quite clear that the verb forms are a combination of stem and suffix. Before the various forms of these two elements can be analyzed, it is necessary to decide where the morpheme boundaries occur, so that it is clear which segments belong to stem and which to suffix.

For all occurring stem types the endings are as stated (ignoring for the moment those infinitive forms which resemble the imperative in that no ending occurs -- for discussion of these see section 4.9 below). In every form, then, there occurs [ə] in the syllable following the syllable which contains the stem vowel (see section 4.3.1 below for motivation of the present tense ending as deriving from əR at an earlier stage in the derivation). Excluding the infinitive forms, where the ending consists only of [ə], and which is assumed below (see section 4.3) to be the suffix, the [ə] must be explained as belonging either to the stem or to the suffix.

	<u>Infin.</u>	<u>Present</u>	<u>Pret.</u>	<u>Past Part.</u>	<u>Pres. Part.</u>	<u>Passive</u>	<u>Imper.</u>	<u>Gloss</u>
vowel- final-stems	1. kRu:ə	kRu:p	kRu:əðə	kRu:əð	kRu:ənə	(kRu:əs)	kRu:ʔ	dread
	2. vi:ə	vi:p	vi:əðə	vi:əð	vi:ənə	vi:əs	vi:ʔ	marry
	3. sne:ʔ	sne:p	sne:əðə	sne:əð	sne:ənə	---	sne:ʔ	snow
	4. t ^h Ro:ʔ	t ^h Ro:p	t ^h Ro:əðə	t ^h Ro:əð	t ^h Ro:ənə	t ^h Ro:ʔs	t ^h Ro:ʔ	believe
	5. nɔ:ʔ	nɔ:p	nɔ:əðə	nɔ:əð	nɔ:ənə	nɔ:ʔs	nɔ:ʔ	reach
	6. vi:lə	vi:lp	vi:ləðə	vi:ləð	vi:lənə	vi:ləs	vi:ʔl	rest
sonorant- final-stems	7. kRɔ:nə	kRɔ:nɔ	kRɔ:nəðə	kRɔ:nəð	kRɔ:nənə	kRɔ:nəs	kRɔ:ʔn	turn grey
	8. Ri:mə	Ri:mɔ	Ri:məðə	Ri:məð	Ri:mənə	Ri:məs	Ri:ʔm	rhyme
	9. stü:Rə	stü:Rp/ stü:p	stü:Rəðə	stü:Rəð	stü:Rənə	stü:Rəs	stü:ʔR	steer
	10. t ^h u:ðə	t ^h u:ðp	t ^h u:ðəðə	t ^h u:ðəð	t ^h u:ðənə	t ^h u:ðəs	t ^h u:ʔð	howl
obstruent- final-stems	11. hɔ:pə	hɔ:pɔ	hɔ:pəðə	hɔ:pəð	hɔ:pənə	hɔ:pəs	hɔ:ʔp	hope
	12. napə	napɔ	napəðə	napəð	napənə	napəs	nap	pinch
	13. p ^h ætə	p ^h ætɔ	p ^h ætəðə	p ^h ætəð	p ^h ætənə	p ^h ætəs	p ^h æt	suck
	14. t ^h akə	t ^h akɔ	t ^h akəðə	t ^h ækəð	t ^h akənə	t ^h akəs	t ^h ak	thank
	15. sɛ:və	sɛ:vɔ	sɛ:vəðə	sɛ:vəð	sɛ:vənə	sɛ:vəs	saʔw	saw
	16. k ^h empə	k ^h empɔ	k ^h empəðə	k ^h empəð	k ^h empənə	k ^h empəs	k ^h ɛʔmp	fight
consonant cluster final-stems	17. ɛlskə	ɛlskɔ	ɛlskəðə	ɛlskəð	ɛlskənə	ɛlskəs	ɛʔlsk	love
	18. skiftə	skiftɔ	skiftəðə	skiftəð	skiftənə	skiftəs	skift	change
	19. lɛŋkə	lɛŋkɔ	lɛŋkəðə	lɛŋkəð	lɛŋkənə	lɛŋkəs	lɛʔŋk	chain
	20. klɪmtə	klɪmtɔ	klɪmtəðə	klɪmtəð	klɪmtənə	klɪmtəs	klɪʔmt	flash

Table 4.1: Principle parts of weak verbs, Class 1

If the [ə] in question is taken to be the final segment of the stem, then the situation exists in which every verb stem in the language ends in the same segment. This is a highly suspect situation; the accidental occurrence of the same segment at the end of every verb stem is most unlikely, unless this segment is, rather than part of the stem itself, a type of verb marker. But there is no other evidence that grammatical categories are marked in this way in Danish. It is far more likely that the [ə] is not the final segment of the stem but the first segment of the suffixes.

Of course it is now necessary, under this assumption, to account for the accidental identity of the initial segment in all five of the suffixes in which it occurs (as a part of the suffix rather than--as in the infinitive--as the entire suffix). Such an account is given in section 4.2 below. For the moment it is sufficient to state that for the reason just given, namely that the accidental occurrence of [ə] as the final segment in every verb stem of Danish is most unlikely, the [ə] in question is assumed to belong not to the stem but to the suffixes.

4.2 Motivation for Epenthetic [ə]

If the [ə] which begins the present, preterite, past participle, present participle and passive suffixes

of the verb forms represented in Table 4.1 can be motivated as being epenthetic rather than the reflex of an underlying vowel, then its apparently accidental occurrence in all of these forms will be explained, and a generalization will be captured concerning these verbal suffixes which would otherwise be missed.³ This motivation takes the following form.

It is the case that all of the stem-final consonants and consonant clusters occurring in the verbs listed in Table 4.1 are phonetically permissible word-finally. If the present tense suffix is assumed to be /R/ (see section 4.3.1 below for motivation of [D] as derived from əR), then all resulting consonant clusters are phonetically impermissible word-finally (e.g. /vi:lR/, /gRɔ:nR/, /tu:dR/, /hɔ:bR/, /kempR/, /ɛlskR/, /skiftR/). Therefore a rule inserting [ə] between stem-final consonant or consonant cluster and suffixed /R/ is justified. Since this ə-epenthesis rule is justified in the case of the present tense forms, its generalization to the other four verbal suffixes in question provides an explanation for the occurrence of [ə] in all of them. Moreover, numerous other instances of impermissible word-final consonant clusters in verb forms in the other suffixes are also avoided by positing this rule, for example /kempd/, /ɛlskd/. The necessary rule can be formulated as

(4.1) e-EPENTHESIS
$$\emptyset \rightarrow [\text{ə}]/[+\text{cons}] + \text{ ______ } [+ \text{cons}] \quad (\emptyset \rightarrow \text{ə}/\text{C} + \text{ ______ } \text{C})$$

4.3 The Infinitive

It is clear from Table 4.1 that the majority of infinitival forms end in [ə], as noted above. Accordingly, [ə] is here taken to be the infinitival suffix, which, in line with the analysis presented in section 2.6.3, is assumed to reflect underlying /e/. That this ending is best explained as a suffix, rather than as part of the stem, follows from the discussion in section 4.2 above, where epenthetic [ə] was motivated for all the other verb forms which contain [ə], on the basis of the stems' being consonant-final. Those stems which surface as vowel-final will be taken up in section 4.10 below, where the exceptional behavior of such stems in the infinitive forms will be accounted for.

4.3.1 Apparent Exceptions to Infinitive Formation

The infinitival form of example (9), styre 'steer' [stü:ɒ], deviates from the pattern in that the ending of the form is neither the stem vowel nor [ə], but [ɒ]. The sources of posttonic [ɒ] are discussed by Rischel (1969:196-199), who concludes that there are three such sources, namely Rə, əR, and RəR. (It will be remembered that what Rischel gives as r is here

rendered R.) It is proposed here that [stü:ɒ] derives from the last of these, based on Rischel's reasoning, as follows:

First [ɒ] (non-syllabic [ɒ]) is shown to be generated from underlying /R/, from the evidence constituted by alternations such as

- (1) arm 'arm' [ɑʔm]/plural [ɑ:mə] vs. ærme
'sleeve' [æɒmə]

- (2) barn 'child' [pɑʔn]/plural børn [pœɒʔn]

In [ɑʔm], [ɑ:mə] and [pɑʔn], the stem vowel surfaces as the quite retracted back vowel [ɑ], associated with the proximity of /R/ (see section 2.4.1.2). Therefore in these forms the underlying sequence /aR/ is motivated. The segment [æ] has been analyzed here (section 2.4.4.2) as a reflex either of /a/ before a coronal consonant or of /ɛ/ when preceded by /R/. It is not clear whether Rischel's use of [æ] corresponds to either of these possibilities, since it occurs neither before a coronal consonant nor after /R/ in [æɒmə]. Possibly rule (2.6) (ɛ-LOWERING) should be emended to a mirror-image rule including the environment "before /R/" as well as "after /R/". It does seem clear that, according to the analysis presented in section 2.4.4.2, if [æ] accurately symbolizes the sound in question, it cannot be a reflex of /a/, since /a/ surfaces in the environment as [ɑ]. Under the analysis presented here, with the appropriate modification of

the rule of $\underline{e}$:-LOWERING, the best solution assumes this instance of [ə] to reflect underlying /ε/. In this case, rule (3.4), the rule of $\underline{R}$ -VOCALIZATION, then applies, and /R/ surfaces as [ɹ].

In the case of the form [pœɹʔn], rule (2.13) (see section 2.4.1.2) laxes /ö/ before /R/, then rule (3.4) applies, deriving [ɹ] from /R/.

Thus the first step in the reasoning deriving [ɹ] from the three possibilities mentioned above (əR, Rə, RəR) is to identify the second underlying element reflected in the segment [ɹ], namely /R/, with the underlying form of [ɹ]. It is clear from the above evidence, then, that [ɹ] is a reflex of /R/. This demonstrated, we proceed to Rischel's motivation of the identification of [ɹ] with [ə] + [ɹ].

The second step in Rischel's reasoning begins with a comparison of monosyllabic and bisyllabic forms such as

(3) se 'see' [seʔ]/present tense [seʔɹ/sepʔ]

(4) tale 'count' [t^hε:lə]/present tense [t^hε:lɹ]

[ɹ] has been shown to be generated from /R/. Rischel suggests that [ɹ] is the suffix added to [seʔ] to yield the present tense [seʔɹ/sepʔ], and also that [ɹ] is added to [t^hε:lə] to yield the present tense [t^hε:lɹ], so that [ɹ] is seen to be generated from ə plus /R/:

$$\text{əR} \rightarrow \text{əɹ} \rightarrow \text{ɹ}.$$

Rischel (1969:197) explicitly disregards "the various problems associated with present tense forms: whether the morpheme border is before or after schwa, whether schwa is epenthetic..." since they are not immediately relevant to his discussion. (See section 4.1.3 above for discussion of the morpheme boundary, section 4.2 above for motivation of schwa as epenthetic.) But if the morpheme boundary in [t^hɛ:lə] is assumed to be before the schwa, such that the stem is /tɛ:l/, though the existence of the underlying vowel which reduces to [ə] is quite clear in the infinitival forms, it cannot be assumed a priori to occur in the underlying form either of the stems or of the suffixes. This fact does indeed have relevance to the analysis which derives [ɒ] from [əɒ], since the only motivation so far for positing an epenthetic [ə] in the present tense instances is the suffix [ɒ], which cannot serve as both motivation and independent evidence for positing epenthetic [ə].

Fortunately, epenthetic [ə] can be motivated in this environment (see section 4.2). Moreover, there exists independent evidence, which Rischel does in fact cite, for the identification of [ɒ] with əR, evidence based on the agentive suffix. The relevant data cited by Rischel (1969:196) are:

- (5) male 'paint' [mæ:lə]
- (6) maler 'painter' [mæ:lɒ]
- (7) malerinde 'woman painter' [mæ:lɒnéə/mæ:lɒRéne]

The last example illustrates the fact that sometimes the /R/ actually surfaces as [R]. Rischel demonstrates that the final suffix is unquestionably [ənə] by means of the forms

(8) ven 'friend' [vén]

(9) veninde 'girl-friend' [venénə].

