THE REPRESENTATION OF VOICING CONTRASTS

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by

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Graduate Department of Linguistics
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Abstract

In this thesis the representation of voicing contrasts is explored. The central claim of the thesis is that voicing contrasts that are phonetically similar can arise from several distinct phonological representations. For example, it is argued that a segment phonetically realized as voiced bilabial stop ([b]) may arise from several distinct phonological representations. This segment may be a laryngeally voiced sound, involving the activation of the feature [voice], a dependent of the Laryngeal node in the segmental tree. On the other hand, it may also be a sonorant sound, resulting from the activation of the SV (Sonorant Voicing) node in the segmental tree, a node that is argued to be distinct from the Laryngeal node. As well, there is a third possible representational source for this segment: it may be the result of what I term 'contextual voicing'. A contextually voiced segment is one that has neither a Laryngeal node nor an SV node. Such segments generally surface as voiced when surrounded by other voiced sounds.

In the first two chapters, I outline the theory of SV sounds and a theory of enhancement that allows for minimal specification at the underlying level. In chapter three, I present a typology of laryngeal systems, arguing that the number of different laryngeal systems found in the languages of the world is constrained by the organization of features under the Laryngeal node. In chapters 4 and 5, I present empirical support for the model of segment structure presented in the first three chapters. A variety of languages that show within-sonorant assimilations are analyzed. As well, some problematic
laryngeal systems (in particular, Dutch and Turkish) are explored and it is shown that the theory allows for fresh insights into systems in which the stops and the fricatives behave differently with respect to processes involving voicing. In the concluding chapter an analysis of a variety of consonantial alternations in Northern Turkic languages is presented. Here we see strong support for all aspects of the theory presented in the preceding chapters.

Acknowledgments

Perhaps the greatest joy for me in having completed this dissertation is that I am able to thank all the people who have been instrumental in my linguistics education and who have lent me the support and encouragement that was needed to get through the thesis. Unfortunately, as I dallied for quite some time in the completion of this work, I have built up an enormous debt to all who have encouraged me and these acknowledgments are but a small down payment on the debt.

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To my friends both inside and outside linguistics I owe special thanks. Susan Ehrlich is very special and has been the best friend/surrogate sister anyone could hope for. She has helped me to develop both as a person and as a linguist. For this I am eternally grateful. She knew I would finish when I was ready and not before. Special mention must be made of Tom Wilson, who I have spent countless hours with discussing whatever came into our heads. Sometimes that was phonology, but more often it was baseball, football, soccer, hockey, tennis, horse racing, films, music, alcohol, drugs, marriage, divorce, popular culture in general, finishing dissertations, people we both knew, people one of us knew, people neither of us knew, etc. Bill Isard is another friend that I found in Linguistics. He has been a friend to me in countless ways and has helped me to clarify many of the ideas I have had about phonology over the past several years. I always look forward to long telephone calls with him and hope that they will continue.

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Finally I must acknowledge the support of my wife, Mary Ann Neary, who has waited patiently for the day when I had done with the thesis. She never gave up on me and for that I am truly grateful. My mother, Jo, who never knew exactly what I was up to, still encouraged me. Thanks mom.

I dedicate the thesis to the memory of Carlos Yturlo who was my first linguistics teacher and who exerted an enormous influence on my early linguistics career.
Chapter 1
Sonorants in Segment Structure

1.1 Segment Structure

Clements (1985) proposed the first explicit model of 'feature geometry', arguing against the feature bundle approach to segments and in favour of a hierarchical grouping of features. In this model, the traditional binary features are grouped according to articulatory parameters under what Clements termed CLASS NODES: Laryngeal, Supralaryngeal, Manner and Place.

A conceptual advantage of this grouping of features over the standard feature matrix approach is that it allows for a representation in which features that act together in phonological processes are represented together under the appropriate class node. Thus, features that characterize place of articulation are dominated by the Place node in the segmental representation and features that characterize laryngeal gestures are grouped together under the Laryngeal node. When combined with the formalisms of autosegmental phonology, Clements' theory of segmental organization represented a major step toward reducing the expressive power of phonological rules. The basic organization of the class nodes proposed by Clements is diagrammed in (1).

(1)
The Root node, the highest level of segment structure, dominates the Laryngeal and Supralaryngeal nodes. The Laryngeal node in turn dominates laryngeal features such as [voice], [spread glottis] and [constricted glottis]. The Supralaryngeal node dominates the Manner node and the Place node, which dominate traditional manner and place features, respectively. This model recognizes two different types of nodes: the class nodes, which serve as organizational units and the content nodes, which are associated with and are analogous to traditional binary features. The class nodes play a role in the statement of phonological rules in that a rule can mention a class node such as the Place node or the Laryngeal node either as a target of spreading or a condition on the application of a rule. It does not appear that Clements ever intended that these nodes would play a contrastive role in the phonology; that is, the presence vs. absence of a class node in the representation of two segments, such as Laryngeal as in (2a) and (2b), would not be potentially contrastive.

(2) a. \[ \text{Manner} \quad \text{Place} \]
   \[ \text{Lary} \quad \text{SLL} \]
   \[ \text{R} \]

b. \[ \text{Manner} \quad \text{Place} \]
   \[ \text{SLL} \]
   \[ \text{R} \]

I will argue for a different conception of class nodes in which they are potentially contrastive. Representations such as those in (2), for example, will represent the difference between a voiceless and a 'voiced' segment.

One aspect of this form of representation which is not properly represented in (1) is that each of the nodes is arrayed on a plane or tier. Thus, the representation in (1) should be seen as a cross section of the phonological representation: the Laryngeal node being on a laryngeal tier, the Supralaryngeal node being on a supralaryngeal tier, etc. Given such a representation, the formalisms of autosegmental phonology can be fruitfully utilized in representing processes such as assimilation. For example, a rule of place assimilation can be simply and elegantly captured as the spreading of the Place node (or some feature under the Place node) of a consonant onto an adjacent consonant.

This representation also makes certain predictions about the operation of phonological processes, predictions that were not made in the feature matrix approach. Features represented under specific content nodes should behave independently of the features which are dependents of other content nodes. This prediction is indeed borne out by the numerous examples of voicing assimilation and place assimilation attested in the phonological systems of various languages.

The original model proposed by Clements (1985) has undergone substantial changes in subsequent research. The first major advance was the articulator model proposed in Sager (1985). Rather than using the traditional binary features under the place node, the major articulators Labial, Coronal and Dorsal are used. The Sager model introduced a further level of structure in the form of secondary content nodes, which are binary features dominated by the major articulators. The Place node is illustrated in (3).
(3) The Place Node (Sagey 1986)

```
Place
  Labial
    [round] [+ant] [+dist] [+back] [+low] [+high]
  Coronal
  Dorsal
```

Sagey (1986) argues for this view of the place node based on the independence of each of these articulators. For instance, complex segments such as [kl] can be viewed as segments which have two articulators activated at the same time: the labial and dorsal nodes.

Research in the segment structure framework has uncovered considerable empirical support for both the Place node and the Laryngeal node, but evidence for the Supralaryngeal node and the Manner node has been more difficult to find. For Clements, the Manner node dominated features such as [nasal], [continuant] and [strident], features that do not appear to create a natural class. The most compelling argument in favour of the Supralaryngeal node comes from the process of debockalization, the process involved in the change of /t/ → /s/ or /sl/ → /hl/. This can be viewed as the loss of a Supralaryngeal node leaving only the Laryngeal node and the laryngeal features such as [constricted glottis] and [spread glottis].

While the status of the Supralaryngeal node remains uncertain, most phonologists have rejected the Manner node, preferring to view manner features as relatively independent (Sagey 1986; McCarthy 1988; Halle 1992).

A central proposal of this thesis is that the manner features associated with sonorant consonants form a constituent in segment structure. Grouping the sonorant manner features represents a departure from standard models of feature geometry, though the proposal has previously been put forth in work by Avery & Rice 1989, Avery & Rice 1992, Rice 1992, Rice & Avery 1991, and Piggott 1990, 1991, 1992. In standard models of segment structure, features associated with sonorant segments, such as [sonorant], [nasal], and [lateral], are spread throughout the feature tree. Sagey (1986) proposes that [nasal] is a dependent of the Soft Palate node, and Blevins (1994) (based on Levin 1988) adduces evidence for [lateral] as a dependent of the Coronal node. McCarthy (1988) proposes that the feature [sonorant], along with [consonantal], is an element of the Root node. Taking these positions into account, the model of segmental organization seen in (4) can be constructed (with certain details left out).

(4)

```
[son] [cons]
  Lar
    [sg] [rg] [voice]
  Place
    [nasal] [Lateral]
  Dorsal
```

If sonorant manner features are located at various places in the segmental tree as in (4), these features are not predicted to interact with one another in phonological processes; indeed, it would be surprising to find alternations involving sonorant segments. For example, if [lateral] is a dependent of the Coronal node and [nasal] is a dependent of the Soft Palate node, a rule that
turns a lateral sound into a nasal or vice versa would be entirely unexpected and would require some special stipulation. In chapter 4, we undertake a study of the interactions among sonorant consonants, revealing that sonorant features pattern in phonological processes in a fashion analogous to place features. This will lead us to propose the model of segment structure in (5), a model in which the traditional feature [sonorant] is replaced with the organizing node Sonorant Voice (SV), a node which groups the sonorant features that serve to distinguish nasals, laterals and rhotics.

As can be seen, with respect to segmental organization, the major difference between the model in (5) and that in (4) is in the grouping of sonorant features under the SV node. As shown in (5), there are two levels of organizing structure introduced: SV and Approximant. The SV node dominates either the feature [nasal] or the organizing node Approximant. The Approximant node in turn dominates the feature [lateral].

Another difference between the models in (4) and (5) concerns the binary vs. unary status of features. In (5), all features are unary, a position that will be discussed in more detail in the next section. As well it should be noted that the root node in (5) has no feature content. The feature [sonorant] has been replaced by the SV node, and I will assume that the feature [consonantal] can also be derived from other aspects of the segmental organization. In particular, following work of Clements & Hume (1994), I will adopt the proposal that place features are annotated for C-Place (consonants) and V-Place (vowels). A Place node that is headed by C-Place will define a consonantal segment and a Place node that is headed by V-Place will define a vocalic segment. These features can be percolated to the root node as they are required for syllabification.

A further aspect of the model that I will defend is that at each class node there is an unmarked feature that is supplied by default. I will argue that the unmarked option at the SV node is the feature [nasal] and the unmarked option at the Approximant node is [lateral]. As these features are unmarked, they need not be present in underlying representation, being predictable from the presence of SV or Approximant. The assumption that [nasal] is the unmarked option will be established through the study of assimilations among the sonorant consonants. These assimilations will also lend support to the hypothesis that [lateral] is the unmarked feature at the Approximant node.

I refer to these unmarked features as enhancement features (see Dyck 1995), using the term ‘enhancement’ in a sense similar to that proposed in Stevens and Keyser (1989), though its meaning is extended beyond the acoustic enhancement they discuss. The term as I am using it is closer in meaning to the more traditional term ‘default’ found in the underspecification literature. I am avoiding the term default because it has been proposed that default features often play a role in the phonology of a given language even when they are absent from underlying representation.
This is because default rules can be ordered among the other phonological rules and thus make a feature available in the phonology (see Steriade 1987). My conception is that unspecified features can only act as enhancement features and can never participate in the phonology. This view of enhancement serves to constrain underspecification to a significant degree as enhancement features are never available in the phonology. I automatically rule out the theory of radical underspecification, proposed in Archangeli and Pulleyblank (1986), Abaglo and Archangeli (1989) and Pulleyblank (1988), which allows underspecified features to become specified during a derivation and, subsequently, to be active in the phonology. It is important to note, however, that enhancement features may act as distinctive features in a given language, in which case the rule introducing the enhancement feature is deactivated. This leads to a phonological distinction between a bare organizing node, such as SV with no dependents, and a specified node, such as SV with the feature [nasal] as a dependent. In this situation, the organizing node is phonetically implemented without the addition of the enhancement feature. For example, in the case of a bare SV node, I will argue that when [nasal] is a distinctive feature in the language, the SV node is implemented as a voiced stop such as [d] or perhaps a flap such as [t] (see also Rice 1992 for arguments along these lines). Enhancement and underspecification will be taken up in more detail in chapter 2.

1.2 Traditional features of sonorants

In (6) the binary features traditionally associated with sonorant segments are given. The features [+sonorant], [+consonantal], [nasal] and [lateral] are the major class features that distinguish among the sonorants. Sonorants are generally [+voice] but differ with respect to [continuant]. We will concentrate here on the first four of these features.

(6) Featural classification of sonorants

<table>
<thead>
<tr>
<th>cons</th>
<th>son</th>
<th>nasal</th>
<th>lateral</th>
<th>voice</th>
<th>cont</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
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<td>+</td>
<td>-</td>
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<td>+</td>
</tr>
</tbody>
</table>

The [+consonantal] sonorants are distinguished by the two binary features [nasal] and [lateral]. Intermediate between the nasals and the laterals are the rhotics. These differ from both the nasals and laterals by only a single feature, while the nasals and laterals differ from each other by two feature specifications. In the following sections we will examine the sonorant segments and the features associated with these segments.

1.2.1 [sonorant] and spontaneous voicing

In SPE, [+sonorant] segments are defined as "...sounds produced with the vocal tract cavity in a configuration in which spontaneous voicing is possible" (p. 302). Even though the precise meaning of the term 'spontaneous voicing' is somewhat unclear, most phonologists have accepted this definition of sonorant segments. Note that the definition clearly establishes a link between sonorancy and voicing, amounting to the observation that sonorant segments are redundantly voiced, the [+voice] value being predictable from the presence of the feature [+sonorant]. In generative phonology, and in particular in underspecification frameworks, this has

1 Rhotics appear to come in many forms. The type of rhotic under consideration here is a rhotant. As we will see later, in many languages /r/ sounds appear to pattern with glides.
meant that sonorants need not be marked for [+voice] in underlying representations. Ample phonological evidence that [+voice] cannot be marked on sonorants in underlying representation can be found in the underspecification literature (see for example Kiparsky 1982, 1985; Lombardi 1991; Mascaro 1987; Hayes 1984; Mester and Hó 1989; Padgett 1991). Segments marked [+sonorant] receive their voicing value through the universal default rule given in (7).

(7) $[-\text{voice}] \rightarrow [+\text{voice}]$ [+sonorant]

The type of default rule filling in [+voice] on sonorants is the example par excellence of a redundant value, as the [+voice] specification is entirely predictable from the presence of [+sonorant]. The redundant nature of the voicing specification on sonorants has proved to be crucial in accounting for voicing processes in a wide variety of languages. In Japanese the interaction between a process known as Rendaku (sequential voicing) and a morpheme structure constraint known as Lyman's Law serves as a perfect illustration of this distinction.

Rendaku, illustrated in (8), is a process by which the initial consonant of the second member of some compounds becomes voiced (see Mester and Hó 1986 for details).

(8) a. hon + tana → hondana 'bookshelf'

b. yama + tera → yamadera 'mountain temple'

Rendaku is blocked by Lyman's Law, a constraint operating on the native vocabulary of Japanese which disallows the occurrence of two voiced obstruents in the same morpheme. Therefore, if the target morpheme already contains a voiced segment, the initial segment of the second member of the compound will not be voiced as illustrated in (9).

(9) kami + kaze → kamikaze 'divine wind' ('kamigaze')
gods → wind

Hó and Mester (1986) consider the voicing feature to be a morphemic autosegment that is associated with the compound juncture, as shown in (10).

(10)

Underlying: /hon/ /tana/ /kami/ /kaze/

[voice]

Compounding: /hon+tana/ /kami + kaze/

[voice] [voice]

Association: /hon+tana/ /kami + kaze/

The derivation of [hondana] is straightforward with the [voice] autosegment being associated with the initial consonant of the second member of the compound. In the case of [kamikaze], however, the association of the [voice] autosegment is blocked by Lyman's Law. The result is an initial voiceless consonant on the second member of the compound.

Crucially, it is only voiced obstruents, such as [z] of 'kaze', that serve as blockers of Rendaku. In both of the examples in (8), the sonorant sound in
the second member of the compound (in and da, respectively), does not serve to block the application of Rendaku. If these segments were underlyingly marked for [voice], this behaviour would be unexplained.

In other languages we find that sonorants are transparent to voicing processes. For example, in Russian, voicing agreement in clusters ignores sonorants. Consider the data given in (11) (from Kiparsky 1985).

(11) a. i/z mel/enska [sme] 'from Mzensk'
   b. o/t rmzd/y [dmzdo] 'from the bribe'

In (11a), the voicelessness of the \( /c/ \) of 'Mzensk' is the determining factor in the realization of the \( /z/ \) of the clitic as a voiceless \( [s] \). Crucially, the sonorant \( [m] \), which intervenes between these two segments, plays no role whatsoever in voicing agreement. In (11b), we see that when a voiced obstruent follows a voiceless one, the voiceless obstruent surfaces as voiced. This cannot be attributed to the \( /m/ \) in (11b) because of the situation just outlined for (11a) (but see Padgett 1991 for an analysis in which the voicing value is transmitted by the sonorant). Thus it must be assumed that the feature \( [+\text{voice}] \) on the voiced obstruents following the \( /m/ \) spreads to the \( /t/ \) of the clitic, yielding \( [d] \).

In both Russian and Japanese, sonorants behave as though they do not have any value for the feature [voice] at the point in the derivation where a phonological rule involving [voice] applies. Evidence of this type has been taken to show that sonorants should be unmarked for voicing in underlying representations, with the value \( [+\text{voice}] \) being supplied by a late default rule.

A question that naturally arises from this concerns the need for specifying sonorants as \( [+\text{voice}] \) at any stage in the derivation. Is it not possible that sonorants never have any value for the feature [voice] filled in, that the feature [sonorant] is actually a voicing feature that is unrelated to the voicing feature found on obstruents? Even in SDF, Chomsky & Halle (1968) state that the voicing gesture in sonorants and obstruents differs with respect to the positioning of the vocal cords and their manner of vibration, concluding that '[...voicing in obstruents is a rather different matter than that observed in sonorants]' (301). Stevens & Keyser (1989) also recognize that voicing in sonorants and obstruents appears to differ along the acoustic dimension, with voiced obstruents having weaker low frequency energy than sonorants.

Assigning different features to the voicing in obstruents and sonorants is a position that has not been accepted by most phonologists for the simple reason that there appear to be processes that require the presence of [voice] on sonorants. For example, in Spanish, \( /s/ \) has a voiced allophone \( [z] \) when followed by a voiced consonant, either a sonorant (12a) or an obstruent (12b).

(12) (a) /s/ preceding sonorants
    \( [z]j\)a 'island'
    mijzmlo 'same'
    alznlo 'donkey'

(b) /s/ preceding voiced obstruents
    d\(\tilde{z}\)glusto 'trouble'
    e\(\tilde{z}\)b\(\tilde{b}\)oro 'sketch'
    d\(\tilde{z}\)d\(\tilde{z}\)r 'to scorn'

If we assume that the sounds /b d g/ are marked with the feature [voice], then the simplest account of the data would involve the fill-in of [voice] on the sonorants prior to the application of the rule spreading [voice]. On the
other hand, once SV has been introduced as a node in the segmental tree, it is possible to consider it to be a voicing feature. Many advantages in fact accrue to this position. For example, the voicing assimilation in Spanish can be accounted for by a rule spreading or copying the SV node of the adjacent segment to the /s/ as in (13) (for a discussion of copying see Rice and Avery 1991).

(13)  

\[
\begin{array}{c|c|c|c|c}
\text{R} & \text{R} & \text{R} & \text{Copy} & \text{SV} \\
\hline
\text{SV} & \text{SV} & \text{SV} & \rightarrow & \text{SV} < < \text{SV} \\
\hline
[\text{]} & [\text{]} & [\text{]} & \text{[]} & [\text{]} \\
\end{array}
\]

Under this analysis SV rather than the feature [voice] marks the voiced obstruents of Spanish. There are indications that such an analysis is correct. First, the voiced stops of Spanish do not pattern with the voiceless stops. The voiced stops have no distinctive voiced fricative counterparts but instead are in complementary distribution with the voiced fricatives. This differs from the voiceless stops which do have distinctive voiceless fricative counterparts.

A second argument is that the SV representation appears to provide a more accurate account of the phonetics of Spanish. Analysts refer to the voiced fricatives of Spanish as glides (for example, Carr 1993). As the voiced fricatives are in complementary distribution with the voiced stops, the glide-like behaviour of the fricatives is predicted if both the stops and fricatives have an SV node. The presence of the SV node in the underlying representation of the voiced stops and sonorants allows us to derive the patterning of these sounds in the transmission of voicing to the /s/

directly from the representations, without the need for a default rule inserting [voice] on the sonorants.

Another frequently found process that takes a voiceless obstruent and voices it in the environment of a sonorant is post-nasal voicing. In (14), examples of post-nasal voicing from Modern Greek (Newton 1972: 94) are provided.

(14)  

\[
\begin{array}{c|c|c}
\text{}/k\text{uNp}\text{t}/ & \rightarrow & \text{[kumbi]} \\
\text{}/\text{p}\text{\text{\text{n}}N\text{t}}\text{e}/ & \rightarrow & \text{[p\text{\text{n}}nde]} \\
\end{array}
\]

The voicing of the post-nasal consonant can be analyzed in the same way as the Spanish voicing through the copying or spreading of the SV node of the nasal consonant as shown in (15).

(15)  

\[
\begin{array}{c|c|c|c|c}
\text{R} & \text{R} & \text{R} & \text{R} & \text{Copy} \\
\hline
\text{SV} & \text{SV} & \text{SV} & \rightarrow & \text{SV} > > \text{SV} \\
\hline
[\text{m\text{\text{\text{n}}sal]} & [\text{m\text{\text{\text{n}}sal]} & [\text{m\text{\text{\text{n}}sal]} \\
\end{array}
\]

Another process bearing on the relation between sonorants and voiced stops is post-nasal hardening, a process found in a large number of Bantu languages. The process generally involves an alternation between a continuant sonorant and a voiced stop. An example is given in (16) from Lumusaaba (Brown 1972).²

²Note that we are considering the bilabial fricative /f/ to be a sonorant here. This is because it appears to pattern with the other sonorants rather than the obstruents. The same point could be made in other Bantu languages, such as Swahili, where /w/ alternates with /f/ after a nasal (cf. Swahili /m\text{\text{w}}al/ \rightarrow /m\text{\text{f}}al/).
(16) /†i\N+†uga/ → [imbuga] 'a hole' ([katuga] 'a small hole')
/†i\N+N+i/ → [riqdi] 'roots' ([luli] 'a root')
/†i\N+N+yeda/ → [iqeda] 'I help' ([ayeda] 'he helps')

Here we find that /p/, /b/ and /y/ are all realized as voiced stops when preceded by a nasal. A standard analysis would claim that both the feature [-continuant] and the feature [-sonorant] change value. We do not need to claim that the sonorant value of the glides has been changed to [-sonorant]. If we assume that /p/, /b/ and /y/ are all SV sonorants that share some property such as continuancy, then hardening simply involves a process through which the [-continuant] feature of the nasal is transmitted to the following glide creating a stop, a process that is part of the place assimilation that the nasal undergoes. Previous analyses were forced to assume a change from [+sonorant] to [-sonorant] that accompanied the change in continuancy, as voiced stops were by definition [-sonorant]. Such analyses can offer no explanation as to why a [+sonorant] segment such as a nasal should induce a change in a following [+sonorant] segment to [-sonorant]. Under the analysis proposed here this issue does not even arise because there is no need to propose that the sonorancy of the hardened segment has been altered.

These examples show that an elegant analysis of many voicing processes can be proposed if the SV node is responsible for the voicing associated with sonorant segments. We can thus dispense with the ordering of default rules in the phonology, and with rules that change the sonority value of segment in assimilation processes. In instances where the feature [voice] is involved, SV segments are invisible to the process. When SV segments are visible, I claim the feature involved is SV itself. Fuller discussion of these issues must be postponed until chapter 3 when a theory of Laryngeal vs. SV voice contrasts is presented.

1.2.2 [nasal]

The status of [nasal] as a distinctive feature is relatively uncontroversial. In most, if not all, work in distinctive feature theory, the feature [nasal] has been posited to distinguish between nasal sounds, produced with a lowered velum, and oral sounds, produced with a raised velum. Typological studies have revealed that almost all languages have at least one nasal consonant (Ferguson 1963; Maddieson 1984), the principal exceptions to this generalization coming from a group of Northwest Coast languages (see Thompson & Thompson 1972). Nasals are members of the sonorant class of consonants, sharing this property with glides, liquids, and vowels. Like other sonorants, nasals are redundantly voiced.

The feature [nasal] has some properties that set it apart from other features. First, it can be distinctive on both consonants and vowels. In the overwhelming majority of cases it serves as a distinctive feature on consonants, but there are a number of languages where it serves as a distinctive feature on vowels (see discussion in Cohn 1993). The feature [nasal] is distinctive on segments at the extremes of the sonority scale, being compatible with the vocal tract configuration found in low sonority stops and high sonority vowels. Only in the marked case does [nasal] occur with the segments between (glides, liquids and fricatives). When [nasal] is distinctive on vowels, it is the sole distinguishing feature between the nasal and oral set of vowels, but in the case of consonants, there are generally other features serving to distinguish the nasals from the other consonants. A further
property of the feature [nasal] that sets it apart from most other consonantal features is its ability to participate in long distance spreading operations. There are a variety of languages that exhibit nasal harmony. A final property of nasal consonants that distinguishes them from some other consonantal sonorants (i.e., liquids) is that they can be specified distinctively for place of articulation. The liquids rarely occur at more than one place of articulation, while the nasals usually pattern with the stops of an inventory in that they occur at the same places of articulation or a subset of the places of articulation of the stop inventory of the language. However, in nasal-obstruent clusters, nasals are generally parasitic for place of articulation on the following obstruent.

Recent studies of the feature [nasal] have focussed on the location of the feature in segment structure and its relation to other features. We will briefly consider each of these issues in turn.

1.2.2.1 The location of [nasal]

The debate surrounding the location of the feature [nasal] in segment structure has generally focussed on whether [nasal] is a daughter of the Root node or a daughter of the Supralaryngeal node. Sagey (1986) located [nasal] as a daughter of the Supralaryngeal node dominated by the Soft Palate node, an articulator governing velic closure. Other researchers have located [nasal] as a daughter of the Root node (see Trigo 1993 and Cohn 1993 for discussion of these alternatives). Thus, we have the two hypotheses in (17).

(17) Location of [nasal]

\[
\begin{array}{c}
a. \quad R \\
\quad \quad [nasal] \\
\quad \quad S.P. \\
\quad \quad \text{Place}
\end{array}
\]

It is difficult to find convincing evidence in favour of either (17a) or (17b), but the predictions of the two are somewhat different. Locating [nasal] below the Supralaryngeal node more closely accords with the phonetics of the feature, as [nasal] is implemented in the supralaryngeal cavity. The prediction is made, however, that [nasal] should spread along with Place features in processes that spread the Supralaryngeal node. There is little if any evidence for this type of spreading, a fact that led McCarthy (1988) to abandon the Supralaryngeal node altogether. However, Trigo (1993), citing Harris (1988), provides evidence for the Supralaryngeal hypothesis from an assimilation process found in some Caribbean Spanish dialects where it appears that [nasal], [continuant], and Place features spread as a unit. Piggott (1987) argues from nasal stability effects that [nasal] must be a daughter of the Root node.

The theory being presented in this thesis rejects both of these accounts of the location of the feature [nasal]. The major difference is that, under the SV theory, [nasal] is grouped with other sonorant features and is predicted to display interactions with these features, a position we will defend in some detail in Chapter 4. However, the overall structure that we are proposing
shows no intimate connection between the Place node and the feature [nasal] and in that respect is closer to the proposal in (17a).

Piggott (1992) develops a detailed theory of the nasals based on an extensive study of nasal harmony systems and concludes that the location of [nasal] is variable. He identifies two language types: in type A languages [nasal] is a dependent of the Soft Palate node, which is a daughter of the Root node, and in type B languages [nasal] is a dependent of the SV node. In this thesis, I argue that Piggott’s analysis is on the right track to the extent that [nasal] is a dependent of SV; however, I do not adopt the variable dependency model, and, in particular, I reject the Soft Palate node. I would argue that a theory without variable dependency is superior to one that allows such devices. This still requires, however, that the range of data covered by Piggott can be accounted for by other independently motivated devices of the theory. While I believe that this is possible, it is beyond the scope of this thesis to detail arguments against the variable dependency model proposed by Piggott (1992) and I leave the matter to future research. To the extent that I do not present examples that require anything beyond an SV representation of nasals, I assume that the SV model is supported.

1.2.2.2 Nasals are voiced and sonorant

Pulleyblank (1989), in a survey of nasal spreading processes, suggests that the affinity between nasals, on the one hand, and sonorancy and voicing, on the other, plays an important role in simplifying the statement of spreading rules involving the feature [nasal]. He proposes that this relationship should be formalized through the statement of feature cooccurrence conditions in the form of implicational statements. Such conditions can be stated both positively and negatively in a theory with binary features and he proposes the two sets of conditions in (18).

(18) a. NASAL/VOICING

i. POSITIVE: If [+nasal] then [+voiced].

ii. NEGATIVE: If [+nasal] then not [+voiced].

b. NASAL/SONORANT

i. POSITIVE: If [+nasal] then [+sonorant].

ii. NEGATIVE: If [+nasal] then not [+sonorant].

The approach represented by conditions such as those in (18) is justified to the extent that the conditions do not represent hard universals. Thus, if we find nasal sounds that are voiceless, it would appear that an approach that permits such sounds would be more highly valued than an approach that had no way of representing such sounds. Under the SV hypothesis, there is no way of representing voiceless nasals because SV is a voicing feature and [nasal] is a dependent of SV. Thus, if we were to find voiceless nasals, the SV hypothesis would be called into question. On the other hand, if it could be shown that the conditions in (18a,b) are the only possible state of affairs, then the dependency approach represented by the SV hypothesis receives support, as this is the prediction of the SV hypothesis. The question is, therefore, a matter of the existence of voiceless nasals. On this, I refer to Lombardi (1991), who reanalyzes reported cases of so-called ‘voiceless nasals’ as examples of aspirated nasals. Under such an analysis, the voicelessness of the nasal does not arise from a [voice] specification or for that matter a [-sonorant] specification; rather, the laryngeal feature [spread glottis] masks the sonorant voicing features of the [nasal] sounds. Such a sonorant devoicing process can be seen in English where the sonorant in an initial voiceless stop-sonorant
cluster surfaces as ‘voiceless’ when the voicing feature of the sonorant is
masked by the aspiration of the initial voiceless stop (e.g. [plan]). Thus, it is
no accident that voiceless nasals always appear to occur in languages that also
have distinctive aspirated stops. What is marked about these languages is
that the laryngeal features are extended to the SV sounds, a situation that is in
principle possible, but also one that yields complex segments. Rather than
two separate inviolate cooccurrence restrictions on nasals as in (18), we have
instead a violable cooccurrence restriction barring a segment with both an SV
node and a Laryngeal node specified. Such a constraint follows from notions
of segmental complexity, an issue discussed in Rice and Avery (1991). Rice
and Avery claimed that presence of structure at one node places limitations
on the expansion possibilities at other nodes. From this it was argued that the
absence of place features on laterals was the result of a complexity condition.
Similarly, I am arguing that the rarity of aspirated nasals among the
languages of the world follows from complexity conditions, as such segments
require the presence and expansion of both the Laryngeal node and the SV
node.

1.2.2.3 Nasals are stops

Nasals differ from the liquids /l/ and /r/ by being distinctively specified
for place of articulation. In this respect, nasals pattern with stop consonants,
being found at the same places of articulation or a subset of the places of
articulation of the stop consonants in a given inventory. There is ample
phonological evidence for grouping the nasals with the stops of an inventory
as nasal consonants pattern with stops in phonological rules. Anderson
(1976) presents data from Finnish showing that nasals form a natural class
with stops in the operation of a phonological rule of continuant
dissimilation. As well, in the process of nasal place assimilation, nasals
always assimilate to following stops but sometimes they do not assimilate to
following fricatives. For example, the nasal of a nasal-stop sequence in Polish
is realized as a nasal consonant homorganic to the following stop consonant.
In nasal-fricative sequences, on the other hand, the nasal is realized as a glide
without specified place of articulation (Padgett 1991; Craykowska-Higgins
1988). The reverse is never the case; that is, we do not find languages in
which the nasals assimilate to fricatives but not to stops (see Padgett 1991 for
discussion). In denasalization processes or in nasal spreading processes,
nasals always alternate with voiced stops, and never with fricatives. In many
cases of nasal assimilation, the nasal causes hardening of a continuant sound
to which the nasal has become place-linked.

The question as to how this dependency between nasality and continuancy
should be represented is a difficult one. Clearly, it is not a universal as
reportedly languages such as Igbo have contrastive nasal fricatives (Green and
Igwe 1963) and Trigo (1988) has shown that nasal glides exist and glides are
continuant sounds. This is a good candidate for a cooccurrence restriction of
the type proposed by Pulleyblank (1989) for [nasal], [sonorant] and [voice].
This could be accomplished with a statement along the lines in (19).

(19) [nasal]/[continuant] cooccurrence

If [nasal], then [-continuant].

The question remains, however, as to how nasals come to be specified as
[continuant] segments. Are nasal consonants underlyingly specified as
[continuant] or is this a redundant feature that is filled in during the
phonology? The answer to this question will depend in part at least on the
specification of stops. I will not explore this issue here, but will assume that if the stops of a language are underlyingly specified for continuancy, then the nasals are as well.

1.2.2.4 Summary

In this section we have proposed that the relationship between nasality, sonorancy, and voice is directly encoded in the representation of nasal segments. This is accomplished by making the feature [nasal] a dependent of the SV node, a node that encodes both sonorancy and voicing. This means that nasals must always be both sonorant and voiced. The relationship between nasality and continuancy, on the other hand, does not follow from feature geometry and must be the result of a feature cooccurrence restriction. Since nasals can be continuant a different treatment is warranted. I return to feature cooccurrence restrictions in the discussion of the relationship between laterals and coronals.

1.2.3 [lateral]

The feature [lateral], like the feature [nasal], has been the subject of a number of studies, particularly in the feature geometry framework. Unlike [nasal], however, [lateral] is not universally accepted as a distinctive feature. Some linguists appear to be uncomfortable with a feature that has a scope as narrow as [lateral] does, since, in general, the only segment requiring positive specification for this feature is /l/. This situation has made [lateral] a target for elimination from the set of distinctive features available to languages. With respect to the elimination of the feature [lateral], there are two identifiable camps. On one side are those who argue that laterality should be derived from manner or airflow features. For example, Mohanan (1990) introduces a new binary feature [stop] to supplement [consonant] and Piggott (1991) claims that the SV dependent approximant is sufficient to derive laterals. The approach taken in this thesis is to maintain [lateral] as a manner feature, as has been done traditionally, but to make it part of the SV complex, being directly dominated by the approximant node which is in turn dominated by SV, as in (20). This position is at odds with both of those presented above, though it is quite close to the proposals in Piggott (1991), Brown (1995) and Rice (1993).

(20) Lateral structure

```
          R
         /\  
Place SV
       /    
    Approximant
       |    [lateral]
```

Let us turn briefly to some of the issues raised by the representation of laterals, in particular the connection between laterality and place and laterality and continuancy.

1.2.3.1 Laterality and Place features

The work of Blevins (1994) is the most influential attempt to derive the coronality of laterals from feature-geometric considerations. Blevins maintains the feature [lateral] as part of the set of distinctive features but argues that it is a Coronal dependent, based on the implicational statement in (21):

(21)
(21) If a segment is [lateral], then it is also Coronal.

Her proposed structure is given in (22).

(22) Lateral as a Coronal dependent

```
R
|
|
Place
|
|
Coronal
|
| [lateral]
```

Blevins recognizes that a not insignificant number of languages have been reported to have phonemic dorsal laterals, a situation that directly contradicts the structure in (22), but she is able to show that a careful analysis of the phonology of the laterals in these languages reveals that the dorsal laterals are underlyingly Coronal. Thus, in languages such as Yagaria and Kuman, reported to have distinctive dorsal laterals, Blevins investigates the alternations these segments participate in and shows that processes such as delateralization do not result in dorsal segments, as would be predicted if they were marked as dorsal, but rather the resulting segment is a coronal.

