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Lexical Morphology and Phonology of Kannada

by

Siddaramaiah Chandrashekar

A thesis
presented to the University of Ottawa
in fulfillment of the
thesis requirement for the degree of
Master of Arts
in

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ABSTRACT

The theory of Lexical Phonology developed by Kiparsky (1982 a, b); Mohanan (1982) claims that certain phonological rules that require morphological information for their application must apply in the lexicon. Those that do not require lexical information may apply either lexically or postlexically or both. In this framework, the lexicon itself is organized into a hierarchy of levels, morphological and phonological. It is claimed that the phonological rules may apply within the lexicon to the output of each morphological process in a cyclic fashion.

The second phase of the development of the theory focuses on the constraints on rule application. It is assumed that the application of lexical phonological rules is governed by severely restrictive principles such as the Strict Cycle Condition (SCC) and Structure preservation. Kiparsky (1982- a) claims that lexical rules are governed by the SCC and Structure preservation and postlexical rules are not. However, it is evident from the recent literature that not all lexical rules are governed by the SCC. It has been shown that the non-structure changing rules such as syllabification in Spanish and stress in English do not observe the

SCC. It is also been observed that a particular level of lexical rules may be exempt from the SCC. For example, Kiparsky (1985) claims that the last level in English (i.e. word level) is not constrained by Strict Cyclicity.

The present study examines the assumptions made in the framework of Lexical Phonology in the light of data from Kannada, a Dravidian language spoken in the province of Karnataka, Southern India. The contents and organization of this thesis are as follows: In Chapter one, the background literature is reviewed. The motivation for Lexical Phonology is discussed. Chapter two present arguments for levels, morphological and phonological, in Kannada. In Chapter three, the syllable template for Kannada is given. Arguments supporting the No-Coda Hypothesis and featureless (X) skeletal slots are presented. Finally, in Chapter four, some of the Lexical and Postlexical rules in Kannada are discussed. Concluding the thesis, it is observed that the SCC proposed by Kiparsky (1985) is inadequate and fails to explain the facts satisfactorily. A revised version of the model of Lexical Phonology is suggested.

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Chapter I

LEXICAL PHONOLOGY: AN OVERVIEW

1.1 Introduction

The publication of The Sound Pattern of English (henceforth SPE) by Chomsky and Halle (1968) generated much discussion over the abstractness of phonological representations. For example, the analysis of 'nightingale' in SPE is given as /nixtInɣəl/ with $ix \rightarrow i \rightarrow ay$ by other rules. These rules, Chomsky and Halle claim, are required on other grounds. They posited an underlying segment /x/ to block the rule of Trisyllabic laxing from applying to it. The segment /x/ never surfaces in English. It was for precisely this reason that many phonologists questioned the validity of such an analysis. They expressed doubts about the child's ability to learn rules with no overt phonetic motivation. An extreme position regarding this issue was taken by Hooper (1976). She argued that these abstract phonological rules should be disallowed on the grounds that these rules cannot be learned. Concluding her remarks, she stated that such grammars are necessarily untestable and unlearnable.

The so-called 'abstractness controversy' resulted in efforts by phonologists to constrain the level of abstractness to eliminate 'clever' analyses whose linguistic justification was highly dubious. One outcome of such an effort resulted in the formulation of 'Lexical Phonology' (Mohan 1982, Kiparsky 1982).

1.2 Abstractness controversy

The issue of 'abstractness' became the pivotal point of discussion among phonologists for almost a decade. Several phonologists proposed constraints on the abstractness of phonological representations. It was Kiparsky (1968 b) who for the first time proposed a constraint on underlying representations - what he called the Strong Alternation Condition.

(1) Strong Alternation Condition:

Obligatory neutralization rules cannot apply to all occurrences of a morpheme.

This constraint, in effect, restricts the abstractness of underlying representations to cases motivated by phonological alternations. In other words, Kiparsky suggested that the underlying representations should not be set up unless they are realized somewhere as surface distinctions. The effect of such a constraint would severely restrict the types of segments appearing in underlying representations.

Although the Strong Alternation Condition effectively constrains the 'abstractness' of underlying representations to cases motivated by phonological alternations, it is not interpretable as a formal condition on grammars. Kiparsky (1982:148) states that in order to check whether it is satisfied in a given grammar, it would be necessary to inspect every derivation of that grammar. Without going into the details of the controversy over the alternation condition we will state the revised alternation condition as follows:

(2) Revised Alternation Condition: (RAC) (Kiparsky 1982)

Obligatory neutralization rules
apply in derived environments.

That is, an obligatory neutralization rule which converts one segment to some other segment in some context, applies only in derived environments. Kiparsky (1982) defines the notion of derived environment as follows:

(3) Derived Environment:

An environment E is derived with respect to a rule R if E satisfies the structural description of R crucially by virtue of a combination of morphemes or the prior application of a rule.

What RAC essentially does is restrict neutralizing rules like Trisyllabic Laxing in English to derived inputs. It blocks neutralizing rules from applying to nonderived words. For example, RAC restricts Trisyllabic laxing to derived

inputs like (divine + ity). Therefore, this rule is inapplicable to monomorphemic words like 'nightingale'. This analysis rules out phonetically unmotivated abstract segments in many cases.

Although the RAC, to some extent, succeeded in explaining the earlier problematic cases, it does not correctly account for other cases.

There are neutralization rules which apply in derived as well as non-derived environments. For example, Velar Softening in English applies to derived forms like criticize (critic - criticize) as well as underived forms like conceive, proceed, recite etc. Prohibiting this rule from applying to underived inputs generates wrong results.

Kiparsky overcame this problem by adopting the proposal made by Mascaro. It was Mascaro (1976) who for the first time observed the cyclic nature of phonological rules that have 'derived environment only' conditions for their application. Kiparsky reformulates the Strict Cycle Condition of Mascaro and states it as follows:

(4) Strict Cycle Condition (SCC)

- (a) Cyclic rules apply to derived representations
- (b) Def: A representation ϕ is derived w.r.t rule R in cycle J iff ϕ meets the structural analysis of R by virtue of a combination of morphemes introduced in a cycle J or the application of a phonological rule in cycle J.

The SCC predicts that the restriction on neutralizing rules to 'derived environments only' are strictly cyclic in nature. They are prohibited from applying on the first cycle. Neutralizing rules applying in derived as well as non-derived environments are essentially non-cyclic rules. Thus the formulation of SCC further constrains the application of phonological rules by stating that rules like Trisyllabic laxing in English are cyclic and rules like Velar softening are non-cyclic.

Although SCC was quite an improvement over the alternation condition stated previously, it still left some problems unexplained. We know that metrical rules such as the stress rule in English and syllabification in Spanish are cyclic in nature, yet they apply on the first cycle. Furthermore, the application of the stress rule to a monomorphemic word like 'nightingale' creates a 'derived environment' according to (4). In that case we cannot block the rule of Trisyllabic laxing from applying to 'nightingale'. The following derivation illustrates this point.

(5)	/nītingā1/	/divīn/	U.R.
	[nītingā1]	[divīn]	Stress
	--	[[divīn] ity]	Affixation
	*[nītingā1]	[[divīn] ity]	TSS

In order to overcome the deviant behaviour of Metrical rules, Kiparsky invoked the 'Elsewhere condition' which he had proposed earlier to block morphological rules from applying to certain words. This condition does the same job of blocking certain phonological rules from applying to underived inputs. The slightly modified version of the 'Elsewhere condition' proposed in Kiparsky (1973, cf. Koutsoudas, Sanders and Noll, 1974) is given below:

(6) Elsewhere Condition:

Rules A, B in the same component apply disjunctively to a form ϕ if and only if

- (i) The structural description of A (the special rule) properly includes the structural description of B (the general rule).

- (ii) The result of applying A to ϕ is distinct from the result of applying B to O.
In that case, A is applied first, and if it takes effect, then B is not applied.

(Kiparsky 1983:9)

At this stage Kiparsky assumed a special rule for underived inputs, which he calls a 'lexical identity rule'. He treats this rule on a par with other phonological rules. Given a situation wherein the structural description of the lexical identity rule and a phonological rule are similar, then according to (6) the lexical identity rule takes precedence over a more general phonological rule. For example, the structural description of the lexical identity rule of a word like /nitinḡal/ is a proper subset of the structural

description of Trisyllabic Laxing. Then, (6) predicts that the lexical identity rule applies first. If it is applicable, the rule of Trisyllabic Laxing is blocked from applying to /nitingæl/, because the outputs of these two rules are distinct. However, a metrical rule, like stress in English, although it is cyclic, is still allowed to apply on the first cycle, because the outputs of the lexical identity rule and the stress rule are not distinct. We have two forms, one without stress and one with stress. There is, however, no change in the structure of the outputs. In such cases cyclic rules are allowed to apply on the first cycle. At this point one notices the distinction drawn between two kinds of cyclic rules. One set of rules performs a structure changing function and the other, a structure-building function. Metrical rules belong to the latter category.

Although the adoption of the Elsewhere Condition as a formal condition in the grammar results in overriding the need for specifying the SCC in the grammar, Kiparsky's assumption of equating the lexical identity rule with other phonological rules seems ad hoc. Specifying the morphological category as a lexical identity rule for underived stems in morphology is convincing. But the same argument doesn't quite fit the description of underlying phonological segments. Moreover, as we will see later in this chapter, Kiparsky encounters problems in blocking the phonological rules applying on the second cycle at the same level. The

Elsewhere Condition can block a rule applying on the second cycle only if it is assumed that the output of each cycle is a lexical entry. However, in his 1982 paper Kiparsky states that the output of each layer of derivation (i.e. at the end of every level) is a lexical item. In that case, the Elsewhere Condition fails to block the rule from applying on the second cycle. (This situation has led Kiparsky to reintroduce a modified version of SCC in his 'Consequences' paper). Moreover, Mohanan and Mohanan (1984) argue that the derivation of the SCC from the Elsewhere condition poses technical and conceptual problems. (For details see M. & M (1984:592).)

1.3 Motivation for Lexical Phonology

Motivation for the development of Lexical Phonology comes from the fact that some of the cyclic phonological rules are sensitive to morphological information. An interesting intrinsic property of cyclic phonological rules that emerged out of linking them to derived environments is their repeated application after each successive morphological operation. In other words, these rules are sandwiched between morphological operations and therefore apply in cyclic fashion. Developing this idea further led to the assumption that phonological rules interact with morphology in word derivation processes and exhibit certain characteristic properties.

Further impetus to this idea comes from the rich contribution made by Siegel (1974) and Allen (1978) in morphology. It was Siegel who drew attention to the fact that some morphological processes, like -al suffixation in English, are sensitive to the phonological structure of the stem they attach to. Furthermore, the development of the 'Level Ordered Hypothesis' by Siegel helped Kiparsky and Mohanan to develop the theoretical framework of Lexical Phonology.

Siegel demonstrated in her work that affixes are ordered and that morphological processes are assigned to distinct levels. For example, the adjective forming suffix -ian and the noun forming suffix -ism in English can appear only in the order -ian-ism as shown in (7).

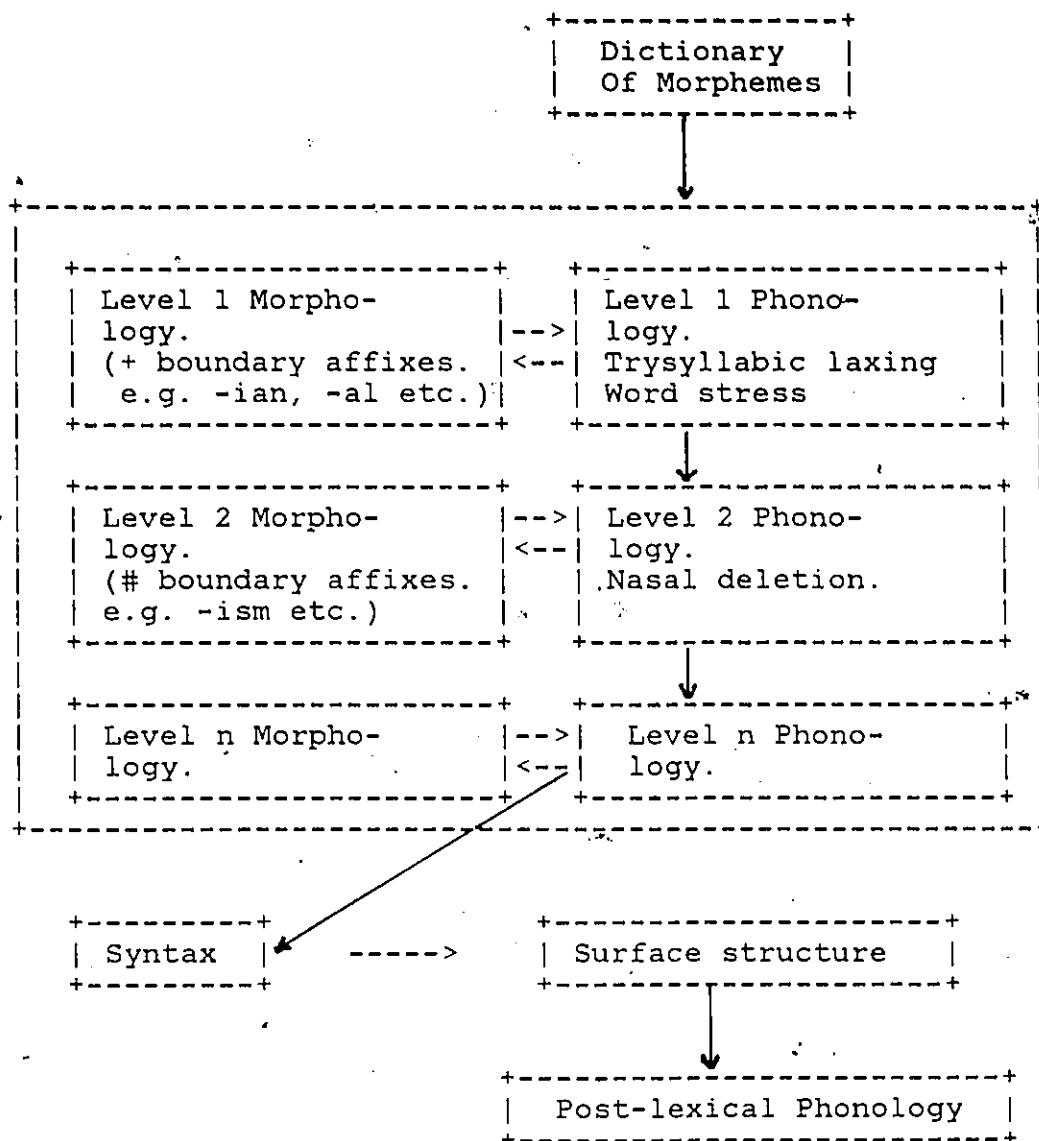
- (7) a. Mendelianism
 b. Mongolianism
 * c. Mendelismian
 * d. Mongolismian

This kind of ordering cannot be explained on the basis of the subcategorization frames of the above suffixes. -ism attaches to nouns or adjectives to form nouns, while -ian attaches to nouns to form adjectives. These subcategorization frames are shown in (8)

- (8) a. -ism / N/A --
 b. -ian / ~N--

Judging from the frames above, we might expect (7c,d) to be well formed. Siegel proposes that -ian is a primary suffix while -ism is a secondary suffix, and she suggests that primary affixes are attached before secondary affixes. This ensures that primary affixes (prefixes or suffixes) are always closer to the root than secondary affixes. Siegel distinguishes primary affixes by a /+ boundary (e.g. +ian) and secondary affixes by a # boundary (e.g. #ism). This kind of ordering of suffixes assigns at least two levels of morphology for English. However, the number of levels of morphology for English is still a topic of discussion. Kiparsky (1985) argues for three levels, whereas Halle and Mohanan (1985) argue for four. The revised model of the grammar now looks like (9). This is called the 'Level Ordered Hypothesis' for phonology and morphology.