Thus the occurrence of a reflex of /R/ can only be attributed to an underlying /R/ in the stem, which vocalizes to [ɒ] only because it is preceded by a vowel (forms in final [lR] do not occur), and whether the vowel is underlying or epenthetic is irrelevant here.

Thus the source əR for posttonic [ɒ] is motivated, for verbal forms such as the above-cited [t^hɛ:lɒ] as well as for substantive forms such as [mæ:lɒ].

To return to the form originally under consideration, namely the infinitival form [stü:ɒ], we have seen that this deviates from the general pattern of infinitives in that it ends in [ɒ] rather than [ə]. Rischel demonstrates that [ɒ] is also a reflex of underlying /CV/ or /CVC/ sequences. The forms which constitute evidence for this conclusion are the following infinitives:

(10) kue 'cow' [k^hu:ə]

(11) ændre 'change' [ɛntRɒ]

(12) spærre 'block' [spæɹɒ]

(13) kure 'slide' [k^hu:Rɒ] or [k^hu:ɒ]

Stems (11) - (13) clearly all end in /R/. Since this is the case, and the infinitival suffix is [ə], the

sequence [Rə] also yields [ɒ].

The third step in Rischel's line of reasoning is as follows. It is established that [ɒ] derives from [əR] and that the present tense forms can thus be analyzed as ending in the sequence /eR/. According to Rischel (1969:198) the present tense of kue 'cow' and kure 'slide' are quite commonly pronounced alike: [k^hu:ɒ]. Thus the present tense forms ku:RəR and ku:əR may both surface as [k^hu:ɒ], and the sequence RəR is demonstrated to underlie some instances of [ɒ].

To return to the infinitive of example (9) of Table 4.1, [stü:ɒ] (as in (12) above, [k^hu:ɒ]), final [ɒ] can be assumed to derive from /Re/; thus at the underlying level the form is not deviant but quite regular.

The rules necessary to account for the infinitive form [stü:ɒ] include the rule of e-REDUCTION formulated as (2.23) and the rule of R-VOCALIZATION formulated as (3.4). A rule deleting [ə] after [ɒ] is required to follow this rule, and may be formulated as

(4.2) e-DELETION

ə → ∅ / [ɒ] ____

4.3.2 Summary

The regular forms of the infinitive have been accounted for by positing the underlying infinitival suffix /e/. The apparent exceptions exemplified by certain verbs

surfacing in stem-final vowels have been accounted for by a rule of ə-DELETION which applies in the environment of a preceding high vowel. The apparently deviant behavior of verbs in stem-final /R/ has been accounted for by motivating the occurrence of the final segment [ɒ] in the infinitives of these verbs as a reflex of underlying /Re/.

4.4 The Present Tense

As noted in section 4.1.3 above, the present tense of all of the verb forms represented in Table 4.1 ends in [ɒ]. Motivation for the analysis of this segment as deriving from əR has just been presented in section 4.3.1. That the sequence əR is indeed the ending at an earlier stage of the derivation of the present tense forms has been motivated in section 4.2, where epenthetic [ə] was proposed and argued for. At the underlying level, then, the suffix /R/ is posited for the present tense forms, and rule (4.1), the ə-EPENTHESIS rule, followed by rule (3.4), the R-VOCALIZATION rule, yields the sequence, as in example (6) of Table 4.1 for instance, vi:ləɒ. Thus a rule of ə-DELETION before [ɒ] is required to achieve the correct phonetic output [vi:lɒ]. Rule (4.2), posited in section 4.3.1 above, can be generalized to include this environment; it may now be written as the mirror-image rule

(4.3) $\underline{e}$ -DELETION₂

$$e \rightarrow \emptyset / [p].$$

That is, e deletes in the environment of a preceding or a following $[p]$.

With the positing of the underlying suffix $/R/$ for the present tense forms of the verbs listed in Table 4.1, and the application of rules formulated earlier and the now more general rule of $\underline{e}$ -DELETION₁, the regular phonetic output is accounted for. A restatement of the necessary rules will appear, for convenience, after the following analysis of present tense forms in stem-final $/R/$.

Table 4.2 in section 4.4.1 below presents some sample derivations to illustrate the processes which occur in the forms which have just been discussed (i.e. the infinitive forms in stem-final $/R/$) and those which are discussed in the section which follows immediately.

4.4.1 Analysis of $/R/$ -final Stems in the Present Tense

Example (9) of Table 4.1 shows a loss of the stem-final $/R/$ in the present tense similar to that which occurs in the infinitive. Assuming the underlying representation of this form to be $/stü:R\uparrow R/$, $[e]$ is inserted between the two instances of R by rule (4.1), $\underline{e}$ -EPENTHESIS. By the argument presented in 4.3.1, the derivation of $[p]$ from the sequence $R\uparrow R$ is motivated, and the realization of the present tense of this verb as $[stü:p]$ is accounted

for.

The previously formulated rules which are necessary to yield this output and that of the infinitive forms of verbs in stem-final /R/ are repeated here and followed by Table 4.2, which illustrates their application.

(4.1) a-EPENTHESIS

$$\emptyset \rightarrow [a] / [+cons] + __ [+cons]$$

$$\begin{array}{l} \left[\begin{array}{l} +syll \\ (2) -hi \\ -lo \end{array} \right] \rightarrow [a] / [-str] \\ \left[\begin{array}{l} +syll \\ -hi \\ -lo \\ -bk \\ -rnd \\ +tns \end{array} \right] \rightarrow [a] / [-str] \end{array}$$

(3.4) R-VOCALIZATION

$$\left[\begin{array}{l} +cons \\ -son \\ +cont \\ -ant \end{array} \right] \rightarrow \left[\begin{array}{l} -cons \\ +syll \\ +lo \end{array} \right] / [+syll] __$$

(4.3) a-DELETION₂

$$a \rightarrow \emptyset / [D]$$

(3.17) ASPIRATION

$$\left[\begin{array}{l} -cont \\ -voi \end{array} \right] \rightarrow [+asp] / \$ __$$

	<u>Infin.</u>	<u>Present</u>	<u>Infin.</u>	<u>Present</u>	<u>Alternate</u>	<u>Present</u> ⁴
UNDERLYING FORM	/stü:R+e/	/stü:R+R/	/ku:R+e/	/ku:R+R/	/stü:R+R/	/ku:R+R/
<u>e</u> -EPENTHESIS	---	stü:RəR	---	ku:RəR	stü:RəR	ku:RəR
<u>e</u> -REDUCTION	stü:Rə	---	ku:Rə	---	---	---
<u>R</u> -VOCALIZATION	stü:ɒə	stü:ɒəɒ	ku:ɒə	ku:ɒəɒ	stü:Rəɒ	ku:Rəɒ
<u>e</u> -DELETION ₂	stü:ɒ	stü:ɒɒ	ku:ɒ	ku:ɒɒ	stü:Rɒ	ku:Rɒ
VOWEL REDUCTION	---	stü:ɒ	---	ku:ɒ	---	---
ASPIRATION	---	---	k ^h u:ɒ	k ^h u:ɒ	---	k ^h u:Rɒ
SURFACE FORM	[stü:ɒ]	[stü:ɒ]	[k ^h u:ɒ]	[k ^h u:ɒ]	[stü:Rɒ]	[k ^h u:Rɒ]

Table 4.2: Derivations illustrating the analysis of /R/-final stems

The rule of VOWEL REDUCTION which appears in Table 2.2 requires explanation. Two underlying vowel lengths have been posited in this analysis (see section 2.5), necessitating the positing of rules of vowel lengthening and shortening in the phonology of Danish. Thus there is no constraint against the occurrence of derived long vowels. It does appear to be the case, however, that sequences of two long vowels do not occur in Danish. Thus a rule is required which will shorten one vowel in such a sequence, for example the sequence derived by the application of the rule of e-DELETION in the present tense form of /ku:R+eR/, in which the R-VOCALIZATION rule has applied to the stem.⁵ The form at this point in the derivation is ku:ɒɒ; the surface realization is [k^hu:ɒ]. Therefore the rule of VOWEL SHORTENING must apply to delete one occurrence of [ɒ]. This rule may be considered a redundancy rule of Danish. A possible formulation of this rule is

(4.4) VOWEL REDUCTION

$$[+syll] \rightarrow [-long] / \begin{bmatrix} +syll \\ +long \end{bmatrix} ___$$

4.4.2 Analysis of the Present Tense Form [nɔʔ]

All of the present tense forms listed in Table 4.1, with the single exception of (6), are bisyllabic and end in [ɒ]. The apparently exceptional form of (6), then,

which is the only monosyllabic form, and yet which ends (ignoring for a moment the stød), as do the other present tense forms, in [ɒ], remains to be accounted for.

Evidence will be presented below in section 3.10 that the stems which surface in final vowels have in their underlying form a final consonant. Ignoring for the moment this underlying consonant, it is assumed that the present tense suffix /R/ is added to the stem form nɔ (the stød in vowel-final forms being predictable--see section 2.7.5). Application of the rule of R-VOCALIZATION will yield the derived form nɔ:D.

Clearly a further rule is required to eliminate the unrealized vowel. A rule $\text{ɔ} \rightarrow \emptyset / ___ [\text{D}]$ would accomplish this deletion, but is somewhat ad hoc. A rule has already been formulated to account for the behavior of ɔ: when followed by R⁶--namely, rule (2.5) of section 2.4.1.2, which lowers ɔ: to [ɒ:] in this environment. Application of this rule to the derived form with which the foregoing partial derivation ends, nɔ:D, results in the form nɒ:D. This form contains in effect the sequence ɒɒɒ. A quite natural morpheme structure condition might be formulated to handle such infelicitous cases: $V_1V_1V_1 \rightarrow V_1V_1$. When invoked in this instance, it would result in the derived form nɒ:. When the rule of STØD-PLACEMENT is applied to this form, the correct surface form [nɒ?] results.⁷

4.4.3 Summary

The regular forms of the present tense have been accounted for by positing the underlying present tense suffix /R/ and a rule of ə-EPENTHESIS. Application of the previously formulated rule of R-VOCALIZATION yields a sequence əɒ, which necessitates a further rule of ə-DELETION, whose application results in the correct phonetic form of the present tense suffix as [ɒ]. The phonetic shape of the suffix when affixed to /R/-final stems has been accounted for on the basis of Rischel's argument for one source of posttonic [ɒ] as RəR. The rules required to account for nearly all of the present tense forms have been restated and illustrative derivations have been presented. For those instances in which application of the rules yields a sequence of two long vowels, which is an impermissible phonetic sequence in Danish, a redundancy rule has been proposed to reduce the second of these vowels to a short vowel. Further investigation is indicated to determine if there are other situations in which such a sequence is derived, which would constitute further evidence for this rule.

Finally, the occurrence of an apparently exceptional monosyllabic present tense form has been accounted for on the basis of its stem-vowel being identical to the derived suffix [ɒ], which leads to a derived sequence of three identical vowels. A morpheme structure con-

dition has been formulated and invoked to reduce this sequence to a long vowel. Thus all of the present tense forms listed in Table 4.1 have been accounted for.

4.5 The Preterite

The verbs listed in Table 4.1 all occur with the preterite ending [əʔə], as was discussed in section 4.1.3 above. Since the first instance of [ə] in these forms has been motivated as being epenthetic (see section 4.2), the final sequence [ʔə] can be taken as the reflex of the underlying suffix. The segment [ʔ] has been analyzed as a reflex of underlying /d/ (see section 3.5.8.2) and [ə], when not epenthetic and when not in alternation with any other vowel, as a reflex of underlying /e/ (see section 2.6.3). Therefore the underlying preterite suffix is here assumed to be /de/. By application of the rules of e-REDUCTION (restated above in section 4.4.1) and SPIRANTIZATION (formulated in section 3.5.7), in combination with whatever other rules are required by the forms of particular verbs, the correct surface forms are generated. The following derivations serve to illustrate the process.