Blevins’ arguments for a [lateral]-Coronal dependency and her arguments for deriving surface dorsal laterals from underlying coronals are quite convincing and have been generally accepted; however, her feature-geometric account of these facts has been criticized on several grounds. Clements and Hume (1994) mention several problems for a dependency account. First, they point out that if [lateral] is a dependent of the Coronal node, then wrong predictions are made about nasal place assimilation. It is not normally the case that a nasal becomes a lateral when it assimilates in place of articulation to a following lateral (a point made in Rice and Avery 1991). Usually this results in an alveolar nasal, though Clements and Hume admit that there are cases where the results do follow from a dependency account, such as Seyalarese (Mithun and Basri 1985). A more difficult case for the Coronal dependency hypothesis is found in Tahitan, discussed in Shaw (1991), where laterals are transparent to long-distance coronal assimilation.

Blevins’ (1994) response to some of the criticisms levelled against her theory of [lateral]-Coronal dependency highlights some of the weaknesses of her approach. For example, consider her account of the English data in (23) which is problematic for the [lateral]-Coronal dependency hypothesis.

(23) English coronal assimilation (Blevins 1994: 343, ex 53)

<table>
<thead>
<tr>
<th>/l/</th>
<th>/l/</th>
</tr>
</thead>
<tbody>
<tr>
<td>/n/</td>
<td>[nt]</td>
</tr>
<tr>
<td>tenth</td>
<td>tent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>/w/</th>
<th>/w/</th>
</tr>
</thead>
<tbody>
<tr>
<td>/l/</td>
<td>[wel]</td>
</tr>
<tr>
<td>wealth</td>
<td>well</td>
</tr>
</tbody>
</table>

The data reveal that the nasal and the lateral behave in exactly the same way with respect to place assimilation, as both take on the place properties of a following coronal consonant. Crucially, the lateral assimilates in place of articulation to the following obstruent but does not lose its laterality. If [lateral] is a dependent of the Coronal node we might expect assimilation as in (24).

---

3 Blevins (1994) is to a large extent based on Levin (1988) but incorporates responses to various criticisms of the earlier paper.
(24) Place assimilation of lateral to interdental

\[
\begin{array}{c|c}
/l/ & /\alpha/ \\
R & R \\
\hline
\text{Place} & \text{Place} \\
\hline
\text{Coronal} & \text{Coronal} \\
\hline
\text{[lateral]} & \text{[+anterior]} \\
\end{array}
\]

If the rule of place assimilation is allowed to operate as in (24), then the lateral should lose its laterality. The spreading of the Coronal node from the /\alpha/ should cause delinking of the Coronal node of the /l/. Even under an analysis which allows for fusion of the Place nodes, we would expect the loss of the feature [lateral] as fusion generally causes the delinking of dependent features of the left-hand segment (see Hulik 1986 on fusion in Ponapean). If the spreading feature is [+anterior] and if this spreading does not cause delinking, then the correct results can presumably be obtained. However, this would represent a highly marked type of spreading as under any approach to spreading or fusion that I am aware of there is only a single surviving feature. In the case of fusion, it is the feature of the righthand segment that survives and in the case of spreading, it is the spreading feature.

In order to maintain her dependency account, Blevins must claim that "(t)he facts of natural language seem to point to a subdivision in coronal articulations between the sides and central portion of the tongue blade..." (p. 343). This leads her to propose the structure in (25) for the coronal node.


\[
\begin{array}{c}
\text{CORONAL} \\
\hline
\text{[lateral]} & \text{CENTRAL} \\
\hline
\text{[anterior]} & \text{[distributed]} \\
\end{array}
\]

Inspection of this structure reveals that if the assimilation process is defined as the spreading of the Central node, then the failure of the /l/ to lose its laterality is explained because the feature [lateral] is not a dependent of the Central node. The major problem with this proposal is that it lacks independent motivation. The only justification Blevins presents for this structure is the fact that it allows her to maintain her analysis of laterals. In principle there is nothing wrong with such a reworking of the feature hierarchy, but in this case some independent motivation is required, since there is an alternative theory where [lateral] is not a dependent of the Coronal node, which handles the data easily.

Blevins' work represents a major step forward in our understanding of lateral consonants. She argues convincingly against Spencer (1984), who attempts to eliminate the feature [lateral] and to replace it with other (Coronal) place features such as [distributed]. As well, her analysis of dorsal laterals as Coronals allows for a better understanding of the phonological behaviour of these segments. I will reject Blevins' account of the location of the feature [lateral] in the tree, however, preferring an analysis of [lateral] as an SV feature.

Another account of the lateral-coronal dependency has been offered in Rice and Avery (1991). There it is claimed that phonological theory needs to
recognize at least two ways in which cooccurrence restrictions between features can be encoded in the grammar. One is through feature dependency of the type proposed by Blevins, a type that is well-suited to the feature geometry model. The other is through cooccurrence statements of the type discussed for [nasal] and [continuant] in §1.2.1.4, statements which can take the form of positive or negative implications. Cooccurrence statements are generally not universal, representing instead strong cross-linguistic tendencies. In the specific case of the [lateral]-Coronal cooccurrence restrictions, Rice & Avery argue that this is motivated by considerations of segmental complexity. They argue that segments with elaborated SV structure, i.e., SV which has marked structure, such as Approximant and [lateral], will not have elaborated place structure. Since the presence of [lateral] implies expansion at the SV node, there should be no expansion at the Place node. This derives the [lateral]-Coronal cooccurrence restrictions as laterals will appear only with the unmarked Coronal place of articulation (Avery & Rice 1989).

An account such as that presented in Rice & Avery (1991) represents an attempt to derive cooccurrence restrictions from general constraints that make no reference to specific features but instead appeal to independent notions such as complexity. To the extent that such an approach can be extended beyond the [lateral]-Coronal restrictions, it becomes a strong alternative to deriving cooccurrence from geometric relations, particularly in those cases where the cooccurrence constraint appears to be violated in ways that the dependency model has difficulty in representing. Some independent support for this account may come from an investigation of inventories of nasal consonants. In general, nasals occur at the same places of articulation as the stops of an inventory. Frequently, however, languages are missing a distinctive velar nasal even though they have a distinctive velar stop. In nasals there is at least some SV structure present either in the form of an SV node or SV dominating [nasal]. With respect to place of articulation, Avery & Rice (1989) argued that velars have a more elaborated place structure than either coronals or labials. They propose that the unmarked dependent of Place is Coronal and the marked dependent is the Peripheral node. The unmarked dependent of the Peripheral node is Labial and the marked dependent is Dorsal. This is shown in (26) where features in parentheses represent the unmarked choice at a given node.

(26) Place structure (Avery & Rice 1989)

```
Place
   (Coronal)  Peripheral
      (Labial)  Dorsal
```

The presence of SV on the nasals appears to create a degree of complexity that can have an effect on the expansion of the Place node. The reason that velar nasals are frequently missing from the nasal inventory is due to complexity considerations. Note that the place structure given in (26) is motivated for reasons completely independent of complexity considerations. This serves to support the claim that both complexity constraints and dependencies are required in the segment structure. Further, we can see that the complexity constraints should be soft constraints in that they are violable, while the dependencies represent hard constraints because they are not violable.
1.2.3.2 Lateral and airflow features

While it is clear that nasals form a natural class with the [-continuant] sounds, the proper airflow specification of laterals is less obvious. The common alveolar laterals clearly involve blockage in the oral cavity at the location of the primary stricture with the air escaping around the sides of the tongue, rather than over the centre of the tongue as with the obstruent continuants. Chomsky & Halle (1968) note that laterals sometimes appear to behave phonologically as [-continuant] sounds and at other times as [+continuant] sounds. In their feature charts for the consonants, they mark the lateral as [-continuant]. This decision appears to be influenced by the behaviour of laterals in Athapaskan languages such as Chipewyan where the laterals pattern with the fricatives in phonological processes. However, they also mention a dialect of English spoken in Scotland where /l/ behaves as a [-continuant] segment as opposed to [l] which is [+continuant]. (See Atten’s Law discussed in (39) below.) It would appear therefore that they are allowing for the possibility that the specification of laterals for the feature [continuant] is a language specific matter, perhaps depending on the behaviour of laterals with respect to phonological processes. The definition of [continuant] found in SPE allows for this indeterminacy in the classification of laterals as all that is stated is that there is blockage of air at the site of the primary constriction. On the one hand, it may be argued that laterals are [-continuant] because there is a blockage of air at the primary constriction. On the other hand, it may be argued that the air escapes around the primary constriction and therefore they should be marked as [+continuant]. The latter seems to be the position that Chomsky & Halle take with respect to English in spite of the evidence from the Scottish dialect where /l/ patterns with the stop consonants.

Halle & Clements (1983) redefine the feature [continuant] so that laterals are [-continuant] sounds. Under their definition, all sounds involving blockage of the airstream in the mid-sagittal region of the oral cavity are [-continuant], and as laterals involve blockage in the mid-sagittal region, the dental/alveolar laterals are classed as [-continuant]. This leaves the problem of how to capture the [+continuant] status of the Athapaskan laterals which clearly pattern with the continuants in undergoing a voicing rule. Consider the data in (27) exemplifying the phenomenon in Slave (data from Rice 1989: 66):

(27) *Continuant voicing in Slave

| sch | -bígh | *spít, *kíhčína |
| kl | -yíshí | *song |
| xch | -yázhí | *pack |
| br | -lem | *smoke |
| me | -we | *belt |
| ña | -mí | *mouth |

The rule that Rice proposes to account for the alternations crucially refers to the continuant status of the segments that undergo the voicing as shown in (28).

(28) [+continuant] → [ +voice] /X_ / in nouns, postpositions
X = any segment (Rice 1989: 66)

In Spanish as well it has been claimed that laterals are [+continuant] because of the rule of spirantization, a process by which voiced obstruents surface as continuants when following a vowel as shown in (29) or a non-homorganic sonorant as shown in (30).
We ignore the location of the features in the feature tree, noting only that the analysis requires that the feature [+continuant] be the spreading feature and that /l/ must be specified as [+continuant] to account for the surface fricatives in algo and albor. The blocking of spreading in the case of the /ld/ cluster is achieved through marking the /d/ as [-cont] and ensuring that this specification overrides the [+cont] specification of the lateral when the two segments come to share place of articulation through a place assimilation rule. Given Padgett’s theory of consonantal stricture, this can be achieved because of a dependency relationship between place features and [+continuant]. Thus, when /l/ is followed by a coronal such as /d/, it is automatically placed linked to the /d/ and, as a consequence, loses its [+continuant] feature. Padgett proposes the rule in (32).

(32) Place assimilation in Spanish /ld/ clusters (Padgett 1991: 276, ex. 24)

We return to an account of these data without recourse to Place-[continuant] dependency below, but first we should consider the theory developed by Mohanan (1990). Mohanan discusses the dual nature of laterals with respect to continuancy and claims that the features [continuant] and [lateral] are inadequate to capture this patterning. He argues that [lateral] should be eliminated from the inventory of distinctive features and that a new binary feature [stop] should replace it. This gives us two airflow features:

---

(29) dedo → deño 'finger'
bibir → bipir 'drink'
abogado → apoyaño 'lawyer'

(30) a. banda → ban[di]a 'ribbon'
ambos → am[b]los 'both'
leguva → le[d]guva 'tongue'
kalo → ka[dl]o 'broth'

b. algo → all[yl]o 'something'
albor → all[p]lor 'dawn'

Harris 1969, in discussing these facts, claims that “the nasals and /l/ comprise just the set of non-continuant sonorants in the dialect of Spanish under study” (p. 39). This is to allow for an account of the blocking behaviour of both the nasals and the /l/ in (30a). In a theory that requires assimilation to be expressed in terms of spreading, considering /l/ to be a non-continuant poses problems in those cases where spirantization takes place after an /l/ as in (30b), a fact recognized in Harris (1984). This is because the source of the feature [+continuant] must be an adjacent vowel or consonant. Padgett (1991) provides the spreading account sketched in (31).

(31) Spanish spirantization (Padgett 1991)
[continuant] and [stop]. Mohanan provides the following definition in (33) for the two features:

(33)  a. In [+stop] sounds, there is no air flow through the oral cavity.
     b. In [-continuant] sounds there is no air flow through the center of the oral cavity.

Mohanann has thus taken the SPE definition of [continuant] and called this feature [stop] and the Halle & Clements (1983) definition of [continuant] and maintained the terminology. Given these definitions, we have the classification of the obstruents and sonorants found in (34).

(34) Classification of consonants using [stop] and [continuant]

\[
\begin{array}{ccccccc}
 & d & n & l & r & z \\
\text{stop} & + & + & - & - & - \\
\text{continuant} & - & - & + & + & \\
\end{array}
\]

With respect to the feature [stop] the laterals falls in with /l/ and /r/. On the other hand, they are classed with /d/ and /n/ with respect to the feature [continuant]. Mohanan argues that the rules that treat laterals together with the continuant sounds are sensitive to the feature [stop]. Those that treat the laterals as non-continuant sounds are sensitive to the feature [continuant]. Thus, the Slave voicing rule, discussed in (28), rather than referring to the feature [+continuant] would instead refer to the feature [-stop]. In Scottish English where the lateral is grouped with the stops, the rule would require reference to the [-continuant] sounds.

One argument for this classification put forward by Mohanan concerns across-word assimilation of coronal nasals and obstruent stops in English as in (35) (from Mohanan 1990:5).

(35) Across-word assimilations in English

<table>
<thead>
<tr>
<th></th>
<th>ten pounds</th>
<th>ten kings</th>
<th>ten fingers</th>
<th>hot potatoes</th>
<th>hot cakes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[np]</td>
<td>[lg]</td>
<td>[sl]</td>
<td>[lp]</td>
<td>[kk]</td>
</tr>
<tr>
<td>b. his pants</td>
<td>[lp]</td>
<td>[ek]</td>
<td>[ok]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mohanann claims that the lack of assimilation in (35b), where we find the fricative, the lateral and the rhotic, can be accounted for if the assimilation rule is sensitive to the category [stop]. The [+stop] coronal segments undergo assimilation while [-stop] coronal segments do not.

There is, however, another analysis of these data that does not make use of a feature such as [stop] is available, however. It is possible that a complexity constraint blocks the realization of laterals as velar or labial segments (an analysis requiring the feature [lateral]). If /s/ and /l/ are specified for place of articulation they do not assimilate to labials and velars because the rule only applies to forms that are unmarked for place of articulation. Note that as shown in (36) /l/ does assimilate to the palato-alveolar affricate of English in allegro speech and as illustrated in (23), laterals assimilate within the coronal place of articulation as well.

(36) this chair

[kl]

If the assimilations in (35) and (23) are part of the same assimilation process as that illustrated in (36), then the restriction to [+stop] segments cannot be correct because the rule is applying to the fricative /s/. This lends

---

4 Presumably Mohanan meant to have [lp] here.
support to an analysis in terms of segments unmarked for place of articulation or restricted to applying within a particular articulator.

Another argument put forward by Mohanan concerns a rule of English that inserts an intrusive stop in words such as else [ɛls] and prince [prɪns]. This process groups laterals and nasals together and would appear to require reference to the [-continuant] status of these sounds. Interestingly, there are dialects that do not have intrusive stops following nasals or laterals, other dialects that have them following only nasals and others that have them after both nasals and laterals. The fourth logical possibility, a dialect with intrusive stops after laterals but not after nasals, does not occur. Mohanan points out that this supports his classification as there is no way to capture this fourth dialect using his feature system as summarized in (37).

(37) Summary data for intrusive stop insertion

<table>
<thead>
<tr>
<th>Dialect</th>
<th>[lts]</th>
<th>[prints]</th>
<th>feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>√</td>
<td>√</td>
<td>[-continuant]</td>
</tr>
<tr>
<td>B</td>
<td>×</td>
<td>√</td>
<td>[-stop]</td>
</tr>
<tr>
<td>C</td>
<td>×</td>
<td>×</td>
<td>rule absent</td>
</tr>
<tr>
<td>D</td>
<td>√</td>
<td>×</td>
<td>no feature</td>
</tr>
</tbody>
</table>

Mohanan's framework presents something of a challenge to the account of laterals being presented in this thesis. In chapter 3, I will present a good deal of data supporting the SV hypothesis with respect to laterals. For now I will only suggest that the evidence for Mohanan's airflow theory is not as strong as it at first appears. We have already discussed the cases of place assimilation in English, arguing that the array of facts discussed by Mohanan may not constitute evidence against the feature [lateral] or in favour of his classification system. With respect to the intrusive stop data, it only establishes that laterals are sometimes specified as [-continuant] in some dialects. It says nothing about whether a feature such as [-stop] is necessary. This could merely be the difference between a specified and an unspecified feature. The reason there are no dialects with an intrusive stop in else but not in prince has to do with the cooccurrence restrictions between the feature [nasal] and the feature [continuant]. In those dialects without the rule, it may be that neither the nasal nor the lateral has a specification for [-continuant]. Thus, it is not a matter of the rule being absent but a matter of the representations not creating the appropriate configuration for intrusive stop insertion.

The Athapaskan data in (27), repeated below, at first blush also appears to support the analysis of Mohanan.

(27) Continuant voicing in Slave

| sch | -tʃr | spit, saliva |
| l | -tʃn | song |
| xch | -kə | pack |
| f | -lən | smoke |
| me | -wɛn | bell |
| da | -də | mouth |

There is, however, an alternative to the airflow analysis proposed by Rice (1989). This is to consider the voiceless 'fricatives' to be sonorant aspirates and to claim that the process is a reduction process deleting the Laryngeal node from sonorant aspirates as shown in (38).
Similarly, the case of Aitken's law in Scottish which has been argued to require a \( [+\text{continuant}] \) specification for laterals in order that they act as a natural class with the stops of the inventory really provides no evidence for the classification of laterals. It does appear to require that \(/r/\) be specified as \( [+\text{continuant}] \), however. Consider the data in (39) from McMahon (1991).

(39) Aitken’s Law

\[ \begin{array}{c}
\text{[l]}: \text{boat} \\
\text{[l]:} \text{beer}
\end{array} \]

The data show that the process of lengthening is sensitive to the presence of a voiced continuant. The fact that \(/l/\) does not induce lengthening only tells us that \(/l/\) is not marked as \( [+\text{continuant}] \); it tells us nothing about the specification of \(/l/\) with respect to continuancy. We would argue that these data show that \(/l/\) has no specification for continuancy.

1.2.3.3 Summary

We have investigated several proposals for laterals that are at odds with the one that I will defend in this thesis. None of the evidence presented thus far is contrary to my proposal. The evidence to be presented in chapter 3 will show that data from a wide variety of languages is not only consistent with but supports the view that \( [\text{lateral}] \) is a part of the \( SV \) complex.

1.2.4 \( /r/\)-sounds

Rhotics, or \( /r/\)-sounds, have always presented a problem for phonologists. Unlike laterals, no one has proposed a distinctive feature that is unique to \( /r/\) sounds. Instead \( /r/\) has been distinguished from other sonorant consonants through the use of feature specifications such as \( [-\text{lateral}] \). Selecting a single feature to cover \( /r/\)-sounds is difficult because of the extreme diversity of the sounds included under the rubric of \( /r/\)-sound. Not only do the \( r\)-sounds cover a wide range of possible articulations, even the description of these sounds is non-trivial. This presents a major obstacle to developing a comprehensive theory of rhotics. Ladefoged (1982: 148) provides the following summary of \( /r/\) type sounds found in the languages of the world.

(40) \[ \begin{array}{ccc}
\text{[r]} & \text{voiced alveolar trill} \\
\text{[r]} & \text{voiced alveolar tap} \\
\text{D} & \text{voiced alveolar flap} \\
\text{[j]} & \text{voiced alveolar approximant} \\
\text{\ldots} & \text{voiced retroflex approximant} \\
\text{\ldots} & \text{voiced uvular trill} \\
\text{\ldots} & \text{voiced uvular fricative or approximant} \\
\text{\ldots} & \text{voiced labiodental flap}
\end{array} \]

Having descriptions of such a diversity of \( /r/\)-sounds still does not solve the descriptive problem of \( /r/\). For example, even in a well-studied language such as American English, the phonetic description of the \( /r/\) sound is not uncontroversial. This sound has been described as a voiced retroflex approximant by Ladefoged (1982) and as a pharyngealized velar approximant by Lass (1981) (on the pharyngeal nature of \( /r/\) in American English see Delattre 1971).

Given the diversity of articulatory characteristics associated with \( /r/\)-sounds, Lindau (1985) studied these sounds in a variety of languages in a
search for an invariant acoustic cue. Her hypothesis was that this cue was a lowered third formant. While her study confirmed that a lowered third formant was a consistent cue for /r/ in American English, this was not the case in the other languages and in fact it was a rather rare cue among the languages she investigated. Her conclusion was that rather than proposing an invariant cue for /r/ sounds, we should think of the /r/ sounds as belonging to a family of sounds, all of which are interconnected but some of which do not share any characteristics.

Two questions arise from an examination of this diverse group of /r/-sounds: How many /r/ sounds need to be distinguished phonologically, and what features are required to distinguish /r/ from other sonorant sounds? If our main interest is in the phonological distinctions possible, it does not really matter how many different /r/ sounds there are, only whether we can capture the phonologically relevant distinctions in a manner that allows us to make the appropriate phonological generalizations.

Most commonly, languages have only a single r-sound, and it does not appear that languages ever distinguish more than two rhetics, at least if we exclude voiced/voiceless pairs. In the Australian languages Kunjen and Bardi (reported in Maddieson 1984, 327-8), there is reportedly a distinction between a trilled /r/ and an approximant /rl/. Spanish is reported to distinguish between a trill and a tap /r/, but this distinction is probably not phonemic or may be related to gemination (Harris 1969; see also Mascaró 1976 on Catalán). While some languages are reported to distinguish between an alveolar and a retroflex /rl/, thus having two /r/-sounds in the coronal area, there are no languages I am aware of that make a phonemic distinction between a uvular articulation for /r/ and an alveolar articulation, indicating that outside of the coronals, place of articulation cannot be distinctive for /r/.

Place of articulation for /r/ can function as a social marker in some languages as we see in the dialect variation found in languages such as French and German that have a uvular fricative or approximant /r/ in some dialects but an alveolar trill in others, paralleling in some respects the rhetic vs. non-rhetic dialects of English.

It is often the case that /r/-sounds, unlike nasals and laterals, often do not occupy any positive space in phonological systems, but are rather defined through their lack of positive specification for any specific feature. In a discussion of the place of /r/-sounds in phonemic systems, Trubetzkoy (1939: 73-4) notes that the 'phonemic content' of /r/ depends to a large extent on the structure of the phonemic inventory and that this can lead to a good deal of variability in terms of pronunciation. In his discussion of German, he notes that /r/ contrasts only with /l/ and, because the phonemic content of this /r/ is "purely negative", the actual pronunciation of the /r/ may vary widely. He points out that the German /r/ can be pronounced as a dental vibrant, a uvular vibrant, a guttural spirant, or even a non-syllabic vowel of indeterminate quality depending on factors such as dialect and phonological environment. He contrasts this situation with that found in a language such as Czech where the /r/ sound contrasts not only with /l/ but also with the special Czech /r/-sound. In this case the /r/ has a single pronunciation in all positions because it must maintain its contrastive character. He further notes that /r/ may participate in the fricative system, giving as an example Gilyak. As in Czech, the pronunciation of the Gilyak /r/ is stable with a tendency towards a voiced fricative production. One further possibility mentioned by Trubetzkoy is the situation found in languages such as Japanese where there
is no opposition between /r/ and /l/, but rather a single liquid. Here again we find a good deal of variability in the pronunciation of the liquid, with it being pronounced sometimes as /l/ and sometimes as /r/. A similar situation exists in Korean where [.ll] and [rr] are positionally conditioned variants of a single liquid phoneme.

Anderson & Ewen (1987), in a discussion of r-types, argue that it is necessary to recognize different representations for the various types of /r/ in the languages of the world on both phonetic and phonological grounds. They discuss the necessity for a 'fricative' type /r/ in the history of Scots. In many Scots dialects, /r/ patterns with the voiced fricatives /v z ð/ in Aitken’s law, as have we seen, that shortens long vowels everywhere except before /rv z ð/#/ and lengthens non-high short vowels before /rv z ð/#/. However, Anderson & Ewen reject the characterization of /r/ as simply a voiced fricative because there is evidence from other Scots dialects that such sounds behave differently from voiced fricatives, instead patterning with the liquid /l/. Their claim is that the 'fricative' /r/’s “...must have a representation which will enable (them) to be distinguished from /l/ and from the voiced fricatives but which will allow (them) to pattern with either.” (Anderson & Ewen 1987: 160)

Thus far, we have seen that /r/ forms a natural class with /l/ in languages such as German and with voiced fricatives in languages such as Scots English or Gilyak. In languages with only a single liquid, there may be variation in the realization of this liquid between [ll] and [rr]. One further pattern we need to account for involves an alternation between an /r/-sound and /nl/ or /dl/. According to Rice (1989), this is the case in Slave where [rr] is derived from an underlying /nl/ or /dl/.

We thus have three basic ways that /r/ may pattern within a system. First, /r/ may be minimally distinct from /l/; second, it may pattern with the fricatives of a language and thus be marked as [continuant]; third, it may be a variant of noncontingents such as /d/ and /n/. Our theory of segment structure provides several possible representations for these various /r/ sounds. Where /r/ contrasts with /l/, as in German or English, /r/ and /l/ are distinguished solely by the presence of the feature [lateral] on the /l/, as in (41a). The /r/ sound in this case is a generalized Approximant and should show wide variation, at least across dialects. In languages with the 'fricative' /r/, the feature [continuant] is specified on /r/ as in (41b). The Approximant node is not present in this situation as the bare SV node will mark the /r/ as a sonorant. In languages where the /r/ alternates with /dl/ or /nl/, the /r/-sound is a minimal SV segment as in (41c). The addition of [nasal] creates a nasal sound and the deletion of the SV node will create a /dl/ sound.

(41) /r/ representations

<table>
<thead>
<tr>
<th>a. /l/ vs. /r/ (German)</th>
<th>b. [continuant]: /r/ (Scots)</th>
<th>c. SV-/r/ (Slave)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/l/</td>
<td>/r/</td>
<td>/r/</td>
</tr>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>SV</td>
<td>SV</td>
<td>SV [cont]</td>
</tr>
<tr>
<td>Approx</td>
<td>Approx</td>
<td>[lateral]</td>
</tr>
</tbody>
</table>

Of course, each of these representations depends in large part on the other segments in the inventory. For example, the SV-/r/ in (41c) can only arise if there are no contrastive SV stops such as /d/ and [nasal] is specified. It will
most often be a derived representation rather than an underlying representation, particularly if an /r/ is present in the inventory. The liquid in Japanese or Korean has this minimal representation as there is no contrasting /l/ forcing the presence of the Approximant node. This may allow us to explain the difference in the phonetic possibilities of the German /r/ and the Japanese /l/. Trubetzkoy noted that the /r/ of German can have a uvular or an alveolar pronunciation but that the /l/ of Japanese is restricted to the alveolar area. He attempts to derive this from the presence of a palatalized /r/ in Japanese. However, we represent this as a difference between an Approximant sound and a plain SV sound. It appears that an Approximant sound can be realized at various places of articulation and that it behaves like a glide. On the other hand, the SV sound is limited to the coronal place of articulation and is most often realized as a tap or flap.

1.3 The Representation of Sonorants

In this chapter we have discussed the representations of nasals, laterals and /r/-sounds, concluding that nasals and laterals are defined positively through the presence of the features [nasal] and [lateral] and that these features are dependents of the SV node. On the other hand, the /r/-sounds do not have such a defining feature and are represented as minimally contrastive with the other sonorants, giving three quite distinct representations. In our discussion of underspecification, we will see that both the features [nasal] and [lateral] are frequently absent from underlying representation, but these features are supplied to nasals and laterals at some point in the phonological derivation. The situation with /r/ is quite different as the lack of a feature specifying the /r/ in underlying representation is not changed through the application of a rule providing a feature. The lack of

such a feature is responsible for the wide variability in the realization of /r/’s in the languages of the world.

In the next chapter I will discuss the role of underspecification in the theory, in particular, as it applies to the sonorant consonants.
Chapter 2
Underspecification and Enhancement

2.1 Underspecification and Enhancement

A major issue in all phonological research concerns the nature of phonological redundancy. An adequate theory of phonology must provide a principled account of redundancy at both the universal level and the language-specific level. As usual, the line between language specific and universal is not a simple one to draw; however, work in the area of underspecification theory has helped to clarify the issues involved and has allowed phonologists to see more clearly what is at stake. While the term underspecification has taken on connotations associated with a specific view of the nature of underlying representations, it should be remembered that some form of underspecification is assumed in most approaches to phonology developed in this century.

For our purposes, underspecification refers to the elimination of redundant features from underlying representation. Most theories of underspecification have taken as a starting point the assumption that features are binary and questioned whether both plus and minus values of a feature are present or whether only a single value is present. Most phonologists agree that, within a given segment, a feature that is predictable from the presence of another feature can be absent from underlying representation; for example, [+voice] being predictable from [+sonorant] means that [+voice] need not be specified in underlying representation of sonorants. Steriade (1987) refers to such feature specifications as redundant values. Disagreement surfaces when we consider the underspecification of feature values that serve to minimally distinguish two segments and cannot be predicted based on the presence of another feature. These are termed distinctive values (Steriade 1987). Kiparsky (1982), Archangeli & Pulleyblank (1986) and Archangeli (1989) propose that only a single value of a distinctive feature need be present underlingly, the choice of the feature being supplied by either universal markedness conditions or, in the marked case, by language specific considerations. This position has come to be known as radical underspecification (see Archangeli 1989) and is illustrated in (1a) with respect to the feature [voice]. Steriade (1987) and Clements (1987) have retreated from this view, arguing that generally both values of a distinctive feature must be present underlingly. This position is known either as contrastive specification or contrastive underspecification and is illustrated in (1b).

(1a) Radical underspecification of [voice]

<table>
<thead>
<tr>
<th></th>
<th>p</th>
<th>b</th>
<th>t</th>
<th>d</th>
<th>k</th>
<th>g</th>
<th>m</th>
<th>n</th>
<th>l</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>voice</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1b) Contrastive specification of [voice]

<table>
<thead>
<tr>
<th></th>
<th>p</th>
<th>b</th>
<th>t</th>
<th>d</th>
<th>k</th>
<th>g</th>
<th>m</th>
<th>n</th>
<th>l</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>voice</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As can be seen in (1), the two theories treat the sonorants in the same way, leaving them unmarked for [voice] because [+voice] is predictable from the [+sonorant] value of these segments. The theories treat the obstruents:
differently, however, with the voiceless obstruents remaining unmarked for [voice] under radical underspecification but marked under contrastive specification. In a theory adopting radical underspecification, the universal default rule in (2) must be part of the grammar.

\[ (2) \quad \emptyset \rightarrow [-\text{voice}] [\text{-son}] \]

As a marked option, the [-voice] value could be the marked value in a particular language and thus present in underlying representation. A language specific complement rule would then apply filling in the appropriate value of the underspecified feature.

Contrastive specification avoids the necessity of language specific complement rules by requiring that both segments be specified underlingly for minimally contrastive features. This restricts the scope of default rules to the filling in of redundant values only, avoiding the problem of markedness reversals.

While the workings of underspecification are relatively simple to contrast when we are dealing with binary features and feature matrices as in (1), certain complications arise when we adopt unary features. The situation becomes more complex when underspecification is extended to segment structure and in particular when we consider nodes to be contrastive elements. Clements (1987) deals overtly with the issue of the underspecification of the articulator nodes dominated by the Place node (Dorsal, Coronal, Labial), claiming that these nodes cannot be underspecified and are thus always present in underlying representation. He points out that the use of unary nodes allows for automatic underspecification, a situation that obtains because the presence of one articulator node, such as Labial, implies the absence of the other articulator nodes. As these nodes are unary, we do not require a default rule filling in [-Coronal] on a segment that is specified as [Labial]. While this restricts options available to a theory of underspecification, there remains some convincing evidence that some nodes are at least sometimes underspecified. Coronal, for example, often appears to be a default articulator node that only surfaces on a particular segment when there is no adjacent consonant that could share place of articulation with the segment (see Avery & Rice 1989 and many of the papers in Paradis & Prunet 1991). Such facts can be interpreted to mean that Coronal is not specified in underlying representation, but is supplied by a default rule as in (3).

\[ (3) \quad \text{Coronal default rule} \]

\[
\begin{array}{c}
\text{Place} \\
\quad \\
\quad \\
\text{Coronal}
\end{array}
\rightarrow
\begin{array}{c}
\text{Place} \\
\quad \\
\quad \\
\end{array}
\]

This rule simply inserts Coronal when a Place node has no dependents. If Coronal is underspecified in underlying representation and is supplied by a default rule such as the one given in (3), then the assimilatory behaviour of coronal consonants receives a straightforward explanation.

Setting aside for the moment the new set of problems that a rule such as (3) poses for the theory, let us briefly consider the issue of whether features are binary or unary. We can discern two basic approaches to this problem. In one approach, arguments are marshalled for the unary status of a particular feature that has been previously argued to be binary. For example, in the past
several years features such as [round] (Sagey 1986), [nasal] (Piggott 1992), [voice] (Mester and R6 1989), [spread glottis] and [constricted glottis] (Lombardi 1991) have been argued to be unary, rather than binary valued features. When considered in conjunction with the place features, which under the articulatory model of segment structure are also unary, we see that a significant number of features that were once considered to be binary can be analyzed as unary, leaving only features such as [continuant], [consonantal] and a few others as binary features. The other approach to the binarity problem has been to adopt as a working hypothesis a theory in which all features are unary, with presence versus absence giving the appearance of binarity (Avery & Rice 1989; Anderson & Fwen 1987). Proponents of this approach argue that there is little evidence for the phonological activation of both values of any given distinctive feature and that the few residual cases where binarity appears to play an important role are subject to reanalysis.

In this thesis, I will take the position that all features are unary. For the most part I will be dealing with features such as [voice] that have been independently argued to be unary. However, this requires a rethinking of the underspecification debate as both radical underspecification and contrastive specification assume binary features. We will see that the adoption of unary features allows us to find a middle position between radical underspecification and contrastive specification, maintaining the restrictiveness of the contrastive approach but maintaining the representational advantages of the radical underspecification approach.

Let us consider the workings of radical underspecification and contrastive specification in segment structure, taking for illustrative purposes an example involving [voice] as a distinctive feature. The minimally contrasting segments /p/ and /b/ are given in (4a-b) as they would be represented in the two theories.

4) /p/ ~ /b/ contrast

a. Radical underspecification

\[ /p/ \quad /b/ \]

\[ \text{Place} \quad \text{Labial} \quad \text{R} \quad \text{Labial} \quad \text{R} \quad \text{Labial} \]

\[ \text{Laryngeal} \quad [+\text{voice}] \quad \text{Labial} \quad [-\text{voice}] \quad \text{Labial} \quad [+\text{voice}] \quad \text{Labial} \]

b. Contrastive Specification

\[ /p/ \quad /b/ \]

\[ \text{Place} \quad \text{Labial} \quad \text{R} \quad \text{Labial} \quad \text{R} \quad \text{Labial} \]

When segment structure enters the picture, we have a third option not taken by either radical or contrastive underspecification, which is to use the class node dominating [+voice] as a contrastive element. We need to ask whether there is a difference between a representation in which there is no Laryngeal node present as in (4a) and a representation in which there is a Laryngeal node present as in (5).

5)

\[ \text{R} \quad \text{Labial} \quad \text{Laryngeal} \quad \text{Place} \]

We must determine the status of class nodes in the overall structure of contrastiveness in a given inventory. For example, if the Coronal articulator is unspecified, we can create a contrast between a representation with a bare Place node as in (6a) and a representation without a Place node as in (6b) and we must determine whether this is a valid contrast.
(6) Presence vs. absence of the Place node

\[
\begin{array}{c}
\text{R} \\
\text{Lar} \quad \text{Place} \\
\text{Lgl}
\end{array}
\quad \quad
\begin{array}{c}
\text{R} \\
\text{Lar} \quad \text{Place} \\
\text{Lgl}
\end{array}
\]

In (6), there is a reasonable candidate for the realization of (6b), that segment being a glottal stop which is in contrast with a glottalized /t/ as represented in (6a). Under this approach, the Coronal default rule in (3) can only apply when there is an empty Place node and will not supply Coronal in those cases where no Place node is present. This means that we recognize a contrastive role for the Place node and to be consistent we must also recognize the potential contrastiveness of all class nodes, including, of course, the Laryngeal node. This would force us to select the representation in (5) over that in (4a) for a /p/ that is in contrast with a /b/ that is specified for the Laryngeal feature [voice].

Hard empirical evidence concerning these issues is hard to find; in the meantime, it is the structure of the theory itself that must resolve such issues. For example, in a theory with spreading, one could restrict the operation of spreading in such a way that the representational issue is in part resolved. This could be achieved by claiming that spreading of a particular node or feature can only occur if there is a target present (as in Avery & Rice 1989; Piggott 1992; Gorecka 1989; Inkelas and Cho 1993). If we had a rule that spread Labial, it could be blocked in cases where a structural target for Labial was not present in the representation. The rule could apply in (7a), but would be blocked in (7b).