(9)



This organization of grammar has important consequences for the phonological component. As a result of the ordering of morphological levels and of allowing phonological rules to interact with the morphological process in building words, the phonological rules fall into two divisions. Those rules which apply within the lexicon (word building

component of the grammar) are referred to as lexical phonological rules and those rules which operate on the output of syntax are called post-lexical phonological rules. Another important theoretical advantage of this model is that the cyclicity of lexical phonological rules is no longer an inherent property of the rules themselves, but follows from the organization of the lexicon.

This organization of grammar was first suggested by Pesetsky (1979) and further developed by Kiparsky (1982) and Mohanan (1982). In the following section I turn to a discussion of the theory of Lexical Phonology as presented by Kiparsky (1982a,b; 1985) and Mohanan (1982). Following this discussion, I shall summarize briefly the papers published by Jensen (1983), Mohanan & Mohanan (1984), Halle & Mohanan (1985), and Booij & Rubach (1985).

1.4 Theory of Lexical Phonology

Ever since Kiparsky (1982) and Mohanan (1982) published their work on Lexical phonology, there have been modifications and revisions of many aspects of the theory. Both Kiparsky and Mohanan have revised their earlier assumptions in the light of new findings. Booij & Rubach (1985), keeping the spirit of the theoretical assumptions intact, have suggested some modifications. But what is agreed upon by

all these people is that the morphology is organized into a number of levels of word formation. At each of these levels, certain affixation processes occur. After each affixation or at the end of all affixations when a level is non-cyclic, the derived form is submitted to the phonology where it is checked for rule application. All those rules (phonological and morphological) which apply in the word derivation component of the grammar (i.e. lexicon) are called Lexical rules and all those rules which apply after the words are inserted into the syntax are called post-lexical rules.

1.4.1 Kiparsky (1982 b)

In his paper 'Lexical Morphology and Phonology', Kiparsky further develops the idea of level ordered morphology and shows how the rules of phonology interact with morphology in creating levels. Reserving this discussion to the next chapter, I shall state the main features of lexical and post-lexical rules.

The following is the summary of the properties of lexical and post-lexical rules (taken from Kiparsky (1982)).

(10) Lexical rules	Post-lexical rules
a. word bounded	not word bounded
b. access to word-internal structure assigned at the same level	access to phrase structure and segmental information only
c. cyclic	apply only once
d. apply in derived environments	apply across the board
e. structure preserving	not structure preserving

Of these properties, the ones which are most often referred to in Kiparsky's papers are a) structure preservation, b) strict cyclicity, c) derived environment condition.

Lexical rules are claimed to be structure preserving in the sense that they do not add to the lexical segmental phonological inventory of a particular language (see Pulleyblank (1983):25). To be structure preserving, rules cannot for instance introduce segments into the lexical phonology which are not lexically distinctive. To cite an example, no lexical rule of English phonology introduces aspiration on voiceless stops; such aspiration is not lexically distinc-

tive. Post-lexical rules, however, need not be structure preserving, according to this theory. Therefore, aspiration is a post-lexical rule in English. That it is indeed a post-lexical rule is further confirmed by its other properties: it does not refer to word-internal structure; there is no reason to believe that it is cyclic and it has no lexical exceptions.

On the other hand, the rule of Trisyllabic laxing is a lexical rule. It is clearly word-bounded. It is sensitive to word internal structure. For example, it applies in saŋ-ity (from sāne), but not in the phrase count on it. Again, this rule is structure-preserving in the sense that the segment it introduces, in this case, also occurs in simple words like cat (cæt). This is predicted by the theory. Further confirmation to this assumption comes from the fact that Trisyllabic laxing has exceptions. Exceptions to Trisyllabic laxing include obēse (obēs+ity) and nōte as in denotātive (vs compār+ative).

Kiparsky adopts a further constraint on lexical rule application which he calls the 'Bracket Erasure Condition' (BEC). This formulation differs from the BEC in Pesetsky (1979) which erases brackets at the end of every cycle. BEC block rules (morphological and phonological) from having access to the internal structure derived on an earlier level. In order to achieve this result, brackets are erased at

the end of every level in Kiparsky's model. Kiparsky states this condition as follows:

(11) Bracketing Erasure Condition: (BEC)

Internal brackets are erased
at the end of every level.

The following illustration demonstrates the application of BEC.

In English, -ation is a level 1 suffix and -ing is a level 2 suffix. English also has a phonological rule such as (12).

(12) Nasal deletion rule:

$n \rightarrow \emptyset / [+nasal] __]$.

Rule (12) is a level 2 (word level) rule in English by virtue of the SCC. (See below)

To see the effect of BEC consider the derivations of dam-
nation and damning.

(13) LEVEL 1.

/damn/	/damn/	UR
-	-	Phonology
[[damn]ation]	-	Affixation
-	-	Phonology
[damnation]	-	BEC

LEVEL 2.

[damnation]	[damn]	
-	[[damn]ing]	Affixation
BLOCKED	[[dam] ing]	Nasal deletion
-	[daming]	BEC

Given bracketing erasure at the end of level 1, (12) will correctly fail to delete/ⁿin damnation at level 2.

1.4.2 Mohanan (1982)

Mohanan (1982), developing the theory of lexical phonology, discusses an interesting set of data from Malayalam. He argues in his thesis that word formation in Malayalam is stratum (level) ordered.

His argument for levels comes from two types of compounds in Malayalam. He calls these two types of compounds subcompounds and cocompounds. Subcompounds have the structure of

modifier + head; cocompounds, on the other hand, have a coordinate structure stem+stem+... . Some examples of each class are given in (14) and (15). (Examples are from Mohanan (1982)).

(14) Subcompounds:

- a. taaraakaantanmaar 'Tara's husband'
 (Tara ; kaantan 'husband'; maar 'plural')
- b. kaattemaram 'forest tree'
 (kaat 'forest'; maram 'tree')

(15) Cocompounds:

- a. accanammamaar 'parents'
 (accan 'father'; amma 'mother'; maar 'pl')
- b. yaksakinnaragandharwaadikal
 (Yaksan; Kinnaran; Gandharwan; aadi etc.; kal 'pl')
 (Yaksa's, Kinnara's, Gandharwa's etc.)

Mohanan observes that there are two phonological rules which distinguish cocompounds from subcompounds. One is gemination; which occurs in subcompounds but not in cocompounds. The other is stress and tone assignment, which apparently occurs at the stratum of cocompounding and nowhere else. In addition, there are two other rules which occur in both subcompounding and cocompounding, though not in derivational or inflectional morphology. These are 'nasal deletion' and 'vowel sandhi'.

Mohanan suggests that the following be taken as the structure of the stratum-ordered lexicon for Malayalam:

- (16) Stratum 1: Derivation
 Stratum 2: Subcompounding
 Stratum 3: Co-Compounding
 Stratum 4: Inflection

With respect to compounding, this makes the prediction that subcompounding can occur within cocompounds, which is indeed the case:

- (17) maatr sneehapatniwidweesaam
 (maatr 'mother'; sneeham 'love'; patni 'wife';
 widweesam 'hatred')
 'love of mother and wife hatred'

However, it is also true, as Mohanan points out, that cocompounds may occur within subcompounds. It is in fact possible to have a whole sequence of nestings of subcompounds within cocompounds as shown in (18).

- (18) [[[maatr sneeham] [patni widweesam]] [wikaaram]]
 N1 N2 N3 N4
 'the emotions of mother love and wife hatred'

N1 and N2 are subcompounds. N3 is a cocompound and N4 is a subcompound.

In order to account for this, Mohanan introduces into the theory the device of the loop, which is illustrated in the diagram below.

- (19) Stratum 1: Derivation
 ↳ Stratum 2: Subcompounding
 ↳ Stratum 3: Cocompounding
 Stratum 4: Inflections

Thus, even though the ordering of the levels in the basic model of Malayalam morphology does not allow compounds within subcompounds, the loop now allows for this possibility since it is possible in the revised model to do an operation of cocompounding at level 3, and then return via the loop to the second level in order to do an operation of subcompounding.

Although the device of the loop facilitates an account of the counterexamples to the stratum ordered hypothesis in Malayalam, it rather weakens the arguments in favour of the 'Level ordered hypothesis'. At best, it can be an ad hoc solution. But, no alternative has been suggested to this solution in the literature to date.

Mohanan also discusses the 'Opacity principle' as a constraint on the application of lexical rules. This formulation is empirically equivalent to the bracket erasure convention of Kiparsky.

- (20) Opacity Principle (Mohanan (1982)) (=BEC)

The internal structure at one stratum
 is invisible to the process at another.

The consequence of the opacity principle is the same as BEC.

Any rule of phonology or morphology which applies at stratum n will be unable to make use of any internal structure of words derived at stratum n-1 or at previous strata.

One argument for the opacity principle comes from Malayalam and is discussed in Mohanan (1982:29). Mohanan notes that the initial /k/ of the last member of a subcompound such as yaksakinnarakkuṭam exhibits gemination. This is in accordance with the rule of gemination in subcompounds. But the question is why the /k/ of kinnaran does not also geminate.

(21) Cocompound	[[yaksan][kinnaran]]	compounding
	[[yaksa][kinnaran]]	nasal deletion
	--	vowel sandhi
Subcompound	[[yaksakinnaran][kuṭam]]	compounding
	[[yaksakinnara] [kuṭam]]	nasal deletion
	[[yaksakinnara] [kkuṭam]]	gemination

Mohanan states the rule of gemination as follows: (pp.104)

(22) Gemination (domain: stratum 2)

Onset -->^% ____][

Rule (22) applies at the subcompounding stratum to the initial /k/ of kuṭam. It does not apply to kinnaran

because the internal brackets of the compound [yakṣan kinnar-an] are opaque at this level and therefore the structural description of (22) is not met. *

Finally, Mohanan (pp. 6) proposes another stipulation on the application of phonological rules in the lexicon. He states that if a phonological rule R applies at both stratum m and stratum n where $n > m$, the R must also apply on all strata m+1 through n-1. This he calls the Stratum Domain Hypothesis:

(23) Stratum Domain Hypothesis:

The domain of a rule is specified
as a set of continuous strata.

Although, in the absence of counterevidence, Mohanan agrees with Kiparsky (1982) in stating that all lexical rules are cyclic, he does this with some reservation. In fact, he later revises his position in the light of new evidence in favour of lexical non-cyclic rules.

Mohanan also makes an interesting observation regarding the status of the phonological component in the grammar. As we noted earlier, Kiparsky (1982) observes that the reorganization of grammar motivates the division of the phonological component into lexical and post-lexical phonological components. But the analysis of Malayalam phonology shows that the same rules or similar rules apply both at different

levels in the lexicon and post-lexically. This prompts Mohanan to stipulate the domains on the phonological rules, making the phonological component 'independent' of modules. This situation made Kiparsky revise his idea about the phonological component of the grammar within the lexical phonological framework. Recognizing the range of arbitrariness in the theory in restricting the mode and scope of application of lexical and post-lexical rules, he revises some of the assumptions made in his 1982 paper. The result is his 'Consequences' paper.

1.4.3 Kiparsky (1983 ms. (1985))

Kiparsky's 'Consequences' paper is a major step forward in the development of the theory of lexical phonology. While there is increasing evidence in support of the assumption that the same phonological rules may apply in the lexicon at different levels and post-lexically, Kiparsky makes an attempt to constrain the arbitrariness of such an application. He argues that domains of lexical rules are indeed to a considerable extent predictable. They are governed by independent principles such as a. Cyclic application, b. restriction to 'derived environments' and c. Structure-preservation.

Such a stipulation of these principles in the theory results in allowing phonological rules to apply freely in

the lexicon at different levels and at the post-lexical domain. But their mode and scope of application is governed by the independent principles stated above. Therefore, Kiparsky claims that there is no need to specify the domain in which a lexical phonological rule must apply.

This approach to the phonological rule systems is similar to Chomsky's (1981) approach to syntax. In his Government and Binding theory, Chomsky states that the movement rules (Wh-movement and NP-movement) are free to apply anywhere (i.e. move_α). But their movement is governed by independent principles such as a. the binding theory b. the theta criterion c. control theory etc. (For similar arguments, see Mohanan & Mohanan (1984:590).

In the following section we shall briefly discuss the restrictive principles stated above.

1.4.3.1 Strict Cycle Condition (SCC)

Earlier in this chapter, we remarked that the derivation of the SCC from the Elsewhere Condition embodies problems of a technical and conceptual nature. At best, it is an ad hoc constraint. The Elsewhere Condition, coupled with the BEC, fails to block certain cyclic phonological rules on the second cycle. "Suppose A and B are cyclic rules, where B could feed A but in fact does not. We can block feeding on

the same cycle by ordering A before B, but we cannot block the output of B from undergoing A on the next cycle" (Kiparsky, 1985, pp.88). The Elsewhere Condition fails to block the rule on the second cycle because, according to Kiparsky, brackets are erased at the end of a level as opposed to at the end of each cycle as in Pesetsky (1969). Moreover, Kiparsky seems quite uncertain whether one can treat the output of each cycle as a lexical entry having an identity rule.

However, acknowledging the need for the stipulation on SCC in the grammar on other grounds, he states his revised version of SCC as follows:

(24) Strict Cycle Condition (SCC):

If W is derived from a lexical entry W' where W' is non-distinct from XPAQY and distinct from XPBQY, then a rule A --> B / XP ___ QY does not apply to W until the word level.

Before giving an example to illustrate the effect of the SCC on phonological rules in Polish (taken from Kiparsky), an explanation of the notation used in (24) is in order.

- (25) W' = Lexical entry
 W = Lexical entry + affix

A --> B / XP ___ QY

XPAQY = W'

XPBQY = W

Example: [damn] . . . = W'

[[damn] ation] = W

- (26) Nasal deletion rule ((12))

n --> Ø / [+nasal] ___]

A	B	XP QY

i.e. XP n QY (XPAQY) (dam n ation)

XP Ø QY (XPBQY)

Here, W'(damn) is non-distinct from XPAQY and distinct from XQBQY. According to (24), (26) does not apply to W (damn ation) until the word level. In other words, the nasal deletion rule in English is a word level rule. Kiparsky illustrates the effect of SCC by citing an example from Polish taken from Rubach (1981).