UNDERLYING FORM	/ski:ft+de/	/tak+de/
ə-EPENTHESIS	ski:ftəde	takəde
VOWEL SHORTENING	skiftəde	---
e-REDUCTION	skiftəde	takəde
SPIRANTIZATION ₂	skiftəʔe	takəʔe
ASPIRATION	---	t ^h akəʔe
SURFACE FORM	[skiftəʔə]	[t ^h akəʔə]

(See section 2.4.1 for formulation of the rule of VOWEL

SHORTENING.)

Clearly e-REDUCTION must apply before SPIRANTIZATION, since the latter is dependent upon the affected segment's being syllable-final, and this position is assured by the syllable-readjustment process triggered by the occurrence of derived [ə] (see section 3.5.2).

4.5.1 Constraints on Sequences of Segments Occurring with /ed/ Suffix

Apart from the sporadic occurrence of verbs which irregularly take the [tə] preterite ending, and which must be so marked in the lexicon, there is one class of verbs which takes only this ending, never the /de/ suffix just posited, and which must also be so marked in the lexicon. This class, as noted in section 4.1.3, consists of verbs containing the sequence short vowel plus [l m n ŋ]. This sequence may be characterized in terms of distinctive features as $\begin{bmatrix} +\text{syll} \\ -\text{long} \end{bmatrix} \begin{bmatrix} +\text{cons} \\ +\text{son} \end{bmatrix}$. That is, the consonants involved form the natural class of sonorants (excluding the segment /R/, since this segment has been analyzed as [-son]--see section 3.4.1.3).

It will be observed that, under this formulation, it is surface information that determines the marking of these verbs as taking not the /de/ suffix but the suffix realized as [tə]. That is, since the segment [ŋ] has been analyzed as the underlying sequence /ng/ (see section 3.4.4),

its inclusion in the set of conditioning factors responsible for the marking of this class of verbs for preterite suffix entails that derived phonological forms serve as input to syntactic rules. If, on the contrary, underlying representations rather than surface representations are considered to be the conditioning factor here, /ng/ is the only instance of a consonant cluster rather than a sonorant which serves as such, and the generalization is missed. It should be noted that the analysis presented here supports the notion of local rule ordering, since the rule of REGRESSIVE ASSIMILATION formulated as (3.8), which derives [ŋ] from /ng/, must apply in this case before the rule which specifies the form of the suffix.

4.5.2 Summary

In this section the preterite suffix /de/ and the rules required to achieve the correct phonetic output have been motivated. A class of verbs excluded from taking this suffix has been accounted for on the basis of its containing the sequence of short vowel plus a member of the natural class of sonorant consonants. This explanation has been seen to lend support to the theory of local ordering, since the generalization captured by specifying the natural class as [+son] can only be made after the application of the rule of regressive assimilation which derives [ŋ] from /ng/, and thus converts its underlying form from a consonant cluster

to a nasal, placing it in the class of sonorants.

4.6 The Past Participle

The past participle of every verb listed in Table 4.1 surfaces with the ending [əð]. The [ə] having been motivated as epenthetic, the underlying suffix is here assumed to be /d/, from which [əð] is derived by the application of the rule of ə-EPENTHESIS followed by the rule of SPIRANTIZATION, as illustrated by the following derivation:

UNDERLYING FORM	/ɛlsk+d/
<u>ə</u> -EPENTHESIS	ɛlskəd
SPIRANTIZATION ₂	ɛlskəð
SURFACE FORM	[ɛlskəð]

4.7 The Present Participle

In the case of the present participle, each instance of the ending has the shape [ənə]. The underlying form is here taken to be /ne/, which by the application of the ə-EPENTHESIS rule and the ə-REDUCTION rule becomes [ənə]:

UNDERLYING FORM	/tu:d+ne/
<u>ə</u> -EPENTHESIS	tu:dənə
<u>ə</u> -REDUCTION	tu:dənə
SPIRANTIZATION ₂	t ^h _u :ðənə
ASPIRATION	t ^h _u :ðənə
SURFACE FORM	[t ^h _u :ðənə]

4.8 The Passive

The passive form in each instance surfaces in final [əs]. This ending is here assumed to reflect under-

lying /s/:⁸

UNDERLYING FORM	/tak+s/
e-EPENTHESIS	takes
ASPIRATION	t ^h akes
SURFACE FORM	[t ^h akes]

4.9 The Imperative

All of the imperative forms listed in Table 4.2 have the same phonetic shape as that portion of the other forms which has been assumed here to be the stem, with the additional feature that--except for examples (12), (13), (14) and (18)--they all occur with stød. Ignoring for the moment difficulties presented by those stems which surface as vowel-final (and which will be taken up in the following section), it is clear that if zero suffix is posited for the imperative, the STØD-PLACEMENT rule presented in section 2.7.5 and re-stated here for convenience, is adequate to account for the form of the imperative.

(2.24) STØD-PLACEMENT

$$\emptyset \rightarrow [\text{st}\emptyset\text{d}] \left\{ \begin{array}{l} \left[\begin{array}{l} +\text{syll} \\ -\text{cons} \\ +\text{long} \end{array} \right] \\ \left[\begin{array}{l} +\text{syll} \\ -\text{cons} \\ -\text{long} \end{array} \right] \left[\begin{array}{l} -\text{syll} \\ +\text{cons} \\ +\text{voi} \end{array} \right] \left[\begin{array}{l} -\text{syll} \\ +\text{cons} \end{array} \right] \left(\left[\begin{array}{l} -\text{syll} \\ +\text{cons} \end{array} \right] \right) \# \end{array} \right\}$$

That is, for those stems which surface in a vowel, the vowels are long (diphthongs being also included in this category); this condition holds true for those stems

ending in a single consonant as well (e.g. /sne:/, /vi:l/, /hɔ:l/, /hɔ:b/). Thus the first environment stated in curly braces is satisfied and the rule applies. With respect to stems in a short vowel, those followed by a voiced consonant plus consonant(s) (e.g. /ɛlsk/, kliɪmt/) also occur with stɔd, as predicted by the second environment stated in curly braces. The stems in short vowel plus non-sonorant consonant(s) (e.g. /nap/, /skift/) predictably do not occur with stɔd. Therefore zero suffix is here posited for the imperative forms of these verbs; the rule of stɔd-placement is adequate to account for their phonetic shape.

4.10 Stems Surfacing in a Final Vowel

In section 4.2 epenthetic [ə] was motivated in the suffix of present, preterite, past participle, present participle and passive forms of the verbs under consideration. This motivation was based on the fact that while all of the occurring stem-final consonants and consonant clusters in these forms are permissible word-finally, none of the resulting consonant clusters is permissible word-finally when the present tense suffix /R/ is affixed. While this fact constitutes a strong argument in favor of the epenthetic nature of [ə] in these forms, the class of stems which surface in a final vowel presents a difficulty for this analysis. If epenthetic [ə] results

from the juxtaposition of two consonants, its presence in forms such as [kRu:ɒ, kRu:əʔə] and [vi:ɒ, vi:əʔə] must be explained.

A plausible explanation for the presence of epenthetic [ə] in such forms is that the stems are in fact consonant-final in their underlying form, and that the final consonant has been deleted subsequent to the application of the *s*-EPENTHESIS rule. Motivation for this hypothesis is presented in section 4.10.1.

4.10.1 Motivation of Consonant-Final Stems

It will be noted with respect to the forms in question that all of the stem vowels occurring in these forms are long, as indeed they are as well in all of the stems in which the vowel is followed by a single (underlyingly) voiced consonant (e.g., [kRu:ɒ], [vi:ɒ], [kRo:ɒ], [t^hu:ʔɒ]). The stem vowels followed by a consonant cluster or a single (underlying) voiceless consonant are, on the other hand, all short (e.g., [k^hɛmpɒ], [t^hakp]). In the case of stems in a final consonant cluster, it is difficult to draw any conclusions as to the underlying quantity of the stem vowel, since an underlyingly long vowel may be shortened in this environment (see section 2.4.1.1). In the case of the stems in a single underlyingly voiced consonant, it is precisely this environment which conditions the lengthening of an

underlying short vowel (see section 2.5.2). Therefore, under the hypothesis that a final consonant has been deleted in the forms which surface in a stem-final vowel, the deleted consonant must be one which conditions vowel lengthening, since all such vowels, as noted, occur as long.

It will also be noted that, among the examples given in Table 4.1 of the voiced consonants occurring in stem-final position, [ɣ], [v] and [h] fail to occur. In section 3.4.1.3 it was pointed out that of all the consonants posited as underlying, /h/ is the only one which has a limited distribution, occurring only syllable-initially. Thus its absence from this list is not surprising. Since [v] has been posited as being derived (see section 3.4.5.2), and never occurs in syllable-final position, its absence is also predictable. Thus only underlying /g/, of which [ɣ] is the reflex in this position, is not represented among the stem-final consonants. Since it is the underlying voiced consonants which both fail to trigger vowel shortening and provide the environment for vowel lengthening, /g/ is a possible candidate for the deleting consonant here.

4.10.2 Evidence for Underlying /g/

In section 3.5.8.2 underlying /g/ was analyzed as having the alternants [y] and [w], and these alternants

were shown to delete in certain environments among many speakers (and often depending upon rate or style of speech). Since /g/ is both the only consonant which does not occur stem-finally in the verb forms under consideration and the only consonant which deletes in this phonetic context, the presence of underlying /g/ in these forms is strongly motivated. In these cases, as in the ones cited in section 3.5.8.2, which are also verbs and constitute additional examples of the process being examined here, it is hypothesized that /g/ undergoes SPIRANTIZATION and subsequent GLIDE-DELETION.

4.10.3 Summary

The evidence just presented constitutes convincing support for the hypothesis that, epenthetic [ə] having been motivated in these forms by the assumption of an underlying stem-final consonant, the consonant in question is /g/. The rules posited to spirantize /g/, and to form glides of the resulting [ɣ], and to delete it in this context, are required elsewhere in the grammar. The following derivation illustrates the process here.

UNDERLYING FORM	/vi:gtR/
e-EPENTHESIS	vi:gəR
SPIRANTIZATION ₂	vi:ɣəR
GLIDE-FORMATION	vi:yəR
GLIDE-DELETION	vi:əR
R-VOCALIZATION	vi:əɒ
e-DELETION ₂	vi:ɒ
SURFACE FORM	[vi:ɒ]

(The underlying vowel is rendered here as long, but there is no evidence either way as to its quantity, since its environment (following voiced consonant) is a lengthening environment.)

4.10.4 Infinitive Forms without Suffix

An explanation of the behavior of the forms in which the stems surface as vowel-final has been posited; there remain to be accounted for those infinitive forms which surface as identical to the imperative, occurring without the infinitive suffix and with stød (i.e., [sne:ʔ, t^hRo:ʔ, no:ʔ]). These can be explained as being subject to a rule of ə-DELETION in the infinitive of all weak verbs of this class of which the stems end in underlying /g/. This rule of deletion applies just in the case of the only consonant which has as a reflex a glide. It may be posited that the glide constitutes the environment for the deletion of the suffixed [ə], and the rule may be formulated as

(4.5) ə-DELETION

$$ə \rightarrow \emptyset / \left[\begin{array}{l} -\text{syll} \\ -\text{cons} \end{array} \right]_+ ___$$

It will be noted, however, that there are exceptions to this rule, namely examples (1) and (2) of Table 4.1, [kRu:ə] and [vi:ə]. It is the case that in all such exceptional forms the stem vowel is /i/ or /u/.⁹ These

can be excluded from the rule of e-DELETION by constraining the rule to apply in the case of non-high vowels only. It may thus be re-formulated as

$$(4.6) \quad \underline{e}\text{-DELETION}_3 \\ e \rightarrow \emptyset / \left[\begin{array}{c} +\text{syll} \\ -\text{high} \end{array} \right] \left[\begin{array}{c} -\text{syll} \\ -\text{cons} \end{array} \right] + \text{---}$$

In this manner the generalization is captured that stems in underlying /g/ occur without the infinitive suffix. The exceptions to this rule are explained on the basis of the stem-final consonant's being preceded by a high vowel.