(7) a. Spreading applies

\[
\begin{array}{c}
\text{R} \\
\text{Place} \\
\text{Labial}
\end{array}
\quad \quad
\begin{array}{c}
\text{R} \\
\text{Place} \\
\text{Labial}
\end{array}
\]

b. Spreading blocked

In the blocking case, (7b), there is no target for the Labial to spread to and the rule cannot apply, while in the spreading case, (7a), the presence of the empty Place node licenses the application of the rule. While such a solution has been proposed in work by Avery & Rice (1989) and Piggott (1992), there are certain problems. What is preventing the Place node dominating Labial from spreading in (7a)? While this approach is suggestive of how class nodes can be used in the phonology, it does not answer the question as to how it is decided whether a given class node is part of a representation. It would be circular to use arguments from rule application to establish presence or absence of a class node in the representation when the theory of rule application has been formulated to capitalize on this distinction. Clearly, we must turn to inventory considerations and in particular to the notion of contrast to determine the nature of segment representation.

In the SPE framework, with binary features and a feature matrix representation, two segments could be said to contrast if they differ in their values for at least one distinctive feature. Two segments could be said to minimally contrast if they differ in their values with respect to one and only one distinctive feature. Segments such as /p/ and /b/ are minimally contrastive because they differ only in the value attached to the feature [voice]. If we assume unary features, it is not possible to define minimal
contrast in this way, as it is only the presence or absence of the feature that is
making the segments minimally distinct. However, taking segment structure
into consideration allows us to redefine minimal contrast as in (8) to include
reference to nodes.

(8) Minimal contrast

Two segments α and β are said to be minimally contrastive if they
differ by the presence of a single feature or node.

Thus, the representations in (4b) display a minimal contrast between /p/
and /b/ while those in (4a) do not. We can link the presence of such a
distinction to the process of acquisition by requiring that the acquisition of
a contrast always involves the creation of a new minimal contrast, a not
unreasonable requirement in a theory that sees minimal contrast as central to
both acquisition and rule application.

Let us return briefly to the two models of underspecification outlined at
the beginning of this section and see how they are accommodated in a theory
that adopts unary features and incorporates organizing nodes as potentially
creating minimal contrast, a theory we will refer to as Modified Contrastive
Specification following Paradis and Prunet (1991) and Dresher, Piggott and
Rice (19945). The restriction to unary features would appear to have much in
common with the theory of radical underspecification in that only a single
value of a feature can be present underlyingly. However, it differs from
radical underspecification in that there can be no cases where the universal
default rules are overridden by language specific requirements that the
marked value of the feature be the underlying value. This option is discussed
in Archangeli (1988) with respect to the specification of vowel systems.

Therefore it would not be possible for a language to have [+voice] as the
underlying value and [-voice] supplied by default, a reversal of the normal
default case. To the extent that there are such cases, the theory of radical
underspecification receives support over a theory with unary features.
Abaglo and Archangeli (1989) argue that such power is needed to capture the
difference between a vowel system in which /i/ is the unmarked vowel and
one in which /e/ is the unmarked vowel. The only cases I am aware of
where underlying values must differ from language to language involve
vowel systems. This may point to a limitation in the current feature theory
of vowels. I am not aware of any convincing evidence that the same
situation holds in consonant systems. If there are no clear examples of
different languages requiring both values of a binary distinctive feature
underlyingly, i.e, [+voice] in one language and [-voice] in another, then a
theory with unary consonant features is to be preferred. This also eliminates
one of the more problematic aspects of radical underspecification from a
learnability perspective.

With respect to contrastive specification, a theory with unary features
cannot duplicate the results achieved by the underlying presence of both
values of a distinctive feature. However, the introduction of class nodes such
as Laryngeal and Place as integral parts of the representation can achieve
many of the results that the theory of contrastive specification attempts to
capture.

In the next section we return to our account of sonorant segments, but we
develop the theory of Modified Contrastive Specification as a theory of
enhancement, further restricting the options available to the theory and
eliminating the diacritic use of underspecification.
2.2 Enhancement and the Representation of Sonorants

We now turn to an account of the underspecification of sonorant segments when underspecification is interpreted strictly as enhancement. By way of background, I will be assuming the model of segmental acquisition outlined in Rice & Avery (1995). The central proposal in this work is that the acquisition of segment structure follows a developmental path, with the learner proceeding from a relatively impoverished segmental representation to a more elaborated one as contrasts are acquired. This necessarily involves a straightforward additive relationship among segments. Thus, segments that are more specified include, in a real sense, segments that are less specified on the same developmental path. For instance, if [l] and [d] are identical except that [d] has a single extra specified feature, we say that they are *minimally contrastive* in the sense discussed in the previous section. As [l] is contained in the representation of [d], the prediction is that a rule delinking this specified feature from a [d] would create a [l]. This rather simple picture becomes more complex when we add the notion of enhancement features to the analysis. Let us illustrate the model with the feature [nasal], which is the SV enhancement feature when the SV node has no dependents. The Nasal Enhancement Rule is given in (9).

(9) Nasal Enhancement Rule (NER)

\[ SV \rightarrow SV \]

\[ \uparrow \]

[nasal]

The NER is a universal rule that operates at the end of the phonology when the phonological representation is input to the phonetic component.

There are two situations when the NER does not apply. First, it does not apply when SV has a dependent, since the structural description of the rule is simply not met. The more important situation arises when [nasal] is a distinctive feature of the language, and nasal sounds are thus minimally contrastive with some bare SV segment, generally realized as a voiced stop. In this case the NER is deactivated and will not supply the feature [nasal] to a segment specified with a bare SV node. We state this as the Enhancement Rule Deactivation Condition.

(10) Enhancement Rule Deactivation Condition 1

Enhancement rules cannot introduce distinctive features.

The result of a delinking process will therefore depend on whether a particular enhancement rule has been deactivated in the language under consideration. For example, if a language had a rule that delinked the Approximant node, the result would depend on whether the NER is active in the language. If [nasal] is a distinctive feature, the result of delinking should be a voiced stop; if [nasal] is not distinctive, the result should be a nasal sound.

Enhancement rules are taken to be similar, though not identical to default rules. We do not refer to them as default rules because they are restricted to operating at the end of the phonology. Thus, enhancement cannot introduce features that play a role in the phonology, a condition not generally associated with default rules. In this respect they are similar to the enhancement rules discussed by Stevens & Keyser (1989), where enhancement rules are seen as adding non-distinctive features to segments in order to make them distinct from others.

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1 Essentially the same claim is made in Dyck (1995). Charni (1995) presents a counterexample to this claim.
phonetically more salient. The notion of enhancement is extended here to a wide variety of features. I claim that each node has a universal enhancement feature. As enhancement features are part of the set of distinctive features that are the building blocks of inventories, any feature that is distinctive in a language is no longer available as an enhancement feature in that language. If an enhancement feature is distinctive, the enhancement rule associated with that feature must be deactivated. When an enhancement rule such as the NER has been deactivated, the feature [nasal] must be distinctive in the phonology. However, if the NER is active in the phonology, then the feature [nasal] is not distinctive.

A question that arises from this view concerns how the child acquiring a language could determine whether a potential enhancement feature is an active feature in the language or a feature introduced by an enhancement rule. Clearly, the unmarked case must be the situation in which the enhancement rule is active and the feature is inactive. This means that there must be some positive evidence that the feature in question is not an enhancement feature. The hypothesis I will pursue is that feature activation (and enhancement rule deactivation) is the result of the acquisition of contrasts in the inventory of the language. Again, the assumption is that the child starts with minimal structure and builds up the inventory of the language by adding structure to the segment along a developmental path determined by the universal segment structure (see Rice & Avery 1995 for an elaboration of this view). Thus, segments that are less marked, in the sense of structurally less complex, will be acquired first, and more marked segments will be acquired later. In the unmarked case all enhancement rules are active in the phonology and do not contribute to the acquisition of a contrast. If a child has the sounds /p/ and /m/ in her inventory, this reflects a distinction between an SV and a non-SV sound. Once a sound such as /b/ is introduced into the inventory, however, [nasal] is potentially a distinctive feature and the feature [nasal] could be underlyingly present on a sound such as /m/, resulting in the deactivation of the NER.

An interesting consequence of this view of enhancement is that the number of features a segment has specified at the underlying level will not necessarily reflect the markedness of that segment in the inventory. Consider the following representations of a nasal [m] and an SV [b].

```
(11)    [m]    [b]
    R          R
  Place   SV    Place   SV
                 Labial   [nasal]   Labial
```

In (11), the nasal [m] has more features than the voiced stop [b] by virtue of the presence of the feature [nasal]. However, in this case the presence of the SV sound [b] implies the presence of the nasal sound [m]. We would not expect the child to acquire the [b] first, because the turning off of an enhancement rule is a marked situation (see Rice & Avery 1995 for an explanation of the learning path).

Another illustration of this reasoning can be seen with the feature [strident], which is an enhancement feature on coronal fricatives such as [s] and [z]. The non-strident coronal fricatives [f] and [v] are much rarer in the
languages of the world even though they are 'simpler' in terms of feature count by virtue of the absence of [strident]. For the [r] and [l] to become part of the inventory of a language, however, the enhancement rule that adds the feature [strident] must be suppressed because it has become a distinctive feature of the language. This is shown in (12) and (13).

(12) Strident Enhancement Rule

(13) /s/, /o/ contrast

Again, this reverses the normal implicational relationship as the presence of the segment with more structure is required for the segment with less structure to be present. Markedness is usually seen in a rather different way, with the segment with the more structure being the more marked segment.

As the principal concern in this thesis is the representation of the sonorant consonants /n, r, l/, the consequences of this view will be illustrated with these segments. Before proceeding we should consider the enhancement rules that occur at the SV and Approximant nodes. We have already discussed the addition of [nasal] to a bare SV node, the NER. In our discussion of /r/-sounds, we implied that the enhancement rule at the Approximant node inserts the feature [lateral] as shown in (14).

(14) Lateral Enhancement Rule (LER)

Given the SV features available to distinguish sonorant sounds, there are four possibilities for the expansion of the SV node.

(15) The representation of sonorants

Segments

In (15a), the bare SV node can be phonetically realized as either a [d], [n], [l], or even [l], depending on whether the NER is active in the language and other factors. If [nasal] is a distinctive feature, the nasal sounds will have the feature [nasal] present underlyingly as in (15b). A bare Approximant node can be the representation for either [r] and [l], depending on whether [lateral] is distinctive, as shown in (15c). Finally, if [lateral] is distinctive, the representation for /l/ is as in (15d).

In chapter 4, we will examine a variety of data that support the representations of sonorant consonants in (15). In chapter 5, we will present an account of voicing in obstruents.
Chapter 3
Laryngeal Distinctions in Obstruents

In this chapter I discuss the representation of laryngeal features and the way that these interact with the SV node. A major component of this thesis is the justification of the category of "sonorant obstruents", i.e., voiced stops and fricatives that have an SV node. It is therefore necessary to investigate the representation of laryngeal distinctions among obstruents to show how such sonorant obstruents differ from laryngeal obstruents. In this chapter, I discuss the phonetic basis of the laryngeal features, detailing many of the problems that arise in both the phonetic description of laryngeal segments and in defining the mapping between phonological and phonetic representation. Then I survey the laryngeal systems found in the languages of the world, showing how these are built up from the basic laryngeal features.

3.1 Phonetic Dimensions of Laryngeal Distinctions

The proper characterization of laryngeal distinctions has long been controversial. The problem arises in large part because of the unstable phonetic cues that signal laryngeal distinctions. For example, phonetic researchers (see Lisker 1986; Kohler 1979, 1984; Keating 1984, 1990) have discussed the large number of acoustic and articulatory cues that serve to signal the voiced-voiceless distinction, claiming that these may include vocal fold vibration, duration, tenseness, glottal spreading or constriction, and articulatory force. Such diversity has made it difficult for phonologists to define features and to determine the precise nature of the relationship between phonological representation and phonetic implementation. Even the definition of a common feature such as [voice] is controversial. Some researchers define [voice] as actual vocal fold vibration, while others, including Chomsky & Halle (1968), consider [voice] to describe a glottal position. Such diversity need not be problematic if we consider features to be relative attributes of segments rather than absolute attributes. For example, Keating (1990: 326) takes the position that a phonological feature indicates the presence of a property to some unspecified degree. In the language-specific mapping between phonological representation and phonetic implementation, quantitative information is supplied. So, if we consider something like aspiration, it is at this language-specific level that the degree of aspiration is determined. At the phonological level, we simply mark the presence or the absence of aspiration with the appropriate feature.

In the case of voicing features it is probably best to treat the features as cover terms for a set of properties relevant to a particular phonological distinction. Thus, if voicing involves a set of cues, such as duration, tenseness, articulatory force and vocal fold vibration, then we should see voicing as a cover term for this variety of cues. We would then expect that some or all of these features would be present in the implementation of voiced consonants. However, the wide variety of cues leads to a good deal of redundancy in the acoustic signal, so that absence of one or more cues in the pronunciation of a given instance of a voiced segment should not lead to confusion. This view of features and feature implementation accords well with studies of voiced consonants as it appears that, in languages such as
English, the primary cue for voiced consonants is not vocal fold vibration, even though this is sometimes present (research on cues for voicing in English is reviewed extensively in Docherty 1992).

It is a basic tenet of phonology that the final phonetic representation is underdetermined by the phonological representation. For example, it is enough in most languages to state that /l/ is labial and to leave the further specification of this sound as labiodental to the phonetic component. Similarly, in most languages there is no contrast between an alveolar and a dental stop. It is thus not necessary to specify a sound such as /l/ as either alveolar or dental. In this way we have an inexact relationship between the phonological representation and the phonetic implementation. The phonological representation provides a general guide to the articulation of a segment, but the details are left vague (see also Steriade 1995).

There may be reasons why a language chooses one type of implementation over another. Consider the case of the coronal stops in English and Spanish. In English these stops are alveolar and in Spanish they are dental. There could be a variety of reasons behind the choices for the implementation of the stops in the two languages. It may be a question of dispersion in phonetic space, with Spanish maximizing the distinction between the coronal stops and the alveopalatal affricates by having a dental articulation for /l/. In English, on the other hand, it could be that the pronunciation of the stop at the alveolar place of articulation renders the production of aspiration that accompanies the voiceless stop simpler to implement. These considerations are not part of the linguistic system, though it is not inconceivable that they could ever an influence on that system over time.

In this chapter I follow Lombardi (1991) in assuming that only three monovalent laryngeal features are necessary to capture all the potential laryngeal contrasts found among the languages of the world: [spread glottis], [constricted glottis], and [voice]. In line with the position taken above on the phonetics-phonology mapping, Lombardi’s features account for the large number of phonetic distinctions that can be attributed to laryngeal mechanisms. Henton, Ladefoged and Maddieson (1992) (hereafter HLM) in a survey of the stop types found in the languages of the world list 12 different types. These types are summarized in (1).

(1) Stops of the world’s languages (adapted from HLM (1992: 67))

<table>
<thead>
<tr>
<th>1. Phonation type</th>
<th>2. Language examples</th>
<th>3. Laryngeal feature involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (preaspirated)</td>
<td>Icelandic, Gaelic</td>
<td>[spread glottis]</td>
</tr>
<tr>
<td>2. voiceless</td>
<td>most languages</td>
<td>[spread glottis]/O</td>
</tr>
<tr>
<td>3. aspirated</td>
<td>Danish, Thai</td>
<td>[spread glottis]</td>
</tr>
<tr>
<td>4. pulmonic (fortis)</td>
<td>Korean</td>
<td>[spread glottis]</td>
</tr>
<tr>
<td>5. breathy voiced</td>
<td>Hindi, Marathi</td>
<td>[spread glottis], SV</td>
</tr>
<tr>
<td>6. creaky voiced</td>
<td>Hausa, Mazatec</td>
<td>[constricted glottis]</td>
</tr>
<tr>
<td>7. stiff</td>
<td>Jingpho, Korean</td>
<td>[constricted glottis]</td>
</tr>
<tr>
<td>8. (voiceless) ejactive</td>
<td>Haida, Uduk</td>
<td>[constricted glottis]</td>
</tr>
<tr>
<td>9. voiceless implosive</td>
<td>Igbo</td>
<td>[constricted glottis]</td>
</tr>
<tr>
<td>10. voiced implosive</td>
<td>Igbo, Sindhi</td>
<td>[constricted glottis], SV</td>
</tr>
<tr>
<td>11. voiced</td>
<td>most languages</td>
<td>[voice]/SV/O</td>
</tr>
<tr>
<td>12. slack</td>
<td>Javanese, Wu</td>
<td>[voice]/SV</td>
</tr>
</tbody>
</table>

1 We ignore what HLM term prenasalized stops, affricates, nasally released stops, laterally released stops and long stops. None of these, with perhaps the exception of long stops involve contrasting laryngeal features.
The first column of the table lists the different phonation or airstream mechanisms responsible for the stop type and the second column provides an example of a language as given in HLM. In the third column of the table in (1), I have indicated the possible laryngeal feature or features involved in the implementation of the different consonant types. As pointed out by Lombardi (1991), no language ever contrasts more than six different types and thus there is a good deal of overlap in the HLM table. As an inspection of the third column reveals, many sounds that involve different phonation or airstream mechanisms from a phonetic point of view are representationally non-distinct. For example, the feature [spread glottis], which is phonetically defined as the abduction of the vocal folds and is interpreted to mean that sometime during the articulation of a [spread glottis] consonant the vocal folds will be spread, can be present in preaspirated consonants (row 1), plain voiceless consonants (row 2), voiceless aspirated consonants (row 3), pulmonic (fortis) consonants (row 4) and breathy voiced (voiced aspirated) consonants (row 5). Thus, [spread glottis] is the normal position of the vocal folds during the articulation of a voiceless consonant and is generally associated with aspiration. The feature [spread glottis] alone undergenerates the laryngeal distinctions found in (1). The different articulations should be seen as a result of different timing effects that are found in various languages. I follow Lombardi (1991) in treating these distinctions as phonetic rather than phonological, not requiring separate phonological representations. With respect to the phonetic implementation, researchers such as Kingston (1985), Keating (1990), and Steriade (1993) have proposed that in the phonetic representation of stop consonants we need to recognize two separate phases: closure and release. These two phases are never phonologically significant and thus do not need to be recognized as part of the phonological representation of stop consonants. Much of the variability in the realization of a feature such as [spread glottis] on stop consonants can be directly attributed to the possibility of associating this feature with either the closure or the release portion of a stop.

(2) Attachment of [spread glottis] to bipositional stops (phonetic)

a. STOP
   Closure Release
   Lar

b. STOP
   Closure Release
   Lar

   [spread glottis] [spread glottis]

In (2a), the Laryngeal node that dominates [spread glottis] is attached to the Release portion of the stop, an attachment that will yield an aspirated (voiceless) stop. If this Laryngeal node is associated to the Closure portion of the stop as in (2b), the stop is realized as fortis (and voiceless) or perhaps preaspirated. I will not detail the consequences of this theory for the overall view of segmental organization being proposed in this thesis. I only introduce this to show how in the phonetic implementation the same feature could have a variety of phonetic consequences without affecting the phonological representation.

The feature [constricted glottis] refers to the adduction of the vocal folds and is the laryngeal feature that is responsible for the various glottalized consonants found among the languages of the world, as can be seen in rows 6-10 of (1). As with [spread glottis], I assume that this feature could be associated with either the release portion or the closure portion of a stop as in (2).
yielding the ejectives and implosives, as well as the 'stiff' sounds found in languages such as Korean and Jingpho.

The final laryngeal feature is [voice]. As already discussed the phonetic correlates of voiced sounds are complex and appear to involve a variety of acoustic and articulatory cues. It is also my claim that voicing in obstruents has more than one source, that being through the feature [voice] or the bare SV node. As well, I would argue that in languages such as English, the voiced consonants are unmarked for Laryngeal features as well as SV features. It may be that sounds that involve the feature [voice] do display vocal fold vibration, but that sounds that are SV or have no Laryngeal features are those that do not have vibration. I leave this as an open question.

We also find two categories of sounds that involve the presence of a laryngeal feature and the SV node, the breathy voiced sounds of row 5 and the voiced implosives of row 10 in (1). These representations differ from those in Lombardi (1991) as in her system the laryngeal feature [voice] cross-classifies both [spread glottis] and [constricted glottis], giving breathy voiced and voiced implosive sounds, respectively. The SV representation of these sounds solves a problem that arose in Lombardi's analysis of Marathi and Bengali, languages that have both breathy voice sounds and a laryngeal neutralization process. The problem is that in syllable-final position aspiration but not voicing is neutralized. This means that for Lombardi a process that is normally completely general, that is, syllable-final laryngeal neutralization, must target particular features, in this case [spread glottis], and exclude other laryngeal features, in this case [voice]. The SV representation runs into no such difficulties as the SV node is independent of the Laryngeal node. Thus, a process that delinks a dependent of the Laryngeal node should not be expected to have any effect on the SV node, and this is indeed the case. Illustrative data from Marathi are given in (3).

(3) Marathi Neutralization (from Lombardi 1991: 128)

<table>
<thead>
<tr>
<th>a. tap  'fever'</th>
<th>b. tōp  'cannon'</th>
<th>c. vad  'discussion'</th>
<th>d. dud  'milk'</th>
</tr>
</thead>
<tbody>
<tr>
<td>tapala</td>
<td>tōp'ala</td>
<td>vadala</td>
<td>dud'ala</td>
</tr>
<tr>
<td>'to the fever'</td>
<td>'to the cannon'</td>
<td>'to the discussion'</td>
<td>'to the milk'</td>
</tr>
</tbody>
</table>

As can be seen the final neutralization found in the forms in (3b, d) only affects the aspiration. On the other hand, the voicing displays no alternations as shown in (3c, d). This is entirely unexpected in a system that allows the simultaneous presence of both [voice] and [spread glottis] under the Laryngeal node. Under the SV system, however, such facts are not unexpected, though the presence of both the SV node and the Laryngeal node on the same segment is a marked situation.

3.2 Laryngeal Oppositions

In chapter 1, I introduced the SV node, arguing that it serves to organize sonorant features such as [nasal] and [lateral]. I also argued that it is responsible for voicing in sonorants and suggested that the SV node could be responsible for voicing in some sounds that have traditionally been considered obstruents, such as the voiced stops /b, d, g/ and the voiced fricatives /β, ϑ, ɣ/, creating a class of sounds that may be termed 'sonorant obstruents' (see also Rice 1993; Piggott 1992). As the SV node is not intended to replace the feature [voice] in true obstruents, there are two distinct representations of voiced 'obstruent' sounds, as shown in (4).
(4) a. Laryngeal obstruent voicing | b. Sonorant obstruent voicing

\[
\begin{array}{c}
R \\
\text{[voice]} \\
\text{[voice]} \\
\text{Lar} \\
\end{array}
\]

\[
\begin{array}{c}
R \\
\text{SV} \\
\end{array}
\]

These two representations are justified by the phonological behaviour of the voiced obstruents in different languages. In a language where the voiced obstruents pattern with the voiceless obstruents in phonological processes, they have the representation in (4a). In a language where the voiced obstruents pattern with the sonorants, we have the representation in (4b). In languages that have the representations in (4a), there should be evidence for the feature [voice] in phonological processes such as spreading. On the other hand, in a language with the representation in (4b), there should be no evidence for the presence of the feature [voice]. However, in addition to the two phonological representations for voiced obstruent sounds in (4), I propose a third representation in order to capture the patterning of these sounds in different inventories. The voiced sounds need not pattern with either the obstruents or sonorants, but may also occupy a position intermediate between them. Using the sounds /p/, /b/ and /m/ as representatives of voiceless, voiced, and sonorant sounds, the patterning possibilities are outlined in (5). Voiced and voiceless sounds pattern together to the exclusion of nasals in (5a), voiced sounds and sonorant sounds pattern together to the exclusion of the plain voiceless sounds in (5b), and the intermediate position is shown in (5c).

(5) Different possibilities for the voiceless-voiced-sonorant opposition

\[
\begin{array}{l}
\text{a.} \quad \{p \ b \ m\} \\
\text{b.} \quad \{p\} \ {b \ m}\ \\
\text{c.} \quad \{p \ b \ m\} \ \text{AND} \ \{p\} \ {b \ m}\end{array}
\]

All of these patterns are found among the languages of the world and each displays different phonological properties. Traditionally, the differences among the systems have been attributed to the rule component. My account of the phonological properties of the different systems relies primarily on the representational component, the behaviour of the segments with respect to rules being in large part a consequence of representational differences. The proposed representations are given in (6), with irrelevant information omitted.

(6) Representations of the voiceless-voiced-sonorant opposition

\[
\begin{array}{l}
\text{a. Laryngeal Voice (LV) languages} \\
\quad \{p \ b \ m\} \\
\quad R \ R \ R \\
\quad \text{[voice]} \\
\quad \text{Lar} \ \text{Lar} \ \text{SV} \end{array}
\]

\[
\begin{array}{l}
\text{b. Sonorant Voice (SV) languages} \\
\quad \{p\} \ {b \ m}\ \\
\quad R \ R \ R \\
\quad \text{SV} \ \text{SV} \ \text{[nasal]} \\
\quad \text{Lar} \ \text{SV} \end{array}
\]
c. Contextual Voice (CV) languages

<table>
<thead>
<tr>
<th>p</th>
<th>b</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>r</td>
<td>r</td>
</tr>
<tr>
<td>Lar</td>
<td>SV</td>
<td></td>
</tr>
</tbody>
</table>

In (6), the sounds symbolized by /b/ display the most variation with respect to their phonological representation. These sounds have a Laryngeal node dominating the feature [voice] in the Laryngeal Voice (LV) languages of (6a), a bare SV node in the Sonorant Voice (SV) languages of (6b), and no specified voicing feature in the Contextual Voice (CV) languages of (6c) (often identified as voiceless unaspirated). We can see as well that the representation of the nasals also varies depending on whether they contrast minimally with the voiced sounds. The sounds represented by /p/ generally have a Laryngeal node present but there are cases where /p/ has the same representation as the voiced sounds in the CV languages, that is without any laryngeal representation.

Several predictions follow from the representations in (6). Only LV languages should display voicing assimilation through the spreading of [voice] because only in these languages is the feature [voice] active. LV languages may also display final devoicing, a process that results in the delinking of the feature [voice] in certain positions. Languages such as Russian and Dutch that display final devoicing and voicing spread fall into this category.

SV languages should not display interactions that are restricted to the traditional obstruent consonants, such as /p, b/. If these languages do have some type of voicing agreement, voiced obstruents and sonorants should behave as a natural class in the transmission of voicing. Moreover, these languages should lack final devoicing, a process that appears to be restricted to laryngeal dependents, as can be seen in the common restriction of devoicing to [sonorant] segments. Among the languages that have SV obstruents are many languages with nasal harmony, particularly those that display alternations between sounds such as /b/ and /m/. This is because the feature [nasal] is active in these languages, distinguishing among the SV segments. Note that it is only in SV type languages that we would expect to find spreading of the feature [nasal], as it is only in these languages that the feature is active. We also argue that languages such as Spanish, where alternations between voiced approximants and voiced stops are found, also have SV type obstruents. In these languages, the voiced fricatives are more 'glide-like' than consonant-like, since they are derived from SV type obstruents.

In the CV languages, sounds that surface as voiced consonants have neither an SV node nor a Laryngeal node. These segments receive their voicing value from the surrounding context, being fully voiced when in a fully voiced environment and partially voiced or voiceless in initial and final position or adjacent to a voiceless consonant. An important property of the contextually voiced segments is that they are phonologically inert. While they may undergo phonological processes involving voicing, they never act as triggers for phonological rules. An examination of final devoicing phenomena in CV languages will reveal that this does not involve the delinking of [voice], but rather is an additive process involving the insertion of a Laryngeal node. Languages such as Turkish, German and English fall into this category of languages. Turkish is discussed in some detail in §5.2.
An interesting result of the theory being proposed is that it can explain certain stop-fricative asymmetries with respect to voicing phenomena. I will argue in §5.1 that the voiced-voiceless distinction among stops in Dutch is typical of LV languages in that there is voicing spread and final devoicing. The fricatives, however, are part of a CV system: they undergo voicing agreement and are voiceless finally, but do not trigger voicing agreement, all properties expected of a CV system. A similar distinction is found in Turkish, except that I will argue there that the stops are part of a CV system while the fricatives display characteristics of SV voicing.

In this chapter I will review some of the typological characteristics of laryngeal distinctions. The theory is that the basis of all laryngeal systems should be one of the systems outlined in (6). If a language displays more than a two-way contrast, it should be possible to arrive at the system through the simple addition of a single structural element to one of the representations in (6). Thus, even though there is phonetically a large number of possible laryngeal systems, the actual number should be quite small and restricted by the structural choices available through the expansion of segment structure. Conversely, systems that may at first look phonetically identical may in fact belong to different structural types.

Before surveying the laryngeal systems, it is important to review some of the assumptions I will be making about the Laryngeal node (abbreviated Lar) and its dependents. First, I assume that the Lar enhancement rule in (7) applies to consonants with a bare Laryngeal node.

(7) Lar enhancement rule

\[
\text{Lar} \rightarrow \text{Lar} \\
\text{[spread glottis]}
\]

As discussed previously, the feature [spread glottis] is usually associated with aspiration, but whether there is any aspiration depends on whether the feature is a closure or release feature in the phonetic implementation. The difference between an aspirated and a fortis consonant merely reflects a difference in laryngeal timing rather than a phonological distinction, as all consonants with a bare Laryngeal node will receive the enhancement feature [spread glottis].

With respect to the relationship between the two Laryngeal dependents [voice] and [constricted glottis], it appears that most laryngeal systems select [voice] before [constricted glottis], indicating that [voice] is less marked in some sense. This would explain the predominance of voiced-voiceless languages over languages which display a voiceless-glottalized contrast. However, as will be shown below, part of the reason for the predominance of the voiced-voiceless distinction lies in the various sources for this distinction. As we shall see, in three-term systems [constricted glottis] appears to be frequently selected before [voice]. We return to this in our discussion of three-term systems.

One further assumption is that there is a cooccurrence restriction blocking the simultaneous appearance of SV and Lar as in (8). This blocks the spreading of either SV or Lar to a segment specified for the other.
(8) Lar-SV Constraint

\[ \text{R} \]
\[ \text{Lar} \quad \text{SV} \]

I assume the phonological representations in (9) for the six possible laryngeal segments, though as I will show, an investigation of the inventory may be required in order to determine the representation of some of the segments. I ignore place of articulation, focussing only on the Laryngeal and SV nodes.

(9) Representations of Laryngeal distinctions

\[
\begin{array}{ccccccc}
\text{R} & \text{R} & \text{R} & \text{R} & \text{R} & \text{R} & \text{R} \\
\text{Lar} & \text{Lar} & \text{Lar} & \text{SV} & \text{Lar} & \text{SV} & \text{Lar} \\
\text{[lg]} & \text{[lg]} & \text{[lg]} & \text{[lg]} & \text{[lg]} & \text{[lg]} \\
\text{/p/, /b/} & \text{/p/, /ph/} & \text{/b/} & \text{/p/} & \text{/b/, /mb/} & \text{/bh/} & \text{/b/} \\
\end{array}
\]

There are thus seven possible representations once the SV voiced segment is included. The significance of each of these representations will be established in the next section where I investigate the nature of laryngeal systems.

---

2 As we will see this constraint is violated in languages that have implosives, aspirated sonorants, or glottalized sonorants. However, this is not meant to be an inviolable constraint and the rarity of such sounds argues for its validity.

3.3 Typological Characteristics of Laryngeal Systems

This section reviews the laryngeal distinctions found among the 317 languages reported in Maddieson (1984), establishing both the range of variation found with respect to laryngeal distinctions, and any implicational universals that might emerge from a classification of the data. The language groupings are based on the number of laryngeal distinctions made in the inventory. A language with only a single obstruent consonant type, usually voiceless unaspirated, is referred to as a one-term system, a language with a contrast between two obstruent types, usually voiced-voiceless, is referred to as a two-term system, etc. We find that most (93%) of the languages in Maddieson have between one and three laryngeal terms, with the majority being two-term systems. The distribution is summarized in (10) for all 317 languages.

<table>
<thead>
<tr>
<th># of terms</th>
<th># of languages</th>
<th>% of langs in survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>51</td>
<td>16%</td>
</tr>
<tr>
<td>2</td>
<td>168</td>
<td>53%</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>24%</td>
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<tr>
<td>4</td>
<td>18</td>
<td>6%</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>&gt;1%</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>&gt;1%</td>
</tr>
<tr>
<td>Total</td>
<td>317</td>
<td></td>
</tr>
</tbody>
</table>

It should be noted in passing that there are a number of difficulties in using Maddieson's inventories. Some of the classifications are uncertain because a distinction may occur at only a single place of articulation, or the nature of the distinction may change from one place of articulation to another. In the majority of cases, the classification presents no insuperable difficulties as inventories do tend to be symmetrical. A potentially more serious problem concerns controversial analyses of some of these inventories.
For example, in the Spanish inventory, the stops are reported to be voiceless and the fricatives voiced. This makes it difficult to determine whether there is a voicing distinction or a manner distinction. Different linguists would make different phonemic distinctions. In some of these cases I have reclassified some of the sounds; these have been noted in the discussion below. Even with these difficulties, I think it is safe to draw conclusions concerning implicational relations when there are many inventories that agree on a certain property. Furthermore, there is enough clear data to circumvent the shortcomings of the few unclear inventories.

A further point to be borne in mind when examining laryngeal contrasts is that these contrasts are often restricted to the stops. The fricatives show far fewer distinctions than the stops, a matter taken up in the discussion of the phonetics of laryngeal distinctions.

Before proceeding to the summary of the data in Maddieson, a few notes on the way that the data has been classified. I have placed the preaspirates in languages such as Ojibwa together with aspirated consonants, and have put voiceless laryngealized consonants with the ejectives, and voiced laryngealized consonants with the implosives. This is plausible because there is never a phonemic contrast between preaspirates and aspirates or between ejectives or implosives and laryngealized consonants. The preaspirates and laryngealized segments are quite rare, as well. Following Lombardi (1991) I recognize six phonological distinctions along the laryngeal dimension: voiceless, voiced, voiceless aspirated, voiced aspirated, voiceless glottalized (ejective) and voiced glottalized (implosive). As representatives of the possible laryngeal distinctions I have chosen the labial stop symbols /p, b, pʰ, bʰ, p', b'/ (as in (9) above). In the charts I have included /m h/ even though I think that in most cases it represents an SV stop (see Piggott 1992). There appear to be languages that have both /b/ and /m h/, and keeping them separate allows me to distinguish between an LV voiced stop and an SV voiced stop. The charts thus include seven categories, discussed in turn below.

3.3.1 One-Term Systems

Maddieson (1984) gives 51 languages that do not appear to have any laryngeal distinctions. Many of these are Australian languages (14) but such limited laryngeal inventories are not restricted to this language group. In the Australian languages, the obstruent consonants are reported to fluctuate between voiced and voiceless. In an overview of the phonological characteristics of Australian languages, Blake and Dixon 1979 make the following statement:

Voicing is not phonologically significant in most Australian languages. ... The part voicing plays varies from language to language and even from speaker to speaker. In some languages the articulation of stops is natural in that there is little if any voicing in word initial position but regular voicing between vowels especially in syllables at a distance from primary stress. (p. 19)

This view is repeated in Dixon (1980) where he states that the voiced variants are usually found in intervocalic position and the voiceless variants word-initially. In the Australian language Yukulta (Keen 1983), stops are voiced when following nasals and either voiced or voiceless elsewhere. Walpiri, another Australian language, has stops that are said to be 'lightly' voiced following nasals and voiceless elsewhere except that bilingual speakers tend to voice stops intervocically (Douglas 1981). Occasionally, researchers report that the stops are always voiceless as in Pitta Pitta (Blake 1981).
Similar statements about other languages without a voicing distinction are found. One example is Tamil, where voiceless consonants are voiced between voiced sounds (Gupta 1990). Among the Yuman languages (Langdon 1975: 229) that do not show a voicing distinction, the stops are generally voiced intervocally but voiceless initially, though the precise conditions appear to vary slightly from language to language.

The preceding are all cases of what I call contextually voiced consonants. They arise when there is neither a Laryngeal node nor an SV node in the representation, and the consonants are voiced or voiceless according to the context in which they appear. It is possible to account for this through a rule, but given the variability and the gradient nature of the voicing process in these languages it is more likely that it is a case of 'phonetic interpolation' (see Cohn 1993). By 'phonetic interpolation' I mean that properties of surrounding sounds tend to be taken on by sounds that have no specification for that property. Thus, a consonant unspecified for either Laryngeal or $S\bar{V}$ properties that is surrounded by vowels or by sonorant segments may take on the voicing properties of those sounds as the voicing feature has no reason to turn off.