Polish has a rule which turns the stem final -x to a pre-palatal (high) fricative before i in nouns. In its simplified version this rule of Nominal Strident-Palatalization (NSP) look like (27).

(27) Nominal Strident Palatalization: (NSP),

$$s \rightarrow \text{ʃ} / _ i$$

Examples:

kapelusz (-š) 'hat'

kapelus + ik (ʃ) 'little hat'

There is another rule in Polish which converts the underlying velars k, g, x into strident palatals č, dž, š before front vowels. An informal statement of the relevant part of the rule is given below:

(28) First Velar Palatalization (FVP):

$$\begin{array}{l} \text{C} \rightarrow \text{-hi} \\ \left[\begin{array}{l} +\text{obs} \\ -\text{cor} \\ +\text{bk} \end{array} \right] \left[\begin{array}{l} +\text{cor} \\ +\text{str} \end{array} \right] / \text{---} \text{---} \left[\begin{array}{l} \text{V} \\ -\text{bk} \end{array} \right] \end{array}$$

Examples:

krzyk 'a shout'

krzyk + e + c (č) 'to shout'

Both are cyclic rules and NSP precedes FVP. This is shown by the fact that š from FVP does not become ʃ by NSP. The following derivation illustrates this in (29): (taken from Kiparsky (1985))

(29)	kapeluš + isk	gmax + isk
NSP	ċ	--
FVP	--	š
	kapeluċ + isk + o	gmaš + isk + o
NSP	--	BLOCKED
FVP	--	--

In a case like this, the Elsewhere Condition fails to block the rule of NSP from applying on gmaš + isk + o on the second cycle. But the revised version of SCC stated in (24) can effectively block the NSP from applying on gmaš + isk + o on the second cycle. The following diagram demonstrates this point.

(30)	$\overbrace{\underbrace{\text{kapeluš} + \text{isk}}_{W'}}^W$	$\overbrace{\underbrace{\text{gmax} + \text{isk}}_{W'}}^W$
------	---	--

W' in both cases is not non-distinct from the input to NSP & FVP and not distinct from their output. In other words, W' in both cases does not have the required environment for the rules to apply. Therefore, according to the SCC, NSP & FVP need not wait until the word level. They are free to apply anywhere. In fact, this is the case. Both the rules apply and convert š to ċ and x to š. But notice that the SCC effectively blocks the NSP from applying on gmaš + isk + o on the second cycle.

(31) 1st cycle: gmax + isk

NSP --

FVP gmaš + isk

2nd cycle: gmaš + isk + o

NSP BLOCKED

On the 2nd cycle, gmaš + isk becomes the W' and gmaš + isk + o is W. This case satisfies the conditions of SCC in the sense that W' is non-distinct from the input and distinct from the output of NSP (i.e. *gmaš + isk + o). It simply means that W here already has the required environment for the rule NSP to apply. In such a situation, SCC predicts that the rule (in this case NSP) has to wait until the word level. Therefore, NSP has to wait until the word level to apply on gmaš + isk + o. Since the affixation of -o takes place at level 1, given the BEC at the end of level 1, the rule of NSP fails to gain access to š in gmašisko^{at} the word level. This is how Kiparsky derives the blocking effect on feeding rules on the same cycle.

Kiparsky also notes that the same rule applying in the lexicon and post-lexically does not constitute mere duplication of the same rule. He claims that the same rule applying at different levels applies to a different set of inputs and yields a different set of outputs. This is predicted by the theory. A rule applying in the lexicon is

governed by the independent principles stated earlier. The same rule applying post-lexically is independent of such principles. He illustrates his claim by giving examples from English and Catalan Nasal assimilation. (For details, see Kiparsky (1985)).

1.4.4 Jensen (1984)

Jensen (1984), discussing the issue of Vowel Harmony in Hungarian, claims that the framework of lexical phonology provides a better solution to this problem as opposed to the non-lexical treatments. Jensen (1978), Ringen (1978), Vago (1970) earlier proposed some solutions in non-lexical frameworks. As Jensen states, the rules proposed to account for this problem were very complex and used 'arbitrary diacritics' to explain the exceptions to the rules. But in the lexical phonology framework, he proposes a simple solution. (For details, see Jensen (1984).)

However, one of the important points one has to take note of in Jensen (1984) is that he adopts a post-lexical 'Absolute Neutralization' (AN) rule that changes $[+bk](\underline{\pm})$ to $[-bk](\underline{i})$. Although the rule of AN seem to work satisfactorily, it brings us back to the question raised earlier about the 'Abstractness' controversy in phonology. The question is, can we allow such AN rules in the framework of lexical phonology? Ironically, the very same issue led to the formula-

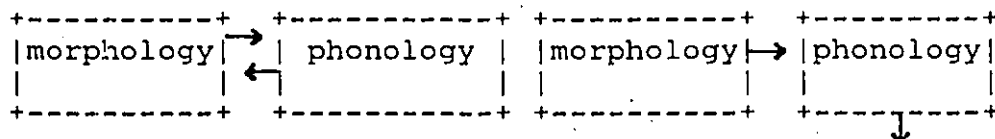
tion of this theoretical framework: Jensen says (personal discussion) such rules are permitted only at the word level and across the board, but not in a cyclic domain. Kiparsky (1985) appears to admit such a possibility although he does not state this explicitly.

In his recent paper, Harold F. Schiffman (1985 ms), commenting on Mohanan & Mohanan (1984), argues in favor of 'abstract analyses' that permit AN rules in the grammar. He says that by positing an underlying ai in Malayalam, which has historical justification, one can account for the process of palatalization in some cases which are treated as exceptions by M & M. He comments that M & M get into this situation because '...their stricture against historical justification for underlying forms, to posit an underlying front vowel in many of the Ma. items that show palatalization of velars...' This brings us back to the arguments in favor of 'abstract analyses' by Dresher. Dresher (1981), commenting on Hooper (1976) states that historical evidence along with other facts support an 'abstract analysis' in old English phonology as opposed to a 'concrete analysis'. He argues that historical evidence sheds light on the synchronic organization of grammar and this supports the abstract theories of phonology. (For details, see Dresher (1981)).

1.4.5 Halle & Mohanan (1984) and Booij & Ruback (1985):

H & M (1984) and B & R (1985) observe that not all lexical rules observe strict cyclicity, as it was believed earlier in Kiparsky (1982) and Mohanan (1982). H & M and B & J cite several examples from English and Polish to show that not all lexical rules are necessarily cyclic. M & M call such rules which do not observe the Strict Cyclicity Condition lexical 'non-cyclic' rules. B & R call such rules lexical 'post-cyclic' rules. Kiparsky (1985) also recognizes a 'word level' at the end of the lexicon, where the requirement that lexical rules apply in derived environments (the so-called Strict Cycle Condition) no longer holds. B & R observe that lexical rules which interact with morphological rules in a direct fashion are subject to the Strict Cycle Condition, whereas lexical rules which do not interact with morphological operations are not subject to the Strict Cycle Condition. Mohanan & Mohanan (1984) arrive at a similar conclusion regarding cyclic and non-cyclic rule application and represent this difference diagrammatically as given in (32).

(32) a. Cyclic Stratum b. Non-cyclic stratum



1.5 Summary:

We have so far presented a brief historical perspective of the theory of lexical phonology. We also highlighted some of the important assumptions made in this framework and their consequences for the phonological component of the grammar. At the end, a summary of the literature published in this framework is given. However, since the theory of lexical phonology is still very much in the process of development, no definite answers can be given to the problems that might arise in this framework at this stage. Many unanswered questions are left to future research.

Chapter II

LEVEL ORDERED MORPHOLOGY

2.1 Introduction

In the previous chapter an overview of the development of Lexical Phonology was given. We discussed the level-ordered morphology and phonology of English and Malayalam. Further, we noticed the interaction of Morphology and Phonology in the lexicon.

In this chapter we continue our discussion of the level-ordered morphology of English. In particular, we discuss Allen (1976) and Kiparsky (1982). This is followed by a discussion of the level-ordered structure of Kannada Morphology.

2.2 Level-ordering in English

Following Siegel (1972), Allen (1976) and Kiparsky (1982) advanced several arguments supporting the level-ordered structure of English morphology.

2.2.1 Allen (1976)

Allen (1976) observed that the negative prefixes in English in- and un- behave differently when they are affixed to words such as relevant, legible, material etc.

The nasal in in- assimilates to the following consonant and the nasal in un- does not. Examples in (1) and (2) show this difference.

(1) in + relevant -- irrelevant
 in + legible -- illegible
 in + material -- immaterial

(2) un + real -- *urreal
 un + loved -- *uloved
 un + mentionable -- *ummentionable

This is accounted for in the lexical model by putting in- and the rule of Nasal assimilation on level 1 and un- on level 2.

(3)	Morphology	Phonology
Level 1	in-	Nasal assimilation
Level 2	un-	Rule P

The derivations of legible and real in (4) illustrate the consequence of linear ordering of affixes.

(4)	Underived lexical item	/legible/	/real/
	Level 1: Affixation	[in [legible]]	--
	Nasal assimilation	[il [legible]]	└--
	BEC	[illegible]	--
	Level 2: Affixation		[un[real]]
	BEC		[unreal]

By restricting the domain of Nasal assimilation to level 1, we prevent its application at level 2 and consequently prevent un- from assimilating.

A further argument comes from the ordering of affixes. The negative prefixes in- and non- are attached to stems only in one order: non-illegible, * in-nonlegible. This is predicted if we order the stratum containing in- before the stratum containing non-.

2.2.2 Kiparsky (1982)

Kiparsky (1982), continuing the arguments supporting the ordered structure of affixes in English morphology, cites several interesting cases. He adduces evidence, morphological and phonological, to show how the affixes 'stack up' in a certain order. In what follows, we will briefly discuss the cases cited by Kiparsky supporting the level-ordered lexicon in English.

2.2.2.1 Trisyllabic Shortening (TSS)

The rule of Trisyllabic Shortening (TSS) in English applies only in derived environments. This rule shortens a vowel in the third syllable from the end of a word (on condition that the penultimate vowel is unstressed). It applies to sane + ity. But not to words like nightingale, Avery, oberon. These are monomorphemic words. What is interesting is that TSS fails to apply in words like needless, tastelessness, even though they do illustrate derived environments. This can be explained if we put the suffix -ity paired with TSS on level 1 and suffixes less, ness on level 2. Since the affixation of less and ness takes place at level 2, they escape the TSS which is a level 1 phonological rule.

2.2.2.2 Word Stress

The stress in English shifts from the verbal stress pattern to the nominal stress pattern when nouns are zero-derived from verbs. The derivation of protest in (4) shows the difference in stress pattern.

(4) Underived lexical item	/protest/ _V
Level 1 Phonology: Stress	[protést] _V
Level 1 Morphology: Zero derivation of Noun	[[protést]∅] _N
Level 1 Phonology: Stress	[[prótest]∅] _N

But this does not happen when verbs are zero derived from nouns. For example, we can derive the verb páttérn from the noun páttérn. Notice that the stress pattern hasn't changed from the nominal stress pattern to the verbal stress pattern; *[páttérn] would be impossible. Again, this difference can be accounted for if we assume the zero derivation paired with the stress rule is on level 1 and zero derivation of verbs from nouns at level 2. Since the stress rule is on an earlier level, the zero derived verbs escapes its application.

2.2.2.3 Compounds

The presence of irregular plurals inside certain compounds can be explained if we order irregular inflection before compounding. In fact this appears to be correct.

(5) Underived lexical item:	/tooth/	/mark/
Level 1 Morphology:		
Irregular inflection	[teeth]	--
Level 2 Morphology:		
Compounding	[[teeth][mark]]	
BEC	[teeth mark]	
Level 3 Morphology		
Inflection	[[teeth mark] s]	
BEC	[teeth marks]	

The only time a regular inflectional affix -s appears inside the compound is when they are 'pluralia tantum' (words that are inherently plural.)

(6) alms giving	* alm giving
Humanities department	* Humanity department
arms race	* arm race

This can be explained if we assume that the inherent plurals are listed in the lexicon.

2.2.2.4 Inflection of Verbal Compounds

Kiparsky observes the difference in the formation of verbal compounds withstood, understood, and the nominal compounds like grandstand. He accounts for this difference as follows. At level 1, the verb stand undergoes irregular inflection to become stood. At level 2, compounding takes place and we get withstood, understood. But, in the case of grandstand, the verb stand is zero derived to form a noun stand at level 1. At level 2, compounding takes place and we get grandstand. This analysis also explains why we get grandstanded and not grandstood. At level 2, the nominal compound grandstand become a verbal compound grandstand by zero derivation. At level 3, this verbal compound picks up the regular inflectional suffix -ed to become grandstanded. This is summarized in the following diagram (adopted from Kiparsky).

- (7) Level 1: [stand]_V --> [stand]_N
 Level 2: [[grand] [stand]]_N --> [grand stand]_V
 Level 3: [grand stand]_V --> [grandstanded]_V

Clearly, since the verb grandstand is formed after the level at which irregular inflection is available, there is no question of irregular inflection of such forms. This is predicted if we assume the linear ordering of affixes in the word derivation process.

2.2.2.5 Inflection of Nominal Compounds

Another set of compounds which Kiparsky discusses are the exocentric or bahuvrihi compounds. Some examples of these follow:

- (8) saber tooth
 red cap
 sky cap
 white cap
 white wall

What makes these compounds exocentric is that neither of the members of the compound, in particular the right hand member, is the semantic head. So, saber tooth, unlike milk teeth or wisdom tooth, is not a tooth, but rather a kind of tiger.

The notable thing about these forms is that they all inflect with regular morphology.