4.11 Summary

In this section the weak verbs of the class under consideration which surface in stem-final vowels have been examined. Since epenthetic e was motivated on the grounds of there arising impermissible word-final consonant clusters when certain suffixes are added to consonant-final stems, the fact that e occurs in stems which do not show a final consonant has to be explained. The hypothesis was proposed that the epenthetic e in these cases is motivated by an underlying stem-final consonant, which deletes after the application of the rule of e-EPENTHESIS. This hypothesis is supported by the fact that among the consonants which occur syllable-finally in Danish, namely all of them but /h/, only /g/ fails to occur in this environment in this class of verbs. Furthermore,

it is just this consonant which is subject to a rule of GLIDE-FORMATION; the derived glides are then subject to a rule of GLIDE-DELETION. Both of these rules are required elsewhere in the grammar; thus they are well motivated and the account of these verb forms leads to no further complication of the grammar.

The infinitive forms which occur without the infinitive suffix *ə* are accounted for by a rule of *ə*-DELETION, and those forms which are exceptions to this rule are accounted for on the basis of their being just those which contain a high stem vowel preceding the glide which conditions *ə*-DELETION.

4.12 Weak Verbs of Class 2

This class of weak verbs consists of the set which takes the preterite ending [tə] and the past participle ending [t]. As noted above (section 4.1.3), this class consists of (a) stems ending in the sequence short vowel plus [l m n ŋ], which, as noted, constitutes the natural class of sonorants, and (b) long vowel plus consonant other than [v]. This is the only set which systematically does not take the [əðə/əd] past tense suffixes; the [ət/t] past tense suffixes are almost entirely restricted to this set. Table 4.3 presents verbal paradigms which constitute examples of the data upon which the following analysis is based. Since the preterite and past participle

forms are the only ones which differ from the previously examined verbs in terms of the suffix which they take, only these two forms and the infinitive are cited in Table 4.3.¹⁰

	<u>Infinitive</u>	<u>Preterite</u>	<u>Past Participle</u>	<u>Gloss</u>
(1)	t ^h _ɛ :lə	t ^h _ɛ ltə	t ^h _ɛ ?lt	speak
(2)	stɛmə	stɛmtə	stɛ?mt	voice
(3)	me:nə	mentə	me?nt	think
(4)	t ^h _{Ræŋ} ə	t ^h _{Ræŋ} tə	t ^h _{Ræŋ} ?nt	press

Table 4.3: Weak verbs of Class 2

4.12.1 The Preterite

Since in every case the preterite suffix surfaces as [tə], it is assumed here that the underlying form of the suffix is /te/. The following derivations illustrate the process of rule applications which yield the correct surface forms from the proposed underlying forms. The rules which apply have all been formulated in earlier sections.

UNDERLYING FORM	/tal+te/	/tRəŋg+te/
REGRESSIVE	---	tRəŋgte
ASSIMILATION		
CONSONANT DELETION ₁	---	tRəŋte
e-REDUCTION	t _h alte	t _h Rəŋte
ASPIRATION	t ^h alte	t ^h Rəŋte
DEVOICING	t ^h altə	t ^h Rəŋte
a-FRONTING	t ^h æltə	t ^h æŋte
ɛ-LOWERING	t ^h æltə	t ^h Ræŋte
SURFACE FORM	[t ^h æltə]	[t ^h Ræŋte]

4.12.2 The Past Participle

Each of the past participle forms ends in [t]. Therefore the underlying form of the past participle suffix is here taken to be /t/, and the following derivations illustrate the necessary rule applications.

UNDERLYING FORM	/stem+t/	/men+t/
STØD-PLACEMENT	stɛ?mt	me?nt
SURFACE FORM	[stɛ?mt]	[me?nt]

4.12.3 Summary

Verbs of Class 2, those weak verbs taking the preterite ending [tə] and the past participle ending [t], differ from Class 1 verbs, those taking the preterite ending [əðə] and the past participle ending [əʔ], in only these two endings. Therefore, the analysis presented with respect to Class 1 verbal suffixes covers those of Class 2 as well, except for the preterite and past tense forms. The underlying forms of these two suffixes of Class 2 verbs have been posited here as /te/ and /t/ respectively. Rules formulated to apply elsewhere in the grammar have been demonstrated to be adequate to yield the correct output from these underlying forms.

4.13 Conclusion

In this chapter the verbal inflections of Danish have been examined and underlying forms have been posited for the suffixes involved. The phonological rules formula-

ted in Chapters II and III have been shown to account for much of the morphophonemic alternation, and additional rules have been formulated where required.

The hypothesis has been proposed that verb stems which surface in a final vowel have in their underlying form a final voiced consonant, and evidence is put forth that this consonant is /g/. This claim explains the behavior both of monosyllabic forms in a stem-final vowel and bisyllabic forms in stem-final schwa.

FOOTNOTES TO CHAPTER IV

1. See footnote (5), Chapter V.
2. See section 2.5 for discussion of underlying vowel length.
3. If the various instances of [ə] are taken to be reflexes of different underlying vowels the situation is also explained. There is, however, no evidence for such an account. Furthermore, [ə] is in the present work assumed to be the reflex of underlying /e/ in all cases in which a surface alternation is not present to account for its underlying status as another vowel (see section 2.6.3). Under these circumstances all of these [ə]'s would be analyzed as reflexes of underlying /e/, leaving their coincidental occurrence in all of the suffixes in question still unaccounted for.
4. The alternate present tense form derived here occurs with the optional non-application of (3.7) R-VOCALIZATION.
5. It is not possible to account for the surface form by a different arrangement of rules: a rule deleting the unwanted [ɒ], applying before ə-DELETION, would have to be posited to apply in the environment of either a preceding or a following ə, as in the derived infinitive form ku:və and the two derived alternate present tense forms ku:pəp and ku:Rəp. It is the form ku:pəp which is crucial here. If the rule deleting one occurrence of p is formulated to delete p preceding ə, it will also delete this segment in the infinitive (derived) form ku:və, ultimately yielding *[k^hu:ə]. If the rule is formulated to delete p following ə, it will delete this segment from the present tense (derived) form ku:Rəp, ultimately yielding *[k^hu:Rə]. Thus the sequence pə cannot be avoided here, and the means for yielding the correct surface representation [p] must be a rule of vowel shortening.
6. Bearing in mind that the stem vowel is considered to be underlyingly long in view of the fact that it occurs with stød when word-final; in any case, rule (2.11) is a context-free rule which lowers (or backs--see section 2.4.2) short /ɔ. to [ɒ] so that the alternation of vowel quality occurs no matter which vowel quantity is assumed to be underlying.
7. The morpheme structure condition suggested here might well have validity as a far more general rule, not limited to Danish.

8. The (East Scandinavian) suffix -s-- derived from an enclitic that began as the reflexive pronoun sik-- took on meanings other than that of reflexive, among them mediopassive. Thus historically it is clear that there was no intervening vowel to begin with.
9. There do occur some verbs in stem-final [i] which are also subject to this rule, e.g., ri 'tack, baste' [Ri:ʔ], and some which occur both with and without the infinitive ending [ə]; for example number (2) of Table 4.1, given as [vi:ə], also occurs as [vi:ʔ]. Those verbs in stem-final [i] which are obligatorily or optionally subject to rule 4.1 must be so marked in the lexicon.
10. Since the infinitive suffix has already been motivated, these stems are also motivated.

	<u>Class 1</u>	<u>Class 2</u>
INFINITIVE	/e/	/e/
PRESENT	/R/	/R/
PRETERITE	/de/	/te/
PAST PARTICIPLE	/d/	/t/
PRESENT PARTICIPLE	/ne/	/ne/
PASSIVE	/s/	/s/
IMPERATIVE	∅	∅

Table 4.4: Underlying suffixes of the verb system

	<u>Infinitive</u>	<u>Present</u>	<u>Preterite</u>	<u>Past Participle</u>	<u>Present Participle</u>	<u>Passive</u>	<u>Impera- tive</u>
UNDERLYING FORM	/vi:g+e/	/vi:g+R/	/vi:g+de	/vi:g+t/	/vi:g+ne/	/vi:g+s/	/vi:g+ø/
<u>STØD</u> -PLACEMENT	vi:ʔge	vi:ʔgR	vi:ʔgde	vi:ʔgt	vi:ʔgne	vi:ʔgs	vi:ʔg
<u>e</u> -EPENTHESIS	---	vi:ʔgæR	vi:ʔgæðe	vi:ʔgæt	vi:ʔgæne	vi:ʔgæs	---
<u>e</u> -REDUCTION	vi:ʔgə	---	vi:ʔgæðe	---	vi:ʔgəne	---	---
SPIRANTIZATION ₂	vi:ʔyə	vi:ʔyəR	vi:ʔyəðe	vi:ʔyæt	vi:ʔyəne	vi:ʔyəs	vi:ʔy
<u>STØD</u> -DELETION	vi:ʔə	vi:ʔəR	vi:ʔəðe	vi:ʔæt	vi:ʔəne	vi:ʔəs	---
GLIDE FORMATION	vi:yə	vi:yəR	vi:yəðe	vi:yæt	vi:yəne	vi:yəs	vi:ʔy
GLIDE DELETION	vi:ə	vi:əR	vi:əðe	vi:æt	vi:əne	vi:əs	vi:ʔ
<u>R</u> -VOCALIZATION	---	vi:əd	---	---	---	---	---
<u>e</u> -DELETION ₂	---	vi:ɒ	---	---	---	---	---
SURFACE FORM	[vi:ə]	[vi:ɒ]	[vi:əðe]	[vi:æt]	[vi:əne]	[vi:əs]	[vi:ʔ]

Table 4.5: Derivations of Class 1 verbs

	<u>Infinitive</u>	<u>Present</u>	<u>Preterite</u>	<u>Past Participle</u>	<u>Present Participle</u>	<u>Passive</u>	<u>Impera- tive</u>
UNDERLYING FORM	/pat+e/	/pat+R/	/pat+de/	/pat+t/	/pat+ne/	/pat+s/	/pat+ø/
STØD-PLACEMENT	---	---	---	---	---	---	---
<u>ə</u> -EPENTHESIS	---	patəR	patədə	patət	patəne	patəs	---
<u>e</u> -REDUCTION	patə	---	patədə	---	patəne	---	---
R-VOCALIZATION	---	patəp	---	---	---	---	---
<u>ə</u> -DELETION ₂	---	patɒ	---	---	---	---	---
SPIRANTIZATION ₂	---	---	patəd̥ə	---	---	---	---
ASPIRATION	p ^h atə	p ^h atɒ	p ^h atəd̥ə	p ^h atət	p ^h atəne	p ^h atəs	p ^h at
<u>a</u> -FRONTING	p ^h ætə	p ^h ætɒ	p ^h ætəd̥ə	p ^h ætət	p ^h ætəne	p ^h ætəs	p ^h æt
SURFACE FORM	[p ^h ætə]	[p ^h ætɒ]	[p ^h ætəd̥ə]	[p ^h ætət]	[p ^h ætəne]	[p ^h ætəs]	[p ^h æt]

Table 4.5: Derivations of Class 1 verbs

	<u>Infinitive</u>	<u>Present</u>	<u>Preterite</u>	<u>Past Participle</u>	<u>Present Participle</u>	<u>Passive</u>	<u>Impera- tive</u>
UNDERLYING FORM	/vi:l+e/	/vi:l+R/	/vi:l+de/	/vi:l+t/	/vi:l+ne/	/vi:l+s/	/vi:l+Ø/
<u>STØD</u> -PLACEMENT	vi:ʔle	vi:ʔlR	vi:ʔlde	vi:ʔlt	vi:ʔlne	vi:ʔls	vi:ʔl
<u>ə</u> -EPENTHESIS	---	vi:ʔləR	vi:ʔləde	vi:ʔlət	vi:ʔləne	vi:ʔləs	---
<u>e</u> -REDUCTION	vi:ʔlə	---	vi:ʔləde	---	vi:ʔləne	---	---
<u>STØD</u> -DELETION	vi:lə	vi:ləR	vi:ləde	vi:lət	vi:ləne	vi:ləs	---
<u>R</u> -VOCALIZATION	---	vi:ləɒ	---	---	---	---	---
<u>ə</u> -DELETION ₂	---	vi:lɒ	---	---	---	---	---
SPIRANTIZATION ₂	---	---	vi:ləðə	---	---	---	---
SURFACE FORM	[vi:lə]	[vi:lɒ]	[vi:ləðə]	[vi:lət]	[vi:ləne]	[vi:ləs]	[vi:ʔl]