Not all languages without a voicing distinction have variably voiced stops as in the languages just described. There are reportedly languages without a voicing distinction in which the obstruents are always voiceless. According to Parke (1976), the voiceless consonants of Pawnee "...show no notable variations in different environments" (p. 14), despite the fact that Pawnee has no voiced-voiceless distinction. Similarly, in Ponapean, where there is no voicing distinction, the obstruents are always realized as voiceless and unaspirated (Rehg & Sohl 1981). This is unexpected if interpolation is considered to be an automatic process. In order to explain this apparent bifurcation of the one-term systems, I propose that languages like Pawnee and Ponapean, which do not show any voicing variation at all have a bare Laryngeal node. Thus, there are two possible representations of the obstruct consonants in languages without a voicing distinction. In those languages that display contextual voicing, there is no laryngeal representation and in those languages where there is an invariant voiceless consonant there is a bare Laryngeal node. These representations are given in (11).

(11) Voicing representations in one-term voice systems

\begin{align*}
\text{a. Contextual voicing} & \\
R & R \\
\text{b. Invariant voiceless} & \\
\text{Lar} & 
\end{align*}

The representation in (11a) is for the Australian type languages discussed by Dixon, and (11b) is for languages such as Ponapean and Pawnee. The absence of a Laryngeal node in (11a) is what allows for the phonetic interpolation of the voicing characteristics of the surrounding environment. The presence of the Laryngeal node in (11b) ensures that there will be no contextual voicing. As the Laryngeal default rule will insert the feature [spread glottis], the stops in these languages should surface as either voiceless unaspirated or as aspirated depending on the timing characteristics of the language in question.

One may wonder why there should be two possibilities for the representation of one-term voicing systems. What is the cue to the difference between the two language types and in particular how do these representations square with our theory of minimal distinctness in inventory
construction? It appears that in those languages that have invariant voiceless stops, the consonant inventory is especially small, with stops at only a few places of articulation, only one or two fricatives and a limited number of sonorants. For example, Pawnee has only 8 phonemic consonants /p, t, k, c, s, r, w, h/. With such a small inventory, very little structural information needs to be specified to distinguish among the segments. One hypothesis that may be worth pursuing is that the presence of the Laryngeal node is forced by something akin to a minimal weight requirement. That is, if there is too little information in the segmental representation, additional structure is needed to provide more substance. In the case of Pawnee, the absence of nasal consonants could also be a contributing factor. This can be compared to the situation in the Australian languages that have contextual voicing. In these languages we sometimes find six contrasting places of articulation, requiring the specification of a highly elaborated place structure. As the representations require such elaboration, the segments would not violate any minimal structure constraints. While this line of reasoning is attractive, any attempt to formalize such weight requirements is quite difficult given the present state of our understanding. Moreover, it appears that the problem of invariant voiceless vs. contextually voiced surfaces in more complex voice systems where there is a choice between a contextually voiced representation and one with a Laryngeal node present. An alternative to the 'weight' explanation may be that the Laryngeal node serves to mark these segments as obstructions, placing them in opposition to those segments without a Laryngeal node. Again the explanation requires further justification, a problem outside the scope of this thesis.3

It should be noted that under the SV hypothesis most of the one-term systems are really two-term systems, contrasting nasals and the voiceless obstruents. In these languages [nasal] is supplied by the nasal default rule so that in underlying representation the contrast is between a root node and an SV node, a contrast also found in two-term systems.

3.3.2 Two-Term Systems

The most common laryngeal system has a two-way contrast, most frequently reported as a distinction between voiced and voiceless segments. These are particularly important to us because we have proposed three ways to represent the voiced-voiceless distinction. Evidence for all three of these language types should be found by investigating the phonological processes of a variety of languages. There are 168 languages in Maddieson (1984) that have a two-way laryngeal distinction, as summarized in (12).

(12) Two-term voice systems

<table>
<thead>
<tr>
<th>Sound</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m,b</td>
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<td>x</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>f</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>17</td>
<td>15</td>
<td>11</td>
<td>7</td>
<td>2</td>
<td>168</td>
</tr>
</tbody>
</table>

An examination of the table in (12) reveals that the combinations are quite constrained. For example, there are no systems that contrast /b/ and /b/; indeed, there are no languages with /b/ and only 2 with /b/. Five of the six types of two-term systems are reported as having a plain voiceless sound, the framework she worked within makes direct comparison impossible. I assume that her notion of minimal complexity and the notion of minimal weight are logically equivalent.
only exception being systems reported to contrast voiced sounds with voiceless aspirated sounds (column 3). However, these languages are best analyzed as more properly belonging in either column 1 or column 2, depending on whether aspiration or voicing is the derived property. Given the Laryngeal default rule it is likely that these languages distinguish a bare Laryngeal node from bare Root node. The segment with the bare Laryngeal node may be realized as an aspirate after the Laryngeal default rule has filled in [spread glottis], and the segment with the bare Root node may be realized as a voiced segment through contextual voicing. One of the languages listed as contrasting /pʰ/ and /b/ is Turkish. In chapter 4, I argue that Turkish underlyingly has a distinction between a laryngeal segment and a non-laryngeal and is thus a CV language. Another language reported as having a voiced versus voiceless-aspirated distinction is German, which has also been analyzed as equivalent to a CV language (see Iverson and Salmons 1995). If all these languages turn out to have a voiced-voiceless or voiceless-voiceless aspirated distinction, then we could claim that all languages with a two-way voicing contrast have a plain voiceless sound. The overwhelming preponderance of languages with plain voiceless sounds acts as strong evidence for a theory that sees inventories as being built from least marked to most marked.

The small number of two-term languages with [constricted glottis] (column 5) indicates that this feature requires a larger inventory before coming into play. The two two-term languages with implosives, Maasai and Nyangik, are Eastern Sudanic, a group that includes some languages with a three-way distinction involving implosives. This could therefore be an areal feature. Further, there appears to be a tendency to produce voiceless stops with a degree of glottalization, without the glottalization feature playing a role in the phonology. Of the seven languages with ejectives, five are Northwestern Amerindian (Nez Perce, K'ekchi, Nootka, Squamish and Shasta) and all are closely related to languages that have a three term system with ejectives. The other two are Southern Amerindian (Ashuslay and Siona) and in both cases the sounds are described as laryngealized and not as ejectives. Again we could be seeing an areal tendency with respect to the implementation of voiceless stops: In any event these languages represent a marked case. The ejectives could be derived in the same way as the /b/ in LV languages. That is, rather than having the feature [voice] dominated by the Laryngeal node, we could have the feature [constricted glottis]. The minimal contrast is given in (13).

(13) A /p/ vs. /p'/ system

```
R     R
|     |
Lar   Lar
[constricted glottis]
```

As can be seen, the system in (13) is parallel to the voiced-voiceless distinction and marks these as LV languages. The relative rarity of such systems indicates that the unmarked path in LV languages involves the feature [voice].

Another system that merits some comment is the one that has a voiceless stop contrasting with a prenasalized stop. According to Maddieson, Apinayé is such a language with a two-way distinction involving a voiceless stop and a prenasalized stop. The inventory is given in (14).
(14) Apinayé Inventory

\[
\begin{array}{cccc}
\text{p} & \text{t} & \text{l} & \text{k} \\
\text{b} & \text{d} & \text{g} & \text{?} \\
\text{v} & \text{s} & \text{?} & \text{?} \\
\end{array}
\]

It is clear that in Apinayé the NER is inoperative, as there are no simple nasal consonants underlyingly. This could be because there are distinctive nasal vowels in the language. The ‘prenasalized’ stops are realized as plain voiced if surrounded by oral vowels, as pre- or post-nasalized when left- or right-adjacent to a nasal vowel and as completely nasal when surrounded by nasal vowels. Steriade (1993) provides the example reproduced in (15).

(15) Contextual realization of ‘prenasalized’ stops in Apinayé

\[
\begin{array}{ccc}
\text{V} & \text{b} & \text{V} \\
\text{V} & \text{n} & \text{b} & \text{V} \\
\text{V} & \text{b} & \text{m} & \text{V} \\
\text{V} & \text{m} & \text{V} \\
\end{array}
\]

The Apinayé system clearly involves a stop with a bare SV node and a stop with no Laryngeal features. The stop with a bare SV node assimilates to the nasalization of an adjacent vowel through the spreading of the feature [nasal] onto the SV node. Thus, Apinayé is an SV type language contrasting SV consonants with plain voiceless.

We may gain further insight into prenasalized stops if we consider a language such as Southern Barasano, described in Smith and Smith (1971). As in Apinayé, there are no phonemic nasals in Southern Barasano, but unlike Apinayé, the prenasalized stops in Southern Barasano freely alternate with voiced stops word-externally.

(16) Prenasalized stops in Southern Barasano

\[
\begin{array}{ccc}
\text{wa} & \text{mba} & \text{wa-ba} \\
\text{\textit{come'}} \\
\text{mba} & \text{гон} & \text{mbа-gо} \\
\text{\textit{enter'}} \\
\end{array}
\]

The realization of an SV segment as a prenasalized stop is not an infrequent phenomenon. Piggott (1992), arguing from a different perspective concerning the nature of the SV node, has proposed that a bare SV node is always phonetically implemented as a prenasalized stop. If we consider the realization of an SV node as a prenasalized stop to be an optional realization, then we can explain the variation found in Southern Barasano as alternate implementations of the SV node.

It would thus appear that most of the languages in the voiceless stop prenasalized stop category should be classified as SV type languages. The difference between these and other SV type languages is that the SV node is implemented as a prenasalized stop rather than as a plain voiced stop or a plain nasal consonant. Such systems could be transitional, moving towards the creation of a system with voiceless stops, voiced SV stops and nasals, or they could be one of the expected outcomes in languages with distinctive nasal vowels, as appears to be the case in Apinayé, at least.

3.3.2.1 Reclassification of the two-term voice systems

In this section I will reorganize the table in (12) taking into account some of the previous comments on the nature of the two-term systems found in Maddieson. If we ignore the two languages that have implosives, reclassify the voiced versus voiceless-aspirated languages in column 3 of (12) as belonging in column 2, and reclassify the languages with prenasalized stops

\[\text{4}\text{This is somewhat arbitrary as they could also belong in column 1. However, it is possible that many of the languages in column 1 belong in column 2.}\]
as phonetic realizations of SV, so that they belong in column 1, then we have the chart in (17).

(17) Reclassification of two-term voice systems

<table>
<thead>
<tr>
<th>Sound</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ph</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>m b</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ph'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>127</td>
<td>32</td>
<td>7</td>
<td>166</td>
</tr>
</tbody>
</table>

Hidden in column 1 are three different possible representations as LV, SV and CV languages. The languages represented by column 2 are CV languages and those in column 3 are alternative LV languages. Statistical information on the breakdown of the languages into LV, SV and CV types must await further research; however, when we study the three-term systems we find that there is evidence that all three types exist and that all three can be seen as the basis for the expansion of a laryngeal inventory.

3.3.3 Three-term systems

While most of the languages in Maddieson’s sample have a two-way laryngeal contrast, there are 76 languages with a three-way contrast. The variety is much greater than that found among the two-term systems, but several generalizations emerge that are consistent with our theory of segmental elaboration. The table in (18) summarizes the classification of the three-term inventories.

(18) Three-term voice systems

<table>
<thead>
<tr>
<th>Sound</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>b</td>
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<td></td>
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<td>ph</td>
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<td>p'</td>
<td></td>
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<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
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<td>x</td>
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<tr>
<td>ph'</td>
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</tr>
<tr>
<td>Total</td>
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<td>18</td>
<td>12</td>
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</tbody>
</table>

Some of the data for languages in (18) have been reclassified, based in part on the reclassification of the two-term systems in the previous subsection. For example, 5 languages were reported as having /b, p', ph/. These could have been reclassified as /p, p'h, p'/ or as /p, b, p'/, depending on whether the /b/ or the /p'h/ represents the least marked segment. I have placed them in the /p, b, p'/ column as this system is most easily derived from an LV system, though arguments could be made for placing them in the /p, p'h, p'/ column as well. The two languages with a /p, p'h, mb/ opposition have been added to the /p, p'h, b/ column based on discussion of prenasalized stops in the previous section. One of these languages, Hakka, has no nasals in the inventory, providing strong evidence that the sounds represented as /mb/ are SV segments. Interestingly, only three of the languages with a three-way distinction are reported as having prenasalized stops. Wapishawa is reported as /p'h, b, b'/ and has been classified as /p, b, b'/, Berta, reported as /b, p', mb/, has been classified as /p, p', b/. This could be an error because Berta is unusual in having ejectives at the labial and velar places of articulation, but implosives at the alveolar place. I have taken the ejectives as basic, but the fact that many languages related to Berta have implosives may indicate that it is actually a /p, b, b'/ language. Maidu which is reported as /p'h, p', b/ has been
reclassified as /p, p', b/ in accord with the statements in Shipley (1964), still a highly unusual system.

One language, Changchow, defies classification. This language reportedly has a distinction between voiceless unaspirated, /p/, voiceless aspirated, /p'/, and voiceless aspirated with breathy release, /p̩/'. I am satisfied to leave Changchow aside as a highly marked system.

An investigation of the three-term systems shows four main groups, all of which have a plain voiceless consonant. As with the two-term systems there are no voiced aspirates, but unlike the two-term systems, we now have a significant number of ejectives and implosives. Three of the languages have a /p, b/ distinction to which is added either an aspirated segment, an ejective or an implosive. Given the variety of sources we claim for the /p, b/ distinction, we should consider what the possible representations are for the three-term laryngeal systems, bearing in mind that they must be built from the available two-term systems. We will look at each system in turn.

An L.V system begins with two terms, as in the left side of (19). The only possible elaboration of the L.V system is given on the righthand side of (19). As additions to inventories must involve the addition of structure and cannot involve the loss of structure, the addition of a segment with a bare Root node is ruled out.

(19) Expansions of L.V

<table>
<thead>
<tr>
<th>Basic System</th>
<th>Expansion</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>/p(b), b, p' /</td>
</tr>
<tr>
<td>Lar</td>
<td>Lar</td>
<td></td>
</tr>
<tr>
<td>[voice]</td>
<td>[glott]</td>
<td></td>
</tr>
</tbody>
</table>

The SV system, shown in (20), requires the presence of the SV node. The Laryngeal node, indicated by the parentheses in (20), is not contrastive and therefore cannot act as a building block for the system.

(20) Expansions of SV

<table>
<thead>
<tr>
<th>Basic System</th>
<th>Expansions</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>/p, b, b'/</td>
</tr>
<tr>
<td>(Lar)</td>
<td>SV</td>
<td></td>
</tr>
<tr>
<td>Lar</td>
<td>SV</td>
<td></td>
</tr>
</tbody>
</table>

The only way to expand on the SV system is through an amalgamation of the two segment types and the addition of the Lar node. Expanding SV would involve the addition of the feature [nasal], not a laryngeal segment and likely already present. The Lar-SV constraint in (8) rules this representation out in many languages; it does, however, appear that an SV segment with laryngeal features is permitted in the marked case, indicating that the constraint is a soft constraint probably related to complexity. Note as well that the Laryngeal enhancement rule must be changed when the Laryngeal node is attached to an SV segment. Rather than inserting the feature [spread glottis], it instead inserts [constricted glottis]. We give the revised Laryngeal enhancement rule in (21).
(21) Lar-SV enhancement rule

The enhancement rule in (21) reflects the fact that there are many more implosives than there are voiced aspirates. That the implosives are themselves marked sounds is reflected in the violation of the Lar-SV constraint.

We now turn to the expansion of the two-term CV system. Unlike the L,V and SV languages, CV systems have three possibilities for expansion rather than just one.

(22) Expansions of CV

<table>
<thead>
<tr>
<th>Basic System</th>
<th>Expansions</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>a, R</td>
<td>i. /p, p', b/</td>
</tr>
<tr>
<td>R</td>
<td>b, R</td>
<td>ii. /p, p', b'/</td>
</tr>
<tr>
<td>Lar</td>
<td>SV</td>
<td>iii. /p, p', p'/</td>
</tr>
<tr>
<td>Lar</td>
<td>Lar</td>
<td>[voice] [lg]</td>
</tr>
</tbody>
</table>

The three different possibilities for expansion of laryngeal contrasts are the addition of an SV node as in (22a), the addition of the feature [voice] as in (22b), or the addition of the feature [constricted glottis] as in (22c). The first two expansions result in systems that are phonetically very similar but which should have phonological differences identical to those found between SV and L,V languages. The third expansion yields a system without a voiced segment (22iii). There is a relatively free choice in this three-term system to expand through the addition of the feature [voice] or the feature [constricted glottis]. Recall that in our discussion of the two-term systems that had a /p, p'/ contrast, we said that this appeared to be a marked option. While there are relatively few languages that display this contrast among the two-term systems, it does appear to be more frequent in the three-term systems, indicating that languages can select either [voice] or [constricted glottis] when they are expanding laryngeal distinctions.

The presence of glottalized consonants in the three-term systems allows for more variety in inventories. As with the two-term systems, however, all the three-term systems appear to be constructed from a plain voiceless segment and expanded along a few different dimensions.

3.3.4 Four, five and six-term systems

Though relatively rare, four, five and six-term voicing systems exist among the languages of the world. In (23), I give a summary of the four-term systems found in Maddieson (1984).

(23) Four-term systems

<table>
<thead>
<tr>
<th>Sound</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>p'</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>[h]p</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[h]</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>18</td>
</tr>
</tbody>
</table>

In the four-term systems, we see the first appearance of a voiced aspirate, a sound that only occurs in one subtype. The phonetic properties of these
sounds has caused a good deal of debate as phoneticians have been reluctant to admit that both vocal fold vibration and aspiration are involved in the production of a sound (Ladefoged 1973). However, following the work of Dixit (1975; 1989), most phoneticians, including Ladefoged, have accepted that this is an accurate description of the sounds.

The systems involving the voiced aspirates are seemingly of a different type from the systems discussed so far. Rather than being incremental, these appear to be parallel. That is, the voiced-voiceless opposition is established and when a new feature is added, in this case aspiration, it applies to both segments. There are three languages that display this type of parallelism with the feature [constricted glottis] found in column 3 of (23).

All of the systems, with perhaps the exception of the one in column 7, can be easily derived from the three term systems outlined in the previous section. I include these here only for the sake of completeness. We have briefly discussed the nature of the systems in column 1 (Bengali and Marathi), but for the most part will not be concerned with the four-, five- and six-term systems.

3.3.5 Summary

In this chapter I have attempted to establish that the laryngeal systems found among the languages of the world are the result of the addition of a small number of features to the basic segmental tree. The increments to the segmental representation that occur as a result of expanding an inventory along the laryngeal dimension are governed by universals of segmental organization. Furthermore, they are driven by a requirement that segments added to an inventory create a minimal contrast with some other segment in the inventory. Universal enhancement rules add features to segments resulting in the violation of minimal contrast, but features added by enhancement rules cannot play a role in the phonology and are not present in the phonology. The use of minimal contrast and unary features allows us to characterize marked and unmarked segments directly, if we define markedness as the presence of structure in one segment that is not present in another segment. However, as discussed in chapter 1, there is also an implicational definition of markedness; that is, the requirement that one segment be present in an inventory before another can be. In this case the marked segment may be the one with fewer features.
Chapter 4
SV as a Node in Segment Structure

In Chapter 1, I argued that sonorant segments, i.e., nasals, laterals and rhotics, interact in phonological rules in a way that suggests that the features that distinguish these segments should all be grouped under the same organizing node. Following standard practice in the feature geometry literature, evidence for an organizing node comes from the behaviour of that node in phonological processes (see Clements 1985; McCarthy 1988). As organizing nodes are expected to participate in processes such as spreading and delinking, in this chapter I will present evidence that the SV node does indeed participate in spreading and delinking processes.

In (1) the structure of the SV node is provided. Recall that I argued that [nasal] is the unmarked SV feature and is thus often absent from underlying representations.

(1) Root
    SV
    | [nasal] Approximant | [lateral]

4.1 SV Delinking

An investigation of the structure in (1) reveals that the delinking of the SV node should produce a voiceless obstruent. In the next two subsections, data from Kuman and Yagaria will be presented that bear this prediction out. In chapter 6, several Turkic languages will be analyzed that also show an alternation between an SV segment and a voiceless consonant, lending further support to the SV hypothesis.

4.1.1 Kuman

Blevins (1994) discusses a set of rules involving the lateral in Kuman, a Papuan language. One of the rules is a process of SV delinking, where an underlying /l/ is realized as a surface [l] when it is adjacent to an alveolar nasal as shown in (2) (data from Blevins 1994).

(2) yobul-na → yobutna 'bone 1st sing.'
yal-nga → yalnga 'plant 2nd sing.'

The underlying inventory of Kuman is given in (3).

(3) Underlying consonants of Kuman
   p  t  k
   b  d  g
   s
   m  n  l
   w  y

As there is no contrast between underlying /l/ and /l/, I assume that the Lateral Enhancement Rule (LER) is active in Kuman and that the lateral has

---

1 Many of the analyses presented in §4.1-3 are revised versions of work that appeared in Rice and Avery (1989, 1990, 1991).
only an Approximant node underlyingly. The contrast between /l/ and /d/ appears to be marked as the underlying presence of SV on the /d/. This means that the /l/ has only a bare Root node. The change from /l/ to [l] is accomplished through the delinking of the SV node of the /l/ when it is adjacent to another SV node\(^2\). Once SV is delinked, the consonant is realized as the default coronal [l]. A derivation is given in (4).

(4) \ /y o b u l - n a/ \[y o b u t n a/ \]
    \ R R \ \rightarrow \ R R \ \text{Delink SV} \ \text{SV} \ \text{SV} \ \text{Approx [nasal]} \ \text{[nasal]}

Note that when the SV node is delinked, the resulting segment is [l] and not [d]. This is the expected result given that the features involved in voicing and those involved in sonorancy are independent. There is no need to claim that the SV delinking rule applies prior to the rule that fills in the voicing feature on sonorants as there is no such rule.

4.1.2 Yagaria

Another language discussed in Blevins (1994) is Yagaria, an East New Guinea Highlands language. In the Move dialect we again find sonorant-voiceless obstruent alternations. In Yagaria we find that not only does the sonorant /l/ alternate with [l], but /o/ alternates with [p], /m/ alternates with [b], and /y/ alternates with /g/. In the /l-t/ /o-p/

alternations, we clearly have a shift in sonority, involving the delinking of the SV node. Some examples are provided in (5)\(^3\).

(5) /l-\t/ alternations (from Blevins 1994: 315 ex. 12)

<table>
<thead>
<tr>
<th>UR</th>
<th>SR</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>/-lata/</td>
<td>'DUAL'</td>
</tr>
<tr>
<td>(b)</td>
<td>/bade-lata/</td>
<td>badelata</td>
</tr>
<tr>
<td>(c)</td>
<td>/at-lata/</td>
<td>atata</td>
</tr>
<tr>
<td>(d)</td>
<td>/-lo?/</td>
<td>'ADJECTIVE'</td>
</tr>
<tr>
<td>(e)</td>
<td>/gapa-lo?/</td>
<td>igopalo?</td>
</tr>
<tr>
<td>(f)</td>
<td>/gipa-lo?/</td>
<td>gipato?</td>
</tr>
</tbody>
</table>

(6) /b-\t/ alternations

<table>
<thead>
<tr>
<th>UR</th>
<th>SR</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>/-b?/</td>
<td>'LOCATIVE'</td>
</tr>
<tr>
<td>(b)</td>
<td>/igpata?/</td>
<td>'into the land'</td>
</tr>
<tr>
<td>(c)</td>
<td>/jipa-\t?/</td>
<td>'into the house'</td>
</tr>
</tbody>
</table>

The inventory of Yagaria is given in (7).

(7) Yagaria Inventory

<table>
<thead>
<tr>
<th>p</th>
<th>t</th>
<th>k</th>
<th>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>d</td>
<td>G</td>
<td>h</td>
</tr>
<tr>
<td>m</td>
<td>n</td>
<td>l</td>
<td>y</td>
</tr>
</tbody>
</table>

\(^2\) The precise conditions under which this rule applies are somewhat obscure but the requirement seems to be that the /l/ and the following SV segment not differ with respect to place of articulation.

\(^3\) Abstract away from the issue of the place of articulation of the laterals. On the surface the laterals are dorsal. Levin argues, based on the lateral-\t alternations, that they are underlyingly Coronal but realized as Dorsal through the operation of a default rule.
As in Kuman, there is no /r/ in the inventory, and the lateral can be represented as a bare approximant node. The conditioning factor in the process is the syllable final glottal stop, which is later deleted. The account is exactly the same as for Kuman. In the case of /l/ → [l], we delink the SV node of the /l/. In the case of the /p/ → /p/ alternation, we only need to assume that the glide /p/ is a labial SV segment and that the delinking of the SV node creates a [p]. The alternations between /m/ and /b/ and /y/ and /g/ are somewhat puzzling from our perspective as we should expect [p] and probably [k], respectively. However, Levin states that she could only find two examples of the /y-g/ alternation and she provides only one of the /m-b/ alternation, suggesting that there could be other factors involved. It is possible that the [b] and the [g] are plain SV segments rather than laryngeally voiced segments, meaning that in the case of /m/ and /y/, the SV node is not delinked. More data would be required to clarify matters.

4.1.3 Summary

The existence of processes that delink the SV node as in Yagaria and Kuman strongly support the hypothesis that SV is a node in the segment structure. It allows for an elegant account of desonorization, through the independently motivated process of delinking. In the next section, we will see that the SV node can also transmit sonorancy to a neighboring segment. In chapter 6, I present numerous examples of SV delinking from several Northern Turkic languages.

4.2 SV Spreading

In the following section data from Korean are presented to show that the SV node can spread. This should be taken in conjunction with the Spanish data presented in chapter 1, where it was shown that the process of /ś/-voicing is best analyzed as the copying of the SV node of a neighboring sonorant consonant. These data further support the argument that SV is a node in the segmental tree.

4.2.1 Korean SV spreading

Korean has a process of nasalization in which stops assimilate in nasality to a following nasal segment as shown in (8). (Data from Cho 1988, 1990; Iverson and Kim 1987; Iverson and Sohn 1992)

(8) a. kukmul → kumul 'soup'
b. kakhok → kakhok 'stick'
c. napnpa → namnna 'sprout'
d. kahni → kanni 'Is it the same?'

According to Sohn (1987), Korean has the consonant inventory shown in (9).

(9) Korean consonant inventory

| p, pʼ, ph | t, tʼ, th | c, cʼ, ch | k, kʼ, kh |
| m | n | l (r) |

Sohn posits that /r/ is phonemic in certain verb forms where it alternates with [l]; however, it is in complementary distribution with /l/ and I assume that the feature [lateral] is not active in Korean. The absence of voiced obstruent stops and fricatives indicates that the NFR applies in Korean, the nasal consonants thus being represented with a bare SV node. Given these
representations for the nasals the derivation of the forms in (8) would be as in (10).

\[
\begin{array}{cccc}
/k/ & /m/ & /n/ & /m/ \\
\text{R} & \text{R} & \rightarrow & \text{R} & \text{R} \\
\text{Place} & \text{SV} & \text{Place} & \text{Place} & \text{SV} \\
\text{Dorsal} & \text{Labial} & \text{Dorsal} & \text{Labial}
\end{array}
\]

After the spreading of SV, both segments are realized as nasals as the NER applies. Note that the place of articulation remains unchanged.\(^4\)

A lateral preceded by a coronal obstruent displays the same behaviour as a nasal, as can be seen in the form in (11).

\[(11) \quad \text{tikiiil} \rightarrow \text{tikiiil} \quad \text{tikiiil} \quad \text{the letters t and l}'\]

In this case, the SV node of the /l/ spreads to the left, yielding a geminate /ll/. As Korean only has a single liquid, I represent /l/ as a bare Approx node, with [lateral] being the default enhancement feature in some contexts.\(^5\)

\[
\begin{array}{cccc}
/l/ & /l/ & /l/ & /l/ \\
\text{R} & \text{R} & \rightarrow & \text{R} & \text{R} \\
\text{SV} & \text{SV} & \text{SV} & \text{SV} \\
\text{Approx} & \text{Approx}
\end{array}
\]

When a consonant other than the coronal /l/ precedes the /l/, the surface form has two nasals rather than two liquids.

\[
\begin{array}{cccc}
\text{kuk-lak} & /\text{kuk-nak} & /\text{paradise} \\
\text{tsap-luk} & /\text{tsam-nok} & /\text{a miscellany}
\end{array}
\]

The spreading process still takes place as shown in (14).

\[
\begin{array}{cccc}
/p/ & /l/ & /l/ \\
\text{R} & \text{R} & \rightarrow & \text{R} & \text{R} \\
\text{Place} & \text{SV} & \text{Place} & \text{SV} \\
\text{Labial} & \text{Approx} & \text{Labial} & \text{Approx}
\end{array}
\]

The result of this process is an ill-formed segment, a labial liquid. When this ill-formed structure arises, a minimal repair can be effected by delinking the Approx node. The NER then applies inserting [nasal]. The result is two nasal segments rather than two laterals. In (15), the derivation after the initial application of SV spread is continued.

\[
\begin{array}{cccc}
/p/ & /l/ & /l/ \\
\text{R} & \text{R} & \rightarrow & \text{R} & \text{R} & \rightarrow & \text{R} & \text{R} \\
\text{Place} & \text{SV} & \text{Approx} & \text{SV} & \text{SV} & \text{SV} & \text{SV} \\
\text{Labial} & \text{Approx} & \text{Labial} & \text{Labial} & \text{Labial} & \text{Labial}
\end{array}
\]

The process of SV spreading in Korean provides evidence for an SV node dominating features such as [nasal] and Approximant, and also illustrates the independence of SV from the Root node. If [sonorant] were a constituent of the Root node, as in McCarthy (1988) or Clements and Hume (1994), then the analysis would require two separate rules, one spreading [nasal] as in (16) and the other spreading [lateral] as in (17). Furthermore, there would have to be a

---

\(^4\) Cho (1990) also discusses a process of spirantization: /kat-sol/ $\rightarrow$ [kсол]. I assume that this process is related to the SV spreading in the sense that both processes involve spreading in the same environment, but not spreading of the same features.

\(^5\) Place is underspecified in both /l/ and the /ll/; see Avery and Rice 1989.
rule that changed the value of the feature [sonorant] in the assimilating obstruents.

(16) /p/ /n/ 
[+son] [+con] → [+son] [+con] 
Place [nasal] | Place [nasal] 
Labial | Labial

(17) /l/ /l/ 
[+con] [+son] → [+con] [+son] 
Place [lateral] | Place [lateral] 
Labial | Labial

4.3 SV Assimilations

In languages that have a contrast only between voiceless segments and sonorants, [nasal] is absent and the NER is active. These are the languages that typically display within-sonorant assimilations. In the following sections we review sonorant-sonorant assimilations in several languages, presenting evidence for the proposed model of segment structure and in particular supporting the SV hypothesis.

4.3.1 Ponapean

Ponapean has the inventory in (18) (from Rehg & Sohl 1981).

(18) Voiceless

<table>
<thead>
<tr>
<th>Labial</th>
<th>Coronal</th>
<th>Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voiceless</td>
<td>p, p̂</td>
<td>t</td>
</tr>
<tr>
<td>Voiced</td>
<td>m, m̂</td>
<td>n</td>
</tr>
</tbody>
</table>

Rehg and Sohl (1981) characterize the non-sonorants in Ponapean as voiceless and the sonorants as voiced. The representation of Ponapean nasals, liquids and obstruents are shown in (19).

(19) a. nasal b. liquids c. obstruent

<table>
<thead>
<tr>
<th>R</th>
<th>R</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV</td>
<td>SV</td>
<td>(Laryngeal)</td>
</tr>
<tr>
<td>Approx</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One or two comments are necessary. As discussed in chapter 3, the Ponapean obstruents never surface as voiced, probably because the Laryngeal
node is present. With respect to the liquids, the /t/ of Ponapean may be a [continuant] /r/, meaning that the feature [lateral] does not have to be specified on the /t/. In any case, the facts are somewhat uncertain and as our central interest in the Ponapean lies in the nasals and laterals we leave this issue unresolved. However, as there are no voiced consonants to create a minimal contrast with the nasals, we can safely assume that the NER is active and that a bare SV node surfaces as a nasal.

As might be expected given the inventory, there is phonological evidence that [nasal] is not present in underlying representation. In rapid speech in Ponapean, /n/ assimilates to /l/, as illustrated in (20).

(20) nan-leng → nléng ‘heaven’
   pan lingan → pléngan ‘will be beautiful’

We can account for this assimilation if we assume that the Approximant feature of the /l/ spreads to the bare SV node as in (21).

(21)  n   |   l   |   l   |   l   |   R   |   R   |   R   |   R   |
      |   |   |   |   |   |   |   |
      SV  SV  Spread  SV  SV  Approx  Approx

Ponapean provides especially strong support for the underspecification of [nasal], because /l-n/ sequences do not display assimilatory behaviour. If [nasal] were to be specified and the rule spread SV dependents regardless of the specification of the SV segment on the left, we would expect to find an /l-n/ sequence surface as [n-n]. On the other hand, if [nasal] is unspecified, there can be no spreading in /l-n/ sequences as /n/ has no features to spread, as shown in (22).

(22)  l   |   n   |
      |   R   |   R   |
      SV  SV  Approx

A further argument for the default nature of [nasal] in Ponapean comes from a process referred to by Rehg and Sohl (1981) as ‘nasal substitution’. When two homorganic non-coronal obstruents come to be adjacent through morpheme concatenation, they undergo a process that fuses the Place nodes of the adjacent segments (110 1986). However, the first of the two fused segments surfaces as a nasal. This is illustrated in (23) (from 110 1986: 137).

(23) a. /kehp-m°ot/ → k°ehm°m°ot ‘variety of yam’
b. /ep-p°oatol/ → e°m°p°oatol ‘game’
c. /asp°-paa/ → sampaa ‘world, earth’
d. /ak-keetli/ → a°kkeetli ‘demonstrate strength’

If [nasal] were a specified feature in the phonology, one would not expect [nasal] to be inserted in this fashion. We would only expect to see nasalization through spreading. Note that there is no local phonetic motivation for the insertion of [nasal] in (23b-d) so there is no question of the feature spreading from an adjacent segment. Clearly nasal substitution is triggered by sonority requirements on rhyme consonants. If those requirements are satisfied by the insertion of an SV node, then the NER can.
apply giving the effect of nasal substitution. Nasal substitution thus provides another clear argument in favour of the underspecification of the feature [nasal] and its insertion through the NFR.

4.3.2 Toba Batak

A variety of sonorant-sonorant assimilations are found in Toba Batak. Before describing these, we first consider the representation of sonorants and obstruents. The phonemic consonant inventory of Toba Batak is given in (24) (from Hayes 1986).

(24) Toba Batak consonant inventory (Hayes 1986: 478)

<table>
<thead>
<tr>
<th>Voiceless stops</th>
<th>Bilabial</th>
<th>Alveolar</th>
<th>Palato-Alveolar</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voiceless affricate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voiceless continuants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m</td>
<td>n</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>r, l</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hayes states that the phonemic status of /h/ is unclear as it could also be derived from /k/ through a weakening process. More importantly, however, we find voiced stops in Toba Batak, a situation that could force the presence of the feature [nasal] on the nasal consonants if the voiced stops are represented with a bare SV node. Alternatively, Toba Batak could have a Laryngeal system which does not affect the SV consonants. Rice & Avery (1991) and Avery & Rice (1992) argue that there are phonological cues to the difference between the SV systems and Laryngeal systems. The assumption is that syllable-final devoicing is universal and characteristic of Laryngeal voice systems, whereas in languages with SV voicing, syllable-final devoicing should not be a categorical rule. (Fuller discussion of this hypothesis is presented in chapter 5.) Rice & Avery's hypothesis concerning syllable-final devoicing implies that Toba Batak has a Laryngeal system. There is no active rule devoicing final stops, but voiced stops do not occur syllable-finally. Hayes gives an exhaustive list of the possible transyllabic clusters and, among the coda consonants, there are voiceless stops, nasals and liquids, but crucially no voiced stops. Thus, we classify Toba Batak voiced consonants as laryngeal and not SV, meaning that [nasal] is not specified on the nasal consonants.

With respect to the sonorants, Toba Batak has /n/, /l/ and /ɾ/ in its phonemic inventory. The representations for these three segments are given in (25).