As Kiparsky notes:

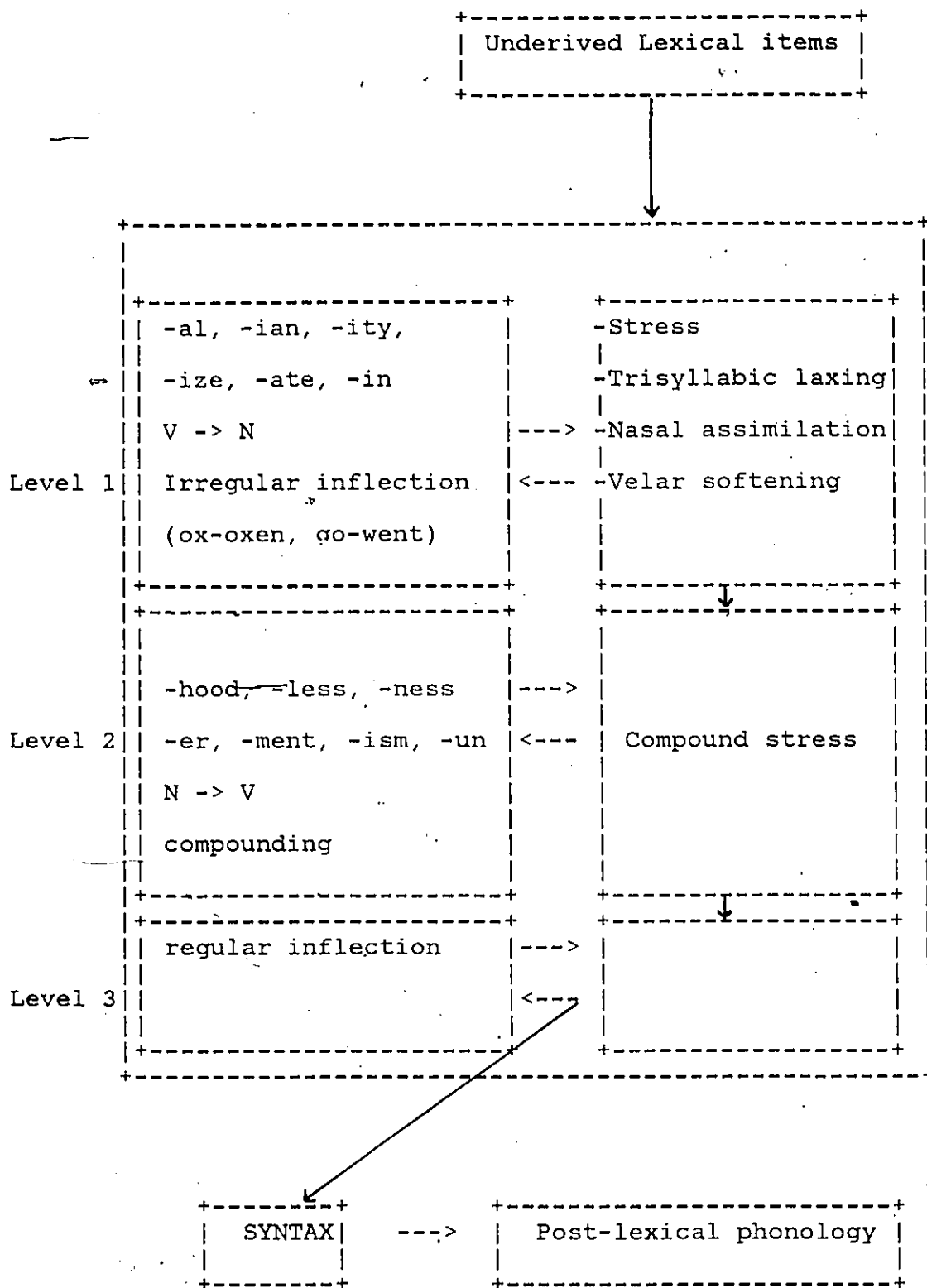
..exocentric (bahuvrihi) compounds are characteristically inflected at level 3 even if their second members are themselves inflected at level 1, whereas endocentric compounds retain the inflection that their second member has by itself. Consider e.g. milk teeth (endocentric) vs saber teeth 'sabertooth tigers' (exocentric). As in the verb compounds just discussed endocentric compounds are formed at level 2 by combining words, including words derived at level 1 such as teeth. Exocentric compounds, however, must on our assumptions be assigned zero derivational suffixes since they otherwise would share the properties of their heads, i.e. be endocentric. But... derivational suffixes cannot be added to (level 1) derived plurals. Therefore exocentric compounds come out of level 2 with exclusively singular morphology and can receive plural endings only at level 3 where they are adjoined to the whole compound. (13-14)

Clearly, the picture that emerges out of this discussion is that the morphological structure of English is expressed by ordering the strata. This model takes on the following form.

- (9) Level 1: Derivation and Irregular inflection
- Level 2: Derivation and Compounding
- Level 3: Regular inflection

The model in (9) coupled with the corresponding phonological levels is diagrammatically represented in (10).

(10)



2.3 Level Ordered Morphology of Kannada

2.3.1 Compounds

Kannada has two types of compounds. One is a regular compound which has the structure modifier + head. The other is of dvandva type which has two forms of the same category that are semantically related to each other. Mohanan (1982) calls the earlier type subcompounds and the latter cocompounds. A few examples of each type are given in (11) and (12).

(11) Subcompounds

- a. maragaalu 'wooden leg'
(mara: 'wood', kaalu 'leg')
- b. biḍigaasu 'loose penny'
(biḍi 'loose', kaasu 'penny')
- c. manegelasa 'house work'
(mane 'house', kelasa 'work')

(12) Cocompounds

- a. tande taayi 'father and mother'
(tande 'father', taayi 'mother')
- b. haṇa kaasu 'money and penny'
(haṇa 'money', kaasu 'penny')
- c. kallu maṇṇu 'stone and dirt'
(kallu 'stone', mannu 'dirt')

In the following section I shall show that these two types of compounds have to be placed on different strata or levels.

2.3.2 Preliminary analysis

2.3.2.1 Voicing of Stops

This rule voices the stops in intervocalic position in derived environments. It applies in mane + kelasa -- manegelasa 'house work' (mane 'house, kelasa 'work'). This rule does not apply to monomorphemic words like kitaki 'window', tuti 'lips', nikata 'near', 'proximate'. The rule of Voicing of Stops can be stated as (13).

$$(13) \quad C \rightarrow [+Voice] / V _ V$$

One reason why subcompounds have to be separated from cocompounds is that the former, but not the latter, exhibit the voicing of stops in derived environments.

(14) Subcompounds

- | | | |
|------------------------|-----|-----------------------|
| a. [[mara] [kaalu]] | --- | [maragaalu] |
| 'wood' 'leg' | | 'wooden leg' |
| b. [[tale] [kuudalu]] | --- | [taleguudalu] |
| 'head' 'hair' | | 'head hair' |
| d. [[hane] [kanpu]] | --- | [haneganpu] |
| 'forehead' 'eye' | | 'eye on the forehead' |

(15) Cocompounds

a. [[haṅṅu] [kaayi]]	---	[haṅṅu kaayi]
'fruit' 'nut'		'fruit and nut'
b. [[tande] [taayi]]	---	[tande taayi]
'father' 'mother'		'father and mother'
c. [[kelasa] [kaarya]]	---	[kelasa kaarya]
'work' 'job'		'work and job'

Notice the voicing of stops in (14) but not in (15).

In order to avoid deriving the wrong results by allowing (13) to apply to cocompounds, we have to pair the rule of voicing of stops with subcompounds on level X and order this level before the level of cocompounding (i.e. level Y).

(16)	Morphology	Phonology
Level X	Subcompounding	Voicing of Stops
Level Y	Cocompounding	P rules

By restricting the domain of Voicing of Stops to level X, we prevent its application at stratum Y and consequently prevent the stops in cocompounds from voicing.

The second reason to separate subcompounds from cocompounds is the presence of an enunciate vowel -u in cocompounds. The vowel -u gets epenthesised to consonant final stems. This epenthetic rule is triggered by the process of cocompounding and not subcompounding. The derivations in (17) and (18) illustrate this point.

(17) Cocompounds

/haŋ/

/kaayi/

UR

ripe fruit

unripe fruit

[[haŋ] [kaayi]]

Compounding

[[haŋu][kaayi]]

u-Epenthesis

[[haŋnu][kaayi]]

Gemination

[haŋnu kaayi]

BEC

ripe and unripe fruit

(18) Subcompounds

/hoN/

/baale/

gold

spathe (flower)

[[hoN] [baale]]

Compounding

[[hom] [baale]]

Nasal assimilation

[hombaale]

BEC

golden spathe

The presence of -u in the first member of a cocompound indicates that it is a word level phenomenon. Moreover, allowing the two types of compounds on one level leads to further complications. We cannot prevent the rule of u-Epenthesis from operating on subcompounds. This further blocks the nasal assimilation rule.

(19)	/hoN/	/baale/	UR
	[[hoN] [baale]]		Compounding
	[[hoNu][baale]]		u-Epenthesis
	[[hoNnu][baale]]		Gemination
	BLOCKED		Nasal Assimilation
	{hoNNubaale}		BEC

The arguments given in 2.3.1.1 show that the two types of compounds in Kannada have to be placed on two different levels. Each morphological level is paired with the corresponding phonological rules that interact with the morphological processes of that level. Thus, the pairing of Subcompounding with the rules of Voicing of Stops and Nasal Assimilation gives the right forms. Similarly, the pairing of Cocompounding with the rule of u-Epenthesis and Gemination predicts the right results. This is represented schematically in (20).

(20)	Morphology	Phonology
	Level X: Subcompounding	Voicing of Stops
		Nasal Assimilation
	Level Y: Cocompounding	u-Epenthesis
		Gemination

Furthermore the Cocompounds have to be ordered after the Subcompounds. This is evident from the fact that Subcompounds occur inside Cocompounds.

(21) /haṇ/ /niir/ /kaayi/
ripe fruit water unripe fruit

[[haṇ] [kaayi]] [[niir] [kaayi]] Subcompounding

[[haṇ] [gaayi]][[niir] [gaayi]] Voicing Assimilation

[haṅgaayi] [niirgaayi] BEC

[[haṅgaayi] [niirgaayi]] Cocompounding

[haṅgaayi niirgaayi] BEC

(an expression to refer to severe beating)

2.3.3 Nominalizing Suffixes

Kannada has two types of nominalizing suffixes. Both have the same phonological form -ike. In Aronoff and Sridhar (1983) Sridhar treats -ike as the same suffix that attaches in two ways, either as a stem suffix or a word suffix. He shows that there is a phonological and semantic difference in -ike suffixation to stems and words. He gives this difference in a table shown below. (taken from Aronoff & Sridhar (1983)).

(22)

Verb	-ike	-ike
beeḍu 'beg'	beeḍike 'plea'	beeḍuwike 'begging'
jaaru 'slide'	jaarike 'slippery'	jaaruwike 'sliding'
heelu 'tell'	heelike 'statement'	heeluwike 'saying'
keelu 'ask'	keelike 'request'	keeluwike 'asking'
naacu 'blush'	naacike 'shyness'	naacuwike 'blushing'
haaru 'fly'	haarike 'flight'	haaruwike 'flying'
hodi 'cover'	hodike 'cover' (n)	hodiyuwike 'voering'
tooru 'show'	toorike 'appearance'	tooruwike 'displaying'
bayasu 'desire'	bayake 'craving'	bayasuwike 'desiring'
maḍisu 'fold'	maḍike 'a fold'	maḍisuwike 'folding'
turisu 'scratch'	turike 'itch' (n)	turisuwike 'scratching'
horaḍu 'leave'	* horaḍike 'departure'	horaḍuwike 'departing'

The very fact that there is a semantic and phonological difference in the output of the -ike suffixation indicates that -ike is not the same suffix attaching in two ways as Sridhar states but two different suffixes. Moreover, Sridhar argues that there is no need for level ordering. In what follows, I argue that the phonological and semantic difference of the -ike suffixes can be better explained if we place these two suffixes on two different levels.

2.3.3.1

-ike(nominalizing)

-ike is a regular nominalizing suffix which attaches to both stems and words. This nominalizing suffix changes transitive and intransitive verbs into nouns. It also changes primary nominal stems into secondary nominal stems. These examples in (23) illustrate the process of nominalization by -ike suffixation.

(23)	Verb		-ike		Noun
a.	anj <u>u</u>	--	anj <u>u</u> ike	--	anj <u>i</u> ke
	'to fear'				'fear'
b.	tur <u>i</u>	--	tur <u>i</u> ike	--	tur <u>i</u> ke
	'to scratch'				'itch'
c.	beed <u>u</u>	--	beed <u>u</u> ike	--	beed <u>i</u> ke
	'to beg'				'plea'
d.	toor <u>u</u>	--	toor <u>u</u> ike	--	toor <u>i</u> ke
	'to show'				'display'
	Noun				
e.	budhiwanta	--	budhiwanta ike	--	budhiwantike
	'wise man'				'intelligence'
f.	suuḷegaara	--	suuḷegara ike	--	suuḷegaarike
	'whore-monger'				'whoredom'

In (23) a-f, we notice that the vowel-final verbal and nominal bases delete their final vowels when they are fol-

lowed by the vowel-initial -ike suffix. Semantically these words are idiosyncratic, action nouns, result nouns and indeterminate cases.

2.3.3.2

-ike(gerund)

This -ike in Kannada is a productive nominalizing suffix roughly equivalent to English -ing in meaning.

	Verb		-ike (gerund)		Noun
(24)	a. anju	--	anju ike	--	anjuwike
	'to fear'				'fearing'
	b. turi	--	turi ike	--	turiyuwike
	'to itch'				'itching'
	c. beed-u	--	beedu ike	--	beeduwike
	'to beg'				'begging'
	d. heel-u	--	heelu ike	--	heeluwike
	'to tell'				'telling'
	e. jaar-u	--	jaaru ike	--	jaaruwike
	'to slide'				'sliding'

Notice that there is a semantic consistency in the words derived in (24). Most of the affixed words get the meaning equivalent to -ing in English. Therefore this -ike can be treated as a gerund in Kannada. Moreover, this gerund suffix attaches only to words as opposed to the regular nominalizing suffix -ike which attaches to words as well as

stems. There is an important phonological difference between these two affixation process. In (23 a-f), we observed that the stem final vowel deletes when a regular nominalizing -ike is attached to it. The rule of Vowel Deletion is given in (25).

$$(25) \quad V \rightarrow \emptyset / _ V$$

But when the gerund -ike is affixed to verbal and nominal stems ending in vowels, a glide is inserted. Moreover, the suffixation of gerund -ike triggers u-Epenthesis in consonant final stems followed by Glide insertion. The rule of Glide insertion is stated as in (26).

$$(26) \quad \emptyset \rightarrow w / V _ V$$

Both are derivational suffixes. If we put these two suffixes on the same level we face the conflict of rule (25) and (26). On the other hand, if we pair the regular nominalizing -ike with the rule of Vowel deletion and the gerund -ike with the Glide insertion rule we can avoid this situation.

(27)	Morphology	Phonology
	Level X <u>-ike</u> (nominalizing)	Vowel Deletion
	Level Y <u>-ike</u> (gerund)	Glide Insertion

The assumption that the derivational process at later levels are semantically more uniform than those at earlier levels is confirmed by the fact that the words derived with gerund -ike are semantically more consistent than the regular nominalizing -ike (for e.g., see (12) & (24)). Moreover, the ordering in (27) is consistent with the productivity difference that we expect between earlier and later derivational processes. The derivation of words by affixation of gerund -ike is more productive than the words derived with the regular nominalizing suffix -ike. Examples given in (28) & (29) shows this difference.

(28) Gerund -ike

beeḍu -- beeḍuwike
 nooḍu -- nooḍuwike
 kaaḍu -- kaaḍuwike
 taḷḷu -- taḷḷuwike
 baresu -- baresuwike

(29) Regular nominalizing -ike

kaaḍ -- * kaaḍike
 nooḍ -- * nooḍike
 bare -- * barike
 taḷ -- * taḷḷike
 beeḍ -- beeḍike

In order to account for the facts discussed in 2.3, I shall assume the following levels for Kannada morphology.