Table 4.5: Derivations of Class 1 verbs

	<u>Infinitive</u>	<u>Present</u>	<u>Preterite</u>	<u>Past Participle</u>	<u>Present Participle</u>	<u>Passive</u>	<u>Impera- tive</u>
UNDERLYING FORM	/lɛŋk+e/	/lɛŋk+R/	/lɛŋk+de/	/lɛŋk+tt/	/lɛŋk+ne/	/lɛŋk+ts/	/lɛŋk+ø/
<u>STØD</u> -PLACEMENT	---	---	---	---	---	---	lɛʔŋk
<u>e</u> -EPENTHESIS	---	lɛŋkəR	lɛŋkədə	lɛŋkət	lɛŋkəne	lɛŋkəs	---
<u>e</u> -REDUCTION	lɛŋkə	---	lɛŋkədə	---	lɛŋkəne	---	---
<u>R</u> -VOCALIZATION	---	lɛŋkəɒ	---	---	---	---	---
<u>e</u> -DELETION ₂	---	lɛŋkɒ	---	---	---	---	---
REGRESSIVE ASSIMILATION	lɛŋkə	lɛŋkɒ	lɛŋkədə	lɛŋkət	lɛŋkəne	lɛŋkəs	lɛʔŋk
CONSONANT DELETION	lɛŋkə	lɛŋkɒ	lɛŋkədə	lɛŋkət	lɛŋkəne	lɛŋkəs	lɛʔŋk
SPIRANTIZATION ₂	---	---	lɛŋkəðə	---	---	---	---
SURFACE FORM	[lɛŋkə]	[lɛŋkɒ]	[lɛŋkəðə]	[lɛŋkət]	[lɛŋkəne]	[lɛŋkəs]	[lɛʔŋk]

Table 4.5: Derivations of Class 1 verbs

	<u>Infinitive</u>	<u>Present</u>	<u>Preterite</u>	<u>Past Participle</u>	<u>Present Participle</u>	<u>Passive</u>	<u>Impera- tive</u>
UNDERLYING FORM	/tɛl+e/	/tɛl+R/	/tɛl+te/	/tɛl+t/	/tɛl+ne/	/tɛl+s/	/tɛl+ø/
<u>STØD</u> -PLACEMENT	---	---	---	tɛʔlt	---	---	tɛʔl
<u>ə</u> -EPENTHESIS	---	tɛləR	---	---	tɛləne	tɛləs	---
<u>e</u> -REDUCTION	tɛlə	---	tɛltə	---	tɛləne	---	---
VOWEL LENGTHENING	tɛ:lə	tɛ:ləR	---	---	tɛ:ləne	tɛ:ləs	---
<u>R</u> -VOCALIZATION	---	tɛ:ləɐ	---	---	---	---	---
<u>ə</u> -DELETION ₂	---	tɛ:lɐ	---	---	---	---	---
ASPIRATION	t ^h ɛ:lə	t ^h ɛ:lɐ	t ^h ɛltə	t ^h ɛʔlt	t ^h ɛ:ləne	t ^h ɛ:ləs	t ^h ɛʔl
SURFACE FORM	[t ^h ɛ:lə]	[t ^h ɛ:lɐ]	[t ^h ɛltə]	[t ^h ɛʔlt]	[t ^h ɛ:ləne]	[t ^h ɛ:ləs]	[t ^h ɛʔl]

Table 4.6: Derivations of Class 2 verbs

	<u>Infinitive</u>	<u>Present</u>	<u>Preterite</u>	<u>Past Participle</u>	<u>Present Participle</u>	<u>Passive</u>	<u>Impera- tive</u>
UNDERLYING FORM	/tReng+e/	/tReng+R/	/tReng+te/	/tReng+tt/	/tReng+ne/	/tReng+s/	/tReng+Ø/
STØD-PLACEMENT	---	---	---	trɛʔngt/	---	---	trɛʔng
ə-EPENTHESIS	---	tRengəR	---	---	tRengəne	tRengəs	---
e-REDUCTION	tRengə	---	tRengtə	---	tRengəne	---	---
R-VOCALIZATION	---	tRengəɒ	---	---	---	---	---
ə-DELETION ₂	---	tRengɒ	---	---	---	---	---
REGRESSIVE ASSIMILATION	tRengə	tRengɒ	tRengtə	trɛʔngt	tRengəne	tRengəs	trɛʔng
CONSONANT DELETION	tRɛŋə	tRɛŋɒ	tRɛŋtə	trɛʔŋt	tRɛŋəne	tRɛŋəs	trɛʔŋ
ɛ(:)-LOWERING	tRæŋə	tRæŋɒ	tRæŋtə	træʔŋt	tRæŋəne	tRæŋəs	træʔŋ
ASPIRATION	t ^h Ræŋə	t ^h Ræŋɒ	t ^h Ræŋtə	t ^h Ræʔŋt	t ^h Ræŋəne	t ^h Ræŋəs	t ^h Ræʔŋ
DEVOICING	t ^h _˙ Ræŋə	t ^h _˙ Ræŋɒ	t ^h _˙ Ræŋtə	t ^h _˙ Ræʔŋt	t ^h _˙ Ræŋəne	t ^h _˙ Ræŋəs	t ^h _˙ Ræʔŋ
SURFACE FORM	[t ^h _˙ Ræŋə]	[t ^h _˙ Ræŋɒ]	[t ^h _˙ Ræŋtə]	[t ^h _˙ Ræʔŋt]	[t ^h _˙ Ræŋəne]	[t ^h _˙ Ræŋəs]	[t ^h _˙ Ræʔŋ]

Table 4.6: Derivations of Class 2 verbs

	<u>Infinitive</u>	<u>Present</u>	<u>Preterite</u>	<u>Past Participle</u>	<u>Present Participle</u>	<u>Passive</u>	<u>Impera- tive</u>
UNDERLYING FORM	/stem+e/	/stem+R/	/stem+te/	/stem+t/	/stem+ne/	/stem+s/	stem+ø/
STØD-PLACEMENT	---	---	---	ste?mt	---	---	ste?m
<u>e</u> -EPENTHESIS	---	steməR	---	---	steməne	steməs	---
<u>e</u> -REDUCTION	stemə	---	stemtə	---	steməne	---	---
<u>R</u> -VOCALIZATION	---	steməɒ	---	---	---	---	---
<u>e</u> -DELETION ₂	---	stemɒ	---	---	---	---	---
SURFACE FORM	[stemə]	[stemɒ]	[stemtə]	[ste?mt]	[steməne]	[steməs]	[ste?m]
UNDERLYING FORM	/mente/	/men+R/	/men+te/	/men+t/	/men+ne/	/men+s/	/men+ø/
STØD-PLACEMENT	---	---	---	me?nt	---	---	me?n
<u>e</u> -EPENTHESIS	---	menəR	---	---	menəne	menəs	---
<u>e</u> -REDUCTION	menə	---	mentə	---	menəne	---	---
VOWEL LENGTHENING	me:nə	me:nəR	---	---	me:nəne	me:nəs	---
<u>R</u> -VOCALIZATION	---	me:nəɒ	---	---	---	---	---
<u>e</u> -DELETION ₂	---	me:nɒ	---	---	---	---	---
SURFACE FORM	[me:nə]	[me:nɒ]	[mentə]	[me?nt]	[me:nəne]	[me:nəs]	[me?n]

Table 4.6: Derivations of Class 2 verbs

CHAPTER V

THE SYSTEM OF NOUN INFLECTIONS

5.1 Introduction

The alternations which occur in the case of Danish nouns arise from the use of suffixes to express (1) singular/plural distinctions, (2) definiteness vs. indefiniteness, and (3) possession. In addition, a gender distinction is reflected in the articles.

The system of case endings in Danish, as in English, has nearly disappeared, so that there exists today a three case system only in the personal pronouns (i.e., nominative, genitive, accusative). The form of nouns is the same for all grammatical cases except the genitive. The noun suffixes treated in this chapter are, then, those which indicate plurality, definiteness and possession.

Danish nouns fall into two classes of grammatical gender, common and neuter (the common gender arising from a falling together of the earlier classes of masculine and feminine). These genders do not affect the form of the nouns themselves, but necessitate differences in the forms of articles and adjectives used in conjunction with them. Most Danish nouns are inflected for number, occurring with different endings in the singular and the plural.

As with Danish verbs, certain noun forms demonstrate

ablaut. These forms occur both with and without differences in endings. The forms occurring with this variation in vowel quality constitute a small closed set; by far the largest number of Danish nouns occur with the same vowel in both singular and plural forms, the inflection residing only in the endings. There are two classes of nouns which are thus inflected: (a) those which occur with the plural ending -er [ɐ] and (b) those which occur with the plural ending -e [ə].

There is also a small set of nouns in Danish, as in English, which evidence only one form for both singular and plural. In section 5.2 the set of nouns demonstrating ablaut will be discussed. Section 5.3 will treat the class of nouns demonstrating differences in endings in singular and plural forms. Underlying forms will be posited, and the rules necessary to relate the underlying forms to the surface forms will be discussed. Section 5.4 will deal briefly with the set of nouns which evidence only one form for both singular and plural; section 5.5 will treat the definite article as it relates to the form of the noun; and section 5.6 will be concerned with the genitive form of nouns.

5.2 Nouns with Ablaut

As mentioned above, there is a small set of nouns in Danish in which there is a difference in the stem vowel

of the singular and the plural. This set constitutes some frequently occurring nouns, such as moder/mødre 'mother' (singular and plural) [moð, mœðRð]; fod/fødder 'foot' [fo:ʔð, fœ:ðð]; tand/tænder 'tooth' [t^hæʔn, t^henð], which have in addition different endings in the singular and plural, and mand/mænd 'man' [mæʔn, mɛʔn]; barn/børn 'child' [paʔn, pœʔn], which differ only in the quality of the stem vowel. In the cases in which vowel quality differs in the singular and plural, the alternation may include a difference along the front/back dimension (as in [foʔð, fœðð]), a difference in height (as in [mæʔn, mɛʔn]), and a difference in rounding (as in [paʔn, pœʔn]--which differ in all three ways). Since there occur alternations in vowel quality of all possible types, there does not seem to be any purpose in positing a single underlying vowel for any such pair and attempting to formulate rules to predict the alternations. Even if such a set of rules were arrived at it would be necessary to mark each member of this class in the lexicon as subject to vowel alternation, as it will be in any case, but also to specify rules of fronting or backing, raising or lowering, rounding or unrounding, for which each of the appropriate nouns would also be marked. It seems simpler to account for the vowel differences in these pairs of nouns by positing different underlying vowels in the singular and plural, which the Danish speaker learns individually.

Since the set of these nouns is small, and the vowel alternations it demonstrates are a non-productive means of distinguishing between singular and plural, this brief analysis is all that will be presented here with respect to it.

5.3 Nouns with Variation in Singular and Plural Endings

As will be observed from Table 5.1 on the following page, singular forms of nouns demonstrate no regularity of ending. Every possible word-final segment and sequence of segments (with the exception of [g]) occurs in the singular forms: vowels, resonants, obstruents, obstruent clusters, diphthongs. The plural forms, on the other hand, fall into two completely regular classes: (a) those which end in the segment [ɒ] and (b) those which end in the segment [ə]. These final segments in the plural forms are assumed to be plural suffixes. The portion of each noun which occurs before the morpheme boundary which precedes the plural suffix is seen to be identical to the form of the noun which represents the singular, except in those cases in which the sequence of segments in the singular is subject to the rule of stɒd-placement (see section 2.7.5). This portion of the noun (minus the stɒd) is assumed to be the noun stem; the singular form, then, consists of the stem alone.