(25)  

<table>
<thead>
<tr>
<th>/n/</th>
<th>/ɾ/</th>
<th>/l/</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>SV</td>
<td>SV</td>
<td>SV</td>
</tr>
<tr>
<td>Approx</td>
<td>Approx</td>
<td>[lateral]</td>
</tr>
</tbody>
</table>

Evidence that these are the correct representations comes from the sonorant-sonorant assimilations outlined in (26).
(26) Sonorant-sonorant assimilations in Toba Batak

<table>
<thead>
<tr>
<th>G2</th>
<th>n</th>
<th>r</th>
<th>l</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>nn</td>
<td>rr</td>
<td>II</td>
</tr>
<tr>
<td>r</td>
<td>RR</td>
<td>rr</td>
<td>II</td>
</tr>
<tr>
<td>l</td>
<td>ln</td>
<td>ll</td>
<td>II</td>
</tr>
</tbody>
</table>

The /n-n/, /r-r/ and /l-l/ sequences require no comment. The /n-r/ and /n-l/ sequences involve spreading of Approximant node of the righthand segment onto the unspecified SV node to its left. No assimilation occurs in /l-n/ or /r-n/ because /n/ has no dependent to spread and the SV node to its left already has dependents, as previously discussed with respect to Ponapean.

The liquid-liquid assimilations are precisely what is expected given the representations of /r/ and /l/. In /r-l/, [lateral] spreads from the /l/ to the empty Approximant node of the /r/, yielding [l-l]. Assimilation in /l-r/ sequences is untested, however, because the /r/ has nothing to spread to the /l/ as /r/ is unspecified for an Approximant dependent.

As can be seen these spreading processes in Toba Batak lend strong support to the overall organization of sonorant features proposed in this thesis. Given the proposed representations in (25) the facts could not have turned out any differently: in each case, the segment with more structure spreads to the segment with less structure.

4.3.3 Klamath

Klamath is another language that displays within-sonorant assimilations. As in Ponapean the sequence /n-l/ becomes [l-l] indicating that the feature [nasal] is absent in underlying representation. Evidence that the feature [nasal] is not present underlyingly in Klamath can be seen through an inspection of the inventory. Klamath has both plain, aspirated and glottalized obstruents and sonorants (see Lombardi 1991). As there are no voiced obstruents, /n/ cannot contrast with a voiced obstruent such as /d/ and thus nothing forces the presence of the feature [nasal]. This is precisely the type of inventory in which the nasal is unspecified and thus the assimilation behaviour of the /n/ is predicted. The process is illustrated in (27). (See Barker (1964), Clements (1985) for discussion.)

(27) honlina → hollina 'flies along the bank'
   w’il’ga → w’il’ga 'lies down on the stomach'

The analysis of this data is identical to that given for the Ponapean /n-l/ sequences. The Approximant node, a dependent of the SV node, spreads to the empty SV node to its left. The rule is shown in (28).

(28) \[
\begin{array}{c}
\text{R} \\
\text{SV}
\end{array} \rightarrow \begin{array}{c}
\text{R} \\
\text{SV}
\end{array}
\]

Approx.

4.3.4 English level 1

Sonorant-sonorant assimilations occur in English level 1 phonology with the prefix /in-/ . The prefix assimilates to a following obstruent in terms of place of articulation, as in (29a), or totally assimilates to a following sonorant consonant, as in (29b). The rule of total assimilation is followed by an independently necessary degemination process (see Chomsky & Halle 1968, Schein & Steriade 1986, Borowsky 1996, for a discussion of degemination in English).
(29) a. /in-/ assimilation to obstruents
   i|m|-balance
   i|n|-dentured
   i|n|-grown
   i|m|-possible
   i|n|-tangible
   i|m|-credible

   b. /in-/ assimilation to sonorants
   i|r|-rational
   i|l|-legible
   i|n|-numerable
   i|m|-measurable

Borowsky (1986) argues that the /n/ of the prefix /in-/ is specified merely as [sonorant], being realized as [nasal] by default when [l] or [r] do not follow. While Borowsky’s analysis captures the appropriate generalization, there is nothing in her theory that predicts such an analysis. Given the structure of the English inventory, the SV theory predicts such within-sonorant assimilations. The underlying representations of the /n-r/ and /n-l/ sequences are given in (30).

(30)  n   r (irrational)   n   l (illegal)
      R   R   R   R
      |   |   |   |
SV   SV   SV   SV
      |   |   |   |
Approx Approx [lateral]

A rule spreading Approx will derive the forms in (31).

(31)  R   R
      SV   SV
      \    \  \Approx

After spreading, degemination takes place, yielding the correct surface forms.

4.3.5 Rotokas

Rotokas, a language of Bougainville, provides interesting supportive evidence for the NFR. According to the description by Firchow & Firchow (1969), Rotokas has one of the smallest consonant inventories among the languages of the world. Firchow & Firchow report that there are two dialects of Rotokas and that in one of the dialects there are no nasal consonants. The dialects are illustrated in (32).

(32) Rotokas (Firchow & Firchow)

<table>
<thead>
<tr>
<th>Dialect A</th>
<th>Aita dialect</th>
</tr>
</thead>
<tbody>
<tr>
<td>voiceless</td>
<td>p  t  k</td>
</tr>
<tr>
<td>voiced</td>
<td>b  r  g</td>
</tr>
<tr>
<td>m  n  n</td>
<td></td>
</tr>
</tbody>
</table>

The Aita dialect is easily accounted for under the proposed typology as a language with bare SV sonorants and the NFR. However, dialect A appears to present a significant challenge to this account. If we consider the underlying representation of the consonants in the two dialects to be the same, i.e., involving a distinction between SV and non-SV consonants, then the voiced consonants should be realized as nasals in both dialects. Examining the allophonic variation found in dialect A reveals that among the free variants of the ‘voiced’ sounds in this dialect we find nasal
consonants. In (33) the allophonic variants of the voiced series of consonants are presented.

\[
\begin{align*}
\text{(/b/:} & \ \text{[b] - [b] - [m]} \ \text{/r/:} & \ \text{[r] - [r] - [l] - [n]} \ \text{/g/:} & \ \text{[g] - [g] - [n]} \\
\end{align*}
\]

If the underlying representation of the two dialects is identical, then the difference between the two lies in the application of the NER. In the Aita dialect, the NER operates categorically. In dialect A, on the other hand, the NER operates variably. Under the SV hypothesis the cross-dialectal variation is captured in the simplest manner possible. All that is required is the assumption that the voiced obstruents in both dialects are underlyingly SV. In dialect A, the NER applies sporadically, while in the Aita dialect it applies regularly. It is worth noting here that the difference between the two dialects may not be as marked as they seem to be in Firchow & Firchow's account. Even in the Aita dialect the nasal enhancement rule does not apply in a categorical manner; Firchow & Firchow say only that the most frequent allophonic variants of the voiced sounds are the nasals.

The Rotokas facts strongly support the hypothesis that SV may be involved in the realization of voiced obstruents, as well as for the claim that [nasal] is a default SV feature. It may be argued that the failure of NER to apply in Rotokas brings a new type of problem to enhancement rules. This type of problem was noticed by Avery & Rice (1989) with respect to the failure of the Coronal enhancement rule in some dialects. Rice (1991) has taken up this problem in more detail with respect to place of articulation features, arguing that when default rules fail to apply, nodes may be interpreted. In the case of Rotokas, the interpretation appears to encompass a wide range of sonorant consonants.

4.4 Liquid Dissimilation

Several languages display a process known as liquid dissimilation in which a sequence of identical liquids /L..L/ or /r..r/ surfaces as /r..L/ or /L..r/, where /.../ may be a string of intervening segments not specified for the relevant features. I will argue that liquid dissimilation strongly supports the model of segment structure being proposed here.

4.4.1 Latin liquid dissimilation

Previous accounts of liquid dissimilation require a binary feature [+lateral]; in fact, Steriade (1987) argues that Latin liquid dissimilation requires that both values of the binary feature [lateral] be present in underlying representation, citing data such as the following:

\[
\begin{align*}
\text{(34a)} & \quad /n\text{av-alis/} \rightarrow [n\text{avalis}] \quad \text{'naval'} \\
\text{(34b)} & \quad /s\text{ol-alis/} \rightarrow [s\text{olaris]} \quad \text{'solar'} \\
\text{(34c)} & \quad /m\text{ilit-alis/} \rightarrow [m\text{ilitaris}] \quad \text{'military'} \\
\text{(34d)} & \quad /l\text{itor-alis/} \rightarrow [l\text{itoralis}] \quad \text{'of the shore'} \\
\text{(34e)} & \quad /f\text{lor-alis/} \rightarrow [f\text{loralis}] \quad \text{'floral'} \\
\end{align*}
\]

The adjectival suffix /-alis/ surfaces as [alis] when attached to a root that has no /L/ as in (34a), as [aris] when attached to a root that has an /L/ as in (34b), and as [alis] if the root has an /L/ but an /r/ intervenes between the stem /L/ and the suffixal /L/. Steriade analyzes this as the delinking of [+lateral] when tier-adjacent to another [+lateral]. The appearance of the /r/ in the

\[
\begin{align*}
\text{116} & \\
\text{117} & \\
\end{align*}
\]
examples of (34c) makes the two \ [+lateral] specifications non-adjacent, under the assumption that /r/ is specified as \ [-lateral]. The reason that segments other than /r/ do not count as \ [-lateral] is that \ [-lateral] is not a distinctive feature on those segments and is thus not present at the relevant point in the derivation. While Steriade does not provide derivations, Cohn (1992: 210) constructs an account of the Latin facts consistent with her analysis as in (35).

\[
\begin{array}{|c|c|c|c|}
\hline
\text{milit-alis} & \text{lio-ri-alis} \\
\text{input} & & & \\
\text{default} & & & \\
\text{Liquid} & & & \\
\text{dissimilation} & & & \\
\text{fill-in} & & & \\
\hline
\end{array}
\]

The SV analysis builds on Steriade’s proposal, but does not require that \ [-lateral] be a binary feature. The presence of the Approximant node eliminates the need for \ [-lateral] as a binary feature, a desirable result given the general move away from binary features in current phonological frameworks. The analysis also obviates the need to specify all non-laterals as \ [-lateral]; since the feature \ [-lateral] is an SV dependent, it can only be relevant to sonorants in the first place. The specification of segments such as /l/ for laterality is thus completely unnecessary. It appears that liquid dissimilation results from a prohibition in Latin against the co-occurrence of two adjacent \ [-lateral] specifications on the tier defined by the Approximant node. In the case of [milit-alis], this prohibition forces the delinking of the feature \ [-lateral] from the offending suffixal segment. This is the most minimal ‘repair’ possible given the input representation, and results in the affected segment being pronounced as [rl]. In the case of [litor-alis], there is no violation of the co-occurrence restriction. This is shown in (36).

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{milit-alis} & \text{lio-ri-alis} \\
\text{input} & & & & & \\
\text{SV} & \text{SV} & \text{SV} & \text{SV} & \text{SV} & \text{SV} \\
\text{Approx} & \text{Approx} & \text{Approx} & \text{Approx} & \text{Approx} & \text{Approx} \\
\text{[lat]} & \text{[lat]} & \text{[lat]} & \text{[lat]} & \text{[lat]} & \text{[lat]} \\
\hline
\text{milit-aris} & \text{lio-ri-alis} \\
\text{Liquid} & \text{dissimilation} & & & & \\
\text{input} & & & & & \\
\text{SV} & \text{SV} & & & & \\
\text{Approx} & \text{Approx} & & & & \\
\text{[lat]} & \text{[lat]} & & & & \\
\hline
\end{array}
\]

4.4.2 Sundanese Liquid Phonology

Cohn (1992) discusses a case of liquid dissimilation in Sundanese that differs from Latin in having a liquid assimilation rule as well as a liquid dissimilation rule. Furthermore, unlike the loss of the feature \ [-lateral] in Latin, her analysis of Sundanese involves the insertion of \ [-lateral]. The data involve an allomorphic alternation in the plural infix between \ [-ar-] and \ [-al-]. Cohn states that the underlying representation of the plural is /-ar-/ based on its appearance in forms that do not contain a liquid. However, when the word contains either an /l/ or an /r/ we find [ar] or [al] depending on a rather complex set of patterns. First, if there is a word initial /l/, the infix is [al]- and if the word begins with an /r/ or the syllable following the infix begins with an /l/, the infix has the [ar] form as shown in (37a, b) (all data from Cohn 1992).
(37) [-ar-] following word initial /r/  
a. ráhit  r-ar-ráhit  ‘wounded’  
   riwat  r-ar-ríwat  ‘startled’  

[-al-] following word initial /l/  
b. lado  l-al-ládo  ‘little’  
   laga  l-al-laga  ‘wide’  

Second, if an /r/ occurs anywhere else in the word, the infix is [-al-] and if an /l/ occurs anywhere else in the word, the infix is realized as [-ar-] as shown in (38a, b).

(38) [-al-] when word contains /r/  
a. baid  b-ar-baid  ‘respect’  
   poréka  p-ar-poréka  ‘handsome’  
   combrek  c-ar-combrek  ‘cold’  
   bighar  b-ar-bighar  ‘rich’  

b. [-ar-] when word contains /l/  
   gös  g-ar-gös  ‘jump’  
   gopolok  g-ar-gopolok  ‘flop down’  
   gotol  g-ar-gotol  ‘diligent’

Finally, if the following onset is /r/ or /l/, the infix surfaces as [-ar-] as shown in (39a, b).

(39) [-ar-] when following onset is /r/  
a. tái-kirim  d-ar-tái-kirim  ‘sent’ PASS  
   turiga  c-ar-turiga  ‘suspicious’  

[-ar-] when following onset is /l/  
b. gilis  g-ar-gilis  ‘beautiful’  
   guliat  g-ar-guliat  ‘stretch’

In order to account for the data, Cohn follows Steriade (1987) and assumes a version of contrastive specification, with both [+lateral] and [-lateral] present underlyingly. She then needs three rules: a rule of lateral assimilation to account for the data in (37b), a rule of r-dissimilation, in conjunction with a rule of [+lateral] insertion, to account for the data in (38a), and a rule of lateral merger to account for the data in (37a) and (39a). These rules are shown in (40).

(40) a. Lateral Assimilation (Cohn 1992: 207)  

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

b. /l/ dissimilation and [+lateral] insertion (Cohn 1992: 208)  

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

\[ \text{[-lat]} \rightarrow \text{[-lat]} \]

Before proceeding, we should explain the format of Cohn’s rules. She assumes a moraic theory of syllable structure in which the only segments directly dominated by the syllable node (\(\alpha\)) are onsets. All coda consonants are dominated by a mora. Thus, a rule that includes the syllable node applies only to adjacent onsets. Of course, when the syllable is not mentioned in the structural description of the rule, the rule applies on the appropriate tier within the word domain.

While Cohn’s rules account for the data, they appear to be arbitrary as there is nothing in the representations leading us to believe that the facts

120

121
could not have gone the other way. Furthermore, Lateral Assimilation and Lateral Node Merger appear to be part of the same process but cannot be unified. Lateral Node Merger blocks /r/ dissimilation so that adjacent syllables with /r/ are preserved and Lateral Assimilation creates identical adjacent onsets.

SV theory allows a more natural account of the assimilation of the /r/ to the word initial /l/ as the spreading of [lateral] to an adjacent Approximant node with no dependents.

(41) SV Lateral Assimilation

As [lateral] spreads only rightward, it only applies when a bare Approximant node occurs to its right, and not in those cases where the lateral is in the onset to the right of the /r/ as in (38b) and (39b).

There are two cases that require further discussion. First, we must account for the infix surfacing as a lateral when there is an /r/-sound to its right that is not in an onset, as in (38a). Second, we must determine why /r/-dissimilation is blocked when the /r/-sounds are in successive onsets, as in (39a). Cohn's rule of Lateral Merger is meant to take care of the second case. As she points out, there is a pervasive constraint in the language preventing the occurrence of two /r/-sounds in a single word. If we agree with Cohn that the constraint is motivated by the OCP, then the constraint can be stated as in (42).

(42) Approximant Constraint

\[ SV \quad \text{SV} \]
\[ \text{Approx} \quad \text{Approx} \]

It would be best if the constraint in (42) was sufficient, that is, if the filling in of [lateral] on the leftmost segment was an automatic consequence of the visibility of the violation. However, under SV theory we might expect the situation to be resolved by the delinking of the Approx node (cf. Kumana and Yagoria) as readily as by the insertion of [lateral]. The insertion of [lateral] is therefore a language specific choice. This is shown in (43).

(43) Lateral insertion

\[ SV \quad \text{SV} \quad \rightarrow \quad \text{SV} \quad \text{SV} \]
\[ \text{Approx} \quad \text{Approx} \quad \text{Approx} \quad \text{Approx} \]
\[ [\text{lateral}] \]

Note that the feature to be added is entirely determined by the feature hierarchy given in the segment structure. No feature other than [lateral] could be added and still allow the Approx node to surface. The [lateral] feature will not spread to the following Approximant because the two Approximant nodes are not onsets.

The second issue that needs to be addressed is the failure of Lateral Insertion when the two /r/-sounds are in the onsets of adjacent syllables.
This is precisely the case for which Cohn proposed Lateral Merger. The situation is sketched in (44), where the square bracket ‘|’ represents the edge of a morpheme and the rounded paren ‘(‘ represents the edge of a syllable.

(44)  

a. |l...r → |l...|  Lateral Spread (36b above)
b. (r...r → (r...r  Lateral Insertion (37a above)
c. (l...r → (l...r  no examples
d. (r...r → (r...r  Lateral Merger (38a above)
e. (r...l → (r...l  no rule applies (38b above)

We have already accounted for cases (44a and b). We would predict Lateral Spread in (44c) but have no examples. We must block Lateral Insertion in (44d) and we also need to be sure that we do not predict any rule application in (44e). Something along the lines of Lateral Merger may be appropriate in the case of (44d), but the SV account would involve the fusion of adjacent Approximant nodes, essentially the same process. However, there are indications that Lateral Merger applies as a repair strategy rather than Lateral Insertion because it can apply. Sundanese reveals an interesting parallelism constraint on the conjunction of the two identical Approximant nodes, a constraint similar to the parallelism constraint on syntactic conjunction. If the Approximant nodes violate the constraint in (42), there are two options: fusion of the Approximant nodes or Lateral Insertion. Both repair the violation of the Approximant constraint in (42) in slightly different environments.

The analysis of the Sundanese data show again that when the SV model is compared to other accounts of sonorant-sonorant interactions, it allows for a more explanatory account of the data. The options are restricted by the structure of the theory and do not require anything beyond what should be expected as language specific. Thus, in the case of Lateral Insertion in Sundanese, the SV theory presents this as one of two possible outcomes for the repair of an OCP-type violation. In a theory that does not incorporate the SV hypothesis, it is difficult to see how the options are restricted, except by stipulation. Furthermore, we see that there is an asymmetry in the behaviour of /rl/ and /ll/ in (43a) and (43a). The model of segment structure that I am proposing predicts that just such an asymmetry should exist. As the /ll/ has more structure than the /rl/, we could expect that it would spread and that the /rl/, as it has no feature associated with it, would not.

4.5 Summary

In this section we have examined evidence for the SV hypothesis and for the particular organization of sonorant features proposed in chapter 1. A representation that has sonorant features dominated by the SV node allows for a wide variety of generalizations that are difficult to capture in a theory without any way of grouping sonorant features. We have established that the SV node displays node-like behaviour in acting as a target for assimilation, in spreading and in delinking.
Chapter 5
Voicing Systems

5.1 Voicing Oppositions

In Chapter 3, I presented a representational theory of voicing oppositions, outlining three possible representations that could be associated with the voiced-voiceless distinction. I proposed that there are languages with an active feature [voice] dominated by the Laryngeal node -- Laryngeal Voice (LV) languages; languages in which voiced segments, such as /b, d, g/, are sonorants and have the SV node activated but not the Laryngeal node -- Sonorant Voice (SV) languages; and, languages in which the voiced segments are unmarked and the voiceless segments have a Laryngeal node present -- Contextual Voice (CV) languages. The representations of each of these language types are repeated in (1) below.

(1) Representations of the voiceless-voiced opposition

<table>
<thead>
<tr>
<th>a. LV languages</th>
<th>b. SV languages</th>
<th>c. CV languages</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Lar</td>
<td>Lar</td>
<td>SV</td>
</tr>
<tr>
<td>[voice]</td>
<td>[voice]</td>
<td>[voice]</td>
</tr>
</tbody>
</table>

Before examining the evidence for the three language types, we must make explicit our assumptions about final devoicing, as well as some of the advantages of the representational theory we are proposing.

Lombardi (1991; 1995) considers the widespread process of final devoicing to be the product of a well-formedness condition that she calls the Laryngeal Constraint, given in (2).

(2) The Laryngeal Constraint (Lombardi 1991)

Laryngeal features are only licensed in the following configuration:

```
\( \alpha \\
\text{Laryngeal} \quad +\text{son} \\
```

In any configuration other than that given in (2), the Laryngeal node of a segment will be delinked, resulting in a voiceless consonant. In the theory I am proposing, the widespread appearance of voiceless consonants in coda position will follow from the Laryngeal Condition, given in (3).

(3) Laryngeal Condition (L.C)

```
\( \text{Cl} \)
\( \downarrow \\
\text{Lar} \\
```

The Laryngeal Condition in (3) is a target representation for all syllable-final obstruents. A segment with a laryngeal dependent that occurs in syllable-final position will lose the laryngeal dependent. This would be the realization of final devoicing in LV languages as illustrated in (4).

(4) Final Devoicing in LV languages.

```
\( \text{Cl}_a \)
\( \downarrow \\
\text{Lar} \\
```

```
\( \text{Cl}_b \)
\( \downarrow \\
\text{Lar} \\
```

Before examining the evidence for the three language types, we must make explicit our assumptions about final devoicing, as well as some of the advantages of the representational theory we are proposing.
In L1V languages, final devoicing involves delinking the feature [voice] in order to conform to the well-formedness condition in (3).

In SV languages, the LC in (3) is not relevant for the voiced segments because of the Lar-SV Constraint proposed in chapter 2, a constraint disallowing the presence of both Lar and SV on the same segment. This constraint is repeated in (5). We, therefore, do not see any manifestation of final devoicing in these languages.

(5) Lar-SV Constraint
\[
\begin{array}{c}
\ast R \\
\downarrow \\
\text{Lar} \\
\downarrow \\
\text{SV}
\end{array}
\]

CV languages will show the effects of final devoicing, but rather than the loss of a feature, there will be the addition of a Laryngeal node, through the process that we refer to as Laryngeal Strengthening. Its effect is illustrated in (6).

(6) Laryngeal Strengthening
\[
\begin{array}{c}
\text{CL} \\
\rightarrow \\
\text{CL}
\end{array}
\]

Both Laryngeal Strengthening and Final Devoicing have the effect of bringing the respective representations into conformity with the Laryngeal Condition. It has generally been supposed that a process along the lines of Final Devoicing is enough. Indeed, that the segments I am referring to as contextually voiced surface as voiceless in syllable-final position has been taken as evidence that there is a voicing feature present on those segments.

However, I will show that the representations that I propose are well motivated based on phonological processes. In CV languages, as the feature [voice] is inactive, there is no spreading of the feature [voice] from segments that are contextually voiced, as would be expected if the feature is not present. On the other hand, L1V languages show evidence for the feature [voice], as can be seen from phonological processes which spread [voice]. SV languages are also without the feature [voice] and, as is the case with the CV languages, show no evidence for the spread of [voice].

Compare this to the theory proposed by Lombardi (1991; 1995), where all voiced segments have the feature [voice] underlyingly and the spread of this feature is a parameter of UG. In her theory, the representation of voiced obstructions in what I have called CV languages is the same as the representation in what I have called L1V languages. The difference in the behaviour of the voiced segments in these two language types follows not from representational considerations but rather from a parameter of the rule component, the parameter referring to the spreading of the feature [voice]. In contrast, I maintain that the rule spreading [voice] is not parameterized; rather, [voice] always spreads if it can. This is what it means for a feature to be active in the phonology. When a feature is inactive it cannot play a role in the phonology of the language because it is not present in the phonology.

It might be thought that a theory of laryngeal contrasts which permits for different representations of segments that appear on the surface to be the same may present problems of learnability. However, the theory does not raise any special learnability problems. All that is required for the child to arrive at the appropriate representation is positive evidence that the feature in question ([voice]) is active in the phonology of the language. If a feature is
active in the phonology of the language, then that feature is present in the underlying representation of segments that bear that feature. This points up a major difference between a theory such as Lombardi’s and the theory being advocated here. In Lombardi’s theory, it would appear that, cross-linguistically, all voiced obstruents have the same representation. Thus, if the child hears a voiced-voiceless distinction in the input, the child will automatically posit a representation with the feature [voice] specified. The child must then determine whether the feature is active or inactive in spreading and set the voicing-spread parameter appropriately. In the theory that I am proposing the child is guided towards the appropriate representations by the universal segment structure as well as the requirement that active features be present phonologically. If a feature is not active, there is no reason for it to appear in underlying representations. In the case of [voice], merely hearing a voiced-voiceless distinction among the obstruents does not force a representation with the feature [voice], as other representations are available. The child needs evidence in the form of a spreading rule to activate the feature phonologically.

Note that the representation with the active feature [voice] is structurally more complex than a representation in which [voice] is inactive. There is a containment relation between segments unmarked for voicing in CV languages and segments marked for voicing in LV or SV languages. This perspective allows us to account for markedness reversals with respect to the voicing distinction. That is, it is possible for a ‘voiced’ obstruent to be less marked than a voiceless obstruent because a voiced obstruent in a CV language has less structure than a voiceless segment.

In §5.2 and §5.3, I present analyses of the voicing systems of Dutch and Turkish, arguing that these are split laryngeal systems in which the stops and fricatives have different representations with respect to voicing. In this way we can account for the asymmetrical behaviour of the stops and fricatives with respect to rules of voicing spread and final devoicing. In §5.4, I present data from Russian, arguing that the theory presented here sheds light on the problematic /v/ sound. I argue that Russian is an LV system except in the case of /v/ which is a CV sound. This provides an explanation of the behaviour of /v/ not available in a theory that lacks alternative representations of voicing.

5.2 Dutch Clusters
5.2.1 Voicing Agreement in Dutch Clusters

In Dutch there is strong evidence that the voicing opposition among the stops is a distinction below the laryngeal node, with the voiced segments carrying a [voice] specification and the voiceless segments consisting of a bare Laryngeal; these representations are, of course, consistent with Dutch as an LV language. The evidence comes from the spread of the feature [voice] in clusters as well as the operation of the Laryngeal Condition, which results in final devoicing. Lombardi (1991, 1995) has proposed that in Dutch a single privative voicing feature is sufficient to capture the relevant properties of the voicing alternations. In her theory, final devoicing is the result of the Laryngeal Constraint, which causes the delinking of [voice] in coda position. Voicing agreement in clusters is achieved either through the spread of the Laryngeal node in the case of uniformly voiced clusters or the delinking of [voice] from the lefthand member of the cluster in the case of uniformly
voiceless clusters. The only way that an obstruent can surface as voiced outside an onset is through parasitic licensing, that is by being linked to a licensed occurrence of the feature [voice]. This situation arises when [voice] spreads from an onset obstruent to a coda obstruent. For the most part, we adopt this analysis for the stops. Consider the Dutch data in (7) (from Berendson 1983).

(7) Final Devoicing

`hui[l]`  `sk'ln`
`kwal[p]`  `lo'be`
`pol[t]`  `pot`
`knaol[p]`  `bu'ton`

The data in (7) show final devoicing in Dutch. We analyze this as the result of conformity to the Laryngeal Condition given in (3). If we merely look at the devoicing cases, we cannot tell if the devoicing is the result of delinking of the feature [voice] or of the process of Laryngeal Strengthening because both have the same result. However, an examination of heterosyllabic, two-consonant, stop-stop clusters reveals that the delinking analysis must be the appropriate one, as the voicing value of the cluster is always the same as the underlying voicing value of the righthand member of the cluster. If that segment is voiced, the cluster surfaces as voiced throughout. If that segment is voiceless, no mechanism will be available to license any other occurrence of the feature [voice] and the cluster surfaces as uniformly voiceless. This is schematized in (8).

(8) Stop-stop clusters (data from Lombardi 1991: 50)

a. `vcls stop-vcls stop → vcls stop-vcls stop`  `pa/kp/aard`  `[kp]

b. `vcls stop-vd stop → vd stop-vd stop`  `za/ko/øek`  `[gyl]

c. `vd stop-vd stop → vd stop-vd stop`  `be/db/ank`  `[db]

d. `vd stop-vcls stop → vcls stop-vcls stop`  `braa/dp/an`  `[lp]

In our theory, these data involve the delinking of [voice] in syllable-final position for (8c, d) and the spreading of [voice] from the righthand segment in (8b, c). We make use of Lombardi's notion of parasitic licensing to explain the presence of the feature [voice] on the coda consonant in (8b, c).

Fricative-stop clusters behave the same way as the stop-stop clusters, with the voicing of the cluster determined by the stop as illustrated in (9).

(9) Fricative-stop clusters

a. `vcls fric-vd stop → vd fric-vd stop`  `ka/s+b/uk`  `[zb] 'cashbook'

b. `vd fric-vd stop → vd fric-vd stop`  `ka/z+b/ot`  `[zb] 'cheeseboat'

c. `vd fric-vcls stop → vcls fric-vcls stop`  `ka/z+p/ers`  `[zp] 'cheese press'

d. `vcls fric-vcls stop → vcls fric-vcls stop`  `ka/s+p/ast`  `[sp] 'cashbook entry'

To summarize, we see that both spreading of [voice] and the Laryngeal Condition are necessary to account for voicing uniformity in two-member clusters where the righthand segment is a stop. Thus far, both the analysis proposed by Lombardi and the analysis being proposed here handle the data equally well. Only when we turn to clusters that have fricatives as the righthand member do we see that only our theory makes the correct predictions.
As shown above, fricative-stop clusters present the same array of facts as are found in stop-stop clusters. However, when a fricative is the righthand segment of a cluster, the cluster always surfaces as uniformly voiceless. As well, underlyingly voiced fricatives in final position are realized as voiceless, as is illustrated in (10).

(10) Stop-fricative and fricative-fricative clusters

a. əp+tsexe → [tsexe] ‘recite’ tsexe ‘say’
b. əp+vure → [pfura] ‘perform’ vura ‘carry’
c. rad+zam → [rabsam] ‘advisable’ zum ‘advice’
d. az+voxel → [asfoxol] ‘scavenger bird’ voxol ‘bird’
e. kaz+vərm → [kasfərm] ‘cheese mold’ vərm ‘form’

In theories that use binary features, these data have been analyzed as involving a rule of progressive [-voice] assimilation (e.g. van der Hulst 1980 and Berendson 1983). That is, when a fricative is the righthand member of a cluster, it assimilates in voicing to a preceding obstruent. Crucially, for this analysis to work in cases such as (10c-e), voicing assimilation must apply after final devoicing, inserting [-voice] on the lefthand obstruent. Lombardi (1995) points out that this analysis is not available in a theory with privative features because there is no [-voice] feature to spread. She suggests that the facts can be explained with a language-specific rule of Progressive Neutralization, a rule that delinks the feature [voice] from voiced fricatives as shown in (11) (Lombardi 1995: ex. 23).

(11) Progressive Neutralization (Lombardi 1995)

\[
\begin{array}{ccc}
\text{[-son]} & \text{[-son]} & \text{[-son]} \\
\downarrow & \downarrow & \downarrow \\
\text{Lar} & \text{Lar} & \text{Lar} \\
\mid & \mid & \mid \\
\text{[voice]} & \text{[voice]} & \text{[voice]}
\end{array}
\]

While the rule of progressive neutralization accounts for the facts, it lacks explanatory power. Why should the rule of progressive neutralization apply in the fashion that it does? There is nothing in the representation of the fricatives, apart from their [+cont] specification, which is entirely independent of the laryngeal node, to indicate that this should be the case. Why should just the fricatives behave in this manner with respect to the loss of the voicing feature in a cluster? Clearly the fricatives are behaving as though they were inert with respect to voicing processes. Our theory allows for a representational distinction to be made between the stops and the fricatives. In the case of the stops, where we clearly find an active voicing feature, we have an LV system and the opposition between the voiced and voiceless stops is under the Laryngeal node, as in the standard analysis of Dutch. The fricatives, on the other hand, are not distinguished in the same way. Instead, they are part of a CV system, the marked member of the fricative pair being the voiceless fricative, which underlyingly has a Laryngeal node. The voiced fricative is unmarked, receiving its voicing value from the surrounding context. The representations of the fricatives are given in (12).
(12) Representation of the voicing opposition in Dutch fricatives

\[
\begin{array}{ccc}
\text{voiced fricative} & \text{voiceless fricative} \\
R & R \\
\text{cont} & \text{cont} & \text{Laryngeal}
\end{array}
\]

When a fricative precedes a voiced stop, the Laryngeal features of the voiced stop can spread to the fricative, whether the fricative is voiced or voiceless as shown in (13c, d). The unmarked fricatives surface as voiced outside the coda where they are always found in a voicing context. In coda position, however, they always surface as voiceless and we can attribute this to Laryngeal Strengthening. Sample derivations for all the fricative positions are given in (13).

(13) Derivations of clusters involving fricatives

a. vd fric vd fric

\[
\begin{array}{c}
R_l & R \\
\text{Strengthen} & R_l \\
\rightarrow & R_l \\
\text{Lar}
\end{array}
\]

b. vcls fric vd fric

\[
\begin{array}{c}
R_l & R \\
\text{Lar}
\end{array}
\]

c. vd fric vd stop

\[
\begin{array}{c}
R_l & R \\
\text{Strengthen} & R_l \\
\rightarrow & R_l \\
\text{Lar} & \text{Lar} & \text{Lar} & \text{Lar} & \text{Lar} \\
\rightarrow & R_l \\
\text{Lar} \\
\text{[voice]} & \text{[voice]} & \text{[voice]}
\end{array}
\]

d. vcls fric vd stop

\[
\begin{array}{c}
R_l & \text{Spread} & R_l \\
\text{Lar} & \text{Lar} & \text{Lar} \\
\text{[voice]} & \text{[voice]} & \text{[voice]}
\end{array}
\]

In the illustration given in (13a, b), the assumption is that if the lefthand segment is marked with a Laryngeal node, then the righthand segment will be realized as voiceless as contextual voicing (or interpolation) does not apply. No phonological rule is necessary to obtain this result. In (13c), Laryngeal Strengthening is shown to apply before the rule spreading the feature [voice].

In this analysis, the behaviour of the fricatives, and in particular their failure to pattern with the stops, follows from representational differences between the two classes of sounds. As discussed previously, the representational difference between the stops and the fricatives should not cause any concern from a learnability perspective. It is clear that obstruent inventories are not always symmetrical with respect to stops and fricatives. A survey of a wide variety of inventories among the languages of the world (Maddieson 1984) shows that the stop and fricative inventories can differ greatly. Generally, there are more places of articulation for stops than fricatives and also more laryngeal distinctions. There is no reason to imagine that the voicing of stops necessarily implies the voicing of fricatives, and likewise, if the stops and fricatives do display a distinction that could be seen as a voicing distinction, it is not necessarily the case that they are representationally identical.

In the next section, we will discuss the past tense morpheme in Dutch. I will propose that this is represented as a contextually voiced segment.
5.2.2 The Past Tense in Dutch

The availability of Contextual Voicing in the phonology of Dutch allows us to propose a new account for a major puzzle in the inflectional morphology. Consider the data in (14).

(14) Realization of the the initial segment past tense morpheme in Dutch
a. Voiced after vowels and sonorants
   ski+de = 'skied'
   talm+de = 'hesitated'

b. Voiced after voiced stops
   krab+da = 'scratched'
   bled+da = 'bled'

c. Voiced after voiced fricatives
   schaav+da = 'planed'
   vecy+da = 'stroked'

d. Voiceless after voiceless stops and fricatives
   schrap+te = 'scraped'
   haat+te = 'hated'
   blas+te = 'barked'
   lax+te = 'laughed'

The initial segment of the past tense morpheme behaves like a voiced stop in (14a-c) but like a fricative in (14d). That is, when it follows vowels, sonorants, voiced stops, and voiced fricatives it surfaces as [d]-initial. When it follows a voiceless stop or fricative, it surfaces as [t]-initial. Trommelen & Zonneveld (1982), who assume binary features, propose that the initial segment of the past tense marker is underlyingly a voiced dental fricative /∅/, a segment that does not appear in the phonetic inventory of Dutch. Being a fricative, this segment is subject to progressive [-voice] assimilation and, when preceded by a voiceless sound, it undergoes this rule. A later rule of absolute neutralization hardens a dental fricative to a stop, either [t] or [d]. In order to explain why [krabda] does not surface as [kraptə], which would be the case if final devoicing could apply to the [∅], Trommelen & Zonneveld propose a verb-final theme vowel which protects the verb-final consonant from undergoing devoicing, making [krabda] underlyingly /krab+∅a/. By ordering the rule of vowel deletion after final devoicing, it is possible to derive the correct surface forms with a uniformly voiceless cluster. Lombardi adopts this analysis but must account for the rule of progressive voice assimilation without regard to the feature [-voice]. She accomplishes this by invoking the operation of the OCP after the deletion of the theme vowel. In this case, the deletion of the theme vowel will create an OCP violation, if both the past tense and the stem-final consonant are marked as [voice]. The process of fusion renders the laryngeal constraint inactive. The derivation as provided by Lombardi is given in (15).