(30) Level 1: Derivation & Subcompounding

Level 2: Derivation, Cocompounding & Inflection

Level 3: Inflection

Level 1 derivational suffixes such as verbal suffix -isu, causative suffix -isu, nominalizing suffix -ike and subcompounds are stem level processes. They attach both to stems and words.

(31) [[Kannada] isu] -- [Kannadisu]

Kannada 'to translate (into Kannada)

[[ood] isu] -- [oodisu]

'to run' 'to (make) to run

[[toor] ike] -- [toorike]

'to show' 'display'

[[hoN] [gejje]] -- [hongeje]

'gold' 'bells' 'golden bells'

[[mara] [kaalu]] -- [marakaalu]

'wood' 'leg' 'wooden leg'

Level 2 suffixes like gerund -ike, cocompounds and -gal, a plural suffix are word level suffixes. They attach only to words.

- (32) nooḍ-u + ike -- nooḍuwike
 'to see' 'seeing'
 tande # taayi -- tande taayi
 'father' 'mother' 'father & mother'
 mooda + gaḷ-u -- mooda gaḷu
 'cloud' pl. 'clouds'

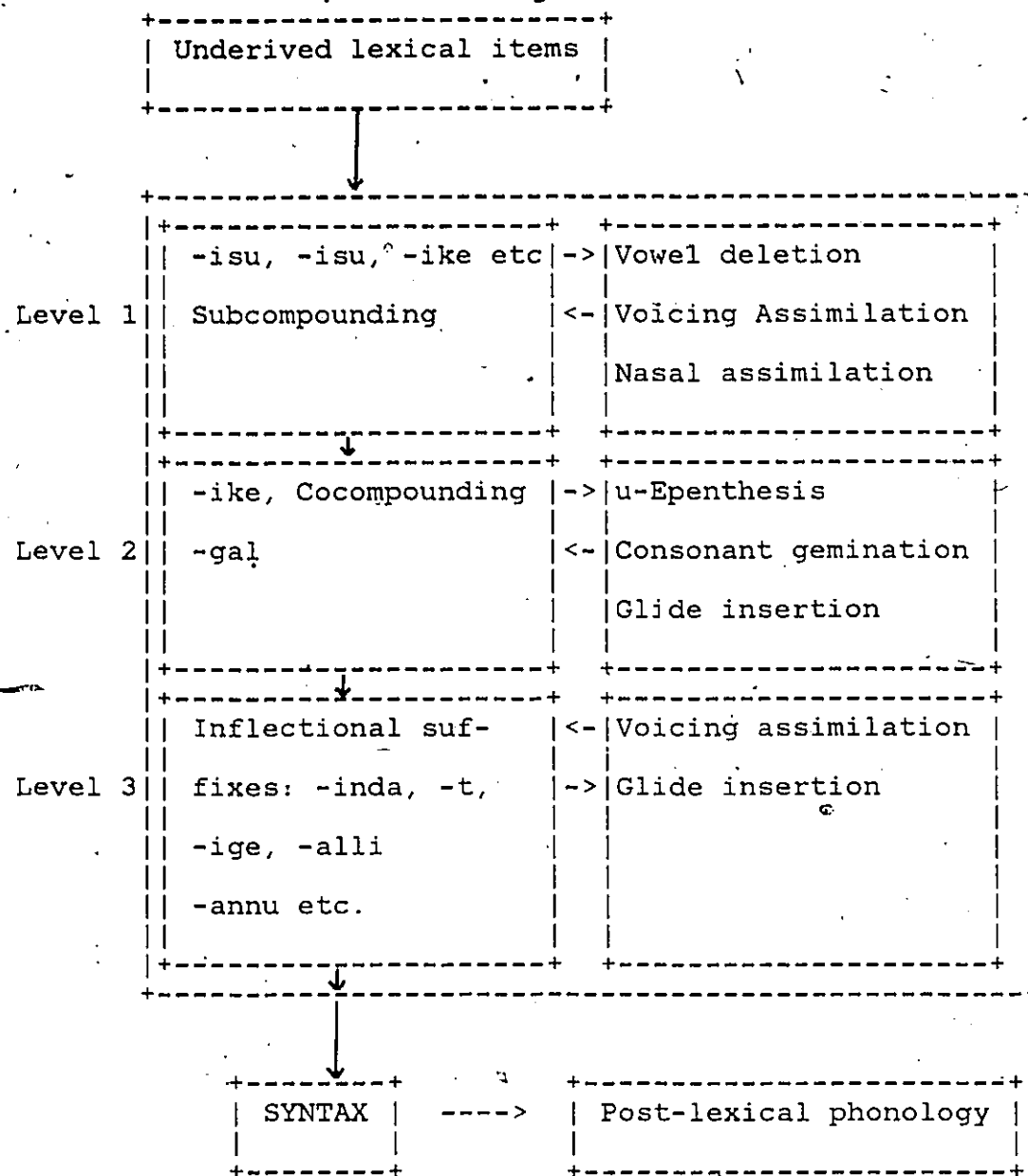
Level 3 suffixes such as case suffixes, tense suffixes and gender suffixes are stem level suffixes. They can be suffixed to stems and words as well.

- (33) [[kaṅ] inda] -- [kaṅṅinda]
 'eye' inst. 'from the eyes'
 [[mane]linda] -- [maneyinda]
 'house' inst. 'from the house'
 [[suḍ] t] -- [suṭṭ]
 'to burn' pst. 'burnt'

Arguments given in 2.3 show that the conclusion drawn by Sridhar in Aronoff & Sridhar (1983) against the need for the Affix Ordering Generalization in Kannada is not true.

After having shown the need for morphological levels in the word building component of Kannada morphology, we shall represent the Kannada lexicon as follows:

(34)



The derivation of kannaḍisisuwikeyannu 'the act of causing (someone) to translate into Kannada' in (35) shows the level ordered structure of suffixes and their interaction with the phonology.

(35) /Kannaḍa/ UR

'Kannada' (a language)

[[Kannaḍa] isu] Affixation

'to translate (into) Kannada'

Level 1: [[Kannaḍ] isu] V --> Ø / _ V

[[[Kannaḍ] isu] isu] Affixation

[[[Kannaḍ] is] isu] V --> Ø / _ V

[Kannaḍisisu] BEC

'to cause (someone) to translate into Kannada'

Level 2: [[Kannaḍisisu] ike] Affixation

[[Kannaḍisisuw] ike] Ø --> w / V _ V

[Kannaḍisisuwike] BEC

'the act of causing (someone) to translate into Kannada'

Level 3: [[Kannaḍisisuwike] annu] Affixation

[[Kannaḍisisuwikey] annu] Ø --> y / V _ V

[Kannaḍisisuwikeyanu] BEC

'the act of causing (someone) to translate into Kannada' (acc).

The ordering of suffixes in (35) makes the correct prediction that derivational suffixes cannot be attached to compounds (or inflected stems), and that compounds cannot contain inflected stems.

2.4 Summary

In this chapter we have further discussed the arguments in support of the level-ordered morphology and phonology of English. This discussion is followed by arguments supporting the ordering of levels of morphology and phonology in Kannada. It is shown that Kannada has three levels of morphology and corresponding phonology. Several examples are given to substantiate this assumption.

Chapter III
KANNADA PHONOLOGY

3.1 Introduction

Having presented the theory of Lexical Phonology, and shown its consequences for the Kannada lexicon, we shall proceed to illustrate some of the phonological rules in Kannada. An extensive analysis of Kannada phonology facilitates a better understanding of the assumptions made in the preceding chapters. This chapter is organised into four sections. First, the syllable structure of Kannada is established (3.1). Arguments supporting the 'no-coda hypothesis' are given in (3.2). In (3.3), we will discuss the proposal made by Levin (1985) in favor of featureless skeletal slots as opposed to the CV slots of McCarthy (1981) and show how the data from Kannada support Levin's proposal. In the fourth section we will present some of the phonological rules frequently referred to in this thesis. A summary is given in (3.5).

3.2 -- Syllable Structure

Kannada syllable structure is simple and unmarked. The general pattern of the syllable structure is CV. For example:

(1) Examples	Gloss
magu	child
karu	calf
tale	head
kudure	horse

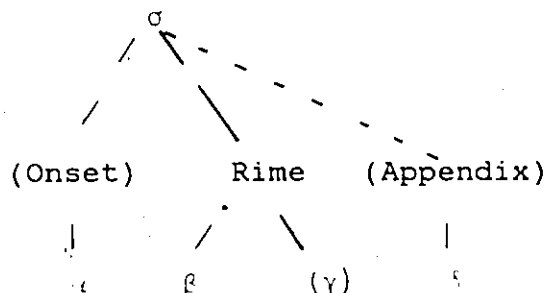
However, there are a few stems that end in consonants. In such cases, to conform to the canonical syllable structure, a vowel (usually 'u') is epenthesised. This epenthetic vowel breaks the CVC pattern into a (C)V.CV pattern. The following examples illustrate this point.

(2) Examples	Gloss
sud -- sud-u	to burn
id -- id-u	this
nag -- nag-u	to laugh
bar -- bar-u	to come
bid -- bid-u	to leave
teer - teer-u	chariot
kaal - kaal-u	leg

Further observation of the language reveals certain collocational restrictions on the sequence of segments than can appear in the Kannada word. They are the type of consonant clusters that are permitted word-medially. These few word-medial clusters are restricted to nasals followed by homorganic stops (i.e. nd , nt , mp , pk) and obstruent geminates (i.e. tt , kk , dd , pp etc.). The surface form in Kannada does not permit the immediate sequence of two vowel sounds, each of which constitutes a separate syllable (i.e. * $\overset{Q}{V} \overset{Q}{V}$).

Having noted the distribution of segments and their collocational restrictions, we can propose the following syllabic template for Kannada.

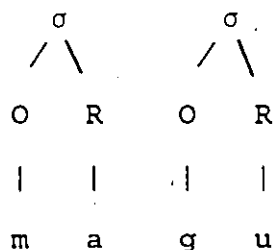
(3) Syllable Template



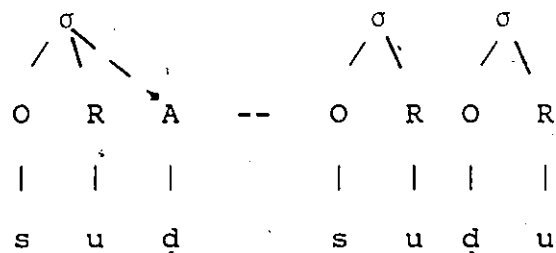
Brackets signify that a constituent is to be regarded as optional. The reason for postulating an appendix for Kannada instead of a coda will be discussed in the next section. Suffice it to note that the rime has two slots followed by

an appendix, an extrasyllabic segment waiting for a rime to create a new syllable. The consequence of (3) for (1) and (2) is given in (4).

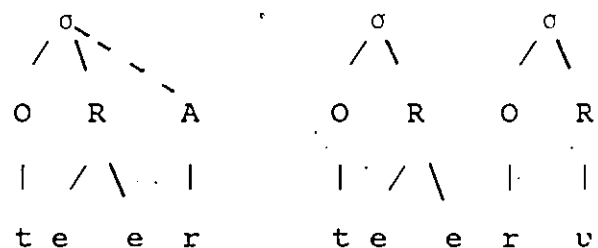
(4) a. /magu/



b. /sud/



c. /teer/



The structure given in (3) adopts the theory outlined in Halle and Vergnaud (1980), McCarthy (1981) and Clements and Keyser (1981). This theory sets up a tier of distinctive

feature specifications called the 'melody' represented as $\alpha \beta \gamma \delta$ in (3), a skeletal tier represented by slots, and a syllabic tier embodying labelled constituents. However, adopting proposals made by Levin (1983, 1984 and 1985) and Archangeli (1984, 1985), I make use of a core skeleton consisting of unlabelled X slots rather than the CV slots McCarthy proposed. An X skeleton has certain advantages over a CV skeleton. Some of these advantages will become obvious when we discuss the process of gemination in (3.3).

3.2.1 The structure of the Rime

In (3), we represented the rime having two slots.

(5) Kannada rime structure

Rime

└─
X (X)

Under this proposal, the branching rime accommodates long vowel (VV), diphthongs, and vowel + sonorant. These are represented as follows.

(6) a. Long vowels (VV):

R	R	R
\diagdown X X \diagup	\diagdown X X \diagup	\diagdown X X \diagup
a	e	u

b. Diphthongs:

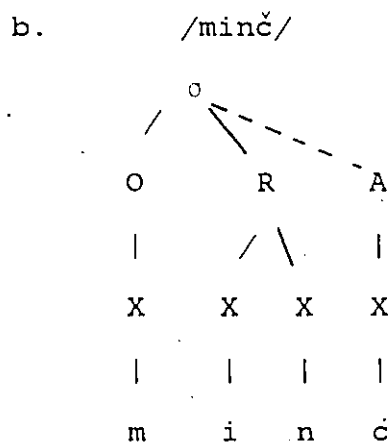
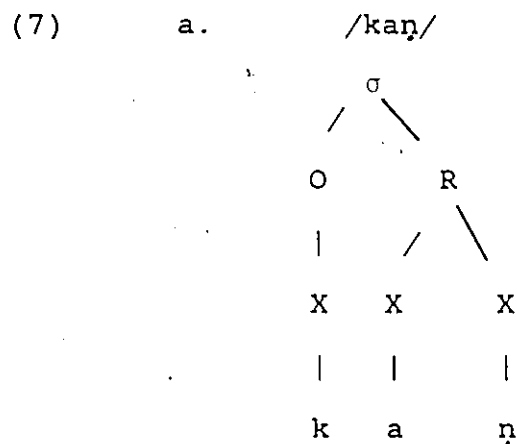
R
\diagdown X X a i

c. Vowel + Sonorant:

R
\diagdown X X e [+son]

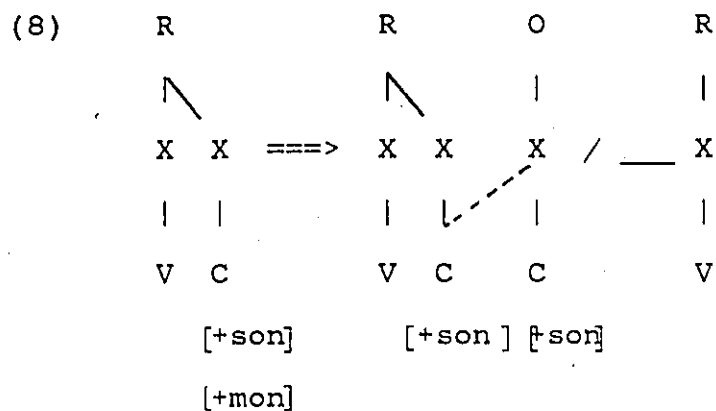
In all cases in (6), the left-most element in the Rime consists of a vowel, whereas the right-most element is indifferently vocalic (5 a) or [+sonorant] (5c). Having a vowel or a sonorant in the right branch of the rime is a language-specific parameter. In fact, Piggott and Singh (1984) and Levin (1983, 1985) advance a proposal that allows the rime to dominate any [+sonorant] element. Following this proposal, I assign the nasal of kan to the right branch of the rime. Similarly, the nasal in minč is

assigned to the rime and the stop following the nasal can be assigned to the appendix. The syllabification of kaŋ and minč may be exemplified as follows:

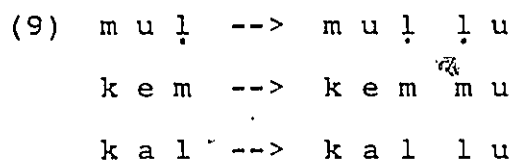


As we noted earlier, a vowel u is epenthesised to the consonant final stems in (7) to conform to the canonical syllable structure (kaŋ --> kaŋ-ŋu, min-č --> min-ču). The reason to adopt this analysis for the sonorant-final stems and stem final homorganic clusters as opposed to the analysis given in (4) is to give a better explanation for the

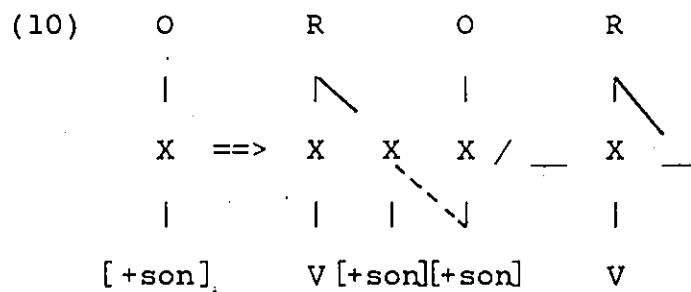
process of gemination in Kannada. The final sonorant of a monosyllabic stem geminates if it is followed by a vowel. This rule is stated in (8).