It will also be observed that the form of the stem, except in the case of vowel-final stems and monosyllabic

stems ending in /R/, has no bearing on the form of the plural suffix. For example, in numbers (8) and (9), [pi:ʔl] and [fi:ʔl], which differ only in their initial sound, one takes the plural suffix [ɒ] and the other the plural suffix [ə].

Most Danish nouns take the plural suffix [ɒ]. Plurals of nouns in stem-final vowels always occur with this suffix, as illustrated by examples (1) - (7) of Table 5.1. Most nouns of foreign origin also take this plural suffix (e.g., avis/aviser 'newspaper' [ævíʔs, ævíʔɒ] (from the French avis 'opinion, information' [æví]). In addition, polysyllabic nouns generally take this plural suffix (e.g., hoved/hoveder 'head' [ho:əʔ, ho:ʔɒ]).

Apart from a few sporadic instances of polysyllabic nouns in a variety of stem-final segments (such as himmel/himle 'heaven' [hɪmɛl, hɪmlə]) which do not take the [ɒ] plural suffix--and which must be so marked in the lexicon--there is a class of exceptions to this generalization, which consists in those polysyllabic nouns in stem-final /R/, which, like the monosyllabic stems in final /R/, regularly take the [ə] plural suffix (e.g., søster/søstre 'sister' [söstɐ, söstRə]).¹

		<u>Singular</u>	<u>Plural</u>	<u>Gloss</u>
Vowel-final stems	(1)	p ^h i:ə	p ^h i:ɒ	girl
	(2)	tu:ə	tu:ɒ	pigeon
	(3)	sö:ʔ	söʔɒ	lake
	(4)	pi:ʔ	piʔɒ	bee
	(5)	ɔ:ʔ	ɔʔ	stream
	(6)	th _{RE} :ʔ	th _{RE} ʔ	tree
	(7)	pRɔʔ	pRɔʔ	bridge
Resonant-final stems	(8)	pi:ʔl	pi:ʔlɒ	car
	(9)	fi:ʔl	fi:lə	file
	(10)	sæ :ʔm	sæ :mə	seam
	(11)	sæ n	sæ nɒ	son
	(12)	saʔŋ	saŋə	song
	(13)	ha:ʔm	ha:mə	slough
	(14)	syaʔŋ	syaŋə	arch (of the foot)
	(15)	tRəʔŋ	tRəŋə	boy
	(16)	tæ :ʔɒ	tæ :ɒ	door
	(17)	fü:ʔp	fü:ɒ	guy
	(18)	po:ʔm	po:mə	bar, gate

Table 5.1: Nouns in different types of stem-final segments.

	<u>Singular</u>	<u>Plural</u>	<u>Gloss</u>
Obstruent- final stems	(19) k ^h lup	k ^h lup	club
	(20) ski:ʔp	ski:pə	ship
	(21) t ^h i:ə	t ^h i:əp	time
	(22) p ^h ru:ʔə	p ^h ru:ə	bride
	(23) k ^h ʌp	k ^h ʌpə	cup
	(24) slʌt	slʌtə	palace
	(25) pek	pekə	brook
	(26) stʌf	stʌfə	matter, substance
	(27) p ^h læs	p ^h læsp	place
	(28) lə:ʔw	lə:və	law
Consonant- cluster- final stems	(29) pʌʔlt	pʌltə	bolt
	(30) pɪsp	pɪspə	bishop
	(31) fest	festə	celebration
	(32) skakt	skaktə	shaft, well
	(33) puʔnt	puʔntə	bunch
	(34) k ^h uʔəs	k ^h uʔəsə	course
	(35) tænsk	tænskə	Dane

Table 5.1 (Continued from previous page): Nouns in different types of stem-final segments.

The plural suffix [p] is by far the most frequently occurring one; it is also the one used with nouns which have recently been taken into the language as foreign borrowings, such as avis, cited above. In addition, it is the plural suffix chosen by native speakers to affix to nouns which are unfamiliar to them, and to forms which are in fact nonsense forms (always with the exception of /R/-final stems). Therefore it may be considered the regular plural suffix, and nouns unpredictably taking the plural suffix [ə] must be so marked in the lexicon. (Those nouns in stem-final /R/ will be subject to a rule which substitutes the [ə] plural suffix for the regular /R/ one.)

5.3.1 Underlying Form of the Plural Suffix [p]:

Consonant-Final Stems

Having presented the facts of occurrence of the plural suffix [p], it now remains to posit an underlying form for this suffix. It has been argued here (section 4.3.1) that [p] may result from a sequence əR earlier in the derivation; under this analysis the question again arises as to the provenance of the ə. An analysis which holds that it is part of the suffix rather than the stem is exactly analogous to the analysis of the present-tense suffix of verbs (section 4.1.3): namely, that it would be a most unlikely situation that all Danish nouns end, accidentally, in [ə] (assumed here, unless there is

evidence to the contrary, to reflect underlying /e/-- see section 2.6.3). The question now arises, as it did in the case of the verbs, as to whether this [ə] is epenthetic or the reflex of an underlying /e/ in the suffix. The situation among nouns is at this point different from that of the verbs, there being five verbal suffixes beginning with [ə]. Therefore, while the occurrence of initial [ə] in five different verbal suffixes is suspect if regarded as reflecting underlying /e/, and thus the best explanation accounts for them by means of a well-motivated rule of epenthesis, in the nouns there is no particular reason not to assume the suffix to have the underlying form /eR/.

On the other hand, if the suffix is assumed instead to have the underlying form /R/, then the same type of argument as was presented with respect to the verbs may be appealed to here, namely that if /R/ is added to consonant-final stems, the resulting final consonant combinations are phonetically impermissible in Danish (e.g., /sön+R/ → *[sönR].) Therefore, under this assumption epenthetic ə is motivated, at least for consonant-final stems. The following derivation illustrates the process with respect to consonant-final stems.

	<u>singular</u>	<u>plural</u>
UNDERLYING FORM	/bi:l/	/bi:l+R/
STØD-PLACEMENT	bi:ʔl	bi:ʔlR
ə-EPENTHESIS	---	bi:ʔləR
R-VOCALIZATION	---	bi:ʔləp
ə-DELETION ₂	---	bi:ʔləp
OBSTRUENT DEVOICING	pi:ʔl	pi:ʔləp
SURFACE FORM	[pi:ʔl]	[pi:ʔləp]

5.3.2 Underlying Form of the Plural Suffix [p]:

Vowel-Final Stems

Turning to the vowel-final stems, represented by examples (1) - (7) in Table 5.1, we might consider an analysis of the plurals similar to that of the verbs which surface in vowel-final stems. The singular forms resemble those verb forms in that they too contain stød (with the exception of those bisyllabic nouns whose singular ends in [ə]). Stød in this situation has been taken as an indication of a long vowel. The long vowel may be either underlyingly so or it may have been lengthened at some point in the derivation of the form. In the case of the verbs, the best account is that which assumes an underlying (lengthening) consonant which deletes (after lengthening has occurred, in the case of underlying short stem-vowels), in accordance with the rules of consonant gradation.

Still in the case of the verbs, there is evidence-- internal, historical, and from related languages (see section 4.10)--to support this hypothesis. The situation is different, however, in the case of nouns, so that

a different analysis is required. This analysis is based on the fact that nouns whose plurals surface in stem-final vowels all occur with stød, followed by the [p] suffix (e.g., [pRo:ʔ, pRo:ʔp]), whereas the verbs which surface in stem-final vowels followed by the [p] present tense suffix all occur with long vowels and no stød (e.g., t^hRo:ʔ, t^hRo:p]). The rule of R-VOCALIZATION posited in section 3.4.2.2 specifies that a vowel must precede the /R/ for the rule to apply so that epenthetic ə is posited as being introduced when the [p] suffix is preceded by a consonant. Rule (2.24), STØD-PLACEMENT, assigns stød to long vowels, but STØD-DELETION, (2.25), deletes it when the vowel is followed by a consonant plus word boundary. Since stød does not occur in the verb forms in question (e.g., [t^hRo:p]), but a long vowel does, it must be assumed that this vowel is followed not by a (in this case single, subsequently deleted) consonant plus word boundary (thus the fact that there is no stød in these forms lends further support to the hypothesized epenthetic ə in them).

Moreover, since stød does occur in the noun forms in question, we may assume that there is no underlying, subsequently deleted consonant in these forms, since a simpler account merely assumes the suffix /R/ to be affixed, as the following derivation illustrates.

	<u>singular</u>	<u>plural</u>
UNDERLYING FORM	/sö:/	/sö:+R/
STØD-PLACEMENT	sö:ʔ	sö:ʔR
R-VOCALIZATION	---	sö:ʔo
SURFACE FORM	[sö:ʔ]	[sö:ʔo]

In the case of the nouns which surface in stem-final vowels, then, they may in fact be considered as underlyingly vowel-final.² Therefore, since there is no evidence for an underlying stem-final consonant in these noun forms, and since they may be accounted for by means of a few simple, independently-motivated rules if the plural suffix is assumed to be /R/, this is the analysis assumed here.

5.3.3 Underlying Form of the Plural Suffix [p]:

Stems in Final [ə]

Examples (1) and (2) of Table 5.1 remain to be accounted for. These examples represent the class of bisyllabic nouns whose singular forms end in [ə]. It will be noted that these nouns contain a long stem-vowel and no stød in both singular and plural forms. These forms resemble the verb forms, like [kRu:p] and [vi:p], which were analyzed as containing an underlying (lengthening) consonant. It will be observed that among the examples of obstruent-final stems in Table 5.1, numbers (19) - (28), there occur no forms in final /g/. It is proposed here that example (1) more properly belongs in this class of stems, though the consonant is not final but followed

by [ə] (/e/), and that the underlying /g/ is deleted in this context in accordance with the rules of consonant gradation. The following derivations illustrate this process.

	<u>Singular</u>	<u>Plural</u>
UNDERLYING FORM	/pi:ge/	/pi:ge+R/
STØD-PLACEMENT	pi:ʔge	pi:ʔgeR
ə-EPENTHESIS	---	---
e-REDUCTION	pi:ʔgə	pi:ʔgəR
R-VOCALIZATION	---	pi:ʔgəʋ
ə-DELETION ₂	---	pi:ʔgʊ
SPIRANTIZATION ₂	pi:ʔyə	pi:ʔyʊ
STØD-DELETION	pi:yə	pi:yʊ
GLIDE-FORMATION	pi:yə	pi:yʊ
GLIDE-DELETION	pi:ə	pi:ʊ
ASPIRATION	p ^h i:ə	p ^h i:ʊ
SURFACE FORM	[p ^h i:ə]	[p ^h i:ʊ]

5.3.4 Nouns in the Plural Suffix [ə]

In section 5.3 above it was noted that, except in the case of vowel-final and /R/-final stems, the form of the noun stem has no necessary bearing upon the form of the plural suffix. Thus each consonant-final noun stem must be marked as to which plural suffix it takes. In line with the analysis presented in section 2.6.3, the plural suffix which occurs phonetically as [ə] is here assumed to reflect underlying /e/. This /e/, then, is posited here as the second variety of plural suffix on Danish nouns.

5.3.5 Summary

In section 5.3 the final segments of plural forms of

Danish nouns have been motivated as constituting plural suffixes. It has been noted that these nouns fall into two regular classes, those in the plural suffix [ɒ] and those in the plural suffix [ə]. [ɒ] has been analyzed as being derived from underlying /R/ preceded by a vowel, and rules required elsewhere in the grammar have been cited as relating /R/ to surface [ɒ]. In the case of consonant-final stems, epenthetic [ə] has been posited to separate the impermissible consonant clusters which arise with the occurrence of suffixed /R/, which then undergoes the rule of R-VOCALIZATION in a manner exactly analogous to that described with respect to the consonant-final verb stems occurring with suffixed /R/.