(15)

\[
\begin{array}{cccc}
\alpha & \delta & \alpha \\
\text{voice neutralization} & \text{DNA} \\
\text{theme vowel deletion} & \text{[vce]} \\
\text{Fusion} & \text{[vce]} \\
\text{Progressive Neutralization} & \text{[∅]} \\
\text{Spread} & \text{DNA} \\
\text{Hardening} & \text{[bda]} \\
\end{array}
\]

138
As can be seen, Lombardi’s analysis is essentially the same as that proposed by Trommelen and Zonneveld (1982), the only difference being that she makes use of fusion to block the application of progressive neutralization. However, she still requires the theme vowel and the abstract segment.

Under my theory, there is another representation of the past tense suffix with properties of both a stop and a fricative. That is, I can assume that the past tense morpheme is a CV (contextually voiced) segment, like the fricatives, but specified as a non-continuant. All that is required is the assumption that the bound morphology constitutes a segmental class on its own (see also Dyck 1995; Steriade 1995). If there is no voicing distinction in the bound morphology, there is no reason to assume that segments are marked in the same way as full lexical entries. The segment I am proposing as the underlying representation of the past tense is representationally distinct from other non-continuant sounds in the language, however, representations that are already required for the fricative inventory of the language are all that need to be invoked. Trommelen and Zonneveld, and Lombardi after them, must propose a unique segment. However, I still require the presence of a theme vowel to block Laryngeal Strengthening from applying.

The underlying representation of the past tense form of /krabde/ is given in (16). The /b/ has a [voice] specification and is in the onset of a syllable, avoiding the Laryngeal Condition. The initial segment of the past tense morpheme is unmarked for laryngeal features and I assume that the theme vowel consists of just a root node.

This representation constitutes a voicing environment for the past tense ending represented by /D/. The theme vowel, being nothing but an empty slot, contributes nothing to the voicing environment, but neither does it take away from this environment. Its primary function appears to be to save the /b/ of the stem from undergoing final devoicing by the Laryngeal Condition and it is not deleted until this consonant is no longer subject to this condition. This analysis holds for all of the cases where the past tense marker surfaces as voiced. When it is between sonorants as in (14a), it is contextually voiced by virtue of being between SV segments. After voiced fricatives as in (14c), it will also be contextually voiced as there is no Laryngeal node present at all in the environment that is available to the voiceless sounds.

Now we will consider the situation where the initial segment of the past tense ending surfaces as a voiceless segment. In this case, the stem-final consonant is underlyingly voiceless and thus is specified as a Laryngeal segment.
Here, there is no voicing in the environment of the past tense ending. Indeed the closest segment with any specification for laryngeal features is the voiceless obstructant of the stem. In this case the context is voiceless and the past tense consonant surfaces as voiceless, just as occurs with the fricative clusters.

This analysis of the Dutch past tense morpheme has several advantages over previous accounts. First, we do not need to propose an underlying fricative segment along the lines proposed in previous studies. While it is true that the stop of this morpheme is not represented in a fashion identical to the other stops of Dutch, the representation proposed for this stop has been independently motivated for the fricatives of Dutch. Given that we allow for more than one representation of the voicing distinction, our prediction is that such asymmetries should arise in languages. Secondly, because our analysis does not require a non-occurring fricative segment, we can dispense with the rule of absolute neutralization that hardens this fricative to a stop, clearly a step in the right direction if all other aspects of the analysis are equal. Finally, it appears that this analysis reveals the true nature of the past tense morpheme. This morpheme is not a fricative, it only behaves like the fricatives of the language. I have shown that the difference between the stops and the fricatives lies in the different Laryngeal representations that these two classes of sounds have. The behaviour of the past tense morpheme has nothing to do with its specification as a fricative, only with the representation of its voicing properties. It happens that it has the same Laryngeal representation as the fricatives of the language, a fact that is independent of its specification for continuancy. In my theory, this can be captured directly through the Laryngeal representation, which appears to locate the idiosyncracy of the past tense morpheme in precisely the right place.

5.3 Turkish

5.3.1 Final Devoicing

In this section I will argue that Turkish, like Dutch, has a split laryngeal system, though the system has properties that make it different from Dutch. In particular, Turkish voiced fricatives have an SV node, while the voiceless stops have no Laryngeal features. Evidence for this will be based on the failure of fricatives to undergo final devoicing and the failure of stops to spread [voice].

The consonant inventory of Turkish is given in (18).

(18) Turkish Inventory

<table>
<thead>
<tr>
<th>Labial</th>
<th>dental</th>
<th>palatal</th>
<th>velar</th>
<th>glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>stops</td>
<td>p, b</td>
<td>t, d</td>
<td>k, g</td>
<td>h</td>
</tr>
<tr>
<td>fricatives</td>
<td>ʃ, v</td>
<td>s, z</td>
<td>s, j</td>
<td>c, ʃ</td>
</tr>
<tr>
<td>affricates</td>
<td>m</td>
<td>n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasals</td>
<td>m</td>
<td>n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>glides</td>
<td>l, r</td>
<td>y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Turkish, the voicing opposition between the stops and affricates is usually suspended in syllable-final position. In syllable-initial position the opposition is between what is generally reported as a voiced-voiceless pair,

---

1 Turkish orthography is used throughout: ʃ = ʃ, c = ç, s = š, j = ğ, ʃ = w.
Though the voiceless member of the pair is aspirated (see Underhill 1976). The fricatives, unlike the stops, have a voicing contrast in both syllable-initial and syllable-final position. The voicing alternations among the stops have generally been analysed with a rule devoicing non-contiguous obstruents in syllable-final position (see for example Rice 1990). A statement of the rule of final devoicing as well as forms illustrating the operation of this rule are given in (19) and (20). In (21), the non-alternating fricatives are presented.

\[\text{(19) } [\text{son}] \xrightarrow{1-\text{voice}} [\text{son}]\]

\[\text{(cont)}\]

(20) Syllable-final stops in Turkish (data from Inkelas and Orgun 1993)

a. Alternating stops
   - nom. kahh
   - 3 sg. poss. kahhi
   - dat. kahha
   - pl. kahha-lar
   - abl. kahha-lan
   - 'mold'
   - 'wing'
   - 'clay pot'
   - kanat
   - kanad-1
   - kanad-a
   - kanat-lar
   - kanat-lan
   - counting

b. Non-alternating stops
   - nom. devlet
   - 3 sg. poss. devlet-i
   - dat. devlet-e
   - 'state'
   - 'art'
   - 'monument'
   - sanat
   - sanat-i
   - sanat-a
   - aml
   - aml-i
   - aml-a

(21) Syllable-final fricatives (no voicing alternations)

- nom. kuz
- 3 sg. poss. kuz-i
- dat. kuz-a
- pl. kuz-lar
- abl. kuz-dan
- 'girl'
- ev
- ev-i
- ev-e
- ev-lar
- ev-dan
- 'house'
- v

These data appear to present a standard case of final devoicing. As the voicing specification of the intervocalic stop is unpredictable and the voicing of the syllable-final stop is predictable, the most parsimonious analysis posits underlying voiced consonants for the alternating forms and voiceless consonants for the non-alternating forms. The rule of final devoicing given in (19) applies, yielding the appropriate surface forms.

The analysis presented in the preceding paragraph provides a descriptive account of the Turkish facts but fails to go any further. Other properties of the system remain outside the purview of the analysis. For example, the failure of the feature [voice] to spread must be derived by a separate stipulation. In order to illustrate this point, let us consider the behaviour of the ablative marker, which has an alternating coronal stop as its initial segment, as shown in (22).

(22) Voicing alternations in the ablative morpheme

<table>
<thead>
<tr>
<th>Stem final</th>
<th>a. vowel</th>
<th>b. sonorant</th>
<th>c. vd fricative</th>
<th>d. vd stop</th>
<th>e. vcls sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR of Stem</td>
<td>/tarîa/</td>
<td>/el/</td>
<td>/kâz/</td>
<td>/kitab/</td>
<td>/sanat/</td>
</tr>
<tr>
<td>ablative</td>
<td>[tarîdan]</td>
<td>[elden]</td>
<td>[kûzdan]</td>
<td>[kitapta]</td>
<td>[sanattan]</td>
</tr>
<tr>
<td></td>
<td>'field'</td>
<td>'hand'</td>
<td>'girl'</td>
<td>'book'</td>
<td>'art'</td>
</tr>
</tbody>
</table>

The normal criteria for establishing the underlying form of the ablative morpheme would lead to proposing [-dAn], with an initial voiced stop. This is because in the intervocalic environment we find the voiced segment as in (22a). Recall that this is one of the environments where voicing is not predictable in Turkish and was crucial in establishing the devoicing rule. However, the appearance of a voiceless stop in (22d, e) causes some problems for such an analysis. If the initial segment of the ablative marker is underlyingly marked for [voice] why does it delink in /kitab+dAn/
obstruents and that the voiced stops are the unmarked members of a CV opposition, we can begin to understand the phonological behavior of these segments. Clearly, the initial consonants of the inflectional suffixes are unmarked with respect to voicing. The analysis is that all of the underlying 'voiced' stops are CV segments. The voiceless stops are the marked members of the voiced-voiceless pair, having a Laryngeal node present. The Laryngeal enhancement rule which inserts the feature [spread glottis] applies to these segments and they are realized as voiceless aspirated consonants.

Inkelas and Orgun (1993) have pointed out that rather than just two types of voicing, it is necessary to recognize three types: voiced segments that alternate between voiced and voiceless, depending on their environment, voiced segments that never alternate, i.e., that remain voiced in all environments, and non-alternating voiceless segments. Data illustrating the necessity of the third type is given in (23).

(23) Non-alternating voiced consonants in coda position

<table>
<thead>
<tr>
<th>nominative</th>
<th>plural</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>etid</td>
<td>etüdler</td>
<td>'étude'</td>
</tr>
<tr>
<td>jeologi</td>
<td>jeologiär</td>
<td>'geologist'</td>
</tr>
<tr>
<td>katalog</td>
<td>katalogär</td>
<td>'catalogue'</td>
</tr>
<tr>
<td>prelud</td>
<td>preludler</td>
<td>'prelude'</td>
</tr>
<tr>
<td>ad</td>
<td>adlar</td>
<td>'name'</td>
</tr>
<tr>
<td>id</td>
<td>idler</td>
<td>'id'</td>
</tr>
<tr>
<td>lig</td>
<td>ligler</td>
<td>'league'</td>
</tr>
<tr>
<td>öc²</td>
<td>öcler</td>
<td>'revenge'</td>
</tr>
</tbody>
</table>

Most of the words that fall into this category are borrowings and the complete list of monosyllables contains only seven words. Inkelas and Orgun propose three separate representations for the voicing distinction, one for

2 Recall that æ represents a voiced alveopalatal affricate.
alternating consonants, one for non-alternating voiced consonants and one for non-alternating voiceless consonants. The representations proposed by Inkelas and Orgun are given in (24).


\[
\begin{array}{ccc}
\text{Root} & \text{Root} & \text{Root} \\
\text{Lar} & \text{Lar} & \text{[asp]} \\
\text{[voice]} & \text{[asp]} & \\
\end{array}
\]

The theory proposed by Inkelas and Orgun is similar to the theory I am proposing in that they see the processes of devoicing and voicing as involving feature addition to the representation in (24a). I give their devoicing rule in (25) and their voicing rule in (26).

(25) Devoicing (after Inkelas and Orgun 1993)

\[
\begin{array}{ccc}
\text{Root[-son]} & \text{Root[-son]} & \\
\text{[cont]} & \text{[cont]} & \text{Lar} \\
\text{[asp]} & & \\
\end{array}
\]

(26) Voicing (Inkelas and Orgun 1993)

\[
\begin{array}{ccc}
\text{Root[-son]} & \text{Root[-son]} & \\
\text{[cont]} & \text{[cont]} & \text{Lar} \\
\text{[voice]} & & \\
\end{array}
\]

Rule (25) is very similar to our rule of Laryngeal strengthening. It affects coda consonants providing them with a Laryngeal node and adding the feature [asp] as a dependent of the Laryngeal node. In my system there is no equivalent to the rule in (26), but it has the same effect as contextual voicing. Of course, we would claim that the voicing feature responsible for the voiced consonants is SV voicing rather than Laryngeal voicing.

The consonants that Inkelas and Orgun refer to as alternating are equivalent to contextually voiced segments in the theory I am proposing. Where I would disagree with Inkelas and Orgun is in the proposal that the non-alternating consonants have the feature [voice] present. As I see no evidence for the active presence of this feature in Turkish, and because this feature is universally delinked in syllable final position, I would claim that the non-alternating consonants, both the stops and the fricatives, are marked by the presence of an SV node. The representations would be as in (27).
The alternating consonants represented as in (27a) will undergo contextual voicing when surrounded by SV segments and will be subject to Laryngeal Strengthening when in coda position. The non-alternating stops and fricatives will not be subject to Laryngeal strengthening because of the Lar-SV constraint and will surface as SV segments (voiced) in all contexts. The non-alternating voiceless consonants only undergo the Laryngeal Enhancement Rule and surface as aspirated.

In general, then, the Turkish stops and fricatives are part of different systems. The stops are part of a CV system, while the fricatives are part of an SV system. As with Dutch, there appears to be some crossover, that is, we find that there are exceptions to the general patterns. However, these exceptions can be easily accommodated within the existing structures of the system. Thus, the non-alternating stops have the same representation as the voiceless fricatives in Turkish, just as the past tense morpheme of Dutch, which is a stop, has the same representation as the voiceless fricatives of Dutch.

5.3.2 Fricative Contrasts in Turkish

We have not discussed the problem of the voiceless fricatives in Turkish. As the fricatives are part of an SV system, we might expect that the voiceless fricatives will be 'contextually voiced' if they are represented as minimally distinct from the voiced fricatives. This is shown in (28).

The facts of Turkish suggest that the representations are more correctly as given in (29).

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of segment structure, we require a theory of the ordering of such structure. In the case at hand there are three major contrasts to be made: obstruent-sonorant, stop-continuant and voiced-voiceless. First, one must assume that the obstruent-sonorant opposition is prior to either the stop-continuant or the voiced-voiceless. Thus, the first opposition acquired by the child is between those sounds that are sonorant and those that are obstruent. In Turkish, this will divide the true obstruents, eventually realized as sounds such as /t, s, D/, from the sonorants, eventually realized as sounds such as /r, d, n, l, r/. Within each of these sets further divisions are now necessary, but as our concern here is chiefly with the obstruent class we will only sketch the further development of the obstruents. The first division among the obstruents will be between what is Laryngeal and that which is not, i.e., in Turkish that is the sound represented by /D/ (the alternating stops) from those eventually realized as Laryngeals /t, s/. At this point /D/ and /s/ are not distinguished as both have a Laryngeal node. The stop-continuant division within the Laryngeal sounds is next and will serve to divide /D/ and /s/. Clearly, under this ordering, the sound that /s/ minimally contrasts with is /D/ and requires the presence of a Laryngeal node. The learning path is given below.

(30) Developmental path for the acquisition of Laryngeal /s/

\[
\begin{array}{c|c|c|c|c}
\text{Son/Obstruent} & \text{Obstruent} & \text{Laryngeal/Non-Laryngeal} \\
\hline
\text{R} & \text{R} & \text{CV} & \text{Lar} \\
\hline
\text{SV} & \text{Lar} \\
\hline
\text{Sounds: /r, d, n, l, r/} & \text{/s, t, D/} & /D/ & /s, t/ \\
\end{array}
\]

c. Stop/ Cont

\[
\begin{array}{c|c|c}
\text{Stop} & \text{Continuant} \\
\hline
R & R \\
\hline
\text{Cont} & \text{Lar} \\
\end{array}
\]

Sounds: /s/, /s/

In order to have a minimal contrast between /s/ and /r/ we would need to make rather different assumptions about the ordering of the contrasts. It would be necessary to rank the acquisition of the stop-continuant division higher than the sonorant-obstruent division. In this case the /s/ would come from the primary stop-continuant distinction as would all other continuants, and be minimally contrastive with the voiced fricative as in (28). However, it does not appear reasonable to assume that manner distinctions within the obstruent class of sounds are acquired prior to the primary division between sonorants and obstruents. It is generally reported that the child first acquires a contrast between an obstruent sound and a sonorant sound when manner is acquired (see Ries and Avery 1995; Jakobson 1941).

Thus, the only way in which /s/ would not have a Laryngeal node in Turkish is if the stop-continuant contrast were ranked higher than the sonorant-obstruent contrast. Consider the nature of the contrasts in this case. If the stop-continuant contrast were ranked first, we would divide the segments into stops such as /D, d, t, l, n/ and fricatives such as /s, z, r/. Already the division looks much less natural that the sonorant-obstruent division and still requires a sonorant-obstruent division within each of the subgroupings. However, if we continue along this path, the next division will be the
sonorant-obstruent division, which among the continuant will yield /s/ vs. /z, t/. In this case /s/ will not have a Laryngeal node as illustrated in (31).

(31) Developmental path for the acquisition of non-Laryngeal /s/
   a. Stop/Continuant   b. Sonorant/Obstruent (among [cont])

<table>
<thead>
<tr>
<th>Stop</th>
<th>Cont</th>
<th>Son</th>
<th>Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>cont</td>
<td>cont</td>
<td>SV</td>
<td>cont</td>
</tr>
</tbody>
</table>

Sounds: /l, d, n, l/ /s, z, t/ /t, r/ /s/

The path in (31) creates a problem as the sonorant-obstruent division must be created in both the stop and the continuant classes of sounds. Thus, if we assume that the sonorant-obstruent division is ranked higher than the stop-continuant division, the presence of a Laryngeal node on the voiceless fricatives is the expected result, not something that must be stipulated.

5.3.3 Summary

We have seen that the Turkish voicing system, like the Dutch voicing system, involves distinct representations for voicing of stops and fricatives. In Turkish the stops are part of a CV system and the fricatives are part of an SV system. We saw that non-alternating stops are probably best considered to be part of an SV system, making their voicing representation the same as that of the fricatives. Again, we see that when both representations are available in the language, the language makes use of both in ways that may be considered somewhat idiosyncratic. In the case of Dutch, we found that the past tense morpheme had the voicing representation of a fricative, while in Turkish, we see that non-alternating stops have the voicing representation of fricatives.

5.4 Russian

5.4.1 Voicing Assimilation and the Behaviour of /w/

Russian is an L.V language with the voiced obstruents marked by the presence of the feature [voice] and voiceless obstruents having a bare Laryngeal node. Russian has the two central processes expected in an L.V. language — final devoicing and voicing assimilation in obstruent clusters. As well, there is no voicing agreement between sonorants and obstruents, showing that they are members of different voicing systems. The facts of Russian voicing assimilation are discussed in some detail in Hayes (1984) and Kiparsky (1985) (see the references cited therein) and I rely on these sources in the following analysis. Hayes (1984: 319) proposes the rules in (32) and (33) to account for the voicing facts.

(32) Final Devoicing (FD)

C → [voice] / #

(33) Voicing Assimilation

In a consonant cluster, assign the voicing of the last obstruent to all consonants on its left.

If we translate these rules into a framework with monovalent features, the facts are accounted for with a rule delinking voice in final position, (34), and a rule spreading voice prior to a laryngeal segment that is not specified for [voice], (35).
(34) Final devoicing (FD)

\[ \begin{array}{c}
R_1, \quad R_1 \\
LV \rightarrow LV \\
|voice| \quad |voice|
\end{array} \]

(35) Voicing Assimilation (VA)

\[ \begin{array}{c}
R \quad R \\
LV \quad LV \\
|voice|
\end{array} \]

Some simple cases illustrating the working of these rules are given in (36).

(36) a. /sadal/ \rightarrow /sat/ 'garden' (nom. sg.) (c.f. /sad+al/ \rightarrow /sada/, 'garden' (gen. sg.))

\[ \quad \text{b. /mozg/} \rightarrow /mosk/ 'brain'. \]

In (36a), we see the operation of FD and in (36b) we see that the application of FD applies even in cases where we might expect a doubly linked structure. The most plausible analysis of this is that there is only a single occurrence of the feature [voice] and that this is associated with the stem-final /g/ \textit{subsequent} to /g/. Thus, the /z/ preceding the /g/ in underlying representation is unmarked with respect to [voice].

The voicing assimilation rule applies to all obstruents between syllable heads. Russian sonorants are transparent to the voicing assimilation rule unless they are syllabic, in which case voicing assimilation is blocked, a fact related to their status as syllable heads, not as sonorants. Thus, the obstruents of an onset and a preceding coda will agree in voicing. If a sonorant intervenes in this domain, it will be transparent to the voicing agreement. This is shown in (37).

(37) Sonorant are transparent to VA

\[ \begin{align*}
a. & \quad \text{i/}z\text{mc/enska} \quad [\text{msk}] \quad '\text{from Minsk}' \\
b. & \quad \text{o/}l\text{mzd/y} \quad [\text{dmzd}] 
\end{align*} \]

In (37a) the underlying /z/ of /iz/ surfaces as [z] even though it is next to a sonorant consonant, because FD has applied. In (37b), the underlyingly voiceless final /l/ of /ot/ surfaces as voiced because of [voice] spreading from the [zd] cluster in /mzdyl/. These data establish the neutrality of sonorants to voicing assimilation. This neutrality follows from the SV hypothesis as they have no representation on the laryngeal tier at any level of the derivation and thus will not be visible to voicing spread and, crucially, they will never spread [voice].

Under the SV hypothesis, the transparency of sonorants is the predicted pattern in LV languages like Russian. Because these sonorants have no Laryngeal representation, we do not expect to find them participating in the VA rule. All that needs to be specified is the domain within which voicing agreement takes place. This domain is constructed between [syllabic] segments on the Laryngeal tier. Thus, if no [syllabic] segments intervene, the Laryngeal segments are adjacent on the Laryngeal tier. As sonorants have no Laryngeal projection, they are transparent to any process involving the Laryngeal tier.
Thus far the facts of Russian are handled quite easily if Russian is analyzed as an L1V system. The interesting problem in Russian centres around the treatment of the sound Hayes analyzes as an underlying /w/. This sound has two surface variants, [l] and [v]. This sound has not been considered either /l/ or /v/ underlyingly because of its behaviour in Russian voicing assimilation. It behaves like a sonorant in that it never triggers VA, but like a voiced obstruent in that it undergoes devoicing. This dual nature of /w/ has been a thorn in the side of phonologists attempting to provide a comprehensive account of Russian voicing assimilation. The data in (38) and (39), from Hayes (1984: 318-319), illustrate these properties of /w/.

(38) Obstruent behaviour of /w/

/w/ undergoes FD
zdoro/w/ → zdogo[l] 'healthy'
korn/w-k/a → korloka 'cow (dim.)'
krn/wd/ → krn[l] 'falsehood (gen. pl.)'

(39) Sonorant behaviour of /w/

a. /w/ does not trigger VA
/s w/ani → [sv]ami 'with you'
b. /w/ is transparent to VA
o/t w/ovv → o[ov]ovv 'from the widow'
/org/go → o/v or [+o] 'from another'
c. /w/ undergoes FD but does not expose preceding voiced segment to FD
tr[e]w/ → tre[z]f 'sober'
xor[u]/gw/ → xor[u]f 'banner'
d. /w/ does not devoice under the same conditions as other voiced obstruents.
zdoro/wl/i → zdogol'i 'healthy?'
aol/l/i → aol'li 'happy?'

In order to capture the fact that /w/ surfaces as [v] in (39a, b, d), Hayes proposes a strengthening rule that applies to the /w/ sound before it surfaces, changing /w/ to [v] by altering the value of the feature [sonorant] as shown in (40).

(40) W-strengthening

w → [s-son]

This rule guarantees that a given /w/ will surface as [v] provided that it has not undergone some other process that makes it voiceless. To obtain the correct surface forms with [l], Hayes claims that all sonorants undergo FD which is ordered prior to W-strengthening. A rule of sonorant revoicing is also necessary so that the sonorants not affected by W-strengthening will surface as voiced. Kiparsky (1985) made a significant improvement to this analysis using underspecification and Lexical Phonology. He claims a sound such as /w/ does not participate in voicing spread because sonorants are lexically unmarked for [voice]. He thus correctly predicts that none of the sonorants will participate in voicing spread. As Kiparsky sees the difference between [v] and [v] as a difference in sonorancy, he still requires the rule of W-strengthening.

We have already seen that Dutch and Turkish have split Laryngeal systems. It appears that Russian might provide yet another case of such a system. In Russian the only member of opposing class of segments is the /w/. The segment that has been considered to be an underlying /w/ is a CV sound, with neither a Laryngeal node nor an SV node. This provides an explanation for its failure to spread [voice], (39a), and its transparency to VA in the case of voicing spread, (39b), as this sound has no Laryngeal node and thus no
representation on the Laryngeal tier. When this sound surfaces as [l], as in (39c), it is the result of Laryngeal Strengthening. This process only applies when the CV /w/ appears in final position postlexically, probably phonological phrase final as evidenced in (39d), where we see that the domain of Laryngeal Strengthening is not the same as the domain of final devoicing, a fact that is undoubtedly related to the component in which the two processes apply.

The analysis of this segment becomes much simpler when it is considered a CV sound and there is no need to appeal to special marking conditions or to redundancy rules in order to derive the surface facts. The only puzzle remaining is the failure of this CV sound to surface as [l] when surrounded by voiceless consonants as in (39b) altıntılara, "from another". According to our previous claims about CV systems, a CV segment should surface as voiceless when between voiceless segments. That this is apparently not the case with this sound may be the result one or two factors. For example, it is possible that a special rule of Russian inserts SV on this sound when it appears in an onset, yielding a [v]. Both Hayes and Kiparsky require that phonetic [v] be non-sonorant. The SV theory does not have such a requirement as it is entirely possible for both [v] and [w] to be SV sounds. Indeed, in many languages /v/ behaves like a sonorant. Not only this, but we frequently find that a surface [v] is an optional realization of /w/, as in Turkish where we have established that the voiced fricatives are SV sounds. In arguing that [v] is an underlying /w/, Hayes makes the following interesting assertion: "for many speakers, /w/ and /v/ vary freely on the surface, at least in certain environments..." (321). This provides good evidence that in Russian [w] and [v] are the same segment and that the surface difference between them is a matter of phonetic implementation and not the realization of different features. Thus, we do not require a rule changing an underlying /v/ to a [v].

5.5 Summary

The three languages that we have studied in this chapter provide strong support for the representations proposed in this thesis. In Dutch, we are able to provide an elegant account of the differing behaviour of stops and fricatives by exploiting the LV-CV distinction. This difference carries over to the past tense marker, which behaves in many ways like a fricative but surfaces as a stop. We are able to capture its similarity to fricatives by allowing it to have the same voicing representation as the fricatives. This obviates the necessity for proposing that the sound is underlyingly a fricative. Instead, we simply propose that the past tense marker of Dutch is a CV segment. The advantage this analysis has over previous analyses lies in the fact that we do not need to use a feature such as [continuant] as a diacritic for the different voicing properties of the past tense marker as compared to the other stops of Dutch. Instead, we are able to locate the difference between the past tense marker and the other stops in the voicing representation, and this is where the difference really lies, not in the continuancy.

In Turkish, a similar case was presented except that the distinction is between a CV system for the stop consonants and an SV system for the fricatives. This analysis allows us to explain the failure of voicing to spread in Turkish as well as to account for the different behaviour of the stops and fricatives with respect to the devoicing rules. We saw as well that our analysis had similarities to that proposed by Inkelas and Orgun (1993) but differed from theirs in that here the feature [voice] is not present in Turkish.
Again we found sounds that on the surface appear to be members of one category but behave like members of the other category. In the case of Turkish, it is the non-alternating stops, i.e., those syllable-final stops that do not undergo Laryngeal Strengthening and thus surface as voiced. Our solution locates the difference between the alternating and non-alternating stops in voicing representation.

For the most part Russian presents a standard LV system, a system that is easily handled by most theories of voicing. The puzzling behaviour of the sound that both Kiparsky (1985) and Hayes (1984) analyze as /w/, however, presents less of a challenge when a CV representation is available. It improves upon previous accounts of Russian /v, ŋ/ in that the behaviour of this sound can be explained through reference to readily available representations. While it is true that the /v, ŋ/ sound is somewhat idiosyncratic in Russian, at least with respect to the behaviour of the other consonants, we can derive this behaviour directly from the representation that the sound is given, a representation that is motivated in a large number of languages.

As there are a variety of representations for what is phonetically considered the same segment, i.e., the voiced obstruent, one might ask if a learnability problem has been introduced into the theory. I do not believe that it has. In the first place there is a learning path through the distinctions. The learner will not posit an underlying feature unless there is evidence for that the feature is active. Thus, the phonetic similarity of two sounds does not have immediate consequences for the representation of those sounds. A sound transcribed as a [b] in one language could be represented with a Laryngeal node dominating the feature [voice], while in another language it could be represented as a contextually voiced sound. In a third language it could have an SV node. Each of these representations has consequences in the system that the child would be aware of prior to establishing the underlying representation of the sounds. So, before activating the feature [voice], the child would require positive evidence in the form of spreading of [voice] in clusters. Before the child activates the feature SV as a component of a phonetic [b] there would be evidence that [nasal] is specified. Failing either of these options the default is that the voiced sounds have no Laryngeal node or an SV node.

The analyses presented in this chapter show that the theory of laryngeal distinctions presented in this thesis shed new light on old problems without introducing a host of new problems. In the next chapter, we show that when combined with a theory of government, we are able to account for a wide variety of assimilations in Northern Turkic languages.
6.2 The SV Hypothesis

As argued in chapter 2, sonorant manner features such as [lateral] and [nasal] are dominated by the organizing node SV. The SV node renders the use of the (binary) feature [sonorant] unnecessary as well as allowing us to capture in a natural way a variety of sonorant-sonorant assimilations found in a number of languages. Most of the arguments adduced for the SV node are taken from sonorant-sonorant interactions found in languages such as Klamath and Ponapean, where /m/ may assimilate to /l/ in /lm/ clusters as detailed in chapter 3. The advantage of the SV hypothesis is that sonorant-sonorant interactions can be captured directly, whereas in models of segment structure which do not group sonorant features together such interactions are unexpected.

In chapter 4, I showed that the underspecification of [nasal] in a language such as Ponapean allows us to account for the asymmetrical behaviour of /ll/ and /ln/ in clusters. Unlike /lm/ sequences, /ln/ sequences do not display assimilatory behaviour. If nasal were specified, we would expect to find an /lm/ sequence surfacing as [n-n] if we assume that rule involves the spread of SV dependents from right to left, as schematized in (1).

(1) \[ \text{SV} \quad \text{SV} \]

\[ \text{NF} \]

If the feature [nasal] is absent from the underlying representation of nasals, however, we predict that there should be no spreading in /lm/ sequences as
/n/ has no SV dependent feature to spread. Even if [nasal] were specified, however, it should not spread to an adjacent lateral segment, unless an independent rule delinked the SV dependent feature [lateral], assuming that spreading cannot cause delinking (see Avery and Rice 1989). Again, this argues for the underspecification of [nasal] because it is nasal segments that regularly undergo such assimilations and not laterals. The asymmetrical behaviour of nasals and laterals can be accounted for if the feature [nasal] is underspecified.

The evidence for the SV node presented in chapter 3 all points to the representational advantages of the SV account. All of the arguments show that by assuming the presence of an SV node, independent mechanisms of phonological theory such as spreading and delinking are all that is necessary to understand the workings of many processes involving sonorants. I did not, however, discuss the motivation for such processes. Why should a sequence such as /n l/ surface as /l l/ in the first place? Following Rice (1992), we will argue that the motivation behind such changes is syllable contact, and that this is best understood in terms of a theory of transsyllabic government. We now turn to an explication of government theory.

6.3 Government

Rice (1992) provides an account of many of the processes that were used to motivate the SV node, noting that it is often the case that feature spreading serves to repair an undesirable sonority profile between two segments. Following Kaye (1990), Kaye, Lowenstamm and Vergnaud (1990), Harris (1990), Murray and Venneman (1983) and Venneman (1988), she notes that, in general, languages prefer to have a less sonorant segment in a coda than in a following onset within a given phonological domain. As /n/ is less sonorant than /l/, falling sonority explains the general preference for /l-n/ sequences over /n-l/ sequences. Kaye (1990) refers to the relationship between an onset and a preceding coda as one of transsyllabic government. Government is a condition that must be satisfied before a coda consonant can be licensed. Through government a segment is licensed and may then be syllabified and phonetically realized. Government states the conditions under which an onset consonant can be a potential governor for a coda consonant. Rice’s version of government theory makes use of the resources of segment structure to define a licit government relationship. She notes that under the SV hypothesis the more sonorant a segment is, the more SV structure it has, as is shown in (2).

\[
\begin{array}{cccc}
\text{Lateral} & \text{Rhotic} & \text{Nasal} & \text{Obstruent} \\
\text{Root} & \text{Root} & \text{Root} & \text{Root} \\
\text{SV} & \text{SV} & \text{SV} & \\
\text{Approx} & \text{Approx} & \text{[nasal]} & \\
\text{[lateral]} & & & \\
\end{array}
\]

Even without considering underspecification, we see that laterals have more SV structure than nasals or obstruents at all times. In Rice’s theory, government is a structural relationship under which the onset must have less specified SV structure than the coda. Thus an /l/ could not govern an /r/, /n/ or an obstruent because it has more SV structure. Rice (1992: 70) provides the following definition of government.
(3) a. A can govern B in an onset if and only if A and B differ by $\alpha$
SV type nodes.
b. Between syllables, A governs B if:
   i. B has more SV structure than A or
   ii. A has no more than $\beta-\alpha$ steps more SV structure than B,
      where $\alpha > \beta$; $\beta > 0$.

This definition is meant to cover the licensing of both tautosyllabic and heterosyllabic consonants, as government is one of the principal ways in which segments are licensed. In (3a) the minimal sonority distance between tautosyllabic onset clusters is set parametrically as languages choose a value for $\alpha$. For example, if a language set the value of $\alpha$ at 2, we would expect to find onset clusters in which the governor, the left-hand segment, and the governance, the right-hand segment, differ by 2 SV node types. Obstruent-liquid or obstruent-glide clusters might then be expected (/pl/, /py/), but not obstruent-nasal (/pn/), assuming that [nasal] is unspecified at the relevant level. Setting the minimal sonority distance $\alpha$ at 2 also affects the possibilities for heterosyllabic clusters. Rice points out that a setting of 2 allows for liquid-obstruent, nasal-obstruent, glide-obstruent and obstruent-nasal clusters (essentially the situation in English).

Rice identifies several strategies languages use to repair a dispreferred sonority profile in a heterosyllabic cluster. Assimilation, as in the nasal-liquid clusters of Ponapean discussed above, is one such strategy. Rice states that if spreading occurs between a governing lateral and a governed nasal, the ill-formed sonority profile is repaired and the nasal is licensed for syllabification. This is illustrated in (4).

(4) Spreading to repair an ungoverned nasal

```
  Nasal  Lateral
    |     |
  Root   Root
    |     |
  SV     SV
    |     |
  Approx [lateral]
```

After spreading the nasal is licensed parasitically as a geminate has been created. (On this type of parasitic licensing, see Lombardi 1991.)

Epenthesis is another strategy identified by Rice for repairing illicit transyllabic clusters. In this case, the ungoverned consonant cannot occur in coda position and is licensed in an onset to the syllable headed by the epenthetic vowel. In a sequence such as /VnV/, the epenthetic vowel is placed between the /n/ and the /V/, removing the government violation. Metathesis and deletion are also identified as processes which repair illicit consonant sequences.

In addition to the repair strategies proposed by Rice, there is another strategy available in certain circumstances. This strategy involves a failure to parse the features of the governor that make it more sonorant than the governance. This is the opposite of the assimilation case where the repair involves making the governee more sonorant. Instead, we find that the repair involves removing SV structure from the governing segment, making it less sonorant. Thus, in a sequence such as /Vn IV/, a failure to parse the relevant material might result in /Vn dV/ as illustrated in (5).
(5) Underparsing in a nasal-lateral sequence

\[
\text{Nasal} \quad \text{Lateral}
\]

\[
\text{Root} \quad \text{Root}
\]

\[
\text{SV} \quad \text{SV}
\]

\[
\text{[nasal]} \quad \langle \text{Approx} \rangle \quad \text{[lateral]}
\]

In (5) the underparsed element is indicated by the use of angle brackets and it is assumed that any dependents of an unparsed element will not be realized. The particular sequence illustrated will surface as [nd], with an SV voiced segment acting as governor for the nasal.