The consequence of (8) is given in (9).

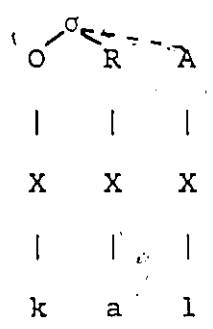


Obviously now the question is, why shouldn't we treat the stem final sonorant as an appendix to conform to the general pattern given in (4b)? If we adopt this proposal, we have to rewrite the rule of gemination as follows.

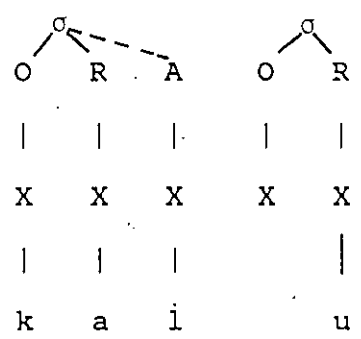


The consequence of (10) on kal is given in (11).

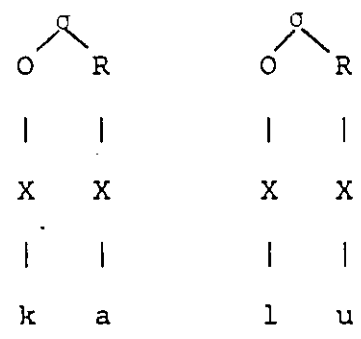
(11) /kal/ 'stone'



Syllabification



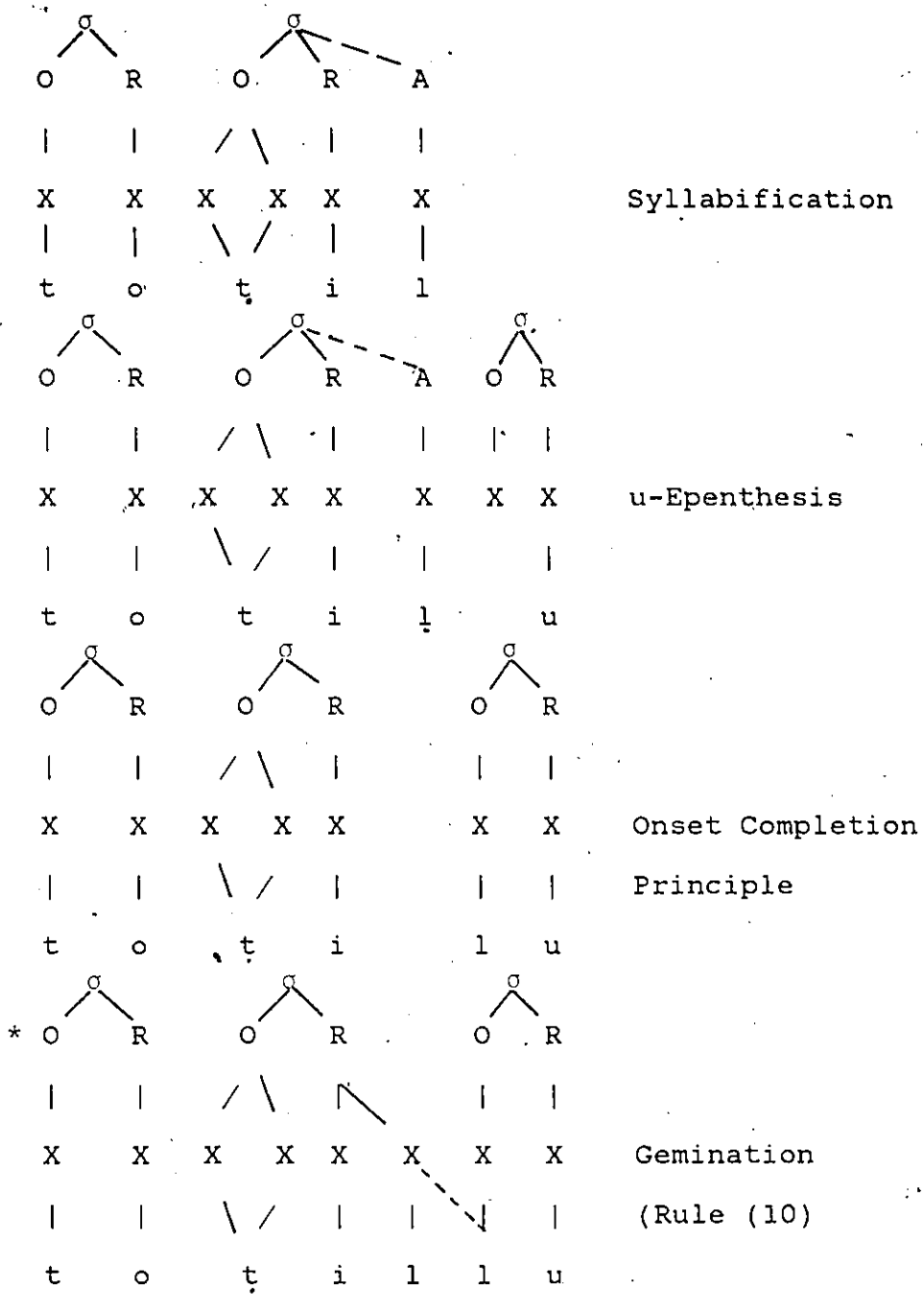
u-Epenthesis



Onset completion principle

(Mohanan, 1982)

(12) /tottil/ 'cradle'



Obviously, we have to rewrite the rule (10) to derive the right surface form (tottilu). This will unnecessarily complicate the rule structure. Therefore, the analysis of stem final sonorants given in (8) is preferred to (11). In any case, as we stated earlier, the rime in Kannada allows the sonorant on its right branch.

3.3 No Coda Hypothesis

The rime structure of Kannada given in (5) does not allow a coda. As we stated earlier, the stem final consonants are treated as extrasyllabic segment, an appendix, and not as codas. The appendix is invoked as a parameter in some languages in order to account for the occurrence of extrasyllabic segments at the ends of morphemes or words.

The reason to postulate an appendix for Kannada instead of a coda may be clearly attributed to the absence of closed syllables in general and the sequential constraints observed in this language. Sonorants are treated as a special case. If the syllable template of Kannada allowed for the inclusion of a coda as a subprime constituent, we wouldn't see any motivation for the rule of u-Epenthesis. Why should this language permit such a rule? Obviously, the only motivation for u-Epenthesis is to complete the syllable by attaching to the unsyllabified segment at the end of the stem.

Another type of evidence to support the 'no-coda hypothesis' comes from the occurrence of possible consonant clusters in word-medial position. This language permits only homorganic clusters. As we noted in (2), the final consonants of stems are not restricted to any particular class of consonants. However, there is a restriction on the co-occurrence of segments in medial clusters, in that they involve only a nasal followed by a homorganic stop or an affricate. If we allow a coda in the syllable template as a subprime constituent, we would expect to find a great many of the stem final consonants in word-internal syllables, which is not the case. For example, when a dative suffix -ge is affixed to a consonant-final stem kaal, we get kaal-i-ge. A high front vowel is epenthesized to break the word-medial liquid + obstruent cluster. If l in kaal were to be assigned to the coda, there would be no motivation for the i-Epenthesis to break the cluster. Kaal + ge belong to two separate syllables and it should have been perfectly correct. But it is not so. On the otherhand, if we treat l as an appendix, lg is not a permissible word-medial cluster and therefore a vowel i is epenthesized to create a new syllable. Moreover, if we don't treat the stem final consonant as an appendix, we will miss a generalization in this language regarding the onset-rime alternation. The process of vowel epenthesis and consonant gemination suggests that in this language onsets and rimes always alternate. If the

rime or onset is missing, it will be filled either by a process of vowel epenthesis or consonant gemination.

3.4 CV Skeletal slots vs X slots

Earlier in this section I mentioned that adopting featureless X slots in place of CV slots has certain advantages. In this section I shall show that the proposal made by Levin (1983) has a distinct advantages over that of McCarthy (1981) in the analysis of the process of gemination in Kannada.

It was McCarthy (1981) who for the first time proposed the CV tier to account for the non-concatenative morphology of the Arabic verbal system. The representation of each binyan as a CV skeleton with consonant and vowel melodies on separate tiers was seen to account for the surface forms of many of the binyanim if one simply assumed one-to-one, left-to-right linking, that all skeleton slots must be linked to melodic elements, and that association lines may not cross. The condition on the linking principle of melodic copies of the stems to the CV skeletal tier is the feature complexes containing the feature [-syll] can be linked only to C slots in the skeleton and feature complexes containing the feature [+syll] can be linked only to V slots in the skeleton.

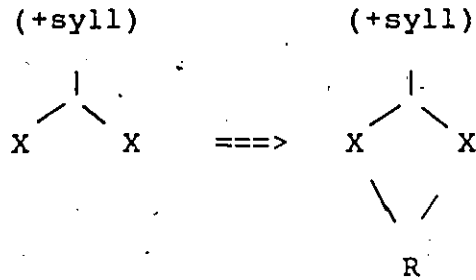
Levin (1983) argues that this encoding of features [+ or -syll] is redundant. In its place, she suggests that the skeletal tier is truly empty in that it consists solely of empty time-sequence slots. Linking of a feature or feature matrix to a slot will involve percolation of all features to the empty slot. Levin supports her argument by examining the process of reduplication in Kusaiean, a Micronesian language spoken on the island of Kusaie; Umpila, an Australian language of the Cape York peninsula, Southern Paiute, and Mokilese, a Micronesian language. It is not necessary here for us to go into the details of her discussion. What is relevant here is the Condition on Syllabic Structure (CSS) she has proposed in order to explain the process of reduplication satisfactorily in the languages mentioned above.

(13) Condition on Syllabic Structure (CSS)

- A. All syllables are branching
- B. A [+syll] element must be immediately dominated by a Rime (R), and R must immediately dominate a [+syll] element at every level.

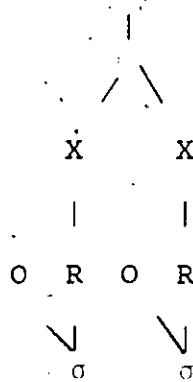
In addition, she adds a corollary to (13) given in (14).

(14) Long Vowel Rule ((11) restated).



(14) rules out the possibility of syllabifying a true long vowel, that is, a single feature matrix containing the feature [+syll] linked to two skeletal slots, as two adjacent rimes, as in (15).

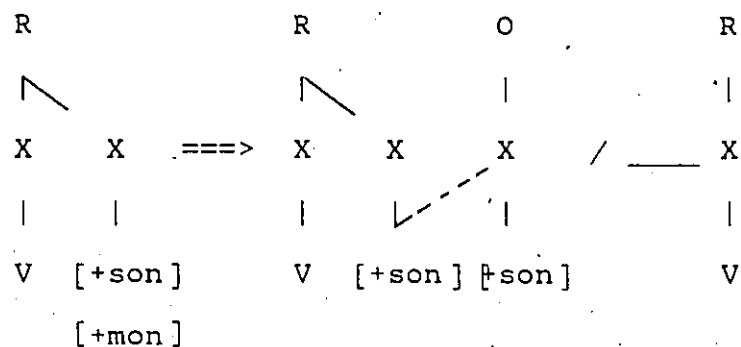
(15) * [+syll]



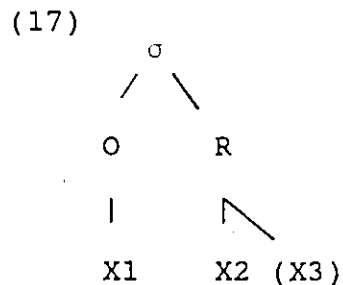
Now, let us look at the process of gemination in Kannada. As we mentioned earlier in our discussion, the final sonorant of a monosyllabic stem geminates if it is followed by a short vowel. The forms in (16) motivate the rules in (17).