The occurrence of suffixed [ɒ] on vowel-final noun stems has also been analyzed as reflecting vowel plus /R/, and explained on the basis of previously formulated rules, most notably the rule of R-VOCALIZATION. Bisyllabic noun stems ending in the sequence long vowel plus [ə] have been explained as deriving from underlying forms with /g/ occurring between the stressed stem vowel and the [ə]; this analysis too is analogous to that presented in section 4.10 with respect to verbs, and indicates that the process involved is a quite general one of Danish phonology.

The plural suffix [ə] has been analyzed as reflecting underlying /e/, also in line with earlier analysis. The derivations presented in Table 5.2 illustrate the processes

described above. Included in Table 5.2 is one example of each of the stem types: (full-) vowel-final, resonant-final, obstruent-final, and consonant-cluster-final. (The derivation of bisyllabic noun stems in final [ə] has been illustrated above in section 5.3.4.)

5.4 Nouns in a Zero Plural Suffix

It was stated above in section 5.1 that there exists among Danish nouns a small set which evidence no change in singular and plural, either of stem vowel quality or of endings. Examples of this set are: mus 'mouse' [mu:ʔs] fisk 'fish' [fɪsk]; ben 'bone' [pe:ʔn]; ord 'word' [op]. These nouns must be marked in the lexicon as taking a zero plural morpheme.

5.5 Articles: Definite and Indefinite

The gender of Danish nouns is reflected, as noted, not in the form of the nouns themselves, but in the articles which occur with them. In section 5.5.1 the facts concerning the singular articles, common and neuter genders, will be described. In section 5.5.2 the facts concerning the plural articles will be described. In section 5.5.3 underlying forms for the articles will be proposed, and the rules relating them to the surface forms will be discussed.

1) Resonant-Final

	<u>[p]-suffix</u>		<u>[ə]-suffix</u>	
	<u>Singular</u>	<u>Plural</u>	<u>Singular</u>	<u>Plural</u>
UNDERLYING FORM	/bi:l/	/bi:l+R/	/sang/	/sang+e/
STØD-PLACEMENT	bi:ʔl	bi:lR	saʔng	---
ə-EPENTHESIS	---	bi:ləR	---	---
e-REDUCTION	---	---	---	sangə
R-VOCALIZATION	---	bi:ləp	---	---
ə-DELETION ₂	---	bi:lp	---	---
REGRESSIVE ²	---	---	saʔng	sangə
ASSIMILATION				
CONSONANT DELETION	---	---	saʔŋ	sanə
OBSTRUENT DEVOICING	pi:ʔl	pi:lp	---	---
SURFACE FORM	[pi:ʔl]	[pi:lp]	[saʔŋ]	[sanə]

2) Obstruent-Final

	<u>/ti:d/</u>	<u>/ti:d+R/</u>	<u>/bRu:d/</u>	<u>/bRu:d+e/</u>
STØD-PLACEMENT	ti:ʔd	ti:ʔdR	bRu:ʔd	bRu:ʔde
ə-EPENTHESIS	---	ti:ʔdəR	---	---
e-REDUCTION	---	---	---	bRu:ʔdə
STØD-DELETION	---	ti:dəR	---	bRu:də
R-VOCALIZATION	---	ti:dəp	---	---
ə-DELETION ₂	---	ti:dp	---	---
SPIRANTIZATION ₂	t _h i:ʔð	t _h i:ðp	bRu:ʔð	bRu:ðə
ASPIRATION	t _h i:ʔð	t _h i:ðp	---	---
OBSTRUENT DEVOICING	--- _h	--- _h	pRu:ʔð	pRu:ðə
SURFACE FORM	[t _h i:ʔð]	[t _h i:ðp]	[pRu:ʔð]	[pRu:ðə]

3) Consonant-Cluster-Final

	<u>/fest/</u>	<u>/fest+R/</u>	<u>/bolt/³</u>	<u>/boltre/</u>
STØD-PLACEMENT	---	---	boʔlt	---
ə-EPENTHESIS	---	festəR	---	---
e-REDUCTION	---	---	---	bolte
R-VOCALIZATION	---	festəp	---	---
ə-DELETION ₂	---	festp	---	---
LAXING ⁴	---	---	bʌʔlt	bʌlte
OBSTRUENT DEVOICING	---	---	pʌʔlt	pʌlte
SURFACE FORM	[fest]	[festp]	[pʌʔlt]	[pʌlte]

Table 5.2: Derivations of singular and plural nouns

4) (Full-) Vowel-Final ([ɒ]-suffix only)

	<u>Singular</u>	<u>Plural</u>
UNDERLYING FORM	/sö:/	/sö:ɾR/
STØD-PLACEMENT	sö:ʔ	sö:ʔR
R-VOCALIZATION	---	sö:ʔɒ
SURFACE FORM	[sö:ʔ]	[sö:ʔɒ]

Table 5.2:(Continued from previous page): Derivations
of singular and plural nouns

5.5.1 The Singular Articles

The singular articles used in conjunction with nouns of the common gender are en 'a' [en] and den 'the' [tɛn]. The singular articles used with neuter nouns are et 'a' [et] and det 'the' [te]. The indefinite articles en and et precede the noun: en dreng 'a boy' [en tRɛŋ]; et hus 'a house' [et hu:ʔs]. The definite articles den and det occur only with modified nouns, where they precede the modifier: den store dreng 'the big boy' [tɛn stop tRɛŋ]; det store hus 'the big house' [te stop hu:ʔs]. When definiteness is to be expressed with respect to unmodified nouns, forms similar to those which precede the nouns as indefinite articles occur as endings on the nouns, the main difference being that they are unstressed in this position and surface with [ə] as their vowel: drengen 'the boy' [tRɛŋən]; huset 'the house' [hu:seʔ].

5.5.2 The Plural Articles

The situation with respect to modified plural nouns is as follows. In the indefinite, there is no article, the plural nouns occurring with the modifier only: store drenge 'big boys' [stop tRɛŋə]. In the definite plural, modified nouns occur with the article de 'the' [ti]: de store drenge 'the big boys' [ti stop tRɛŋə].

With unmodified nouns, the indefinite plural is expressed simply by the plural noun: drenge 'boys' [tRɛŋə]; whereas the definite plural is expressed by

means of an ending [ənə]: drengene 'the boys' [tRɛŋənə]

The situation with respect to the plural articles obtains in nouns of both genders. Table 5.3 summarizes the facts concerning the articles: definite, indefinite, singular, plural, common and neuter genders, modified and unmodified.

5.5.3 Underlying Forms of the Articles Used with Modified Nouns

For nouns of both genders, the indefinite article occurs only in the singular. As separate words occurring before the noun, the articles do not alternate; therefore there is no difficulty in assuming the underlying form of [en] (common gender) to be /en/, and that of [et] (neuter) to be /et/. The definite article in this position is also invariant: [tɛn] for nouns of the common gender, singular, [te] for singular neuter nouns, and [ti] for plurals of both genders. There is no difficulty here either in assuming the respective underlying forms to be /den/, /de/, and /di/, all of which are subject only to rule (3.18), OBSTRUENT DEVOICING.

<u>Modified</u>		<u>Unmodified</u>	
<u>Indefinite</u>	<u>Definite</u>	<u>Indefinite</u>	<u>Definite</u>
Sing. en stor dreng 'a big boy' [en stoɒ tRɛŋ]	den store dreng 'the big boy' [tɛn stoɒ tRɛŋ]	en dreng 'a boy' [en tRɛŋ]	drengen 'the boy' [tRɛŋən]
en stor sø 'a big lake' [en stoɒ söʔ]	den store sø 'the big lake' [tɛn stoɒ söʔ]	en sø 'a lake' [en söʔ]	søen 'the lake' [söʔn]
en stor kvinde 'a big woman' [en stoɒ k ^h vInə]	den store kvinde 'the big woman' [tɛn stoɒ k ^h vInə]	en kvinde 'a woman' [en k ^h vInə]	kvinden 'the woman' [k ^h vInən]
Plur. store drenge 'big boys' [stoɒ tRɛŋə]	de store drenge 'the big boys' [ti stoɒ tRɛŋə]	drenge 'boys' [tRɛŋə]	drengene 'the boys' [tRɛŋənə]
store søer 'big lakes' [stoɒ söʔɒ]	de store søer 'the big lakes' [ti stoɒ söʔɒ]	søer 'lakes' [söʔɒ]	søerne 'the lakes' [söɒnə]
store kvinder 'big women' [stoɒ k ^h vIn]	de store kvinder 'the big women' [ti sto k ^h vIn]	kvinder 'women' [k ^h vInd]	kvinderne 'the women' [k ^h vInənə]

Table 5.3: The form and position of articles--common gender

<u>Modified</u>		<u>Unmodified</u>	
<u>Indefinite</u>	<u>Definite</u>	<u>Indefinite</u>	<u>Definite</u>
Sing. et stort felt 'a big field' [et stoʔt fɛʔlt]	det store felt 'the big field' [te stoʔ fɛʔlt]	et felt 'a field' [et fɛʔlt]	feltet 'the field' [fɛltɛð]
et stort træ 'a big tree' [et stoʔt tʰRɛ:ʔ]	de store træ 'the big tree' [te stoʔ tʰRɛ:ʔ]	et træ 'a tree' [et tʰRɛ:ʔ]	træet 'the tree' [tʰRɛ:ɔð]
Plur. store felter 'big fields' [stoʔ fɛlt]	de store felter 'the big fields' [ti stoʔ fɛltɔ]	felter 'fields' [fɛltɔ]	feltene 'the fields' [fɛltɛnɛ]
store træer 'big trees' [stoʔ tʰRɛ:ʔɔ]	de store træer 'the big trees' [ti stoʔ tʰRɛ:ʔɔ]	træer 'trees' [tʰRɛ:ʔɔ]	træerne 'the trees' [tʰRɛ:ɔnɛ]

Table 5.4: The form and position of articles--neuter gender

5.5.4 Underlying Forms of the Articles Used with Unmodified Nouns

For nouns of both genders, the indefinite articles occur, as with modified nouns, only in the singular, and they are the same as in the case of modified nouns: /en/ in the common gender and /et/ in the neuter. With the definite article the situation is different, however. Since the article occurs in this instance as a suffix on the noun, it is necessary to examine the form of the suffix as it occurs following different classes of stem-final segments. It is the case that it is invariant in all of these classes. Represented in Table 5.3 are consonant-cluster-final stems (dreng, felt), which represent the more general class of consonant-final stems, and vowel-final stems (sø, træ). In addition there is an example of a bisyllabic noun ending in [ə], (kvinde).

The common gender singular definite article surfaces in all cases as suffixed [ən]. The neuter singular definite article surfaces in most cases as suffixed [əʊ].⁵ The plural definite article for both genders surfaces, in the case of nouns in the plural suffix [ə] as [ənə], and in the case of nouns in the plural suffix [ɒ] as [nə].

5.5.4.1 The Definite Article: Singular

Since in nouns of the common gender this article surfaces in all instances as suffixed [ən], it is plausible to posit as its underlying form /en/, and analogously, to

posit /ed/ as the underlying form of the neuter article, which surfaces generally as [əð]. Both of these forms would be subject to rule (2.23), e-REDUCTION, and the neuter form would additionally undergo SPIRANTIZATION (except when affixed to a stem in final /d/).

5.5.4.2 The Definite Article: Plural

The definite article used in conjunction with unmodified plural nouns takes two forms: (a) in the case of consonant-final stems taking the plural suffix [ə], the definite noun has the ending [ənə] (e.g., [tRɛŋənə]); (b) in the case of vowel-final stems, all of which take the plural suffix [ɒ], and those consonant-final stems which also take this plural suffix, the definite form has the ending [ɒnə] (e.g., [k^hvɪnɒnə]).

The simplest account of these two endings is the following: the underlying form of the plural definite article is /ne/, which is suffixed to the plural form of the noun. In the case of [ə]-final plurals, the form surfaces, as expected, with the ending [ənə], which constitutes both the plural and the definite article morphemes. In the case of [ɒ]-final plurals, the form surfaces, again as expected, with the ending [ɒnə], which also constitutes the plural and definite article morphemes. The following derivations illustrate the process.