To summarize, I have presented a view of representations in which segments must be licensed before they can be phonetically realized. Following Kaye (1990) and Rice (1992), I have argued that these segments are licensed under government, and thus made visible to syllabification. The phonology provides several options for dealing with material that may violate government requirements. For example, the unlicensed segment may be deleted or a vowel may be epenthized in order to satisfy the requirements of government. A variety of segmental modifications such as spreading, epenthesis and metathesis were also identified by Rice (1992) that permit segments to meet government requirements. I will argue in addition for an underparsing strategy that creates a licit government relationship. In what follows I develop an account of the government-based alternations found in Northern Turkic languages and am using the term underparsing, as opposed to assimilation or feature deletion or delinking, to describe these alternations. My view of underparsing is as follows: in the underlying representation all features are associated with their host segment, but at the level of the phonology at which the government requirements are enforced, some features can be left unrealized. I am calling the strategy of leaving features unrealized in order to fulfill government requirements underparsing, though logically it is equivalent to either deletion or delinking. I return in §6.5 to the issue of why some segments are subject to underparsing while others are not. With this as background, let us proceed to the Turkic data.

6.4 Northern Turkic Inflectional Morphology

As the Turkic languages we will be discussing in this chapter do not allow onset clusters, no value for \( f \) will be set and the only important clause in the definition is (5b), i.e., the requirement that the governor (B) have more SV structure than the governor (A). We will adopt as a working hypothesis clause (5b) and assume that a governor must be less sonorant than a governor.

6.4.1 The Plural Morpheme

This section investigates the inflectional morphology of Bashkir, Kirghiz, Tuvan and Yakut, all northern Turkic languages with very similar, though not identical, phonological inventories as well as a large set of inflectional morphemes typical of Turkic languages. I will focus on assimilations and dissimilations taking place at morpheme boundaries that clearly involve decreasing the sonority of a suffix-initial consonant that is preceded by a less sonorant consonant. I will argue that these assimilations and dissimilations
serve to create a licit government relationship between the suffix-initial onset consonant, and the preceding stem-final consonant. For example, while a suffix-initial lateral surfaces as a lateral intervocally, when there are no government requirements, it surfaces as a voiceless obstruent when preceded by a voiceless obstruent. This is shown with the plural suffix in Bashkir, Kirghiz, Tuvian and Yakut in (6) and (7). As in most Turkic languages the plural is /1Ar/, with the quality of the vowel determined by the vowel harmony rules in the particular language, a topic we ignore here.

(6) Vowel-final stems take /1Ar/

a. Bashkir
   Singular: baqša
   Plural: baqša-lar
   Gloss: garden
b. Kirghiz
   Singular: kiti
   Plural: kiti-lar
   Gloss: people
c. Tuvian
   Singular: xobu
   Plural: xobu-lar
   Gloss: field, steppes
d. Yakut
   Singular: aya
   Plural: aya-lar
   Gloss: father

(7) Voiceless C-final stems take /1Ar/

a. Bashkir
   Singular: al
   Plural: al-lar
   Gloss: horse
b. Kirghiz
   Singular: it
   Plural: it-lar
   Gloss: work

c. Tuvian
   ot tar
   sanak tar
   kiska tar
   ‘fire’
   ‘sleigh’
   ‘pair of tongs’
d. Yakut
   kus tar
   sep tar
   tobuk tar
   ‘duck’
   ‘tool’
   ‘knee’

There are several arguments for selecting /1/ as the underlying morpheme-initial segment. First, in a wide variety of southern Turkic languages (e.g., Turkish, Uzbek, Uighur, Azerbaijani) the morpheme-initial segment is a non-alternating /1/. Second, in Proto-Turkic the plural form was /1/-initial (Siner 1988). It thus appears that the [1Ar] form is an innovation in the northern Turkic languages. Third, in the four languages under consideration, no independent rule changes an underlying consonant such as /1/ to [1] intervocally, suggesting that /1/ is not the underlying morpheme-initial segment. On the other hand, the change from /1/ to [1] after a stem-final voiceless consonant can be seen straightforwardly as an assimilation process, a process that is common among these languages. It therefore seems reasonable to assume that there has been no restructuring of the featural representation of the initial segment of the plural, the possibility remains that there may be differences in the representation of this segment between the northern and southern Turkic languages. A final argument that the plural suffix is not t-initial comes from the fact that there are other suffixes that begin with coronal stops do not have variants in /1/. These will be discussed in §6.4.2.1.

Assuming that the plural affix is underlyingly /1/-initial, we must consider the changes in this segment and determine how these changes can
best be captured. The data in (6) and (7) show that all four languages behave in the same way when the initial segment of the plural morpheme is intervocalic and when it follows a voiceless consonant. Presumably, then, all are subject to the same analysis. If government and licensing requirements are motivating the changes, the analysis is as follows. When the /l/ of the plural is intervocalic, as in (6), the /l/ does not govern a coda segment and it can therefore surface as [l]. In (7), the preceding coda consonant must be governed by the /l/ in order to be licensed. As /l/ has more SV structure than the preceding voiceless consonant, it cannot govern that consonant, and the coda consonant is not licensed. This situation requires some repair. As discussed above, phonological theory makes available for several options. For example, we might expect epenthesis of a vowel between the governor and governee, deletion of the governee, metathesis of the two segments, or the spreading of the SV node of the lateral. That is, we might expect any of the following in the case of a voiceless stop-lateral cluster.

(8) /at-lAr/ epenthesis [alar]
deletion [alar]
metathesis [alar]
spreading [alar]

All of the repairs in (8) lead to well-formed sequences. However, none of these options is adopted. Instead, the governing consonant is altered so that it is less sonorant than the governee and government is thus possible. In our view, this repair happens as follows: When there is a stem-final voiceless consonant, the SV node of the lateral is not parsed, and the /l/ is realized as a [l].

(9) Voiceless cons-lateral sequence (SV structure only)

<table>
<thead>
<tr>
<th>Input:</th>
<th>/l/</th>
<th>/l/</th>
<th>Output:</th>
<th>[l]</th>
<th>[l]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root</td>
<td>Root</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SV</td>
<td>&lt;SV&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approx</td>
<td>Approx</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[lateral]</td>
<td>[lateral]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In order to repair the input sequence, the SV node is left unparsed as shown in the output of (9), having the effect of delinking the SV node. Note that in order to satisfy government requirements all SV structure must be unparsed, not just the [lateral] feature. As will be shown immediately below, when we look in more detail at the realization of the plural affix in other contexts, underparsing is minimal; that is, only as much as necessary to repair the violation is underparsed.

6.4.1.1 The plural with other stem-final consonants

When consonants other than voiceless obstruents appear in coda position preceding the plural marker, the languages do not all behave in the same way. Consider the data in (10)-(13).

---

1 This is similar to the Kuman case (6.4.1.1) where the loss of the SV node of a lateral yields a [l].
(10) Lateral-final stems

a. Bashkir qoral qoral-dar 'instrument'

b. Kirghiz primer primer-dar 'year'
   Journal Journal-dar 'magazines'

c. Tuvan mal mal-dar 'cattle, groups of cattle'

d. Yakut küöl küöl-ler 'lake'

(11) Glide-final stems

a. Bashkir blyr blyr-ler 'cow'
   llyr llyr-ler 'mountain'
   tay tay-ler 'foal'
   qöl qöl-ler 'girl'

b. Kirghiz ay ay-ler 'month'
   baah baaa-ler 'hero'
   ur ur-ler 'song'

C. Tuvan xoy xoy-ler 'sheep'
   tör tör-ler 'land'
   day day-ler 'mountain'

d. Yakut ubay ubay-ler 'elder brother'
   ärär ärär-ler 'stallion'

(12) Nasal-final stems

a. Bashkir yag yag-dar 'sleeve'

b. Kirghiz adam adam-dar 'human'
   meyman meyman-dar 'guests'

c. Tuvan nom nom-nar 'books'
   koygun koygun-nar 'horses'
   dilig dilig-ner 'squirrels'

d. Yakut aan aan-nar 'door'
   olo olo-nor 'fort'
   tiig tiig-ner 'squirrel'

(13) Voiced Fricative-Final stems

a. Bashkir kolxoz kolxoz-dar 'collective farms'
   garax garax-dar 'garage'

b. Kirghiz siz siz-dar 'you'

c. Tuvan no final voiced obstruents

d. Yakut no final voiced obstruents

The different realizations of the plural morpheme appear in chart form in
(14).

(14) Table summarizing realizations of initial /I/ of /IÀr/

<table>
<thead>
<tr>
<th>Stem Final Segment</th>
<th>Vowel</th>
<th>/I/</th>
<th>Glide</th>
<th>Nasal</th>
<th>Vd. C</th>
<th>Vels. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bashkir</td>
<td>l</td>
<td>d</td>
<td></td>
<td>d</td>
<td>d</td>
<td>t</td>
</tr>
<tr>
<td>Kirghiz</td>
<td>l</td>
<td>d</td>
<td></td>
<td>d</td>
<td>d</td>
<td>t</td>
</tr>
<tr>
<td>Tuvan</td>
<td>l</td>
<td>d</td>
<td></td>
<td>n</td>
<td></td>
<td>t</td>
</tr>
<tr>
<td>Yakut</td>
<td>l</td>
<td>l</td>
<td>d</td>
<td>n</td>
<td></td>
<td>t</td>
</tr>
</tbody>
</table>

---

2 I classify the voiced interdental fricative /β/ as a glide. This issue is taken up in §6.4.2.
As previously noted, all the languages behave in the same way when the stem-final segment is a vowel or a voiceless consonant. However, none display identical behaviour for the other stem-final sounds. In the following sections we will examine each of the languages in order to determine what determines the variation found in (14). We will first develop an analysis of Bashkir and use this analysis as a starting point in looking at the other three languages.

6.4.2 Bashkir

We begin with a consideration of the Bashkir inventory (from Poppe 1964) as this provides a key for understanding the alternations. The Bashkir inventory is presented in (15).

(15) Bashkir inventory:\n
<table>
<thead>
<tr>
<th>Vcls</th>
<th>Labial</th>
<th>Dental</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>stops</td>
<td>p</td>
<td>t</td>
<td>s</td>
<td>x</td>
<td>h</td>
<td>(7)</td>
</tr>
<tr>
<td>fricatives (f)</td>
<td>s</td>
<td>z</td>
<td>x</td>
<td>k</td>
<td></td>
<td>(7)</td>
</tr>
<tr>
<td>affricates (c)</td>
<td>(c)</td>
<td>(c)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vd (SV)</td>
<td>b</td>
<td>d</td>
<td>g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>stops</td>
<td>b</td>
<td>d</td>
<td>g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricatives (v)</td>
<td>(z)</td>
<td>(v)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasals m</td>
<td>n</td>
<td>n</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glides w</td>
<td>Ø</td>
<td>r</td>
<td>y</td>
<td>y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>liquids l</td>
<td>Ø</td>
<td>(l)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All segments in parentheses occur only in the loan vocabulary.

\[3\] All information on Bashkir has been taken from Poppe (1964), a book that is not primarily about phonology. The book does, however, provide a good deal of useful information concerning the distribution of consonants in the form of possible word-internal clusters, as well as a list of what Poppe considers to be the phonemes of Bashkir.

The phonemic inventory in (15) differs slightly from that given in Poppe (1964), in so far as I have not included /q/, a voiceless uvular stop. This sound is an allophone of /k/ in native words with back vowels; however, the appearance of /k/ in some borrowings with back vowels appears to have caused Poppe to recognize /q/ as a phoneme. A similar situation exists with the sounds /g/ and /ɣ/. According to Poppe, /g/ only occurs in words with front vowels. He does, however, list several words that have /ɣ/ and contain front vowels. An unusual feature of the Bashkir inventory is the presence of /ʃ/ and /ʒ/, sounds that are not found in other Turkic languages I am aware of. Clearly, /ʃ/ is a reflex of the /ʃ/ found in other Turkic languages: Bashkir /kʃ/ 'girl', Turkish /koʃ/ 'girl', Kirghiz /koʃ/ 'girl'; Bashkir /aʃ/ 'little, few', Kirghiz /aʃ/ 'little, few'. This sound does not occur in initial position, a restriction it shares with /ʃ/ in the native vocabulary of other Turkic languages. The /ʃ/ sound found in Bashkir is restricted to the loan vocabulary, as are all the other voice fricatives.

I have classified the sounds /ʃ, ɣ, r/ among the glides based on their behaviour in phonological rules. While it is not unusual for /r/ to be considered a glide (as it is in English, see Kahn 1976), it is less usual to find the sounds /ʃ, ɣ/ classified as glides. In Bashkir these sounds pattern with /w, y/ rather than with the voiced fricatives /ʃ, ɣ/. For example, the /ʃ/ of the plural morpheme surfaces as a /ʃ/ when it is preceded by a glide, including /ʃ/, but as /ʃ/ when it is preceded by one of the voiced fricatives /ʃ/ or /ɣ/. Obviously, the continuancy of the fricative does not spread or we might reasonably expect that a preceding /ʃ/ or /ɣ/ would yield a /ʃ/-initial suffix. If we classified /ʃ/ as a voiced fricative, there would be no explanation for the
difference in behaviour between the voiced fricatives /ɹ, ɹ/ and /ʃ/. In (12a) and (14a), we saw the difference in the behaviour of these sounds and how the /ʃ/ patterns with the glides. As far as /ɣ/ is concerned, I can find no examples in Foppe (1964) of a stem-final /ɣ/. This may be because /ɣ/ has changed to /w/ in final position (cf. Bashkir /waw/ ‘mountain’, Tuvan /day/ ‘mountain’). This change lends further support to the classification of /ɣ/ as a glide because, if /ɣ/ is a glide, the change to /w/ only involves the addition of a labial articulation and not a change in manner of articulation. Although this point concerns the general behaviour of voiced fricatives in Turkic languages. Recall that we argued in chapter 5 that the voiced fricatives of Turkish are SV sounds because they do not undergo final devoicing, and thus pattern with the sonorant consonants. In Bashkir the change of /ɹ/ to /ʃ/ was a change from a fricative sound with a bare SV node to a glide sound with an Approximant node dominated by the SV node. Presumably, this change would also entail the loss of stridency that characterizes the alveolar fricatives.

We also need to consider the representation of the lateral segment itself. If /ɹ/ is a glide sound, it would seem that /ɹ/ and /l/ are not minimally contrastive for the feature [lateral] and thus we do not need to specify the laterals underlyingly for this feature. Glides will be distinguished from laterals by the airflow features associated with glides. The laterals, on the other hand, are stops and should be associated with other non-continuant SV sounds such as /d/ and /n/.

A further aspect of this inventory bearing on the representation of sounds concerns the voicing distinction in the stops. As discussed in chapter 3, there are three possible representations for a voicing distinction such as that found in Bashkir. It could be (i) an LV system, with the voiced and voiceless stops distinguished at the Laryngeal node, (ii) an SV system, with the voiced stop specified with SV and minimally contrasting with the nasals, or (iii) a CV system, with the voiced stop unspecified and the voiceless stop having a bare LV node. The three possibilities are represented in (16), (17), and (18).

(16) LV (Laryngeal Voice) System

```
| Voiceless C | Voiced C | Nasal |
| Root        | Root     | Root |
| Lar         | Lar      | SV   |
```

(17) SV (Sonorant Voice) System

```
| Voiceless C | Voiced C | Nasal |
| Root        | Root     | Root |
|             | SV       | SV   |
|             | [nasal]  |      |
```
In (16), the voiced and voiceless consonants (obstruents) are minimally distinct, varying only in the specification of the Laryngeal dependent [voice]. In (17), the voiced consonant contrasts minimally with the nasal, being specified with an SV node. In (18), the voiced consonant is intermediate between the voiceless obstruent and the nasal. In chapter 4, we proposed the representation in (18) for the Turkish stops. In order to determine which of these representations is the appropriate one for the Bashkir inventory, we must determine if any of the marked features such as [voice] or [nasal] are active in the phonology. If there is no evidence of voicing spread, the representation in (16) is excluded, as that representation has an active feature [voice]. If there is no evidence for the feature [nasal] in the phonology, then the representation in (17) is unlikely to be the correct one. With neither [voice] nor [nasal] being active, the default specification is the CV system in (18).

An examination of the consonant clusters in Bashkir shows that there is no active feature [voice], ruling out the representation in (16). There is no voicing spread in clusters, meaning that sequences such as [bl], [dl] and [gd] are not found. As there is a distinction that could be analyzed as a voicing distinction in the language, it is entirely possible that such clusters could exist, as they do among the stop sequences of languages such as Dutch. However, the failure of such clusters to surface anywhere in the language provides strong evidence against any analysis with an underlying voicing distinction involving the feature [voice].

Evidence for or against the specification of the feature [nasal] is somewhat more difficult to find. The spreading of [nasal] in clusters may indicate an active feature, but such spreading could simply be the result of the default rule inserting [nasal], as shown for Korean in §4.2.1. We thus need to investigate whether there are any /d–n/ alternations in the language. Such alternations would indicate that the feature [nasal] is specified underlyingly, as the Nasal Enhancement Rule would be inactive. Recall that no such alternations were found in Turkish among the stop consonants, leading us to the conclusion that the stops are part of a CV system.

Evidence that Bashkir, unlike Turkish, has an SV system can be found by examining a wider range of morphemes in Bashkir. For example, there are inflectional morphemes that are nasal initial, discussed in more detail below. The initial segment surfaces as nasal when intervocalic and as [d] following a nasal consonant. I will argue that these morphemes are specified as [nasal] and that government requires that the feature [nasal] not be parsed when immediately following a [nasal]. These [n–d] alternations provide evidence for the presence of the feature [nasal] in underlying representation. The underparsing of the feature [nasal] is shown in (19). If [nasal] were not unspecified, we would not expect to find an [nd] sequence but rather a [nn] sequence, through the operation of the NER.
(19) Underparsing in a nasal-nasal sequence

\[
\begin{array}{c|c}
\text{Nasal} & \text{Nasal} \\
\hline
\text{Root} & \text{Root} \\
\hline
\text{SV} & \text{SV} \\
\hline
\text{[nasal]} & <\text{nasal}> \\
\end{array}
\]

With an SV system as in (17), the cluster /nd/ is the direct result of underparsing the feature [nasal]. No further repair is required.

The /l-5-d-l/ alternations in the plural also point to an SV system, though the evidence here is less direct. The failure of a nasal consonant to appear as an alternant of the initial segment of the plural shows that the NER (Nasal Enhancement Rule) is inoperative in the language. If it were operative, one might expect [nasal] to be inserted when a bare SV node arises through underparsing, as argued in the above paragraph.

Bashkir, then, has an SV system, with [lateral] not specified. The representation of the Bashkir consonants is given in (20).

(20) SV representation of Bashkir consonants

\[
\begin{array}{c|c|c|c|c|c|c}
\text{Vc} & \text{Vd} & \text{C} & \text{Vd} & \text{C} & \text{Nasal} & \text{Glide} & \text{Lateral} \\
\hline
\text{Root} & \text{Root} & \text{Root} & \text{Root} & \text{Root} & \text{Root} & \text{Root} \\
\hline
\text{SV} & \text{SV} & \text{SV} & \text{SV} & \text{SV} \\
\hline
\text{[nasal]} & \text{Approx} & \text{Approx} \\
\end{array}
\]

These representations account for all the alternations in the plural suffix. As previously discussed, the voiceless consonants result from the underparsing of the SV node of the lateral. This yields a representation identical to the voiceless consonants, and the consonant surfaces as [l]. With a preceding nasal, glide or lateral, only the Approx node is underparsed and the surface should be [d]. This is the correct result for the nasals and laterals. Recall, however, that after a glide-final stem, the plural suffix surfaces as [AlAr]. Initially, this is puzzling as the definition of government given in (6b) requires that the governing segment must have less SV structure than the governor. In the case of the glides, it would appear that the governor has the same SV structure as the governor.

Distributional facts about /d/ and /l/ may help to explain the appearance of /l/ where /d/ is expected. These sounds are in complementary distribution after glides in Bashkir, although Poppe’s statements on the matter are somewhat confusing. According to Poppe (1964), /d/ “occurs initially and medially in intervocalic position and after /m, n, l, r, y/” (p.9). While this list excludes most glide sounds, the presence of /r/ appears to contradict the complementarity between /d/ and /l/ in this position, if /r/ is

\[\text{Note that the glides and laterals will be distinguished by airflow features, though they are identical with respect to SV structure.}\]
to be classed as a glide as claimed above. However, in the exhaustive list of clusters that Poppe provides (pp. 14-18), /rd/ is missing, while /r/t/ is listed. If we assume that there are no occurrences of /rd/, given Poppe’s list of clusters, then we might reasonably conclude that an initial /t/ in the plural morpheme after glides is an allophonic realization of /d/. Another contradiction about the /d/ sound is the Poppe’s statement in the above quotation that /d/ occurs in intervocalic position. Poppe even provides an example: /idara/ ‘rule’. However, in his discussion of the distribution of consonants in intervocalic position, Poppe states: “All native consonants, with the exception of /d/, occur medially in intervocalic position” (p.13). Poppe then goes on to provide examples of all the consonants in intervocalic position. If the second statement is correct, as it seems to be, then the /d/ and /t/ are indeed in complementary distribution: /d/ occurs initially and after nasals and laterals, while /t/ occurs finally, intervocally and following glides. The change from /d/ to /t/ is best characterized as a postlexical rule changing an input /d/ to /t/. Note that in Yakut, which has no /t/, the plural morpheme is /d/-initial after glides.

The failure of the plural marker to surface as /t/ after the fricatives /r, z/ shows that the feature responsible for the continuancy of the fricatives is not spreading and that this feature is not present in the glides. As the fricatives are minimally contrastive with the SV stops, they must be specified as [continuant]. These fricative sounds thus differ from the glides representationally in two ways; first, they do not have an Approximant node, i.e., they only have an SV node, and second, they are specified for the feature [continuant] under the AF (Airflow) node. This is shown below.

(21) Glides vs. Voiced Fricatives

<table>
<thead>
<tr>
<th>Glide</th>
<th>Voiced Fricative</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>SV</td>
<td>SV</td>
</tr>
<tr>
<td>Approx</td>
<td>AF [cont]</td>
</tr>
</tbody>
</table>

These representations allow us to account for the behaviour of the SV fricatives and the glides in a straightforward fashion. As the glides have no specification for continuancy, the underparsing of the Approx node will directly yield an SV stop, the unmarked realization of a plain SV segment.

6.4.2.1 Other suffixes in Bashkir

Several other suffixes of Bashkir behave similarly to the plural morpheme. The form of these suffixes is interesting in several respects. First, they are all easily accounted for in the framework so far developed. Second, they provide further evidence for the representations of voiced stops presented above. Let us pursue the latter point first.

In Bashkir, there are a number of suffixes that clearly have direct correspondences in other Turkic languages but which differ from those in that the form in Bashkir is an alternating nasal, or in one case a lateral, while the form in most other Turkic languages is a stop that surfaces as either voiced or voiceless depending on the phonetic context. The alternating nasal and lateral of Bashkir may surface as a voiced or a voiceless stop, while the alternating voiced stop of the other Turkic languages can only become a voiceless stop. For example, the locative marker in most Turkic languages is
/DA/6 which is realized as either [tA] or [dA]. In Bashkir, we find /LA/ which has the now familiar realizations [tA], [rA], [dA] and [tA]. The ablative case in most Turkic languages is /DAn/ which surfaces as either [t] or [d] initial. In Bashkir, the ablative case is /NAn/, with the realizations [nAn], [bAn], [dAn] and [tAn]. In both of these cases there is no change so that underlying SV obstruent to either a nasal or a lateral sound can be seen as a simple addition of SV structure to the morpheme-initial consonant.

Let us now turn to an analysis of these suffixes. In addition to the lateral-initial suffixes we also find nasal-initial and SV-obstruent-initial suffixes. We have already discussed lateral-initial suffixes and now turn to nasal-initial suffixes and SV-obstruent-initial suffixes.

Consider the data in (22), which illustrate the range of alternations found in the nasal-initial suffixes.

(22) The genitive suffix /-NEg/

| a. Stem-final vowel: | tǎ́r ‘window’ | tǎ́rɑ́n ‘of the window’ |
| b. Stem-final glide: | taw ‘mountain’ | tawɑ́ ‘of the mountain’ |
| c. Stem-final voiced fricative: | yarp ‘earth’ | yarpɑ́ ‘of the earth’ |
| d. Stem-final voiceless stop: | taʃ ‘crown’ | taʃɑ́ ‘of the crown’ |
| e. Stem-final nasal: | yalan ‘steppe’ | yalanɑ́ ‘of the steppe’ |
| f. Stem-final lateral: | tal ‘tongue’ | talɑ́ ‘of the tongue’ |

If we assume that the underlying representation of the genitive suffix has a specified nasal consonant in morpheme-initial position, the analysis of these data is exactly the same as for the lateral. A lateral-nasal sequence is shown in (23).

(23) Lateral-nasal sequence: underparsing of [nasal]

<table>
<thead>
<tr>
<th>Lateral</th>
<th>Nasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root</td>
<td>Root</td>
</tr>
<tr>
<td>SV</td>
<td>SV</td>
</tr>
<tr>
<td>Approx</td>
<td>{nasal}</td>
</tr>
</tbody>
</table>

As an inspection of these representations reveals, the underparsing of the feature [nasal] will allow the sequence to meet the requirements of government, as the nasal segment will then have less SV structure than the lateral. Similarly, when the nasal-initial suffix is preceded by a glide, the underparsing of [nasal] will permit government. As with the /l/-initial suffixes, the realization of the underlying nasal as [l] is a result of an allophonic process. A stem ending in a nasal will also induce the underparsing of [nasal] in order to satisfy government as illustrated in (24).

(24) Nasal-nasal sequence: underparsing of [nasal]

<table>
<thead>
<tr>
<th>Nasal</th>
<th>Nasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root</td>
<td>Root</td>
</tr>
<tr>
<td>SV</td>
<td>SV</td>
</tr>
<tr>
<td>[nasal]</td>
<td>{nasal}</td>
</tr>
</tbody>
</table>

When the suffix is preceded by a voiceless consonant, the SV node is underparsed, yielding a surface [t]. When the suffix occurs after a vowel, there are no government requirements and the underlying nasal is free to surface.

---

6 The capital letters represent the archiphonemic representation. /D/ represents either a [t] or a [d] and /A/ represents a low vowel that harmonizes in backness and, in some languages, rounding with the stem vowel.
Other alternating nasal-initial suffixes are the accusative /NE/, the ablative /NAn/ and the past tense /NE/. All these suffixes like the genitive with respect to the alternations in the initial consonant.

The other suffix type found in Bashkir shows an alternation between a voiced and voiceless consonant. Two consonants display this behaviour: /D/ and /G/. The alternations are very straightforward with suffixes of this type, as shown in (25).

(25) Alternations with suffixes beginning with /-G/
    After vowels and voiced consonants /m, w, b, z, l, n, r, z, y, y/, we find a
    voiced sound /g/ or /y/.
    After voiceless consonants, we find /k/ or /q/.
    Examples with the dative /-GA/
      kül 'lake'                 külgä 'to the lake'
      yalan 'steppe'            yalanya 'to the steppe'
      ittak 'shoe'              ittakkä 'to the shoe'
      at 'horse'                atqa 'to the horse'

    The choice between /g/ and /y/ and between /k/ and /q/ is determined by the
    allophonic rules of the language and depends on whether the word has front
    or back vowels. The patterns described in (25) are entirely expected given the
    government account. If we consider the morpheme-initial segments to be
    underlyingly SV-obstruents, they will govern all other sonorant consonants.
    They will not govern voiceless consonants, however, necessitating the
    underparsing of the SV node.

    The same account holds for the /D/-initial prefixes as illustrated in (26).

(26) Alternations with suffixes beginning with /-D/
    After vowels and the consonants /m, n, g, l, z, y/, we find the voiced
    sound /d/.
    After the glides /w, b, r, y/, we find /l/.
    After voiceless consonants, we find /l/.
    Examples with the ablative /-DAn/
      küldän 'from the lake'
      yaländan 'from the steppe'
      ittaktän 'from the shoe'
      attän 'from the horse'
      qəndän 'from the goose'
      laqändän 'from the mountain'
      yarqändän 'from the steep bank'

    Again, the SV representation makes the correct predictions concerning the
    realization of the alternating consonants. As in the case of /G/, the only time
    we expect alternation in order to satisfy government is with a stem-final
    voiceless stop. The appearance of /e/ can be accounted for allophonically, as
    with the lateral- and nasal-initial suffixes.

6.4.2.2 Summary of Bashkir

We have seen that in Bashkir the complex array of assimilations and
dissimilations can be accounted for elegantly if we allow underparsing
motivated by the need to satisfy government requirements. There are three
types of alternating suffixes in Bashkir: lateral-initial, nasal-initial and
SV-obstruent-initial. When the initial consonant of any of these suffixes
must govern a voiceless stop, the SV node is underparsed and the initial
consonant surfaces as voiceless. When the initial consonant comes into
contact with any other SV consonant, the SV node is parsed but any features
that the SV node dominates are lost; in the case of the lateral- and
nasal-initial suffixes their lateral and nasal features are underparsed and they surface as [l] initial.

6.4.3 Kirghiz

Kirghiz is very similar to Bashkir in the behaviour of the plural morpheme as we saw in the table in (14). The only difference between the two languages concerns the realization of the plural when following a stem-final glide. Recall that in Bashkir the plural is realized as [ßAr] in this circumstance while in Kirghiz it is realized as [lAr]. Thus, for all but the glide-final stems we can maintain the same analysis as for Bashkir. What must be explained is the difference in the glide-final stems. The Kirghiz inventory is given in (27).

(27) Kirghiz inventory:

<table>
<thead>
<tr>
<th>Vcls</th>
<th>Labial</th>
<th>Dental</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stops</td>
<td>p</td>
<td>t</td>
<td>k</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricatives</td>
<td>f</td>
<td>s</td>
<td>s</td>
<td>x</td>
<td>h</td>
<td></td>
</tr>
<tr>
<td>Affricates</td>
<td>c</td>
<td>t</td>
<td>z</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vd (SV)</td>
<td>Stops</td>
<td>b</td>
<td>d</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricatives</td>
<td>z</td>
<td>z</td>
<td>n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m</td>
<td>n</td>
<td>n</td>
<td>g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glides</td>
<td>w</td>
<td>r</td>
<td>y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>l</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This inventory is very similar to the one given for Bashkir apart from the absence of [ß] and [ß]. In Hebert and Poppe (1963) the pronunciation of the sounds and their status in the inventory with respect to native versus foreign is not discussed in any detail. With this state of knowledge it is difficult to draw any firm conclusions concerning the representation of sounds, apart from those that come from an investigation of the alternations in inflectional suffixes. Even with fuller knowledge the appearance of an [ß] initial plural after a glide would remain problematic. One possible explanation involves the structural location of the glides. Two syllabifications are possible for glides: On the one hand, they could be in the nucleus of the syllable and share the same syllabic node as the vowel. On the other hand, they could be dominated by the rime node. These two possibilities are shown in (28).

(28) Syllabic constituency of vowel-glide sequences

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>p</th>
</tr>
</thead>
</table>

In (28a) the glide is structurally associated with the vowel and in (28b) it is dominated by a different node from the vowel. In the configuration in (28a) the glide is in ‘coda’ position and according to government theory is licensed by the preceding vowel. The glide in (28b), on the other hand, is in coda position and must be licensed by a following onset. Hebert and Poppe (1963) provide scant information concerning the pronunciation of Kirghiz vowels or any other alternations that may indicate the appropriate representation of the vowel-glide sequences. One suggestive piece of evidence is the presence of long vowels, vowel-vowel sequences that are frequently analyzed as in (28a). If we assume that the appropriate representation is that in (28a), then the surfacing of the plural morpheme as
/AR/ after a glide is accounted for. This analysis is called into question, however, when we study nasal-initial suffixes, to which we now turn.

Kirghiz, like Bashkir, has other suffixes with alternating initial consonants. For the most part these are subject to the same analysis as the plural morpheme. An example of a nasal-initial suffix is provided in (29).

(29) The accusative suffix /-NI/
   a. Stem-final vowel:  ečki 'goat'       ečki 'goat' (acc.)
   b. Stem-final glide:  aγ 'moon'        aγ 'moon' (acc.)
   c. Stem-final nasal:  kar 'snow'       kard 'snow' (acc.)
   d. Stem-final voiced fricative:  kir 'eye'       kör 'eye' (acc.)
   e. Stem-final voiceless stop: at 'horse'       atli 'horse' (acc.)
   f. Stem-final lateral:  no example found

As can be seen, the nasal-initial suffixes are for the most part identical to those found in Bashkir. Crucially, they do not surface as [n]-initial when following a glide, indicating that this environment underparsings to satisfy government requirements is relevant to the surface form. This contradicts an account of the plural morpheme that has the glide was in the nucleus governed by the preceding vowel. At present I have no explanation for the difference between the plural morpheme and the morphemes with an initial nasal. My expectation is that they should behave in a similar fashion when preceded by a glide, but evidently they do not. Hebert and Poppe (1963), in their discussion of the plural morpheme make the following statement:

"The plural is formed by adding /-ep/ directly to the noun before any other inflectional suffix. /-ep/ is affixed to nouns ending in a vowel, /-ep/ to nouns ending in a voiced consonant, and /ep/ to nouns ending in a voiceless consonant." (p. 18)

Throughout the Manual, Hebert and Poppe consistently refer to the set of voiced consonants as the sounds /b, d, j, g, w, r, m, n, q, l, r, y/., which would indicate that the plural should begin with the /d/ form after /rl/ or /yl/. In their introduction of the plural Hebert and Poppe provide very few examples and none of them show the realization of the plural after a glide. A search of the reading passages found in the Manual yielded the examples given in (11), with a lateral-initial suffix. However, there is another /l/-initial suffix discussed by Hebert and Poppe, the suffix /λlk/, a noun formative. They provide four examples, three of which show a vowel final stem, and the other an /l/ final stem as in (30).

(30) The /l/-initial suffix /λlk/
   sütči 'dairyman'       süttčiλč 'dairy industry'
   bir 'one'               birčd 'unity'

These data strongly suggest that the glides behave as we might expect if they enter into a government relationship, i.e., they cause the underparsing of the Approximant node. The realization of the plural after the glides awaits further research.

An interesting complication that arises from a comparison of Kirghiz and Bashkir concerns morphemes that are invariant even when a government violation is created. For example, the negative marker in Kirghiz begins with a labial nasal but has three realizations: [mA] after a vowel, [bA] after a voiced
consonant (including nasals) and [pA] after voiceless consonants. This should be compared with Bashkir where the negative is realized with an invariant [m] as the initial segment of the morpheme. This is interesting because it presents a serious problem for our government account. Clearly, we would like to analyze the alternations in the Kirghiz negative morpheme in the same way we have done for all the other alternating morphemes, that is, as a case of underparsing to satisfy government requirements. Our problem is as follows: if government is an operative constraint in the language, then we should find evidence of it everywhere and not only in selected places. Moreover, violations of government should be shown to be illusory or restricted to specific contexts.

A theory such as Lexical Phonology could provide a solution to the problem by placing suffixes such as the alternating plural and the non-alternating negative at different levels. Then it would be possible to say that government is only relevant at the level at which the alternating suffixes are attached but has ‘turned off’ by the time the non-alternating suffixes are attached. This also provides a solution for the difference between two closely related languages such as Kirghiz and Bashkir. In Kirghiz, where the negative is an alternating suffix, it is located at the same level as the other alternating suffixes, the level at which government is obeyed. In Bashkir, on the other hand, the negative suffix is non-alternating and is at a different level from the alternating suffixes, a level at which government requirements are not relevant. We mention this problem only in passing in this section but will return to it when data from Tuvan and Yakut have been examined.

6.4.4 Tuvan

Krueger (1977) provides a comprehensive grammar of Tuvan that includes useful detail about the phonology. For this reason we can be more certain about the phonology and consequently about its analysis than with either Bashkir or Kirghiz and this makes it, in some ways, a better test of the SV/government account. As detailed in (10)-(13) and summarized in (14), the initial consonant of the plural marker in Tuvan has four variants: /l, n, d, t/. The conditions under which each of these variants occurs are similar to those discussed for Bashkir and Kirghiz, with the [l] form occurring after vowels and the [n] form occurring after voiceless consonants. In Tuvan, the [d] form also occurs after glides while the [t] form only occurs after a stem-final lateral.