(16)	Examples		Gloss
	kaṇ	----- kaṇṇ-u	eye
	kaḷ	----- kaḷḷ-u	stone
	muḷ	----- muḷḷ-u	thorn
	maṇ	----- maṇṇ-u	mud

(17) Rule of gemination ((8) repeated))



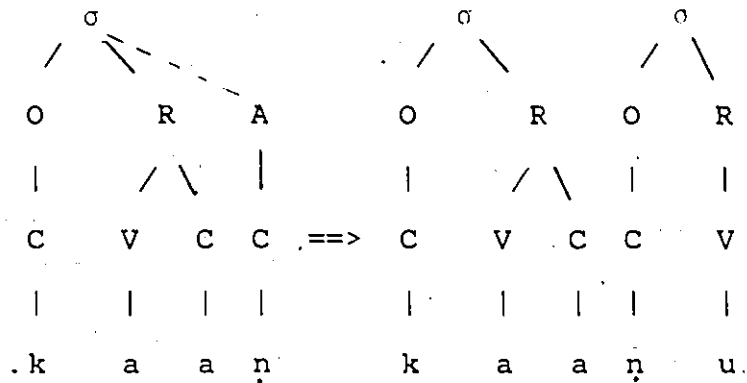
Earlier we adopted a two-slot rime structure for the Kannada syllable such as in (18):



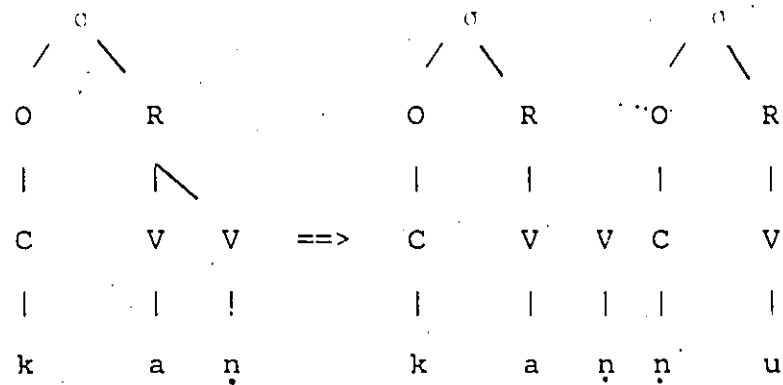
According to the syllable structure condition (CSS), X1 is not [+syll] since all [+syll] elements are immediately

dominated by R. However, we see an ambiguity in identifying X2 or X3 in the rime as [+syll]. The CSS states that one of the slots dominated by rime must be [+syll], but both may not be. In fact, the left branch of the rime is [+syll] in this language. Whether X3 is specified for [+ or - syll] depends on the language-specific parameter. In this case, as we noted earlier, X3 is unspecified for [+ or - syll]. It allows a [+syll] element if the syllable has a long vowel or a [-syll] element if it is a geminated consonant. It is precisely in this rime spot that the specification of [+ or - syll] is problematic for the CV tier analysis. Using a CV-skeleton, it is unclear whether to represent the branching rime as a VC or VV sequence. Either representation will create a conflict in linking the melody tier to the CV-skeletal tier. We need special linking rules to overrule the basic association principle which states that the feature [-syll] can be linked only to C slots in the skeleton, and feature complexes containing the feature [+syll] can be linked only to V slots. On the other hand if we adopt featureless skeletal slots we won't be trapped into this kind of ambiguity. Further, this solution eliminates the need for special linking rules. The illustration in (19) and (20) supports this argument.

(19)



(20)



In (19) the [+syll] element is linked to a C slot in the skeletal tier and in (20) the [-syll] element is linked to a V slot in the skeletal tier. In such cases, a feature-less tier coupled with the CSS correctly predicts unspecified linking.

3.5 Some rules of Kannada Phonology

3.5.1 u-Epenthesis

A large number of morphemes in Kannada end in basic consonant. For example, maad 'do', tar 'bring', naac 'to blush', heel 'tell' etc. To all such consonants a vowel, usually 'u' is added. This vowel is called by Cadwell (1913: 134-35) the 'enunciative vowel'. Cadwell states that the short 'u' of all the vowels is the weakest and lightest, and is largely used, especially at the end of words for euphonic purposes, or as a help to enunciation.

(21)	maad	----	maadu
	tar	----	taru
	naac	----	naacu
	heel	----	heelu

This is particularly obvious in borrowings:

(22)	spuunu	----	'Spoon'
	kaaru	----	'Car'
	railu	----	'Rail'
	benču	----	'Bench'
	pennu	----	'Pen'
	bassu	----	'Bus'
	kappu	----	'Cup'

The above facts suggest that the enunciative vowel is wholly predictable by rule. This rule can be stated as follows:

(23) $\emptyset \rightarrow u / C _ \#$

(Bright, 1958: 13, sec. 2.2
and 1970, rule 8)

However, a small number of morphemes end in basic 'u'. For example, hulu 'worm', magu 'child', naḍu 'waist', karu 'calf', hasu 'cow' etc.

Ramaswami Aiyar (1935) states that there is no difference in the phonetic character or value of the original 'u' and enunciative vowel 'u'. Both have same features [+hi, +bk, and +rd].

3.5.2 Voicing of Stops

The rule of Voicing of Stops voices a voiceless stop in intervocalic position in derived environments. This rule is stated in (25).

(25) $C \rightarrow [+voice] / V _ V$
 $\left[\begin{array}{l} +obs \\ -voice \\ -cont \end{array} \right]$

The effect of (25) is seen in the following derivations.

(26) mara kaalu --- maragaalu
 wood leg wooden leg
 keḷa tuti --- keladuti
 lower lips --- lower lips

3.5.4 Vowel Deletion

Kannada does not permit Vowel hiatus in surface forms. When two vowels belonging to two separate syllables come together, the preceding vowel will be dropped by the rule of Vowel Deletion. This rule is stated in (29).

(29) $V \rightarrow \emptyset / _ V$ (Level 1)

The following examples illustrate the effect of (29).

(30) $kali+isu \rightarrow kalisu$
 learn to learn
 $kannada+isu \rightarrow kannadisu$
 Kannada to translate into Kannada
 $kedu+isu \rightarrow kedisu$
 spoil to spoil

3.5.5 Glide Insertion

The Glide Insertion rule in Kannada inserts a glide between two adjacent vowels, agreeing in roundness and backness with the preceding vowel. This rule is stated as in (31).

(31) $\emptyset \rightarrow \begin{matrix} [ard] & [ard] \\ [\beta bk] & [\beta bk] \end{matrix} / V _ V$ (Level 2)

The effect of (31) is seen in the following derivations.

(32) magu+ina --- maguwina
 child acc. child's
 kaddi+inda --- kaddiyinda
 stick instr. with the stick
 noodu+iike --- nooduwike
 see N+ing seeing
 mane+inda --- maneyinda
 house instr. from the house

3.6 Summary

In this chapter we have established the syllable template of Kannada. We have presented arguments supporting the 'no-coda hypothesis'. We have further shown the interesting behaviour of sonorants in this language. It has been observed that the behaviour of sonorants lends support to Levin's proposal of featureless slots (X's) in the skeletal tier. Finally, we have given some phonological rules with examples.

Chapter IV

LEXICAL AND POST-LEXICAL RULES

4.1 Introduction

In chapter 1, we discussed three important properties of Lexical rules. They are 1) Structure preservation, 2) Derived environment condition and 3) Cyclic application. Kiparsky (1985) observed that these properties act as independent principles governing lexical and post-lexical rule application. Furthermore, the revised version of the Strict Cycle Condition (SCC) now restricts lexical phonological rules within the lexicon either to stem level or the word level.

In this chapter we will consider some of the phonological rules in Kannada mentioned in Chapter 3 and see how the independent principles mentioned above and the SCC restrict their application within the lexicon at different levels and in the post-lexical domain.

4.2 The rule of u-Epenthesis

As we mentioned in Chapter 3, the vowel -u is epenthesised to consonant-final stems in Kannada. For example, the verbal stem nood 'to see' becomes nood-u 'to see'. Cadwell (1913) claims that this addition of -u to the final consonants is done for euphonic purposes, to help the enunciation of final consonants. But -u is not the only vowel which is added to consonant-final stems, though it is the most frequent. Next to -u, the vowel which is most commonly employed is -i. The epenthetic vowel -i is particularly added to stems ending in a glide y. For example, naay 'dog' becomes naay-i baay 'mouth' becomes baay-i. We will confine ourselves to the discussion of the rule of u-Epenthesis in this chapter and won't consider the epenthetic i any further.

The rule of u-Epenthesis is repeated here for the sake of our present discussion.

$$(1) \emptyset \rightarrow u / C _ \#$$

Rule (1) applies inside words. For example it applies in kaad # gal {kaad 'forest', gal 'pl'} -- kaad-ugal 'forests'. It is a Structure-Preserving rule in the sense that the vowel u introduced by this rule is a phoneme in Kannada. Although rule (1) is a word-level rule in Kannada, it has to be treated as a cyclic rule, unlike the situation in Eng-

lish. The issue of cyclicity of the rule of u-Epenthesis will be discussed in the next section. Suffice it say here that the rule of u-Epenthesis has the properties of lexical rules and therefore it can be said that this rule is a lexical rule. The same rule also applies across the board in phrases as in (2).

(2) ond ## u oorinalli obba raajan ## u idda
 one place-loc one-sing-mas king was
 'there was a king in a place'

niin ## u naale nanage band ## u kaan ## u
 you tomorrow I-dat come see
 'you come and see me tomorrow'

Since this rule applies across the board, it also applies to monomorphemic words like nood 'to look' -- nood-u, kan 'eye' -- kann-u. These characteristic features qualify this rule to be treated as a post-lexical rule. In what follows, I shall discuss the issue of cyclicity of the lexical rule of u-Epenthesis.

4.3 Lexical u-Epenthesis

Recall that in Chapter 3 we showed that the lexical rule of u-Epenthesis applies at the word level. Unlike in English, the word level in Kannada is not non-cyclic. In other

words, we cannot allow this rule to apply in non-derived environments. The reason is that, at level 3 for example, a past tense suffix -t can be affixed to a verbal root. The verbal root sud 'to burn' becomes sutt 'burnt' in the past tense. The morphological process of past tense suffixation triggers two phonological rules to change the voiceless, dental stop to a voiced retroflex stop. The rule of Voicing assimilation applies first, followed by the rule of consonant assimilation. The derivation of sud in (3) shows the rule application.

(3)	/sud/	'to burn'	UR
Level 1	--		
Level 2	--		u-Epenthesis
Level 3	[[sud] t]		Affixation
	[[sut] t]		Voicing assimilation
	[[suṭ] ṭ]		Consonant assimilation
	[suṭṭ]		BEC

If level 2 were to be a non-cyclic domain, the lexical rule of u-Epenthesis would apply to sud and we would get sudu at the end of level 2. This -u now blocks the rule of Voicing assimilation and Consonant assimilation from applying to sud-u at level 3. If we wanted to allow these rules to operate at level 3, we would have to have another

rule at this level to drop the epenthetic vowel. This rule has to be ordered before the rule of Voicing assimilation and Consonant assimilation. But allowing rule (1) to operate on monomorphemic stems at level 2 and dropping the inserted vowel at level (3) is certainly not an elegant analysis. Similarly, if the epenthetic vowel -u is allowed to operate on nominal stems like kaŋ 'eye' at level 2, they must drop this vowel at level 3 when they pick up a case suffix beginning in a vowel. On the other hand, a glide w is inserted between the radical vowel of the nominal stems, such as magu 'child', karu 'calf', and the vowel initial case suffix inda. The derivation of magu and kaŋ in (4) shows the difference in the rule application at level 3.

(4)	/magu/ 'child'	/kaŋ/ 'eye'	UR
Level 1	--	--	
Level 2	--	[kaŋ-u]	u-Epenthesis
		[kaŋŋ-u]	Gemination
Level 3	[[magu] inda]	[[kaŋŋu] inda]	Affixation
	[[maguw] inda]	[[kaŋŋuw] inda]	∅ --> w / V __ V
	[maguwinda]	* [kaŋŋuwinda]	BEC
		[kaŋŋinda]	

We can avoid deriving the wrong forms at level 3 if we make level 2 a cyclic domain. But the question is, how do we stipulate the constraint on cyclicity on level 2 (word level) in the present framework?

Kiparsky (1982), and Mohanan (1982) assumed in the beginning that all lexical rules are cyclic. This assumption could have predicted the desired results in the lexical phonology of Kannada. But we know that there can be lexical but non-cyclic phonological rules. Several cases have been cited in Kiparsky (1985); Halle and Mohanan (1985); Booij & Rubach (1985) and Booij (1985). The rule of Nasal Deletion in English is a case in point. This rule drops the nasal segment if it is followed by another nasal segment. For example, it applies to damn # ing, damn # s. This rule also applies to monomorphemic words such as damn. The SCC restricts the rule of Nasal Deletion in English to the word level. In other words, Level 2 in English is the word level. In order to account for the non-cyclic nature of the rule of Nasal Deletion in English, Kiparsky (1985) states that the SCC does not restrict the word-level application of rules. Now the question is, can we generalize this conclusion? Can we say that the word-level rules in all languages are not restricted by SCC? This is not true in the case of Kannada, as we have seen. The cyclicity or non-cyclicity of word-level phonological rules appears to be a language-specific parameter. The revised version of the SCC fails to restrict rules such as u-Epenthesis in Kannada to derived inputs. If the underived lexical entry kan 'eye' has the environment for the rule of u-Epenthesis to apply in the lexicon, how do we interpret the SCC? According to the SCC,

kan is W'. Then what is W? We do not have a W that is derived from W'. On the other hand, if we assume the lexical item to be W, there is no W' from which W is derived. Here we run into technical difficulties. The following diagram facilitates our discussion.

$$\begin{array}{l}
 (5) \quad \text{kan} = W' \\
 \text{kan} + ? = W \\
 \\
 \emptyset \rightarrow u / C _ \# \\
 | \quad | \quad | \quad | \\
 A \quad B \quad XP \quad QY
 \end{array}$$

According to the SCC, the rule of u-Epenthesis is restricted to the word-level. At the word-level, this rule applies to the derived inputs as well as monomorphemic words like kan. We cannot block this rule from applying on monomorphemic words in any case. But, as we saw earlier, we derive wrong outputs if we do. Since we don't have a W' to start with from which to derive W, the only interpretation we can have here is that the lexical phonological rules are inapplicable in such cases. This explanation seems to be ad hoc at the best. In what follows, we shall consider other possible solutions to the problem discussed above.

Kiparsky (1982) adopted the Elsewhere condition to block lexical rules from applying to underived lexical entries.

The same condition can block the rule of u-Epenthesis from applying to monomorphemic words. This case is similar to the Trisyllabic laxing rule in English. But again, as we noted in Chapter 1, the Elsewhere condition fails to block cyclic phonological rules from applying on the second cycle. Kiparsky drops the idea of trying to derive the SCC from the EC. He reintroduces the revised version of SCC in his 1985 paper. The revised version of SCC proves to be inadequate, as we noted earlier. The only possible solution to this problem is to use morphological bracketing ([]) to specify the derived environment condition on the rule of u-Epenthesis. But then, we have two structural descriptions for the same rule, one with the morphological bracket and the other with a morphological boundary. The derivations of nooduwike 'the act of looking' and kanninda 'from the eye' in (6) demonstrate the consequence of morphological bracketing on the lexical rules at the word level.

(6)	/nooɖ/ 'to see'	/kaɳ/ 'eye'	UR
Level 1	--	--	
Level 2	[[nooɖ]ike]	--	Affixation
	[[nooɖu]like]	--	0 --> u / C _]
	[[nooɖuw]ike]	--	0 --> w / V _ V
	[nooɖuwike]		BEC
Level 3	--	[[kaɳ]inda]	Affixation
	--	{[kaɳɳ]inda]	Gemination
		[kaɳɳinda]	BEC

This may not be a desired option. At this point, we can only state that the word level in Kannada is a cyclic level. Any formal way of stipulating a constraint on the cyclicity of word-level rules in languages like Kannada in the present framework of lexical phonology is not possible.

4.4 Voicing of Stops

In chapter 3, we stated the rule of Voicing of Stops (25). We will restate this rule in (7) for the sake of our present discussion.

(7) C --> [+Voice] / V _ V

Rule (7) changes a voiceless stop into a voiced stop in intervocalic position. Consider the examples in (8):

- (8) marakaalu --> maragaalu
 'wooden legs'
 huupuṭṭi --> huubuṭṭi
 'flower basket'
 kaitooṭa --> kaidooṭa
 'kitchen garden'

In the following section, we shall see how independent principles and SCC govern the application of rule (7) in the lexicon.