UNDERLYING FORM	/dRɛŋgɾɛrɛne/	/bi:lɾRɾne/	/trɛ:ɾRɾne/
STØD-PLACEMENT	---	bi:ʔlRne	trɛ:ʔRne
ə-EPENTHESIS	---	bi:ʔlɛRne	---
e-REDUCTION	dRɛŋgɛnɛ	bi:ʔlɛRne	tRɛ:ʔRne
STØD-DELETION	---	bi:lɛRne	tRɛ:Rne
R-VOCALIZATION	---	bi:lɛpne	tRɛ:ɒne
ə-DELETION	---	bi:lɒne	---
REGRESSIVE	dRɛŋgɛnɛ	---	---
ASSIMILATION			
CONSONANT	dRɛŋɛnɛ	---	---
DELETION			
ASPIRATION	---	---	t ^h Rɛ:ɒne
DEVOICING	---	---	t ^h Rɛ:ɒne
OBSTRUENT	tRɛŋɛnɛ	pi:lɒne	---
DEVOICING			
SURFACE FORM	[tRɛŋɛnɛ]	[pi:lɒne]	[t ^h Rɛ:ɒne]

5.5.5 Summary

In section 5.5 the definite and indefinite articles have been examined. Underlying forms have been posited for those articles which occur as separate from the noun and before the noun. The surface forms of these articles do not vary, and the rules relating them to the proposed underlying forms are few, all of them having been previously motivated.

For those forms of the articles which occur as suffixed on the nouns (namely the definite singular when the noun is unmodified)--which constitute the only instances of morphophonemic variation with regard to nouns occurring with articles--underlying forms have also been posited. Again, the rules necessary to derive from them the surface forms are few and independently motivated. Table 5.5 lists all of the underlying forms posited here.

<u>Modified</u>		
	<u>Indefinite</u>	<u>Definite</u>
Singular:	/en/ {common gender} /et/ {neuter gender}	/den/ {common gender} /de/ {neuter gender}
Plural:	∅	/di/ (common and neuter genders)
<u>Unmodified</u>		
Singular:	/en/ {common gender} /et/ {neuter gender}	-/en/ {common gender} -/ed/ {neuter gender}
Plural:	∅	-/ne/ (common and neuter genders)

Table 5.5: Underlying forms of articles

5.6 Conclusion

This chapter has dealt with the noun inflections of Danish. Since the shape of the suffixes resembles in large measure those of the verbal inflection, the rules formulated in Chapters II, III and IV have been shown to be sufficient to account for the noun suffixes as well as for those of the verbs.

Unlike the verbs, noun forms in vowel-final stems have been analyzed as underlyingly vowel-final, on the evidence of the distribution of the stød.

FOOTNOTES TO CHAPTER V

1. It should also be noted that there are certain exceptions to the generalization that nouns in stem-final /R/ take the [ə] plural suffix, (e.g., professor/ professorer 'professor' [p^hʀofésə, p^hʀofesóə]), which must also be so marked in the lexicon.
2. It should be noted here that, unlike those verb forms which were analyzed as having an underlying consonant following the vowel, though this consonant does not surface, in the case of the nouns there is no historical evidence or evidence from related languages which supports the hypothesis of an underlying stem-final consonant.
3. The vowel here is assumed to be short. There is no purpose in positing a long vowel, since there is no such alternation, and it would in any case be shortened in this context (i.e., before a consonant cluster) by the rule of VOWEL SHORTENING, formulated as rule (2.4).
4. This rule is formulated as (2.9).
5. The qualification here results from the fact that there is a variant form which occurs with nouns in stem-final /d/ (which surfaces as [ð]). This variant is [-ət]; its form is easily interpreted as arising from a constraint against the final sequence [dəd] which would otherwise occur; final /d/ following də may be marked as minus the SPIRANTIZATION₂ rule and may undergo a further low-level devoicing rule in this context.

APPENDIX
LIST OF RULES

(2.4) VOWEL SHORTENING

$$\begin{bmatrix} +\text{syll} \\ -\text{lo} \end{bmatrix} \rightarrow [-\text{long}] / \text{---} \begin{bmatrix} -\text{cont} \\ -\text{voi} \end{bmatrix} [+ \text{cons}]$$

(2.5) ɔ:-LOWERING

$$\begin{bmatrix} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ +\text{bk} \\ +\text{rnd} \\ +\text{tns} \\ +\text{lng} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{tns} \\ -\text{lo} \end{bmatrix} / \begin{bmatrix} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{bmatrix}$$

(2.7) ö:-LAXING

$$\begin{bmatrix} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ -\text{bk} \\ +\text{tns} \\ +\text{rnd} \end{bmatrix} \rightarrow [-\text{tns}] / \text{---} \begin{bmatrix} +\text{nas} \\ +\text{cor} \end{bmatrix}$$

(2.9) LAXING

$$\begin{bmatrix} +\text{syll} \\ -\text{lo} \\ +\text{tns} \\ -\text{lng} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{rnd} \\ -\text{tns} \end{bmatrix} / \text{---} [+ \text{cons}] [+ \text{cons}]$$

(2.10) o-LAXING

$$\begin{bmatrix} +\text{syll} \\ -\text{hi} \\ -\text{lo} \\ +\text{bk} \\ +\text{tns} \\ -\text{lng} \end{bmatrix} \rightarrow [-\text{tns}]$$

(2.24) STØD-PLACEMENT

$$\emptyset \rightarrow [rst\emptyset d] / \left\{ \begin{array}{l} [+syll] \\ [-cons] \\ [+lng] \end{array} \right. \left\{ \begin{array}{l} [+syll] \\ [-cons] \\ [-lng] \end{array} \right. \left\{ \begin{array}{l} [-syll] \\ [+cons] \\ [+voi] \end{array} \right. \left(\begin{array}{l} [-syll] \\ [+cons] \end{array} \right) \# \right\}$$

(2.25) STØD-DELETION

$$[rst\emptyset d] \rightarrow \emptyset / \left\{ \begin{array}{l} [+syll] \\ [-cons] \\ [+lng] \end{array} \right. \left\{ \begin{array}{l} [-syll] \\ [+cons] \\ [-cont] \end{array} \right. \left\{ \begin{array}{l} [-syll] \\ [+cons] \\ \emptyset \end{array} \right\} \#$$

(3.2) s-BACKING

$$\left[\begin{array}{l} [+stri] \\ [+cor] \end{array} \right] \rightarrow [-ant] / _ \left\{ \begin{array}{l} [-syll] \\ [-cons] \\ [-bk] \\ [-voi] \end{array} \right.$$

(3.3) y-DELETION

$$\left[\begin{array}{l} [-syll] \\ [-cons] \\ [-bk] \\ [-voi] \end{array} \right] \rightarrow \emptyset / \left[\begin{array}{l} [+stri] \\ [+cor] \\ [-ant] \end{array} \right] _$$

(3.4) R-VOCALIZATION

$$\left[\begin{array}{l} [+cons] \\ [-son] \\ [+cont] \\ [-ant] \end{array} \right] \rightarrow \left[\begin{array}{l} [-cons] \\ [+lo] \end{array} \right] / [+syll] _$$

(3.5) DEVOICING

$$[-syll] \rightarrow [-voi] / \left[\begin{array}{l} [+cons] \\ [-voi] \end{array} \right]$$

(3.8) CONSONANT DELETION₁

$$\begin{bmatrix} +\text{cons} \\ -\text{son} \\ +\text{cont} \\ -\text{ant} \end{bmatrix} \rightarrow \emptyset / \begin{bmatrix} +\text{nas} \\ -\text{ant} \end{bmatrix} __\$$$

(3.10) e-DELETION₁

$$e \rightarrow \emptyset / __\begin{bmatrix} +\text{nas} \\ +\text{cor} \end{bmatrix} \quad (\text{OPT})$$

(3.12) MIRROR-IMAGE ASSIMILATION

$$\begin{bmatrix} +\text{nas} \\ +\text{cor} \end{bmatrix} \rightarrow [\alpha\text{ant}] \text{ */ } __\begin{bmatrix} +\text{cons} \\ -\text{cont} \\ \alpha\text{ant} \end{bmatrix} \quad (\text{OPT})$$

(3.13) REGRESSIVE ASSIMILATION

$$\begin{bmatrix} +\text{nas} \\ +\text{cor} \end{bmatrix} \rightarrow [\alpha\text{ant}] / __\begin{bmatrix} +\text{cons} \\ \alpha\text{ant} \end{bmatrix}$$

(3.14) CONSONANT DELETION₂

$$\begin{bmatrix} -\text{cont} \\ +\text{cor} \\ +\text{voi} \end{bmatrix} \rightarrow \emptyset / \begin{bmatrix} +\text{son} \\ +\text{cor} \\ +\text{voi} \end{bmatrix} __\$$$

(3.15) SPIRANTIZATION₁

$$\begin{bmatrix} -\text{syll} \\ -\text{cons} \\ +\text{bk} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cons} \\ +\text{cont} \\ +\text{ant} \\ -\text{cor} \\ \alpha\text{voi} \end{bmatrix} / __\begin{bmatrix} \alpha\text{voi} \\ -\text{nas} \end{bmatrix}$$

(3.16) CONSONANT DELETION₃

$$\begin{bmatrix} +\text{cons} \\ -\text{son} \\ +\text{cor} \\ -\text{stri} \end{bmatrix} \rightarrow \emptyset / \text{---} \begin{bmatrix} -\text{cont} \\ +\text{cor} \end{bmatrix}$$

(3.17) ASPIRATION

$$\begin{bmatrix} -\text{cont} \\ -\text{voi} \end{bmatrix} \rightarrow [+asp] / \$ \text{---}$$

(3.18) OBSTRUENT DEVOICING

$$\begin{bmatrix} +\text{cons} \\ -\text{cont} \\ -\text{asp} \end{bmatrix} \rightarrow [-\text{voi}] / \$ \text{---}$$

(3.19) REGRESSIVE VOICING ASSIMILATION

$$[-\text{cont}] \rightarrow [-\text{voi}] / \text{---} \begin{bmatrix} -\text{cont} \\ -\text{voi} \end{bmatrix}$$

(3.20) SPIRANTIZATION₂

$$\begin{bmatrix} -\text{cont} \\ +\text{voi} \end{bmatrix} \rightarrow [+cont] / \text{---} \$$$

(3.21) GLIDE-FORMATION

$$\begin{bmatrix} -\text{syll} \\ +\text{cons} \\ -\text{son} \\ +\text{cont} \\ +\text{bk} \\ +\text{voi} \end{bmatrix} \begin{bmatrix} -\text{cons} \\ +\text{syll} \\ \alpha \text{bk} \end{bmatrix} / \begin{bmatrix} +\text{syll} \\ \alpha \text{bk} \end{bmatrix} \text{---}$$

(3.22) GLIDE-DELETION

$$\begin{bmatrix} -\text{cons} \\ -\text{syll} \\ \alpha \text{bk} \end{bmatrix} \rightarrow \emptyset / \begin{bmatrix} +\text{syll} \\ \alpha \text{bk} \end{bmatrix} \text{ ______ }$$

(4.1) e-EPENTHESIS

$$\emptyset \rightarrow [\text{e}] / [+ \text{cons}] + \text{ ______ } [+ \text{cons}]$$

(4.3) e-DELETION₂

$$\text{e} \rightarrow \emptyset / [\text{d}]$$

(4.4) VOWEL REDUCTION

$$[+ \text{syll}] \rightarrow [- \text{lng}] / \begin{bmatrix} + \text{syll} \\ + \text{lng} \end{bmatrix} \text{ ______ }$$

(4.6) e-DELETION₃

$$\text{e} \rightarrow \emptyset / \begin{bmatrix} + \text{syll} \\ - \text{hi} \end{bmatrix} \begin{bmatrix} - \text{syll} \\ - \text{cons} \end{bmatrix} + \text{ ______ }$$

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