A new wrinkle that we have not yet encountered is the occurrence of a nasal-initial variant after a stem-final nasal.

Before proceeding to the analysis of Tuvan, we present the phonemic inventory of the Tuvan consonants.

---

7 I do not provide any examples from Kirghiz as my example set is incomplete. The same process applies in both Tuvan and Yakut, which will be discussed in the next section, where examples and more-detailed discussion will be provided.
This table represents the Tuvan inventory of consonants. The sounds in parentheses are loan words from other languages:

<table>
<thead>
<tr>
<th>Consonants</th>
<th>Labial</th>
<th>Dental</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stops</td>
<td>p</td>
<td>t</td>
<td>k</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricatives</td>
<td>(f)</td>
<td>s</td>
<td>å</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Affricates</td>
<td>(c)</td>
<td>Æ</td>
<td></td>
<td>Ë</td>
<td></td>
</tr>
<tr>
<td>Stops (SV)</td>
<td>b</td>
<td>d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricatives</td>
<td>(v)</td>
<td>(z)</td>
<td>(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m</td>
<td>n</td>
<td>ñ</td>
<td>ỹ</td>
<td></td>
</tr>
<tr>
<td>Glides</td>
<td>r</td>
<td>ỹ</td>
<td>ỹ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>î</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Again, sounds in parentheses occur only in the loan vocabulary. The others represent what appear to be the phonemic contrasts in the native vocabulary of the language, to the extent that this can be determined from a reading of Krueger. He states that [z] occurs intervocally as a positional variant of /s/, and that [q] occurs intervocally as a positional variant of both /f/ and /v/ as well as in some Russian loan words. He also lists /ɡ/ as well as /ɡ/ but states that only one sound is represented, that being a voiced velar fricative.

This inventory does not differ greatly from those that were presented for Bashkir and Kirghiz. In Tuvan there are not as many voiced consonants and their distribution is somewhat more limited than in Bashkir and Kirghiz. As well, the alternations involving voiced and voiceless obstruents are somewhat different. For example, in most other Turkic languages there is a rule devoicing voiced stops in syllable-final position, with the voiced stops surfacing only intervocally, the voicing distinction being neutralized syllable finally but maintained syllable initially. In Tuvan intervocalic /n/ and /n/ are voiced to /b/ and /d/, respectively, resulting in a lack of distinctive voicing for these sounds in medial position. Interestingly, the voiceless stop /k/ does not voice in the same position: instead, we find gemination word internally and deletion (accompanied by vowel lengthening) when a vowel-initial suffix is attached to a stem ending in /k/.

It is also apparent that as in Bashkir and Kirghiz the voiced fricative /ã/ patterns with the sonorant consonants. Krueger states that it is the only voiced obstruent that can occur word finally, a distributional fact that places it among the sonorants such as /l/, /r/ and /y/, which also occur word finally.

A further distributional fact that is of some interest to our account of Tuvan concerns the distribution of possible consonants following /l/. Krueger (1977, 104) says:

"After l, a voiced consonant or sonant always occurs, viz., b (b), g, d, z. By a special rule, the written ç is always pronounced voiced as j (z) after l. Thus, where other Turkic languages have combinations like Ik, Il, In, Iw, Is, Tuvinian will have Ig, Id, Iq, Iz, and so on."

It thus appears that the voiceless consonants are contextually voiced, as is consistent with their being voiced intervocally.

6.4.4.1 Tuvan Plurals

Let us now return to our account of the plural morpheme. The appearance of the /l/-initial form after the glides, /r/, /y/, /y/ and the vowels indicates one of two things: first, it may be that syllable structure is playing a
role, a position that was suggested for Kirghiz. Krueger provides several minimal pairs showing that vowel length is distinctive in Tuvan.

(33) Vowel length:
- äs 'mountainous'
- äs 'mouth'
- ök 'revenge'
- ök 'gullet, foodpipe'
- öt 'dog'
- öt 'sound, noise'
- xerek 'matter, need'
- xerek 'low quality'

The presence of distinctively long vowels may be taken to indicate that the glides are part of the nucleus rather than branching from the rime. As a consequence, they are governed by the preceding vowel and not by a following onset. In this case, the /ll/-initial form of the plural should surface, and indeed it does. There are morphemes with superheavy syllables, i.e., long vowels and final sonorants, for example, /meeg/ 'my'. While it appears that these are rare, Krueger does not mention that the plural form differs when added to these glide-final stems.

The only condition under which the plural surfaces as [d]-initial is following an /ll/-final stem. This should be compared with the Bashkir forms where the plural surfaces as [d]-initial after all the sonorant consonants including the nasals. (Of course, there is the further change of [d] to [b] in Bashkir that occurs after the glides.) As well, we must consider the nasal-initial variant of the plural that surfaces after a nasal. In earlier work (Avery 1995), I assumed that Bashkir and Tuvan were very similar in their government properties but that Tuvan had a subsequent language-specific rule spreading the stem-final nasal feature onto the plural morpheme, as shown in (34).

\[
\begin{array}{c}
\text{(34) Nasal Enhancement Rule} \\
\text{R} \quad \text{R} \\
\text{SV} \quad \text{SV} \\
\text{[nasal]} \quad \text{<Approx>}
\end{array}
\]

In (34) the under parses of the Approximant node of the lateral allows the sequence to meet government requirements and the spreading of the [nasal] feature is the language-specific component. In a language such as Bashkir, [nasal] does not spread and the sequence surfaces as [nd] rather than [nn].

An alternative analysis of the Tuvan data is now available, dispensing with the rule spreading the feature [nasal]. If we consider the distinction between the voiced and voiceless obstruents to be a laryngeal distinction rather than an SV distinction, then nasals are not minimally distinct from the voiced stops, the feature nasal is not present underlyingly but is supplied by the Nasal Enhancement Rule (NFR), repeated in (35).

(35) Nasal Enhancement Rule

\[
\begin{array}{c}
\text{R} \quad \text{R} \\
\text{SV} \rightarrow \text{SV} \\
\text{[nasal]}
\end{array}
\]

When the plural is added to a morpheme ending in a nasal, we have the following derivation.
(36) Derivation of an underlying nasal-lateral sequence

a. \[ \text{SV} \text{ SV Underparse SV SV NER SV SV Approx} \]
b. \[ \text{SV} \text{ SV Approx <Approx> nasal nasal} \]

c. \[ \text{SV} \text{ SV NER SV SV BLOCKED Approx Approx} \]

We see the input in (36a). The Approximant node is underparsed in (36b) and we are left with two bare SV nodes. Both SV nodes are subject to the NER in as in (36c) and they surface as nasals. Presumably, something along the lines of the OCP will fuse the two [nasal] specifications.

When there is a lateral-final stem, the Approximant node is again underparsed as shown in (37b). However, an independent constraint in the language blocks the NER from applying. This is the same constraint that is responsible for Krueger's observation about the phonotactics of l-initial clusters, i.e., *lm, *ln, *lg. In all cases, a potential lateral-nasal sequence surfaces without the nasal feature on the second consonant.

(37) Derivation of an underlying lateral-lateral sequence

a. \[ \text{SV} \text{ SV Underparse SV SV NER SV SV Approx} \]
b. \[ \text{SV} \text{ SV Approx <Approx> nasal nasal} \]

c. \[ \text{SV} \text{ SV NER SV SV BLOCKED Approx Approx} \]

Note that in order to account for the nasal-nasal case, we must allow a bare SV node to act as a governor for a bare SV node. This could be accomplished through a slight revision to the definition of SV Government given in (3).

All we need add is a clause stating that bare SV can govern bare SV. This is shown in (3') where we have included only the relevant clause (bii) and the additional clause (biii).

(3') b. Between syllables, A governs B if:
   i. B has more SV structure than A or
   ii. Bare SV can govern bare SV.

Now we must ask which solution is to be preferred: the underspecification of nasal or the spreading analysis? Both employ independently motivated mechanisms of the theory and are equally acceptable in that respect. But note that the spreading analysis makes the underlying representations in related languages such as Bashkir and Tuvan look very similar, while the underspecification analysis makes the underlying representations different. We will search for decisive evidence in the alternations found in the other morphemes of the language.

6.4.4.2 Tuvan Inflectional Morphology

In Bashkir we found three basic types of alternating morphemes: voiced/voiceless (d/l, g/k), nasal/voiced/voiceless (m/d/l), and lateral/fricative/voiced/voiceless (l/b/d/l). We determined that the underlying representation is always the variant with the most structure, voiced, nasal, and lateral, respectively. This allowed for a relatively straightforward account in terms of underparsing. We have investigated the Tuvan plural and seen that it is a lateral-initial morpheme. We might expect that the other morphemes will fall out as in Bashkir with the segment having the most structure being the morpheme-initial segment. However, as we will see, Tuvan differs from Bashkir in having not three but four morpheme types. In the following we will investigate the other three types.
and attempt to develop a consistent analysis of the data. The morpheme types will be referred to as type 1, type 2, type 3 and type 4, with the lateral-initial morphemes, such as the plural, being type 1. We now introduce the other three types. For the purposes of discussion, and in anticipation of the conclusion to be drawn shortly, we will take [nasal] to be underlyingly present in Tuvan, consistent with the hypothesis pictured in (34) rather than that in (36). This means that the representation of the various consonant types is as in (38).

<table>
<thead>
<tr>
<th>SV Representation of Tuvan consonants</th>
<th>Vcls C</th>
<th>Vd C</th>
<th>Nasal</th>
<th>Glide</th>
<th>Lateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root</td>
<td>Root</td>
<td>Root</td>
<td>Root</td>
<td>Root</td>
<td></td>
</tr>
<tr>
<td>SV</td>
<td>SV</td>
<td>SV</td>
<td>SV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[nasal]</td>
<td>Approx</td>
<td>Approx</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.4.4.2.1 Type 2 Morphemes

The genitive morpheme has three variants as shown in (39).

(39) The Genitive

a. [t] after voiceless consonants
   *ot* 'fire'  *ottug* 'of the fire'
   *inek* 'cow'  *inektig* 'of the cow'

b. [d] after /l/
   *xol* 'arm'  *xoldug* 'of the arm'

c. [n] after vowels or sonorants (except l)
   *nom* 'book'  *nomug* 'of the book'
   *xar* 'snow'  *xarmug* 'of the snow'
   *day* 'mountain'  *daymug* 'of the mountain'
   *biri* 'wolf'  *biriinug* 'of the wolf'

The genitive in Tuvan, like the genitive in most Turkic languages, appears to be underlyingly nasal-initial. The data in (39) present no difficulties not already encountered in the analysis of the plural. As with the plural, the stem-final glides are governed by the stem vowel and thus do not lead to underparsing. As the genitive is underlyingly specified as [nasal], contact with a nasal segment leads to the underparsing of the feature [nasal]. The [nasal] spreading rule reassociates the feature [nasal] to the genitive morpheme and it thus surfaces as a [nasal]. In the case of lateral-final stems, [nasal] is again underparsed but there is no [nasal] to spread, and the genitive surfaces as [d]-initial.

6.4.4.2.2 Type 3 Morphemes

I have only a single example of a type 3 morpheme in Tuvan. The suffix giving negative verbs briefly introduced in the discussion of Kirghiz. Tuvan displays the following pattern in the negative verb.

(40) The negative verb in Tuvan

| b. [b] after voiced consonants and vowels
|---|---|---|---|---|
| al- 'to take' | alba 'not to take'
| boda 'to think' | bodaba 'not to think'

| a. [t] following voiceless consonants
|---|---|---|---|---|
| tut- 'to hold' | tutpa 'not to hold'
| kes- 'to cut' | kespe 'not to cut'

| c. [m] following nasal consonants
|---|---|---|---|---|
| num- 'to ride horseback' | numma 'not to ride horseback'
| dog- 'to freeze' | dogma 'not to freeze'

---

8 Krueger does not consider the intervocalic and the post-sonorant forms to be identical, in fact he transcribes the intervocalic as 'v' and the post-sonorant as 'h'. However, in his discussion of the allophones of 'b', he indicates that these sounds would be pronounced the same.
If we consider the underlying representation to be the form found intervocally, not a completely obvious choice because the /p/-/b/ distinction is neutralized in this position, then the underlying representation of the suffix would be a labial SV consonant. We can account for the surface forms in (40a) if SV is underparsed when in a governing relationship with a preceding voiceless consonant. The forms in (40b) present no difficulties as the bare SV segment will govern the lateral. Intervocally, there is no government relationship and the segment surfaces without any modification. The forms in (40c) show the operation of the [nasal] spreading rule and provide strong evidence that the choice of a bare SV node for the underlying representation of the initial consonant of the negative morpheme is the correct choice. Clearly, the SV node on the negative morpheme is necessary as a target for the [nasal] spreading rule. Without this target, we would expect the negative morpheme to surface as [bA] as we will see with the type 4 morphemes.

6.4.4.2.3 Type 4 Morphemes

We now consider the locative morpheme. The initial consonant of this morpheme has only two variants: [t] and [d]. The [t] variant occurs following voiceless consonants and the [d] variant after all other sounds as illustrated in (41).

(41) The Locative in Tuvan

   a. Final voiceless sounds
      ot  ‘fire’      etta  ‘in the fire’
      ine  ‘cow’      inekte  ‘on the cow’
      do  ‘ice’      dohta  ‘on the ice’.

   b. Final voiced sounds
      uya  ‘nest’      uyada  ‘in the nest’
      xün  ‘sun’      xünde  ‘in the sun’
      kir  ‘ridge’      korda  ‘on the ridge’
      mal  ‘cattle’      malda  ‘in the cattle’
      day  ‘mountain’      dayda  ‘in the mountain’

   The underlying representation of the locative suffix is a bare Root node. It is then subject to contextual voicing, meaning that it should surface as voiceless in the forms in (41a) and as voiced everywhere else as shown in (41b). This is entirely consistent with the realization of contextually voiced sounds in other languages.

   We now are able to account for the four-way distinction in the underlying morphemes as outlined in (42).

(42) a. Lateral initial suffixes:
      variants: /l/-initial intervocally, and after glides
               [d]-initial after /l/: <Approx>
               [n]-initial after nasals: <Approx>, spread
               [nasal]
               [l]-initial after voiceless consonants: <SV>

   b. Nasal initial suffixes
      variants: nasal initial after vowels, glides and nasals
                voiced stop initial after laterals: NER blocked
                vcls. stop initial after voiceless consonants:
                <SV>
c. SV initial suffixes
   variants: voiced stop initial after vowels, glides, nasals and laterals
   voiceless stop initial after voiceless consonants: <SV>

R
SV

d. R suffixes
   variants: voiced stop initial after vowels, glides, laterals and nasals: Contextual voicing
   voiceless stop initial after voiceless consonants: Contextual voicing

A summary chart is presented in (43), with the example suffixes listed.

(43) Summary table of suffix-initial C realizations in Tuvan

<table>
<thead>
<tr>
<th></th>
<th>vowels</th>
<th>glides</th>
<th>laterals</th>
<th>nasals</th>
<th>vcls cons</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>d</td>
<td>d</td>
<td>d</td>
<td>d</td>
<td>t</td>
<td>locative, dative</td>
</tr>
<tr>
<td>SV</td>
<td>b</td>
<td>b</td>
<td>b</td>
<td>m</td>
<td>p</td>
<td>negative</td>
</tr>
<tr>
<td>nasal</td>
<td>n</td>
<td>n</td>
<td>d</td>
<td>n</td>
<td>t</td>
<td>genitive, acc.</td>
</tr>
<tr>
<td>lateral</td>
<td>l</td>
<td>d</td>
<td>d</td>
<td>n</td>
<td>t</td>
<td>plural</td>
</tr>
</tbody>
</table>

Let us briefly review the analysis of Tuvan that we are proposing. We claim that in common with the other Turkic languages we have investigated, [nasal] is underlingly specified. As well, the voiced stops have a bare SV node and the voiceless stops have no underlying specification for voicing. The feature [lateral] can be supplied by default. The realization of features of the inflectional morphemes such as the plural, genitive and locative is a result of the underparsing of features to satisfy government requirements. All of these features are common to the three languages discussed up to now. Where Tuvan differs is in having a language-specific rule spreading [nasal] to a bare SV node, and in the fact that glides are governed by the preceding vowels rather than by the following onset. Furthermore, Tuvan has a morpheme type not encountered in the other two languages, a morpheme not specified for SV. This morpheme corresponds to the SV morphemes of Kirghiz and Bashkir and its realizations are identical to the realizations found in those languages. However, crucial differences between the languages point to the efficacy of the present analysis. Specifically, the neutralization of voiced-voiceless pairs such as /p-b/ and /t-d/ in intervocalic position is in sharp contrast to the situation found in Kirghiz and Bashkir. When these morphemes follow an SV sound (vowel, glide, lateral, nasal) they are voiced. When these morphemes follow a voiceless stop, they are voiceless. The phonetic realization of the initial segment of these morphemes need not be accomplished by a special phonological rule spreading or copying the SV node of the preceding consonant onto the initial segment of the morpheme as we can rely on a process such as phonetic interpolation to accomplish this when the initial segment is realized as a voiced segment. When it is realized as voiceless there is no interpolation and the two adjacent non-SV segments are realized as voiceless. It is highly likely in this case that the Laryngeal Enhancement Rule applies to the stem final consonant protecting either sound from being contextually voiced.

We now turn to Yakut, a language similar to Tuvan but one that has even more assimilations.

6.4.5 Yakut

Yakut displays yet another variation in the realization of the plural morpheme. As we saw in (10) to (13) and summarized in (14), the plural
The morpheme in Yakut has the following realizations: [lAr] after vowels and /I/, [dAr] after glides (y, r), [nAr] after nasals, and [tAr] after voiceless consonants. Thus, Yakut shares with Bashkir, Kirghiz, and Tuvan an [l]-initial plural marker following a vowel and a [d]-initial marker following a voiceless consonant. Yakut is unlike Bashkir, Kirghiz and Tuvan in having an [l]-initial plural morpheme after an [l]-final stem. It is similar to Bashkir in having a [d]-initial marker following a glide. It is similar to Tuvan in having a nasal after a nasal. It also shares with Tuvan a distributional pattern in having no stem-final voiced obstruents.

Before proceeding to the analysis, let us consider the Yakut consonant inventory. The inventory in (44) is based on the quite detailed information provided in Krueger (1962).

(44) Yakut consonant inventory:

<table>
<thead>
<tr>
<th></th>
<th>Labial</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vcls</td>
<td>stops</td>
<td>p</td>
<td>l</td>
<td>k</td>
</tr>
<tr>
<td></td>
<td>fricatives</td>
<td>s</td>
<td>c</td>
<td></td>
</tr>
<tr>
<td></td>
<td>affricates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vd (SV)</td>
<td>stops</td>
<td>(b)</td>
<td>(d)</td>
<td>(g)</td>
</tr>
<tr>
<td></td>
<td>fricatives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>affricates</td>
<td></td>
<td>j</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nasals</td>
<td>m</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>glides</td>
<td>y, ɨ</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>liquids</td>
<td>l, r</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The opposition between /p/ and /b/ is marginal. For instance, /p/ occurs initially only in onomatopoeic words, does not occur except when geminated in intervocalic position and does not contrast with /b/ in final position. /b/

occurs initially and intervocally but not word-finally or geminated. A single /p/ is voiced intervocally.

The opposition between /k/ and /g/ is also marginal, though this is not noted by Krueger. /k/ occurs initially and finally and is found geminated intervocally. It voices to /g/ when it is not a geminate in intervocalic position. /g/ does not occur initially except in loan words and in one native verb /g n/- 'to do', an occurrence that could probably be ignored because this verb is most frequently an auxiliary and occurs as an affix. Thus, the only environment where /g/ freely occurs is intervocalic.

The opposition between /t/ and /d/ is more complete as both /t/ and /d/ occur in initial and medial position. Unlike /p/ and /k/, /t/ does not voice intervocally. According to Krueger, /d/ is quite rare intervocally, but it does occur and he provides several examples.

The affricates /r/ and /r/ occur for the most part in initial position and neither can occur finally. The fricative /s/ has wide distribution. It corresponds to the final fricatives and affricates of other Turkic languages and has the allophone [h] intervocally.

Yakut does not have a /w/ phoneme but it does have /y/ and /r/. Krueger also reports a nasalized /ʁ/ sound, though its distribution is limited. Neither /y/ nor /r/ occur in initial position and both are most frequently found in medial position. Krueger states that /y/ functions as a consonant in Yakut and never as a semi-vowel. Evidence for this comes from the realization of the accusative morpheme which is /-t/ when attached to a
consonant-final stem and /-nl/ when attached to a vowel-final stem. When
attached to a stem ending in /y/, we find the /-la/ form, indicating that /y/ is
functioning as a consonant.

The vowel inventory is similar to the inventory of most other Turkic
languages with the familiar eight vowel system opposing front and back,
rounded and unrounded and high and non-high. As well, all of the vowels
can be either long or short.

With this as background, we now investigate the inflectional morphology
of Yakut.

The Yakut plural receives almost the same treatment as the plural in
Tuvan, having both underparsing and nasal spreading. There are two
differences between Yakut and Tuvan: the post-gliding realization of the plural
is [dAr] rather than [lAr], and the post-lateral realization is [lAl] rather than
[dAr]. In the case of the glides, as they behave like consonants, they are in the
coda of the syllable and must be governed by a following onset. Evidence for
this is found in the realization of the accusative morpheme discussed above,
as well as a variety of other morphemes that alternate between vowel and
consonant initial. In this case we expect the realization of the plural to
involve the underparsing of the Approximant node of the lateral, yielding a
[k]-initial variant of the plural morpheme. After laterals, we find an [l]-initial
variant of the plural, a variant not seen in any of the other languages. In
Yakut, then, we have fusion of the adjacent laterals creating a geminate
structure and avoiding a government violation. The fact that this option is
available in Yakut is probably related to the presence of distinctive geminate
lateral.

(45) Geminate laterals in Yakut
   teley- 'to reveal'   telley 'mushroom'
   uluk  'tired'       ulluk  'haunch'
   kalaan 'blood'      kallaan 'sky'

Such clusters are not found in Bashkir or Kirghiz and, in Tuvan as explicitly
stated in Krueger (1977), /ll/ is always realized as [ld].

In (46) I present a summary of the analysis of how the various variants of
the plural morpheme of Yakut arise.

(46) Realization of the /ll/ of the plural morpheme of Yakut

<table>
<thead>
<tr>
<th>a. Intervocalic:</th>
<th>b. After a voiceless consonant:</th>
</tr>
</thead>
<tbody>
<tr>
<td>no government</td>
<td>underparse SV</td>
</tr>
<tr>
<td>V</td>
<td>RI, JR</td>
</tr>
<tr>
<td></td>
<td>Approx</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c. After a glide:</th>
<th>d. After a nasal</th>
</tr>
</thead>
<tbody>
<tr>
<td>underparse Approx</td>
<td>Approx, spread [nas]</td>
</tr>
<tr>
<td>RL, JR</td>
<td>RL, JR</td>
</tr>
<tr>
<td>SV</td>
<td>SV, SV</td>
</tr>
<tr>
<td>Approx</td>
<td>Approx</td>
</tr>
<tr>
<td>&lt;Approx&gt;</td>
<td>&lt;Approx&gt;</td>
</tr>
</tbody>
</table>
6.4.5.1 General Analysis of the Inflectional Morphemes of Yakut

In Tuvan we found four basic consonant-initial morpheme types and in Bashkir and Kirghiz we found three. Yakut presents a rather different set of morpheme types. First, the genitive morpheme, which is nasal-initial in the other languages, is not found in Yakut. In the accusative, which is also nasal-initial, the nasal is not realized when a stem ends in a consonant. Other morphemes which might be nasal-initial based on their pronunciation in other Turkic languages, such as the negative, appear to be obstructant-initial in Yakut. We thus have no example of a morpheme that is specified with an alternating nasal consonant. We do find two familiar types: the lateral-initial and obstructant-initial.

The lateral-initial morphemes, of which there are several, generally show the same range of variants as those already discussed for the plural. However, another variant of the plural morpheme is found in the 3rd person plural present durative. In this case, the plural marker is added to the 3rd person singular form which ends with the durative marker /r/. Rather than the expected [d]-initial plural marker, we find that the final /r/ assimilates to the /l/ of the plural marker.

(47) Verbal Plural Marker

*ahtir* 'she eats'
*bahlar* 'they eat'
*bar* 'she goes'
*barlar* 'they go'
*ke* 'she comes'
*kele* 'they come'
*dör* 'she grows silent'
*döyöl* 'they grow silent'

Only the durative morpheme /-r/ displays this behaviour. In other circumstances, the verbal plural marker obeys the regular rules for the plural. For example, when following the negative morpheme /-tal/, it has the t-initial variant, [*Arl*]. This indicates that the specification of the plural is probably not different in the present durative. One source of explanation might be the /r/ itself. This assimilating /r/ is an inflectional morpheme that only surfaces in the 3rd person singular of the present durative. The assimilatory behaviour of this particular /r/ is most likely due to some property it has as an inflectional morpheme.

In Yakut, we find several inflectional morphemes that begin with a coronal obstructant. There is, for example, the past tense marker /-TI/ and the partitive marker /-TA/. Intervocically and after voiceless consonants, these are realized as [l]-initial morphemes, after glides as [d]-initial, after laterals as [l]-initial and after nasals as [n]-initial. This is illustrated with the partitive marker.

(48) /TI/-initial Suffixes (Partitive)

a. [l]-initial following vowels

kinige 'book'
kinigete 'of the book'
börö 'wolf'
böröö 'of the wolf'
b. [l]-initial following voiceless consonants
   
   tobuk 'knee'  
   tobukla 'of the knee'
   sep 'tool'  
   septe 'of the tool'

c. [d]-initial following glides
   
   ejiy 'elder sister'  
   ejyde 'of the elder sister'
   domor 'friend'  
   doyordo 'of the friend'

d. [l]-initial after /l/
   
   tal 'neighbour'  
   talla 'of the neighbour'
   kuel 'lake'  
   kuelle 'of the lake'

e. [n]-initial after nasals
   
   oyun 'shaman'  
   oyonna 'of the shaman'
   tiig 'squirrel'  
   tiigye 'of the squirrel'
   silim 'glue'  
   silimne 'of the glue'

As the voiceless variant surfaces in intervocalic position, we can assume that underlyingly the initial segment of the suffix is voiceless. Note that with this as the underlying representation, there can be no government violations motivating any of the assimilations. The nasal variant is accounted for with a rule spreading the SV node of the nasal. The lateral features also spread from the stem to the suffix, making the realizations of this morpheme similar to the plural. The appearance of [d] following the glides may at first sight seem unexpected. I argue, however, that this is not the result of the application of a phonological rule such as spreading. Rather, the realization of an underlying /l/ after a glide as [d] reflects the neutralization pattern found generally in the language with stops following glides; that is, the contrast between the voiced and voiceless variants is neutralized in this position.

The dative suffix, as in most Turkic languages, begins with a velar stop. Again, there are several realizations of this morpheme depending on the

The pattern in the dative, as well as in other alternating suffixes with a velar segment in initial position, is almost identical with the /l/-initial suffixes. The only difference is that the /l/-initial suffixes do not voice intervocically, a situation found throughout the grammar. The voicing of the /K/-initial suffixes intervocically cannot lead us to conclude that these suffixes are underlyingly voiced. Indeed, the simplest position is that they are

---

9 I abstract away from other processes that do not bear on the issues at hand. For example, Kneser states that after a stem-final low vowel we find [g], but after /l, y, y/ and high vowels we find [gg]. I do not at the moment wish to speculate on the difference between the high and the low vowels, though we might assume that the stricture feature of the high vowels does not spread, while the stricture feature of the low vowels does. As well as after [g] we find [g] but [g] is an allomorphic variant of /k/ found in words with back vowels.
not marked for any type of voicing underlyingly. As in both the plural and
the partitive, there is a nasal spreading rule. The features of a lateral will in- 
not spread to a consonant with a specified place of articulation such as Dorsal or
Labial as this would create a segment not part of the underlying inventory, in
violation of structure preservation.

Several labial-initial suffixes are found in Yakut and it would appear that
these are subject to the same analysis as the velar-initial suffixes. This is
illustrated with the negative morpheme, familiar from Tuvan. In Yakut, the
initial labial is realized as [b] following a vowel, glide or /l/, as [p] following a
voiceless consonant, and as [m] following a nasal.

(50) /P/-initial Suffixes (Negative)
a. [b]-initial following vowels and glides
   abaa-  ‘to eat’  ababat-  ‘not to eat’
   kel-  ‘to come’  kelbet-  ‘not to come’
   kör-  ‘to see’  körbät-  ‘not to see’

b. [p]-initial following voiceless consonants
   bss-  ‘to cut’  bspat-  ‘not to cut’
   tik-  ‘to sew’  tikpe-  ‘not to sew’

c. [m]-initial after nasals
   sim-  ‘to blink’  simme-  ‘not to blink’
   top-  ‘to be cold’  təpən-  ‘not to be cold’
   kön-  ‘to correct’  kömən-10  ‘not to correct’

Again the analysis requires little comment as the forms follow the
patterns previously discussed for /T/- and /K/-initial forms.

For completeness I will illustrate a Yakut suffixal pattern that is quite
different from any we have seen in the other languages. There are suffixes
that begin with a geminate /-tt/ which surfaces as a geminate intervocally
and as a /t/ after consonants.

(51) /-tt/-initial Suffixes (Ablative)
a. [t]-initial following vowels and glides
   aya  ‘father’  ayattan  ‘from the father’
   börő  ‘wolf’  böröttön  ‘from the wolf’

b. [t]-initial following consonants
   ejiy  ‘elder sister’  ejiyten  ‘from the elder sister’
   doyort  ‘friend’  doyorton  ‘from the friend’
   küül  ‘lake’  küültön  ‘from the lake’
   tobuk  ‘knee’  tobukton  ‘from the knee’
   sep  ‘tool’  sepən  ‘from the tool’
   oyun  ‘shaman’  oyuntan  ‘from the shaman’
   yatuq  ‘bird’  yätəntan  ‘from the bird’
   ilim  ‘net’  ilimten  ‘from the net’

In this case the suffix-initial consonant is protected from the assimilatory
powers of stem final nasals and laterals by the additional skeletal slot
associated with the prefix. This also permits the violation of a phonotactic
constraint against [rt] and [lt] sequences. Interestingly, the partitive case to
which the ablative morpheme is clearly related historically does undergo all
of the assimilations as shown in (48).

6.4.5.2 Summary of Yakut

The alternating patterns of the inflectional morphemes are summarized
in (52).
(52) Summary table of suffix-initial C realizations in Yakut

<table>
<thead>
<tr>
<th>Suffix initial</th>
<th>Vowel</th>
<th>Glide</th>
<th>Lateral</th>
<th>Nasal</th>
<th>Velar C</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>t</td>
<td>d</td>
<td>l</td>
<td>n</td>
<td>t</td>
<td>partitive, past</td>
</tr>
<tr>
<td>K</td>
<td>g</td>
<td>g</td>
<td>g</td>
<td>g</td>
<td>k</td>
<td>dative</td>
</tr>
<tr>
<td>P</td>
<td>b</td>
<td>b</td>
<td>b</td>
<td>m</td>
<td>p</td>
<td>negative</td>
</tr>
<tr>
<td>Lateral</td>
<td>l</td>
<td>d</td>
<td>l</td>
<td>n</td>
<td>t</td>
<td>plural</td>
</tr>
<tr>
<td>Geminate</td>
<td>t</td>
<td>t</td>
<td>t</td>
<td>t</td>
<td>t</td>
<td>ablative</td>
</tr>
</tbody>
</table>

Inspection of this table reveals that the three suffixes that are listed as voiceless-stop initial, i.e., T, K and P, behave in very similar fashion. Indeed, the K-initial and P-initial suffixes behave identically. The T-initial suffix differs only in that it does not voice intervocally and assimilates to the lateral. Krueger presents data showing that /t/ voices across word boundaries when it is in intervocalic position, as in (53).

(53) Phrasal voicing of /t/.

- *aay- to burn*

  - *umay- to burn*

  - *nu-ice*

  - *muy-ice*

- *may- white*

  - *may- white*

This is very interesting, as it is unclear how to block this voicing rule from applying to /t/ if the labial and velar stops are underlyingly voiceless. One possible analysis would be to consider the underlying representation of the labial and velar stops to be /b/ and /g/, that is to consider them to be SV obstruents. We would then not need a rule voicing /b/ and /g/ intervocally. This would introduce an asymmetry into the system there would be an underlyingly voiceless consonant in the case of the /t/-initial suffixes, but an underlyingly SV-initial suffix in the case of the labial and velar suffixes. An inspection of the distribution of sounds in Yakut may provide some justification for such a move. As previously mentioned, the contrast between /p/ and /b/ as well as /k/ and /g/ is marginal at best, while the /t/-/d/- contrast is more robust, at least in initial and intervocalic positions. Moreover, there is evidence that the representation of /g/ and /b/ with an SV node is not out of the question. First, there are sporadic instances in the dialects of Yakut of alternations between the voiced consonants and nasals.

(54) Obstruent–nasal alternations in dialects of Yakut

- *aay- to burn*

  - *umay- to burn*

  - *nu-ice*

  - *muy-ice*

- *may- white*

  - *may- white*

Precisely this type of alternation is found across many Turkic languages and is seen in many common morphemes such as the 1st person singular pronoun, which is /l/-initial in some languages but /m/-initial in others. We do not generally find that /g/ becomes /h/ but many /k/-initial words of Yakut are /g/-initial in other Turkic languages. Secondly, the failure of /t/ to voice intervocally is very puzzling if /t/ has the same representation as /k/ and /p/. If we follow this line we have the following underlying representations for the obstruent-initial suffixes.

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11Intervocally between back vowels there is no distinction between /g/ and /h/. In fact the status of the phonemic opposition between these sounds is subject to question, though this has been greatly obscured by the loan vocabulary.
(55) Obstruent-initial suffixes

<table>
<thead>
<tr>
<th></th>
<th>Labial</th>
<th>Cor.</th>
<th>Dorsal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vcls</td>
<td>stops</td>
<td>(p)</td>
<td>(l)</td>
</tr>
<tr>
<td>Vd (SV)</td>
<td>stops</td>
<td>b</td>
<td>d</td>
</tr>
</tbody>
</table>

With this representation we can account quite easily for all of the
alternations but a single problem should still be addressed. Do we now claim
that the inventory of Yakut stops is as follows, with /p/ and /k/ being
marginal phonemes?

(56) Revised Yakut stop inventory

"...Bashkir has verbs derived from nouns by adding the suffix -la.
The consonant at the onset of the suffix is always and only l, e.g.,
baškaš “to begin” (cf. batšar “beads”), sag-lar, “to understand” (cf.
sag dar “concepts, ideas”). If Bashkir could not have l after s in
baš and l in -lar had by all means to become -lar in the plural
form batšar, the different suffix-initial consonants in baškar and
bašlar prove that the reason of the morphophonemic
alternation in š > 5 in baškar and absence of it in batša is not of
physiological nature." (p.187)

In the foregoing pages, we have seen that a government-based account,
supplemented with SV theory, handles the alternations in a straightforward
manner. However, data like that presented in the Poppe passage quoted
above suggests that we should further consider the true nature of the
alternations. Why should the initial consonant of some suffixes alternate,
while the same consonant does not alternate in other suffixes? The account
given thus far leaves us without an explanation of why in most other Turkic
languages the plural suffix surfaces as /l/-initial in all circumstances. Thus,
in Turkish, Uzbeck, Azerbajjani and Uighur, we find a non-alternating plural
suffix. The alternations found in the initial consonant of most of the suffixes
are restricted almost exclusively to a voicing alternation. The most obvious
solution to this problem involves invoking the level ordering available in
Lexical Phonology. This allows us to argue that government requirements
must be met at the level at which the alternating suffixes are attached. The
non-alternating suffixes are added at a later level when government requirements have been suspended or turned off.

6.6 Summary

In this chapter we have explored the inflectional morphology of various northern Turkic languages, showing that the SV representations proposed in this thesis allow for fresh insights into a series of assimilations that pose difficulties for other frameworks. For example, there is no straightforward way to capture the changes in the lateral-initial plural morpheme in a theory that does not posit an SV node organizing sonorant features. Furthermore, the proposal that the voicing in sounds such as /d/ is the result of the presence of the SV node rather than the presence of the feature [voice] under the Laryngeal node allows us to capture without any stipulation the [l-d-l] alternations found in the plural morpheme in these languages. The variations in the realization of the plural morpheme found in Bashkir, Kirghiz, Tuvan and Yakut, and the success of a theory based on the SV hypothesis in accounting for these differences, can only lend strong support to the SV hypothesis.

References