4.4.1 Voicing of Stops - A lexical rule.

The independent principles, Cyclic application and Structure preservation, restrict the rule of Voicing of Stops to level 1 in the lexicon.

4.4.1.1 Cyclic application of Voicing of Stops

The rule of Voicing of Stops applies only in derived environments. Consider the examples in (9) & (10).

- (9) maṛa + kaalu --> maragaalu
 'wood' 'leg' 'wooden leg'
 keḷa + tuṭi --> keḷaduṭi

'lower' 'lip' 'lower lip'
 huu + puṭṭi --> huubutti
 'flower' 'basket' 'flower basket'

(10) kiṭaki --> * kidagi
 'window'
 tuṭi --> * tudi
 'lip'
 nikaṭa --> * nigada

The failure of (7) to apply to monomorphemic words given (8) confirms that it is cyclic rule.

4.4.1.2 Structure Preservation

The principle of Structure Preservation states that any feature introduced by a lexical rule should be distinctive in underived lexical items. The voiced feature of stops introduced by the rule of Voicing of Stops is distinct in underived lexical items in Kannada. For example:

(11) gari 'leaf'
 bisi 'hot'
 koogu 'call'
 medu 'soft'
 tuṭi 'lip'
 buḍa 'bottom'

Examples in (11) shows that the voiced feature of stops in Kannada is distinctive in underlying lexical items. Therefore, the rule of Voicing of Stops is a lexical, not a post-lexical rule.

Having seen that the rule (7) is a lexical rule, our next step is to check whether the SCC restricts this rule to the word level or allows it to apply at the stem level in the lexicon. In what follows, I shall show how the SCC restricts (7) to the stem level.

In (7), we observed that the rule (7) applies in derived environments. It applies in mara + kaalu --> maragaalu. Here, mara is W' and mara + kaalu is W. W' (mara) is not nondistinct from XPAQY (i.e. part of the structural description of rule (7)) and not distinct from XPBQY (i.e. the output of the rule (7)). The analysis in (12) helps in understanding the application of SCC in the derivation maragaalu.

(12) mara = W'
 mara + kaalu = W
 mara + kaalu --> maragaalu

XP	A	QY	XPBQY
C	-->	+Voice / V	__ V
A		B	XP QY

W' = XPAQY
 W = XPBQY

The analysis of maragaalu given in (12) does not satisfy SCC. Therefore, the rule (7) is not restricted to the word-level. In fact, this is true. The rule of Voicing of Stops applies only to subcompounds, a level 1 process in Kannada. Cocompounds, being a level 2 process, escape this rule.

4.5 The rule of Nasal Assimilation

The rule of Nasal Assimilation in Kannada makes an interesting case for the theory of Lexical Phonology. Before discussing the theoretical implications, we shall first present the data.

4.5.1 The Nasals in Kannada

The nasal segments in Kannada are N, ŋ, m. N is an unspecified nasal -- the feature for place of articulation is not specified in the feature matrix of this nasal segment. m is a bilabial nasal, ŋ is a retroflex nasal. A few examples of these are given in (13)

(17) Unspecified Nasal (N):

beNki	--	beŋki	'fire'
hoNtaavare	--	hoŋdaavare	'golden lotus'
hoNbaale	--	hoŋbaale	'golden spathe'
taNde	--	taŋde	'father'
saNje	--	saŋje	'evening'
miNču	--	miŋču	'lightning'

Bilabial Nasal (m):

maga 'son'

tampu 'cool'

sama 'equal'

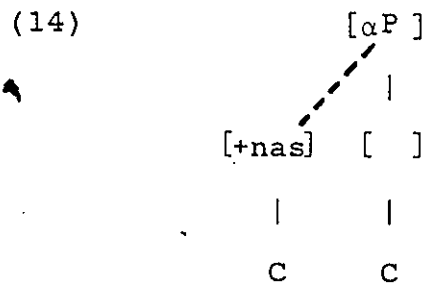
Retoflex Nasal (ṅ)

haṅa 'money'

kuṅṭa 'lame'

baṅde 'rock'

The rule of Nasal Assimilation assimilates the nasal segment unspecified for the place of articulation to the following stop. This rule (rule (14)) is represented in the metrical framework as follows:



(Kiparsky, 1985)

Observe that (14) applies in derived and non-derived environments (e.g (9)). The SCC restricts this rule to derived environments in the lexicon. This rule applies to Subcompounds at level 1 in Kannada. Level 1 in Kannada is a

cyclic domain. Now, the question is, how do we account for the application of this rule in non-derived inputs? We know that the rule of Nasal Assimilation fills in unspecified features. It is not a feature-changing rule. The SCC permits such feature-filling lexical rules in non-derived environments (Kiparsky, 1985). This explains why we have beNki --> benki and hoN + taavare --> hondaavare. At this point, it is interesting to note that not all points of articulation assimilate in the unspecified nasal segment. An independent principle, Structure Preservation, restricts the nasal assimilation only to the bilabial and retroflex features. As we noted earlier, only these two points of articulation are distinctive in the underlying nasal segments. The other three features, dentals, velars, and palatals, assimilates in the preceding unspecified nasal at the post-lexical domain. The derivation of tangi 'sister' and hombaale 'golden spathe' illustrates this point.

(15)	/taNgi/	/hoN/	/baale/	UR
Level 1	--	[[hoN] [baale]]		Compounding
	--	[[hom] [baale]]		Nasal Assimilation
		[taNgi]	[hombaale]	BEC
Level 2	--	--		
Level 3	--	--		
				Post-lexical rules
		[taNgi]		
		[tanɡi]		Nasal Assimilation

Although lexical and post-lexical Nasal Assimilation do not make different empirical predictions we have to allow this duplication in order to accommodate the assumptions made in the theory. But the problem with this analysis is that we cannot stipulate any formal condition on the rule to block the nasal from assimilating to dentals, velars, and palatals in the lexicon. All we can say is that the principle of Structure Preservation does not allow the nasal to assimilate to the points of articulation of the following stops mentioned above. What this means for our theory is that we have to check every derivation to find out whether the lexical rule of Nasal Assimilation is applicable. This

situation is similar to the problem of the Alternation condition. We are not suggesting any alternative analysis here. But an attempt has been made in the conclusion to propose a revised model of the theory to accommodate the problems encountered in this thesis.

4.6 Glide Insertion

The Glide Insertion rule in Kannada inserts a glide between two adjacent vowels, agreeing in roundness and backness with the preceding Vowel. Consider the examples in (16).

- (16) [[nood-u] ike] -- [nooduwike]
 'to look' 'looking'
 [[mane] inda] -- [maneyinda]
 'house' inst.case 'from the house'
 [[ma'gu] inda] -- [maguwinda]
 'child' inst.case 'from the child'

The rule of Glide Insertion is repeated here for our present discussion.

- (17) $\emptyset \rightarrow C / V _ V$
 [u rd] [u rd] V
 [ɛ bk] [ɛ bk]

The SCC does not restrict (17) to the word-level. In the derivation nooduwike 'looking', noodu is W' and noodu + ike is W. W is distinct from XPBQY (i.e. the structural description of W does not include B (=w) and QY (= V)). This satisfies the second part of the SCC. But notice that W' is not non-distinct from XPAQY. It has XP (=V) and A (=0). But QY is absent from its structural description. In other words, the rule of Glide Insertion is not restricted to the word level. In fact, this is true. The rule of Glide Insertion applies at level 2 (word-level) (nood-u + ike --> nooduwike) and at level 3 (stem level) (mane + inda --> maneyinda). Furthermore, the Structure Preservation and Cyclic application principles restrict this rule to the lexical domain. The features introduced by this rule are distinct in the underlying lexical items and this rule is restricted to derived environments. The question of its applicability in non-derived environments does not arise since Kannada does not permit vowel clusters in surface structure.

4.7 Vowel Deletion

The rule of Vowel Deletion drops the stem-final vowel if it is followed by an vowel-initial suffix. For example:

- (18) čitra + isu -- čitrisu
 'picture' 'to picture'

añju + ike -- añjike
'to fear' 'fear'

The rule of Vowel Deletion is stated in (19).

(19) V --> Ø / ___ V
 | | | |
 A B XP QY

In (18), čitra is W and čitra + isu is W. In (19), V is A and Ø is B. XP represents the environment before ___ and V represents QY. W1 has XPA (i.e. tra). But QY (=V, =i) is absent. That means, that W is not non-distinct from XPAQY. Therefore, SCC does not restrict this rule to the word-level. This prediction is correct. We have seen in Chapter 2 that the rule of Vowel Deletion applies at level 1 which is a stem level in the Kannada lexicon.

4.8 Summary and Conclusions

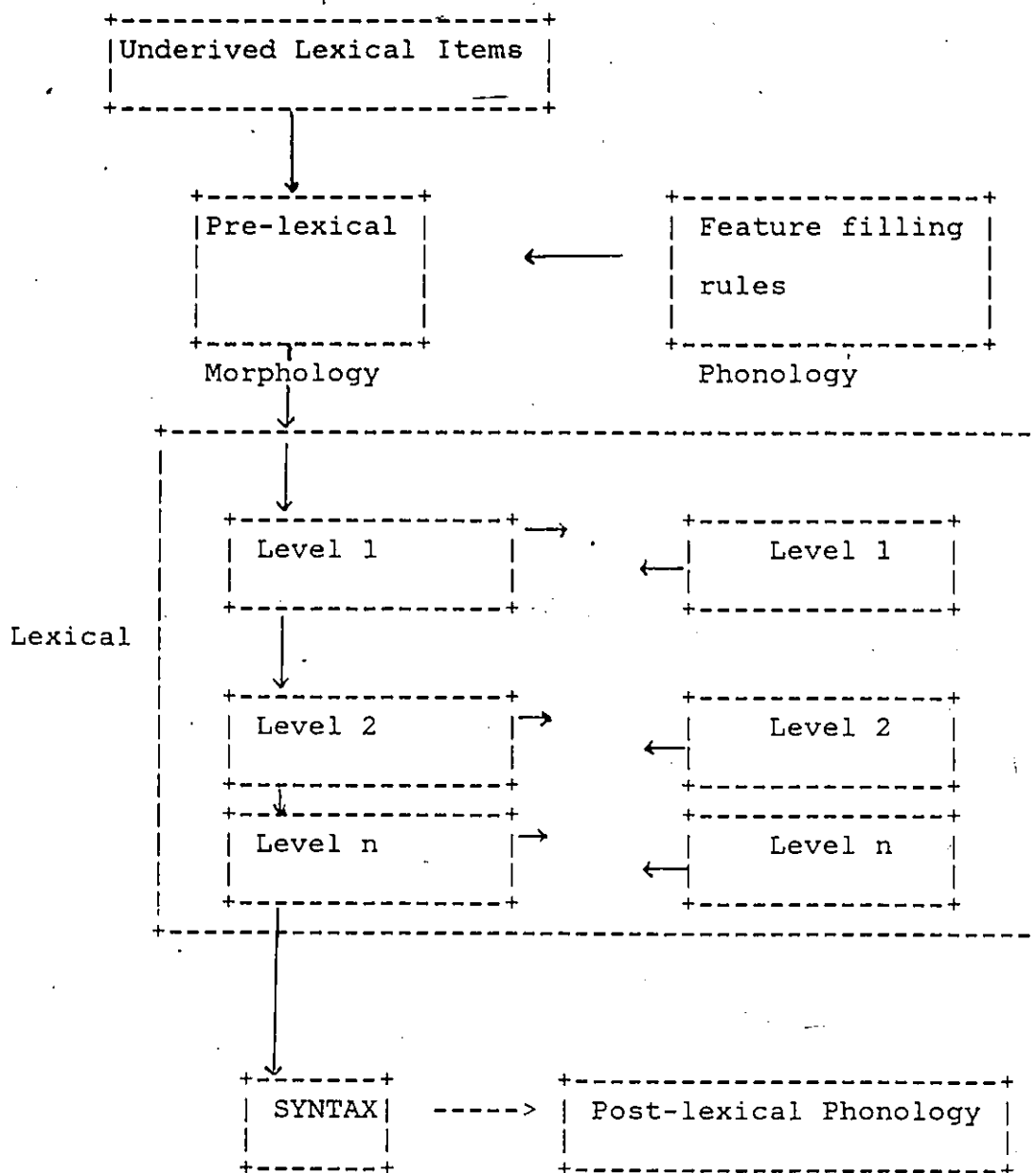
In this Chapter we have shown how independent principles such as a) Structure Preservation, b) Cyclic application, and c) Restriction to "derived environments" restrict the phonological rules in Kannada either to the lexical level or post-lexical level. Further we have shown how the SCC restricts certain lexical phonological rules to the word level.

So far in this thesis, we have discussed the model of Lexical Phonology and its theoretical implications. In accordance with this theory, we have assumed three levels of Morphology and Phonology in Kannada. We have shown the interaction of Morphological processes with the Phonological rules of the same level.

While several phonologists are still debating some of the assumptions made in this theoretical framework, an attempt has been made in this thesis to present an unified view of the development of Lexical Phonology. We have attempted, in particular, to develop a model of Lexical Phonology for Kannada. What has emerged, in the course of our discussion, is a picture of a field characterized by considerable activity. Several scholars are engaged in the analysis of different languages in this framework. A unified version of the theory is yet to be developed. In this thesis, we have raised some of the issues that might pose a problem for the theory. We have seen that the revised SCC does not always restrict lexical rules to derived environments. This is a problem for the analysis of u-Epenthesis in the word building process in Kannada. We have also observed that the rule of Nasal Assimilation in Kannada raises some interesting issues for the theory. As we stated earlier, we have not given any definite solutions to the problems raised in this thesis. But an alternative analyses can be considered.

Feature-filling rules like Nasal Assimilation in Kannada, Word stress in English, and Syllabification in Spanish can be allowed to apply on the first cycle in the Pre-lexical level. Unspecified features are filled in on the first cycle at this level. By placing a restriction on the lexical rules stating that lexical rules apply only in derived environments (i.e. on the second cycle) we can restrict the phonological rules in the lexicon to apply only to derived inputs. The revised approach, a tentative one, keeps the spirit of Lexical Phonology, expressing the morphological sensitivity of lexical phonological rules. Furthermore the SCC restricts some lexical rules to the word-level. Post-lexical rules apply both within words and in phrases, and are not necessarily structure preserving. The revised model is given in (14).

(14)



The model proposed in (14) allows structure-filling rules on the first cycle in the pre-lexical domain. The same structure filling rules are triggered by the morphology in

the lexicon. The structure-changing rules apply in the lexicon if they are triggered by the morphology. Otherwise, they apply at the post-lexical domain if they are applicable. The only restriction on the lexical rules is, they do not apply in non-derived environments. The idea proposed here is a general one. The details of this model have to be worked out. The theoretical implications of this model have to be checked with data from different languages before accepting this model. This task is left to future research.

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